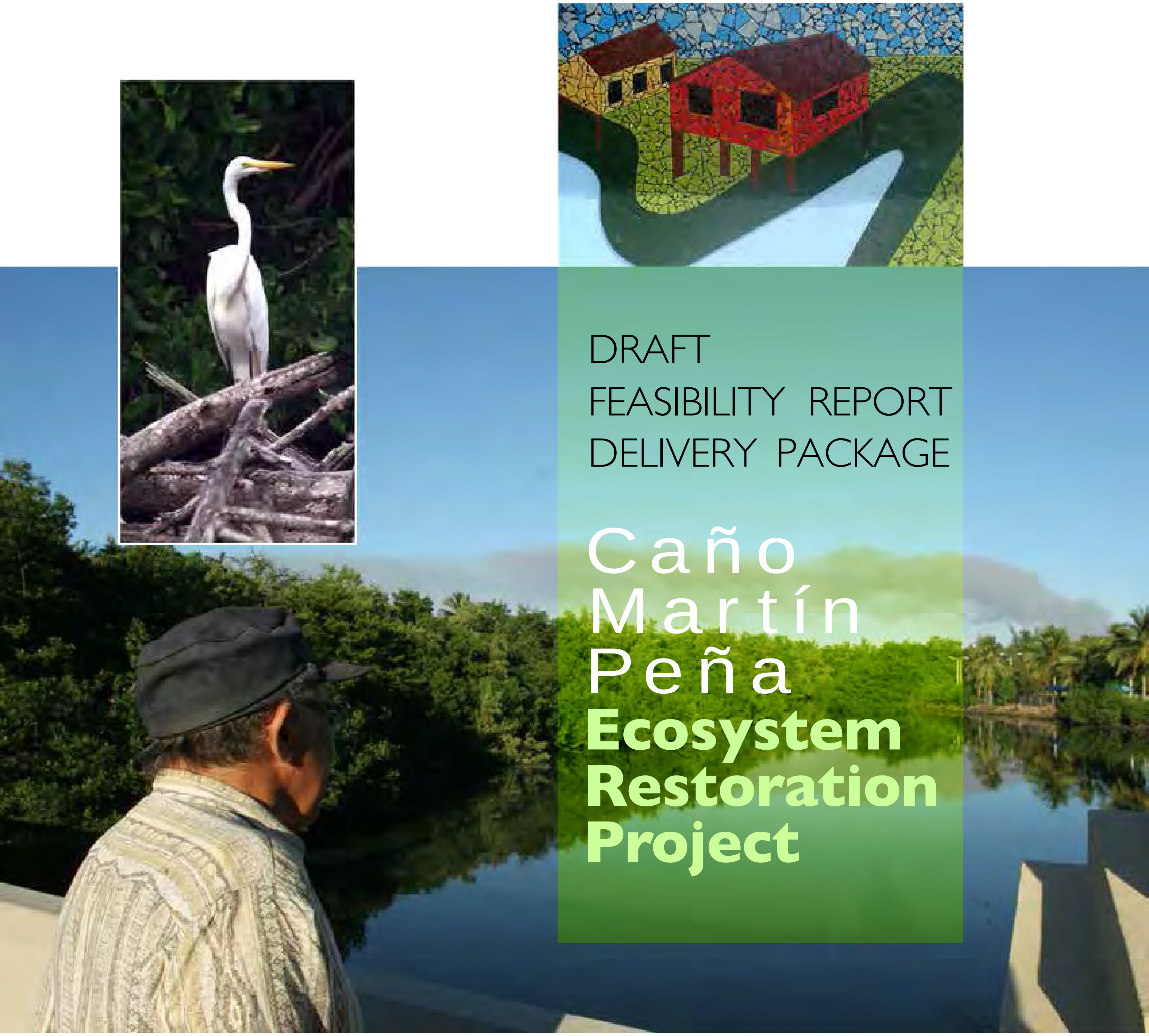

DRAFT
FEASIBILITY REPORT DELIVERY PACKAGE

Caño Martín Peña Ecosystem Restoration Project

SEPTEMBER 2015

U.S. ARMY CORPS OF ENGINEERS
JACKSONVILLE DISTRICT

CORPORACIÓN DEL PROYECTO
ENLACE DEL CAÑO MARTÍN PEÑA

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The Draft Feasibility Report Delivery Package contains 11 TABS as required by U.S. Army Corps of Engineers Planning Regulation ER 1105-2-100, Appendix G, Amendment #1, dated 30 June 2004.

- **TAB 1** – Draft Feasibility Report and Environmental Impact Statement
- **TAB 2** – Policy and Procedure Issues
- **TAB 3** – Peer Review Plan and Activities
- **TAB 4** – Federal and Commonwealth Environmental Compliance
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- **TAB 8** – Status of Land, Easements, Rights-of-Way, Relocation, and Disposal Areas Issues and Activities
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Acronyms and Abbreviations

ac	acres
AAHU	Average Annual Habitat Unit
ACGIH	American Conference on Governmental Industrial Hygienists
ACI	American Concrete Institute
ACM	Articulated concrete mat
ADCP	Acoustic Doppler Current Profilers
adICPR	advanced Interconnected Pond Routing
ADS	Autoridad de Desperdicios Sólidos
ALOHA	Areal Locations of Hazardous Atmospheres
AMC	Antecedent Moisture Condition
ASTM	American Society for Testing Materials
ATSDR	Agency for Toxic Substances and Disease Registry
ATR	Agency Technical Review
B2EHP	Bis (2-ethylhexyl) phthalate
BA	Biological Assessment
BACT	Best Available Control Technology
BDL	Below Detection Limit
BI	Benthic Index
BMP	Best Management Practice
C&D	Construction and demolition debris
°C	degrees Celsius
CAA	Clean Air Act
CAD	Contained Aquatic Disposal
CBIA	Coastal Barrier Improvement Act
CBRA	Coastal Barrier Resources Act
CBRS	Coastal Barrier Resources System
CCMP	Comprehensive Conservation & Management Plan for the San Juan Bay Estuary
CDLUP	Comprehensive Development and Land Use Plan
CDRC	Ciudad Deportiva Roberto Clemente
CE/ICA	Cost Effectiveness/Incremental Cost Analysis
CEM	Conceptual Ecological Model
CEQ	President's Council on Environmental Quality
CERCLA	Federal Comprehensive Environmental Response, Compensation and Liability Act

CERCLIS	Federal Comprehensive Environmental Response, Compensation and Liability Information System
CFMC	Caribbean Fisheries Management Council
CFR	*Code of Federal Regulations*
CFU	Fecal coliform bacteria units
CH3D-WES	Curvilinear Hydrodynamics in 3 Dimensions, WES version
CHDO	Community Housing Development Organization
CM	Construction Management
cm	centimeters
CMP	Caño Martín Peña
CMP-CLT	Caño Martín Peña Community Land Trust
CMP-ERP	Caño Martín Peña Ecosystem Restoration Project
CMP-MTZ	Caño Martín Peña Maritime Terrestrial Zone
CO	Carbon monoxide
CO_2	Carbon dioxide
COC	Contaminants of Concern
CORRACT	Federal Corrective Actions List
CPI	Consumer Price Index
CRIM	Municipal Tax Revenue Collection Center
CSD	Combined Sewer Discharge
CSO	Combined Sewer Overflow
CSRA	Cost Schedule Risk Analysis
CSS	Combined Sewer System
CVM	Contingent Valuation Method
CWA	Clean Water Act
cy	cubic yards
CZMP	Coastal Zone Management Program
dB	decibel
dB(A)	A-weighted decibel
dbh	diameter at breast height
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
DMMP	Dredged Material Management Plan
DNER	Puerto Rico Department of Natural and Environmental Resources
DO	Dissolved oxygen

DSS	Decent, Safe and Sanitary housing
DTPW	Puerto Rico Department of Transportation and Public Works
EA	Environmental Assessment
EC	Engineering Circular
ECC	ENLACE's Community Committee
ECO-PCX	Ecosystem Restoration Planning Center of Expertise
EDR	Environmental Data Resource, Inc.
EFH	Essential Fish Habitat
EGM	USACE Economic Guidance Memorandum
EIS	Environmental Impact Statement
EMF	Electromagnetic field
ENLACE	Corporación del Proyecto ENLACE del Caño Martín Peña
ENLACE Project	Caño Martín Peña ENLACE Project
EO	Executive Order
EPG	Emergency Power Generator
EQ	Environmental Quality Account
ER	USACE Engineering Regulation
ER	Engineering Report
ERAMPT	Ecosystem Restoration Adaptive Management Planning Team
ERDC	USACE's Engineer Research and Development Center
ERL	Effects Range–Low
ERM	Effective Range–Median
ERNS	Federal Emergency Response Notification System
ERP	Ecosystem Restoration Project
ERPG	Emergency Response Planning Guidelines
ESA	Endangered Species Act
ESI	Environmental Sensitivity Index
EUA	Ecological Uplift Assessment
°F	degrees Fahrenheit
FDA	Food and Drug Administration
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FMC	Fishery Management Council

FMP	Reef Fish Fishery Management Plan
FONSI	Finding of Non-Significant Impact
fps	feet per second
FR	Feasibility Report
FR	*Federal Register*
FRM	Flood Risk Management
FRP	Federal Recreation Plan
ft	feet
ft/s	feet per second
ft/y	feet per year
ft^2	square feet
ft^3	cubic feet
FWCA	Fish and Wildlife Coordination Act
FWPRA	Federal Water Project Recreation Act
FY	Fiscal year
g	grams
G-8	Group of the Eight Communities bordering the Caño Martín Peña
GHG	Greenhouse gas
GIS	Geographic Information System
GPS	Global Positioning System
H	Hybrid
H&H	Hydrology and Hydraulics
H_2S	Hydrogen sulfide
ha	hectare
HAP	Hazardous Air Pollutant
HAPC	Habitat Areas of Particular Concern
HDPE	High-density polyethylene
HEC	Hydraulic Engineering Circular
Hg	Mercury
HHW	Household Hazardous Waste
HIA	Health Impact Assessment
HTRW	Hazardous, Toxic, and Radioactive Waste
HU	Habitat Unit
HW	Household Waste
IA	Initial Assessment
IBC	International Building Code

IDC	Interest During Construction
IEPR	Independent External Peer Review
in	inches
in/yr	inches per year
INCICO	Instituto de Ciencias para la Conservación de Puerto Rico
IPCC	Intergovernmental Panel on Climate Change
IPRC	Institute of Puerto Rican Culture
IWR	USACE Institute for Water Resources
kg	kilograms
JD	Jurisdictional Determination
km^2	square kilometers
kV	kilovolt
L_{10}	Noise value exceeded 10% of the time
LBC	Level Bottom Capping
LC	Los Corozos
LEERD	Lands, Easements, Rights-of-Way, Relocations, and Disposal Area
L_{eq}	Equivalent (or average) noise level
LI	liquidity index
LL	liquid limit
LLC	Los Corozos Lagoon
LMM	Luis Muñoz Marín
LSJ1	Water Quality Station San José Lagoon 1
LSJ2	Water Quality Station San José Lagoon 2
LUST	State Leaking Underground Storage Tank
M	Million
m/s	meters per second
m^2	square meters
m^3/d	cubic meters per day
m^3/s	cubic meters per second
MCACES	Micro-Computer Aided Cost Engineering System
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mg/mg^3	milligrams per cubic milligrams
MGD	million gallons per day
MHHW	mean higher high water
MHW	mean high water

mi	miles
mi^2	square miles
mL	milliliters
MLLW	mean lower low water
MLW	mean low water
mm/yr	millimeters per year
MOA	Memorandum of Agreement
MP	Monitoring Plan
mph	miles per hour
MPRSA	Marine Protection, Research, and Sanctuaries Act
MRF	Material Recovery Facility
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
msl	mean sea level
MTL	Mean Tide Level
MTZ	Maritime Terrestrial Zone
MTZ-CMP	Public Domain lands within the Caño Martín Peña Maritime Terrestrial Zone
NAAQS	National Ambient Air Quality Standards
NAD 83	North American Datum 1983
NCDC	National Climatic Data Center
NED	National Economic Development
NEP	USEPA's National Estuary Program
NEPA	National Environmental Policy Act
NER	National Ecosystem Restoration
NH_3	Ammonia
NMFS	National Marine Fisheries Service
NO_2	Nitrogen dioxide
NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NO_x	Nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NPL	National Priority List
NRC	Natural Research Council
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
NTP	Notice to Proceed

NGVD 29	National Geodetic Vertical Datum 1929
NWI	National Wetland Inventory
O&M	Operation and Maintenance
O_3	Ozone
ODMDS	San Juan Bay Ocean Dredged Material Disposal Site
OGPe	Puerto Rico Permit Management Office (for its Spanish acronym)
OMRR&R	Operation and Maintenance, Repair, Replacement and Rehabilitation
OPA	Otherwise Protected Areas
OSC	On-Scene Coordination
OSE	Other Social Effects Account
OSHA	Occupational Health and Safety Administration
P&G	U.S. Water Resources Council Principles and Guidelines
PAH	Polycyclic aromatic hydrocarbons
Pb	Lead
PCBs	Polychlorinated biphenyls
PDI	Comprehensive Development Plan for the Caño Martín Peña Special District (Plan de Desarrollo Integral y Uso de Terrenos para el Distrito de Especial del Caño Martín Peña)
PDR	Project Design Report
PDT	Project Delivery Team
PED	Preconstruction Engineering and Design
PEL	Probable Effect Level
PI	plasticity index
PL	Public Law
PL	plastic limit
PM	Particulate Matter
PMP	Project Management Plan
PM_{10}	Particulate matter with an aerodynamic diameter less than or equal to a nominal 10 microns
$PM_{2.5}$	Particulate matter with an aerodynamic diameter less than or equal to a nominal 2.5 microns
PPA	Project Partnership Agreement
ppm	parts per million
ppt	parts per thousand
PR (P.R.)	Commonwealth of Puerto Rico
PRASA	Puerto Rico Aqueduct and Sewer Authority
PRCCC	Puerto Rico Climate Change Council

PRCZMP	Puerto Rico Coastal Zone Management Program
PREPA	Puerto Rico Electric Power Authority
PREQB	Puerto Rico Environmental Quality Board
PRGAP	Puerto Rico Gap Analysis Project
PRHTA	Puerto Rico Highway and Transportation Authority
Project Channel	2.2 miles of the Eastern CMP associated with the CMP-ERP
PRPB	Puerto Rico Planning Board
PR SCORP	Puerto Rico State Comprehensive Outdoor Recreation Plan
PRWQSR	Puerto Rico Water Quality Standards Regulation
psu	Practical salinity unit
PUD	Permanent Upland Disposal
RCRA	Federal Resource Conservation and Recovery Act
RCRA-G	RCRA Generators List
RCRA-TSD	RCRA Treatment, Storage, or Disposal List
REC	Recognized Environmental Conditions
RED	Regional Economic Development
REP	Real Estate Plan
RfC	Reference Concentration (for Chronic Inhalation Exposure)
ROD	Record of Decision
ROW	Right-of-Way
SAV	Submerged Aquatic Vegetation
SCS	Soil Conservation Service
SGC	Subaqueous geotextile confinement
SHPO	State Historic Preservation Office(r)
SHWS	State Hazardous Waste Site
SIP	State Implementation Plan
SJ	San José
SJ1	Artificial Pit San José 1
SJ2	Artificial Pit San José 2
SJ3/4/5	Artificial Pit San José 3/4/5
SJB	San Juan Bay
SJBE	San Juan Bay Estuary
SJBEP	San Juan Bay Estuary Program
SJHP	San Juan Harbor Project
SJL	San José Lagoon
SJMA	San Juan Metropolitan Area

SLR	Sea Level Rise
SO_2	Sulfur dioxides
SO_x	Sulfur oxides
SQG	Sediment quality guidelines
SQUIRT	Screening Quick Reference Tables
STAC	Scientific and Technical Advisory Committee
SV	Screening Value
SWMA	Puerto Rico Solid Waste Management Authority
T&E	Threatened and Endangered Species
TC	Technical Committee to the Project
TCLP	Toxicity characteristic leaching procedure
TCM	Travel Cost Method
TEL	Threshold Effect Level
TKN	Total Kjeldahl Nitrogen
TLV	Threshold Limit Value
TM	Thermal Stability Analysis
TN	Total nitrogen
TOC	Total Organic Carbon
tpy	tons per year
TSCA	Toxic Substances Control Act
TSD	RCRA Treatment, Storage, or Disposal List
TSP	Tentatively Selected Plan
TSS	Total Suspended Solids
UDV	Unit Day Value
µg/g	micrograms per gram
µg/L	micrograms per liter
URA	Uniform Relocation Act of Assistance and Real Property Acquisition Policies Act as amended, P.L.91-646; 42 U.S.C. 4601 et seq.
U.S.	Unites States of America
USACE	U.S. Army Corps of Engineers
U.S.C.	United States Code
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

UST	Underground storage tank
UWFP	Urban Waters Federal Partnership
VCS	State Voluntary Cleanup Site
VES	Visual Encounter Survey
VOC	Volatile Organic Compounds
WES	Waterways Experiment Station
WRDA	Water Resources Development Act
WQC	Water Quality Certification
yr	year
Zn	zinc

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Feasibility Report & Environmental Impact Statement for the Caño Martín Peña Ecosystem Restoration Project

SEPTEMBER 2015

US Army Corps of Engineers.

PROYECTO ENLACE DEL CAÑO MARTÍN PEÑA

Volume III

DRAFT

Feasibility Report for the Caño Martín Peña Ecosystem Restoration Project

SEPTEMBER 2015

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DRAFT
ENVIRONMENTAL IMPACT STATEMENT
CAÑO MARTÍN PEÑA ECOSYSTEM RESTORATION PROJECT
SAN JUAN, PUERTO RICO

September 2015

Prepared by:
Corporación del Proyecto ENLACE
del Caño Martín Peña

For review by:
U.S. Army Corps of Engineers

This document has been prepared by the *Corporación del Proyecto ENLACE del Caño Martín Peña* and its consultants Atkins Caribe, LLP, Atkins North America, and Estudios Técnicos, Inc., for review by the U.S. Army Corps of Engineers.

DRAFT
ENVIRONMENTAL IMPACT STATEMENT
CAÑO MARTÍN PEÑA ECOSYSTEM RESTORATION PROJECT
SAN JUAN, PUERTO RICO

Responsible Agencies: The lead agency is the U.S. Army Corps of Engineers, Jacksonville District. The Corporación del Proyecto ENLACE del Caño Martín Peña is the non-Federal cost-sharing partner for the project.

Abstract: This Draft Environmental Impact Statement examines the environmental consequences of the implementation of the Caño Martín Peña (CMP) Ecosystem Restoration Project (ERP). The purpose of the CMP-ERP is to re-establish the tidal connection between the San José Lagoon and the San Juan Bay, and thus, the eastern and western sections of the San Juan Bay Estuary. The Project consists of the dredging of approximately 2.2 miles of the eastern half of the CMP, starting from the San José Lagoon towards the west, in the vicinity of the Luis Muñoz Rivera Avenue Bridge. The CMP-ERP would improve dissolved oxygen levels and salinity stratification, increase biodiversity by restoring or enhancing, among others, fish habitat and benthic conditions, and overall health of the San Juan Bay Estuary System. The Project is also critical for the revitalization of eight impoverished communities settled along the Martín Peña tidal channel, and restoration of this system will significantly improve human health and safety in the area. Recreational navigation will also be reestablished in the area, allowing for increased public and commercial use of the entire estuary. A 100-foot-wide by 10-foot-deep channel was chosen as the Tentatively Selected Plan (TSP) for the implementation of the CMP-ERP. The TSP proved to be the alternative that best meets the study objectives, is the most acceptable, cost effective and best buy. In addition to the contributions to ecosystem restoration, the implementation of the TSP would also contribute to improve socio-economic conditions of adjacent communities.

THE OFFICIAL CLOSING DATE FOR THE RECEIPT OF COMMENT IS 45 DAYS FROM THE DATE ON WHICH THE NOTICE OF AVAILABILITY OF THIS DRAFT EIS APPEARS IN THE *FEDERAL REGISTER*.

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Executive Summary

The non-Federal sponsor, the *Corporación del Proyecto ENLACE del Caño Martín Peña* (ENLACE), has completed a Draft Feasibility Study and Environmental Impact Statement (FR/EIS) for the Caño Martín Peña Ecosystem Restoration Project (CMP-ERP). In accordance with Section 5127 of the Water Resources Development Act of 2007 and the subsequent implementation guidance, ENLACE submits this draft FR/EIS to the U.S. Army Corps of Engineers (USACE) for review and approval of the Assistant Secretary of the Army (Civil Works). This Draft EIS describes the proposed action, the affected environment and discusses the potential environmental consequences of alternatives on the affected environment. This Draft EIS has been prepared following the National Environmental Policy Act (NEPA) of 1969, as amended, and its implementing regulations, and associated rules and regulations of the Council on Environmental Quality (CEQ) and the USACE Procedures for Implementing NEPA, 200-2-2 (33CFR-230).

Project Purpose & Need

The CMP-ERP is an urban ecosystem restoration project to restore the Caño Martín Peña (CMP) and surrounding areas of the San Juan Bay Estuary (SJBE). Restoration of the CMP would re-establish the tidal connection between the San José Lagoon and the San Juan Bay (SJB), which would improve dissolved oxygen levels and salinity stratification, increase biodiversity by restoring fish habitat and benthic conditions, and improve the functional value of mangrove habitat within the estuary.

The CMP is a tidal channel 3.75 miles long in metropolitan San Juan, Puerto Rico. It is an integral part of the SJBE, the only tropical estuary included in the U.S. Environmental Protection Agency (USEPA) National Estuary Program (NEP), which is administered in the Commonwealth by the San Juan Bay Estuary Program (SJBEP). The SJBE's watershed covers 97 square-miles and it is heavily urbanized with over 5,000 people per square-mile. The SJBE includes over 33 percent of the mangrove forests on the Island, with over 124 species of fish and 160 of birds. The eastern half of the CMP, historically between 200 and 400 feet wide and navigable, has a current depth of between 3.94 feet to 0 foot towards the San José Lagoon. Due to years of encroachment and filling of the mangrove swamps along the CMP, the channel no longer serves as a functional connection between the SJB and the San José Lagoon. Sedimentation rates within the eastern CMP are nearly twice as high as in other parts of the SJBE due to infilling and extremely limited water flow. Open waters in areas closer to the San José Lagoon have been lost, as the area has started transitioning into emergent wetlands and uplands. Sediments include a combination of debris, household refuse, and other waste accounting for 10 percent of its composition. In some sites, thickness of this material is close to 10 feet below the bottom.

The conditions within the eastern CMP have led to degradation within the entire estuary. Connectivity of the ecosystem has been severed and the biodiversity within the San José Lagoon has been compromised, as a reduced number of species are found when compared with other lagoons throughout the SJBE. Habitat degradation has in turn decreased the ability of those species still found to respond to natural changes, disease and other stressors, reducing ecosystem functions and values, including losses of economic and recreational opportunities.

Water residence time in the San José Lagoon is of 16.9 days, much higher than a normal residence time, estimated to be about 3 days. This has caused strong salinity stratification, which in turn limits dissolved oxygen levels in the 702 acres of the lagoon's bottom with depths below 4 to 6 feet, severely affecting benthic habitats. Reduced flushing capacity has also led to an increase in sedimentation rates. Habitat for many species of fauna is then lost as reduced mangrove coverage and health decreases forage opportunities and reproductive success.

Ecological degradation within the estuary has also begun to affect human health and safety of surrounding communities. Inability to implement flood risk management measures due to the lack of conveyance capacity in the eastern CMP leads to localized flooding. Subsequent human contact with CMP's waters has been associated with higher rates of asthma, dermatitis and gastrointestinal diseases. Recreational navigation within the estuary has also been severed, restricting public and commercial waterborne traffic within the capital city.

Initial Array of Alternatives

The plan formulation process built directly upon previous planning and design efforts. Structural management measures for the channel dredging, erosion control, dredged material disposal, mangrove planting and construction, recreation, as well as non-structural measures were identified and screened. An Initial Array of Alternatives consisting of rectangular channel cross sections ranging between 75- and 200-foot widths with 10-foot depths was then developed and evaluated. Screening criteria such as completeness, acceptability, cost effectiveness, and secondary effects on adjacent communities, were then used to eliminate unfavorable plans and develop a final array of alternatives.

Final Array of Alternatives, Plan Comparison, and Selection

Final Array: The final array of alternatives consisted of four alternative plans:

No Action Alternative Plan: Involves no further Federal actions.

Alternative Plan 1: Consists of a 75-foot-wide by 10-foot-deep channel; articulated concrete mats along the entire channel bottom for erosion control; an elongated weir under the Martín Peña, Tren Urbano, and Luis Muñoz Rivera bridges involving a 115-foot-wide by 6.5-foot-deep channel with riprap on side slopes and articulated concrete mats at the channel bottom; dredging approximately 680,000 cubic yards (cy) of mixed materials along 2.2 miles of the eastern CMP; and construction of a vertical concrete-capped steel sheet pile with hydraulic connections with the surrounding lands. After dredging and construction of mangrove planting beds, 20.42 acres of open water and 39.62 acres of mangrove wetland would be restored.

<u>Alternative Plan 2</u>: Consists of a 100-foot-wide by 10-foot-deep natural bottom channel; an elongated weir under the Martín Peña, Tren Urbano, and Luis Muñoz Rivera bridges involving a 115-foot-wide by 6.5-foot-deep channel with riprap on side slopes and articulated concrete mats at the channel bottom to reduce water velocity and erosion, and to control scour; dredging approximately 762,000 cy of mixed materials along 2.2 miles of the eastern CMP; and construction of a vertical concrete-capped steel sheet pile with hydraulic connections with the surrounding lands. After dredging and construction of mangrove planting beds, 25.57 acres of open water and 34.48 acres of mangroves would be restored.

<u>Alternative Plan 3</u>: Consists of a 125-foot-wide by 10-foot-deep natural bottom channel; an elongated weir under the Martín Peña, Tren Urbano, and Luis Muñoz Rivera bridges involving a 115-foot-wide by 6.5-foot-deep channel with riprap on side slopes and articulated concrete mats at the channel bottom to reduce water velocity and erosion, and to control scour; dredging approximately 872,000 cy of mixed materials along 2.2 miles of the eastern CMP; and construction of a vertical concrete-capped steel sheet pile with hydraulic connections with the surrounding lands. After dredging and construction of mangrove planting beds, 30.97 acres of open water and 29.08 acres of mangroves would be restored.

For Alternative Plans 1, 2, and 3, approximately 34.46 acres of wetlands would be disturbed for construction activities, including 33.46 acres within the Project Channel and 1 acre at the CDRC staging area. Total construction time for all three Alternatives would be approximately 27 months; maintenance dredging would be required; and dredged material disposal would be divided between upland landfill for solid waste and disposal in the San José Lagoon pits for dredged sediment.

Evaluation and Comparison: Performance measures for Benthic Habitat, Fish Habitat, and Mangrove Habitat were developed to measure alternative output, and ecosystem restoration measure benefits were calculated for each alternative. A cost effectiveness and incremental cost analysis (CE/ICA) was conducted based on a project life of 50 years and a Federal Discount Rate of 3.5 percent and a base year of 2019. Each alternative was considered to be independent and not combinable with the other alternative. Due to weir restrictions to prevent erosion at bridges and other structures for all three action alternatives, average annual habitat units (AAHUs) would be nearly identical among alternatives, totaling 6,133 AAHUs per alternative. As a result, Alternative 2, with an average annual equivalent cost of $8,700,000, was determined to be cost effective and best buy when compared with Alternatives 1 and 3, with average annual equivalent costs of $9,300,000 and $9,100,000, respectively.

Additional considered criteria included project objectives and constraints, a comparison of the Four Accounts, and criteria contained in the “Principles and Guidelines” (P&G) for water resources planning adopted by the Water Resources Council.

Selection: Alternative 2, the 100-foot-wide channel, was identified as the Tentatively Selected Plan (TSP). It is the National Ecosystem Restoration Plan (NER) plan and is both cost effective and a best buy. In accordance with the P&G criteria, Alternative 2 provides a complete solution to the problems identified for the study. It is also the most effective plan and meets the project objectives. The NER Plan is acceptable and has been determined to be in the national and public interest and can be constructed while protecting the human environment from unacceptable impacts.

Tentatively Selected Plan Elements

Construction schedule: Alternative Plan 2 construction is proposed or expected to last between October 2018 and December 2020. However, project construction may be sequenced in order to get some sites within the Project Area worked in advance.

Channel: Alternative Plan 2 consists of dredging approximately 2.2 miles of the eastern half of the CMP to a width of 100 feet and a depth of 10 feet, with slight variations in channel width and depth at the 4 bridges to the west, the Barbosa Bridge to the east, and at the terminus of the CMP with the San José Lagoon. The walls of the Project Channel would be constructed with vertical concrete-capped steel sheet piles with hydrologic connections to the surrounding lands. The sill depth of the window would be set at mean low water so that tidal exchanges are facilitated to the mangrove beds. Riprap would be placed at the four bridges. At the terminus of the Project Channel with the San José Lagoon, an extended channel would be dredged east into the San José Lagoon (over a distance of approximately 4,300 feet) as a hydraulic transition from the CMP. This extended channel would transition from the 10-foot-deep Project Channel to the 6-foot-deep areas of San José Lagoon. The extended channel would maintain the Project Channel's 100-foot width but replace its steel sheet pile walls with a trapezoidal configuration with 5-foot to 1-foot earthen side slopes.

Disposal of dredged material: A barge-mounted mechanical clamshell dredge would be used to widen and deepen the eastern CMP channel, and would place dredged material into dump scows. Approximately 76,200 cy of solid waste (10%) would be screened from the 762,000 cy of dredged material and transported from the staging area to the Humacao Regional Landfill site, which is located approximately 32 miles from the CMP-ERP site. Approximately 37,800 cy of in situ sediments would be used to complete the sheet pile construction and mangrove bed restoration.

After screening and removal of solid waste debris, the remaining 648,000 cy of in situ sediments would be encapsulated within geotextile fabric bags, and transported by shallow draft barges to the San José Lagoon artificial subaqueous pits (SJ1 and SJ2). Additional water quality and sediment testing, such as bioassays, would be conducted prior to placement to ensure their suitability for disposal. Prior to disposal operations, SJ1 and SJ2 would be modified to increase capacity to accommodate the majority of dredged sediments and the required 2-foot sand cap. Approximately 517,581 cy of material would be removed from both sites and deposited within the SJ 3/4/5 artificial subaqueous pits. Material for the sand cap will be quarried from upland quarry sites and transported by trucks to the construction staging area for transfer to dump scows for placement. The proposed layer of sand capping would also help reduce benthic burrowing organisms from reaching and disturbing the sediments. Silt curtains would also be employed around the pits in the San José Lagoon. In critical areas, the curtains may double ring the active area for additional precautions. The curtains would be constructed to the full depth of the water where they are placed.

For activities related to the installation of the weir in the western end of the Project Channel, an upland staging area near the four western bridges would be used to temporarily stockpile and transfer the collected solid waste excavated during the dredging process. Equipment and materials would be staged on floating barges. After the construction of the weir, and once the dredging from the eastern portion of the Project Channel opened the CMP, the temporary cofferdam would be removed, and the stockpiled solid waste would be placed into shallow-draft barges for transport to the Ciudad Deportiva Roberto Clemente (CDRC) staging area. At the CDRC staging area, the material would be off-loaded, placed into trucks, and hauled for disposal at the Humacao upland landfill.

Materials within the CMP-East include various types of solid waste, debris, and other materials. Such materials would require further testing prior to and/or during project construction, as appropriate, in accordance with an agreed sampling plan. If the testing determines that any materials contain hazardous substances at levels that are not suitable for unregulated disposal, they will be managed in accordance with the applicable laws and regulations of the relevant regulatory agencies.

Erosion Control: A weir, or “hump,” would be constructed at the western end of the project area to mitigate water flows into the adjacent waterways. The dimensions of the weir (115 x 6.5 feet) would replicate the cross sectional area of Alternative 1 (75 x 10 feet), and by providing a transition area to reduce bottom water velocities, would prevent scour around bridges, bulkheads, and other marine structures west of the project area. The weir would be constructed with an articulated concrete bottom, while the remainder of the eastern CMP channel would be earthen bottom.

Non-Structural Measures: As an aquatic ecosystem restoration project, there are no non-structural measures for the dredging of the CMP. Non-structural measures related to structure acquisitions and relocations within the confines of the Federal project have been retained and included in the development of alternatives, as well as activities outside of the project that would be conducted by the non-Federal Sponsor. Overall, the non-structural measures considered and used in the development of alternatives included the acquisition of approximately 434 residential structures and relocation of 390 owners/families/occupants, as well as other measures independent of the Federal project to be implemented by the non-Federal sponsor and adjacent communities, such as enforcement of illegal dumping, stormwater and sewer improvements and community education.

Additional Project Components: Approximately 34.48 acres of mangrove wetlands would be restored by grading lands adjacent to the CMP and planting four native species of mangrove.

Additional project components are: Recreation Plan, Project Monitoring and Adaptive Management Plan, Nuisance and Exotic Vegetation Control, and Draft Project Operating Manual. The Recreation Plan includes water access areas that would replace lost functions within the Project Area.

Environmental Consequences of the TSP

The environmental consequences of the TSP and the proposed measures include:

- The TSP would significantly improve the tidal exchange and circulation in the CMP and San José Lagoon and, in turn, improve water quality and ecological conditions in the Project Area. Residence time for the San José Lagoon would be reduced from 16.9 to approximately 3.9 days and consequently salinity stratification resulting in an increase in bottom DO in -4 to -6 feet of water within San José Lagoon. The proposed expanded channel bottom would provide new benthic community area and channel walls would provide encrusting invertebrate community habitat.
- The TSP could provide benefits toward reducing the effects of climate change. Expected net gains of vegetated wetlands and uplands could decrease heat island effects and provide additional means to cope with future increases in temperature. This additional vegetated land cover area would also reduce runoff waters reaching the CMP, therefore, reducing flood frequency, given the expected extreme precipitation events. Indeed, frequent or moderate floods, as well as the 100-yr flood risk (without storm surge), would be reduced under the TSP, albeit not substantially.
- No significant impacts to geology are anticipated as a result of the TSP, while significant beneficial impacts to soils in the Eastern CMP are anticipated as a result of the removal of debris used as fill material. Substrate at the eastern CMP channel behind the sheet pile, would be left without garbage and thus under a suitable condition that would promote its colonization by sediment boring organisms and mangrove.
- No significant permanent adverse impact is anticipated to Essential Fish Habitats (EFH) or federally managed fishery species in the CMP and surrounding waters. Direct impacts to EFH would occur due to proposed dredging activities, and vertical steel sheet pile and concrete bulkhead walls installation. Temporary project construction losses of 34.46 acres of mangrove wetlands and 7.40 acres of open water would occur during construction. However, it would be compensated by restoring mangrove wetlands with greater functional value and, ultimately, a net increase in wetlands with respect to mangroves and open water habitat for fish and wildlife in the SJBE. The TSP would restore 34.48 acres of mangrove and 25.57 acres of open waters, for a net gain of 1.02 acres and 18.17 acres, respectively.
- There are no endangered or threatened species listed under the Endangered Species Act (ESA) in the Project area. However, 19 Federal listed species have been documented in the Study Area (4 species of flora and 15 species of fauna). The Puerto Rico Department of Natural and Environmental Resources (DNER) has designated other 9 species as threatened, endangered or critically endangered under the Regulation for Threatened and Endangered Species of the Commonwealth of Puerto Rico (Reg. 6766). Under current conditions, most mobile

species are not able to thrive in the eastern CMP. Once the connection is established by the Project, there is a potential for the San José Lagoon to be utilized as habitat by the West Indian Manatee (*Trichechus m. manatus*) which presently uses the SJB, and has been sighted in the western CMP and the Puerto Nuevo River. Available foraging habitat for listed species such as terns would be improved with the increase in open water habitat. During CMP dredging, monitoring for potential manatee occurrences would be implemented. In addition, during construction, bird species present in the project area may be impacted by the noise, odor, and exhaust from equipment.

- Dredging of sediments would result in short-term, localized deterioration of water quality. Best Management Practices (BMPs) (e.g. turbidity controls and monitoring) and construction of a weir at the western end of the project would minimize short-term and long-term erosion of the western half of the CMP by reducing sedimentation and water velocities that result in scour.
- Other temporary adverse effects include noise and vibrations during construction. Hydrogen sulfide may be emitted as the dredged material is removed. However, management measures would be implemented if needed.
- During construction, the channel section at the Ponce de León Avenue towards the western half of the CMP, would be closed to minimize the dispersion of contaminants, by placing a sheet pile in the eastern face, under the Martín Peña Bridge. An increase in flood risk at the CMP under a no storm surge scenario is another temporary adverse effect from "plugged" conditions that would be addressed by keeping close coordination with the adjacent community to establish local emergency management strategies.
- Socioeconomic adverse impacts would include the relocation of 335 housing units from the eastern CMP. Efforts would be made to relocate people to other areas within the same community. Some temporary disproportionate adverse effects would be felt by low income and minority communities during the construction phase, however final actions would have a significant positive outcome, improving their living conditions and their quality of life. Also, no disproportionate risks to children are anticipated under the TSP.
- The TSP would result in the direct and indirect creation of 4,275 construction jobs.

Cost of the Plan

The total estimated project first cost is $230,280,000, estimated at October 2014 price levels. Operations, Maintenance, Repair, Rehabilitation, and Replacement (OMRR&R) costs are estimated at $59,423,000 for a total estimated cost of $289,703,000. The cost share for the ecosystem restoration features of the project will be 65 percent Federal and 35 percent non-Federal. Recreational features would be cost shared at 50 percent Federal and 50 percent non-Federal. The Local Sponsor will be responsible for 100 percent costs of lands, easements, rights-of-way, relocations, and disposal areas (LERRDs), ecosystem restoration maintenance, and recreation OMRR&R. Thus, the Federal estimated cost share is $148,139,000 and the non-Federal cost share is $141,564,000.

Areas of Controversy and Unresolved Issues

Throughout the scoping process, some issues have been raised, which are addressed in the Draft Feasibility Report/Environmental Impact Statement (FR/EIS). The most important areas of concern are related to water quality, dredging, and disposal of dredged material, including potentially contaminated sediments. The public has also raised concerns regarding temporary impacts during construction such as noise, odors, vibrations and structure stability, and vectors. The draft EIS discusses recommendations to reduce these impacts.

Among unresolved issues are the sources of sand for capping of the disposal sites of the dredged sediments. Although several sources have been identified, ENLACE, the non-Federal Sponsor, is working on selecting the most economic and environmentally sound source of capping material. Proper coordination with infrastructure agencies were also raised and the possibility to find archeological material in the eastern CMP. This Draft EIS discusses recommendations to reduce these impacts. Furthermore, alternatives presented in the draft FR/EIS were discussed and analyzed with stakeholders.

Major Findings and Conclusions

The most significant adverse impacts of the CMP-ERP are temporary and are associated with the construction phase; namely, the erosion, and turbidity impacts of the dredging operation, and the management and disposal of the dredged material in the deep artificial pit of the San José Lagoon. There are standard management practices that significantly reduce these impacts, and which the current Federal and Commonwealth's regulatory framework thoroughly addresses.

Once the ERP is complete, the water residence time in the San José Lagoon would be reduced from approximately 17 days to less than 4 days. Increased flushing rates should also improve larval recruitment and survivability for many of the organisms that comprise the encrusting community of red mangrove prop roots, therefore increasing the health of that habitat, considered essential to fisheries.

A single species of mussel, *Mytilopsis domingensis* (false mussel), presently dominates the areal coverage of the mangrove roots throughout the San José Lagoon. Increased flushing is expected to result in a red mangrove prop root fouling community that would include multiple types of mollusks, as well as sponges, crabs, polycheate worms, and ascideans. Benthic communities in areas with a maximum depth of 4 to 6 feet are also expected to improve due to higher dissolved oxygen levels and water transparency, possibly allowing proper habitat conditions for the establishment of sea grass beds in some areas of the San José Lagoon.

An increase in tidal flushing would also cause the salinity and dissolved oxygen to increase in the surface layer of the CMP and the San José Lagoon. Both of these parameters have an adverse impact upon bacteria, thus reducing coliform bacteria concentrations and the potential health hazards due to direct or indirect contact with these waters.

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Abbreviations and Acronyms

ac	acres
adICPR	advanced Interconnected Pond Routing
ACGIH	American Conference on Governmental Industrial Hygienists
ACM	Articulated concrete mats
ALOHA	Areal Locations of Hazardous Atmospheres
ASTM	American Society for Testing Materials
ATSDR	Agency for Toxic Substances and Disease Registry
BACT	Best Available Control Technology
BDL	Below Detection Limit
BI	Benthic Index
BMP	Best Management Practice
C&D	Construction and demolition debris
CAA	Clean Air Act
CAD	Contained Aquatic Disposal
CBIA	Coastal Barrier Improvement Act
CBRA	Coastal Barrier Resources Act
CBRS	Coastal Barrier Resources System
CCMP	Comprehensive Conservation & Management Plan for the San Juan Bay Estuary
CDRC	Ciudad Deportiva Roberto Clemente
CE/ICA	Cost Effectiveness/Incremental Cost Analysis
CEM	Conceptual Ecological Model
CEQ	President's Council on Environmental Quality
CERCLA	Federal Comprehensive Environmental Response, Compensation and Liability Act
CERCLIS	Federal Comprehensive Environmental Response, Compensation and Liability Information System
CFMC	Caribbean Fisheries Management Council
CFR	*Code of Federal Regulations*
CMP	Caño Martín Peña
CO	Carbon monoxide
CO_2	Carbon dioxide
COC	Contaminants of Concern
CORRACT	Federal Corrective Actions List
CRIM	Municipal Tax Revenue Collection Center
CSD	Combined Sewer Discharge

CSO	Combined Sewer Overflow
CSS	Combined Sewer System
cy	cubic yards
CZMP	Coastal Zone Management Program
dB	decibel
dB(A)	A-weighted decibel
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
DNER	Puerto Rico Department of Natural and Environmental Resources
DMMP	Dredged Material Management Plan
DO	Dissolved oxygen
DTPW	Puerto Rico Department of Transportation and Public Works
E	East
EA	Environmental Assessment
ECC	ENLACE’s Community Committee
ECO-PCX	Ecosystem Restoration Planning Center of Expertise
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EO	Executive Order
EPG	Emergency Power Generator
ER ERDC	USACE’s Engineer Research and Development Center
ERM	Effective Range Median
ERNS	Federal Emergency Response Notification System
ERP	Ecosystem Restoration Project
ERPG	Emergency Response Planning Guidelines
ESA	Endangered Species Act
EUA	Ecological Uplift Assessment
FDA	Food and Drug Administration
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
FMP	Reef Fish Fishery Management Plan
FONSI	Finding of Non-Significant Impact
fps	feet per second
FR	Feasibility Report
FRM	Flood Risk Management

ft/s	feet per second
ft/y	feet per year
FWCA	Fish and Wildlife Coordination Act
FWPRA	Federal Water Project Recreation Act
g	grams
G-8	Group of the Eight Communities bordering the Caño Martín Peña
GHG	Greenhouse gas
GIS	Geographic Information System
H	Hybrid
H&H	Hydrology and Hydraulics
H_2S	Hydrogen sulfide
ha	hectare
HAP	Hazardous Air Pollutant
HAPC	Habitat Areas of Particular Concern
Hg	Mercury
HIA	Health Impact Assessment
HTRW	Hazardous, Toxic, and Radioactive Waste
HU	Habitat Unit
HW	Household Waste
HHW	Household Hazardous Waste
IA	Initial Assessment
in	inches
in/yr	inches per year
INCICO	Instituto de Ciencias para la Conservación de Puerto Rico
IPCC	Intergovernmental Panel on Climate Change
IPRC	Institute of Puerto Rican Culture
Kg	kilograms
kV	kilovolt
L_{10}	Noise value exceeded 10% of the time
L_{eq}	Equivalent (or average) noise level
LBC	Level Bottom Capping
LEERD	Lands, easements, rights-of-way, relocations, and disposal area
LLC	Los Corozos Lagoon
LMM	Luis Muñoz Marín
LSJ1	Water Quality Station San José Lagoon 1
LSJ2	Water Quality Station San José Lagoon 2
LUST	State Leaking Underground Storage Tank

m^3/d	Million cubic meters per day
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mg/mg^3	milligrams per cubic milligrams
mhw	mean high water
mi	miles
mi^2	square miles
mllw	mean lower low water
mlw	mean low water
mm/yr	millimeters per year
mph	miles per hour
MPRSA	Marine Protection, Research, and Sanctuaries Act
MTZ	Maritime Terrestrial Zone
msl	mean sea level
NAAQS	National Ambient Air Quality Standards
NE	North-East
NED	National Economic Development
NEP	USEPA's National Estuary Program
NEPA	National Environmental Policy Act
NER	National Ecosystem Restoration
NMFS	National Marine Fisheries Service
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides
NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NPL	National Priority List
NRC	Natural Research Council
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetland Inventory
O_3	Ozone
ODMDS	San Juan Bay Ocean Dredged Material Disposal Site
OGPe	Puerto Rico Permit Management Office (for its Spanish acronym)
O&M	Operation and Maintenance
OMRR&R	Operation and Maintenance, Repair, Replacement and Rehabilitation

OPA	Otherwise Protected Areas
OSHA	Occupational Health and Safety Administration
P&G	Principles and Guidelines
PAH	Polycyclic aromatic hydrocarbons
Pb	Lead
PCBs	Polychlorinated biphenyls
PDI	Comprehensive Development Plan for the Caño Martín Peña Special District (Plan de Desarrollo Integral y Uso de Terrenos para el Distrito de Planificación Especial del Caño Martín Peña)
PDT	Project Delivery Team
PED	Preconstruction Engineering and Design
PEL	Probable Effect Level
PL	Public Law
PM	Particulate Matter
$PM_{2.5}$	Particulate matter with an aerodynamic diameter less than or equal to a nominal 2.5 microns
PM_{10}	Particulate matter with an aerodynamic diameter less than or equal to a nominal 10 microns
ppm	parts per million
ppt	parts per thousand
PR	Puerto Rico
PRASA	Puerto Rico Aqueduct and Sewer Authority
PRCZMP	Puerto Rico Coastal Zone Management Program
PREPA	Puerto Rico Electric Power Authority
PREQB	Puerto Rico Environmental Quality Board
PRHTA	Puerto Rico Highway and Transportation Authority
PRPB	Puerto Rico Planning Board
PRWQSR	Puerto Rico Water Quality Standards Regulation
psu	Practical salinity unit
PUD	Permanent Upland Disposal
RCRA	Federal Resource Conservation and Recovery Act
REC	Recognized Environmental Conditions
RfC	Reference Concentration (for Chronic Inhalation Exposure)
ROD	Record of Decision
ROW	Right-of-Way
SGC	Subaqueous geotextile confinement
SHPO	State Historic Preservation Office
SHWS	State Hazardous Waste Sites

SIP	State Implementation Plan
SJ	San José
SJ1	Artificial Pit San José 1
SJ2	Artificial Pit San José 2
SJ3/4/5	Artificial Pit San José 3/4/5
SJB	San Juan Bay
SJBE	San Juan Bay Estuary
SJBEP	San Juan Bay Estuary Program
SJHP	San Juan Harbor Project
SJMA	San Juan Metropolitan Area
SLR	Sea Level Rise
SO_2	Sulfur dioxides
SO_x	Sulfur oxides
SQUIRT	Screening Quick Reference Tables
STAC	Scientific and Technical Advisory Committee
SV	Screening Value
SWMA	Puerto Rico Solid Waste Management Authority
T&E	Threatened and Endangered Species
TC	Technical Committee
TEL	Threshold Effect Level
TKN	Total Kjeldahl Nitrogen
TLV	Threshold Limit Value
TOC	Total Organic Carbon
tpy	tons per year
TSCA	Toxic Substances Control Act
TSD	RCRA Treatment, Storage, or Disposal List
TSP	Tentatively Selected Plan
TSS	Total Suspended Solids
µg/L	micrograms per liter
URA	Uniform Relocaton Assistance and Real Property Acquisition Act
U.S.	Unites States of America
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

VCS	State Voluntary Cleanup Sites
VOC	Volatile Organic Compounds
WES	Waterways Experiment Station
WRDA	Water Resources Development Act
yr	year
Zn	Zinc

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1.0 ACTION PURPOSE AND NEED

1.1 ACTION AUTHORIZATION

The Puerto Rico Department of Natural and Environmental Resources (DNER), custodian authority of the Maritime-Terrestrial Zone of the Caño Martín Peña (MTZ-CMP), and the USACE have performed preliminary technical analyses concerning the dredging of the CMP under a Support for Others Memorandum of Agreement dated March 3, 1996, and amended on May 24, 1999. This work concluded with the report “Dredging of Caño Martín Peña, Project Design Report and Environmental Impact Statement (EIS)” (USACE, March 2001).

After the Caño Martín Peña Ecosystem Restoration Project (CMP-ERP) was assigned to the Puerto Rico Highway and Transportation Authority (PRHTA), the USACE prepared the “Reconnaissance Report Section 905(b) Water Resources Development Act of 1986 (WRDA 86) Analysis, Caño Martín Peña, Puerto Rico Ecosystem Restoration.” This report was prepared under a Congressional Resolution by the Committee on Transportation and Infrastructure of the U.S. House of Representatives, Docket 2702, dated September 25, 2002, which reads as follows:

> *Resolved by the Committee on Transportation and Infrastructure of the United States House of Representatives, That the Secretary of the Army is requested to review the report of the Chief of Engineers on the Puerto Nuevo River, Puerto Rico, and other pertinent reports to include the dredging of Caño Martín Peña Project Design Report and Environmental Impact Statement, dated March 2001, to determine whether modifications to the recommendations contained therein are advisable at the present time in the interest of environmental restoration and protection and related purposes at the Martín Peña Canal, San Juan, Puerto Rico.*

The purpose of the reconnaissance study was to determine whether there was a Federal interest in the USACE participating in a cost shared feasibility phase study for ecosystem restoration and other related purposes along the CMP in San Juan, Puerto Rico. This Reconnaissance Report, which was completed in 2004, presented the results of studies for the CMP ecosystem restoration and concluded that there was a strong Federal interest in continuing the study into the feasibility phase. This conclusion was based on the likelihood that a Federal ecosystem restoration project would be environmentally and economically justified and implementable.

The 110th Congress enacted Public Law (PL) 110–114, known as the “Water Resources Development Act of 2007,” or WRDA 2007, on November 8, 2007. Section 5127 directed that:

> *The Secretary shall review a report prepared by the non-Federal interest concerning flood protection and environmental restoration for Caño Martín Peña, San Juan, Puerto Rico, and, if the Secretary determines that the report meets the evaluation and design standards of the*

> *Corps of Engineers and that the project is feasible, the Secretary may carry out the project at a total cost of 150,000,000.*

On October 27, 2008, the Director of Civil Works issued an implementation guidance memorandum for Section 5127 of the WRDA 2007, which established that the feasibility study "will follow the requirements set forth in Appendix H of Engineering Regulation (ER) 1105-2-100 for projects authorized without a report and be submitted for approval by the Assistant Secretary of the Army (Civil Works)."

As indicated above, the proposed CMP-ERP was authorized as a multipurpose Ecosystem Restoration and Flood Risk Management project. Prior to embarking on the Feasibility Report, an appraisal of potential Flood Risk Management (FRM) benefits was conducted for the proposed project. Initial analysis indicated that the FRM National Economic Development (NED) benefits would not be equivalent to those that would be generated from a National Ecosystem Restoration (NER) analysis. As a result, it was concluded that the project would be more aptly formulated as a single-purpose, Ecosystem Restoration project with incidental FRM benefits. A qualitative analysis has been conducted for FRM and those benefits are identified within the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (P&G) Four Accounts description and Recommended Plan sections of this Report. Federal recreation features have also been included in the CMP-ERP consistent with ER 105-2-100.

1.2 LOCATION OF ACTION

The CMP is a tidal channel 3.75 miles long in San Juan, Puerto Rico. It is part of the San Juan Bay Estuary (SJBE), found in the northern coast of Puerto Rico and the largest system of its kind in the Island. The SJBE is the only tropical estuary in the National Estuary Program and the only one found outside the continental Unites States and is located within the San Juan Metropolitan Area (SJMA), the most urbanized and densely populated region in Puerto Rico.

The SJBE is characterized by a network of lagoons, channels, man-made canals, a bay and wetlands permanently and seasonally flooded with woody and herbaceous plants. Associated marine ecosystems include those hard (e.g. coral and rock reefs) and soft (e.g. seagrass beds and sandy bottoms) substrates found north of the SJBE. These are influenced by the exchange of ocean waters and the discharges of waters exiting the estuarine system. The SJBE's network includes the San Juan Bay (SJB), the Condado Lagoon, the San José Lagoon, Los Corozos Lagoon, La Torrecilla Lagoon, and the Piñones Lagoon, as well as the interconnecting CMP and San Antonio Channels and the Suárez Canal. Estuarine waters are exchanged with those of the Atlantic Ocean through three openings or outlets in the SJBE: Boca del Morro at the SJB, El Boquerón at the Condado Lagoon, and Boca de Cangrejos at La Torrecilla Lagoon.

The SJBE's watershed includes parts of eight municipalities: Toa Baja, Cataño, Bayamón, San Juan, Guaynabo, Carolina, Loíza, and Trujillo Alto, covering an area of approximately 97 square miles (mi^2). Fresh water flows into the system from the creeks and rivers flowing mostly north from its watershed, which include the Puerto Nuevo River, Juan Méndez Creek, San Antón Creek, and the Blasina Creek. During medium to extreme flood events, fresh water is also received from the Río Grande de Loíza River. Several flood control pump stations and stormwater sewers also discharge into the system. The SJBE and its associated marine ecosystems are considered the "Study Area," since the proposed ERP is expected to have direct, indirect, and cumulative beneficial effects on this whole region (Figure 1-1).

The "Project Area" is where relocation, dredging, construction, and overall restoration activities would take place. It has been defined as: the eastern CMP, where dredging would take place; the adjacent delimitation of the public domain lands within the maritime terrestrial zone, where relocations are scheduled to occur; the San José Lagoon southeastern most artificial dredged pits, where dredged sediments would be disposed and turned into a Contained Aquatic Disposal (CAD) site, and the 6-acre Ciudad Deportiva Roberto Clemente (CDRC) dredged material staging area, where trash and debris would be transported to by barges in order to be handled and transferred by trucks for their final disposal at the Humacao Regional Landfill. Also included are the boating routes from the eastern CMP to the CDRC, through the San José Lagoon (Figure 1-2). The approximate distance between the Project's Area western and eastern limits is 6.27 km (3.90 miles), following the contours of the CMP. The approximate linear distance between these two points is 5.60 km (3.48 miles). The Project Area is divided between the Municipality of San Juan, to the West, and the Municipality of Carolina, to the East. The Project Area is found between latitudes 18.4463 N and 18.4134 S and longitudes -66.0079 E and -66.0603 W (WGS 1984 decimal degrees); Lambert Coordinates Easting (X): 244945.734 and 239404.699 Northing (Y): 267885.442 and 264256.914 (State Plane NAD 83).

Most of the detailed descriptions discussed in this Draft EIS are limited to the three distinctive areas where direct construction activities, and thus most expected impacts would take place: the eastern CMP, the San José CAD site and the CDRC. Detailed descriptions on the San José Lagoon and Los Corozos Lagoon (hereinafter, collectively referred to as "the San José Lagoon") are made in this Draft EIS. The San José Lagoon and the eastern CMP are the SBJE's water bodies that are expected to experience the most significant, quantifiable benefits from the proposed ERP, and thus, merit special attention.

Figure 1-1. CMP-ERP Study Area

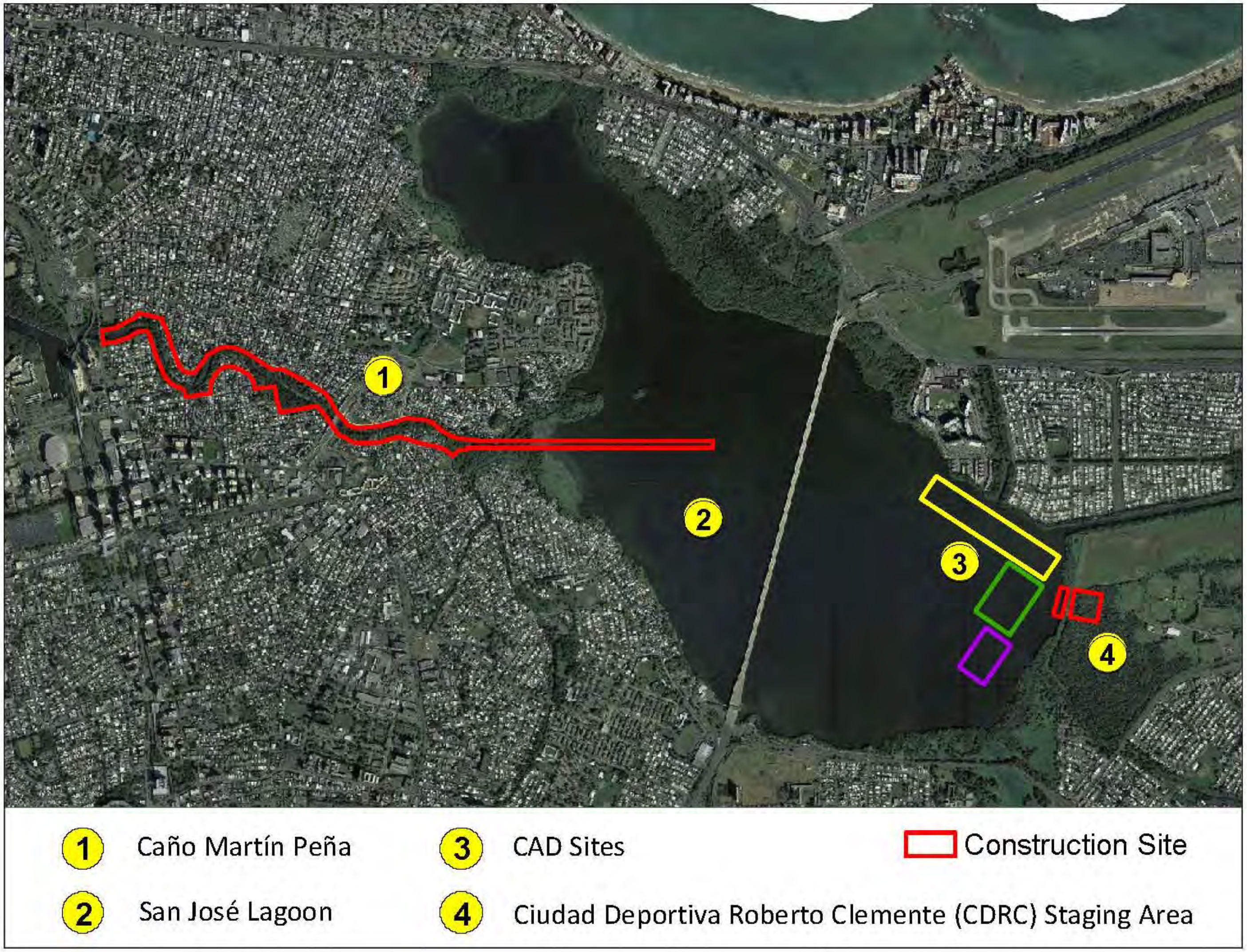

Figure 1-2. CMP-ERP Project Area

1.3 PURPOSE OF ACTION

The project has been formulated and evaluated as a single-purpose ecosystem restoration project for the environmental restoration of the CMP. The following objectives have been developed for the CMP-ERP.

- Improve fish habitat in the SJBE system by increasing connectivity and tidal access to estuarine areas.
- Restore benthic habitat in San José Lagoon by increasing dissolved oxygen in bottom waters and improving the salinity regime to levels that support native estuarine benthic species.
- Increase the distribution and population density and diversity of native fish and aquatic invertebrates in the mangrove community by improving hydrologic conditions in the SJBE.

Unless otherwise noted, the objectives are intended to begin being met immediately upon construction of the project and deliver ecosystem restoration benefits throughout the project's life. The timing and duration for the objectives would occur over the period of analysis, beginning at the end of project construction in year 2020 and continuing for 50 years.

1.4 HISTORICAL BACKGROUND

1.4.1 Caño Martín Peña

For centuries, the SJBE has been affected by dredging, channelization, the mining and placement of fill material, and sedimentation (SJBEP, 2000). The first known intervention in the CMP was made around year 1519 and consisted of a "paso," or causeway. "Pasos" were typically made by piling rocks or stones at the bottom of a shallow waterbody, hardening the soft sediments found at the bottom, reducing its depth to facilitate its crossing, while still allowing flow. This "paso" divided the channel nearly in half, and was located in the general area where various bridges have been built since 1579. The latest and still in use, the Ponce de León Bridge (Martín Peña Bridge), was built in 1939 (De Figueroa, 1519).

In 1776, Thomas O'Daly drafted a map of San Juan, which is one of the earliest and best detailed descriptions of most of the SJBE and adjacent uplands. This map shows the CMP fringed by mangrove forests next to a marsh of considerable size at its northwestern half, as well as a chain of haystack hills or "mogotes" in its northeastern side. The western half of the CMP is shown to have been between 10 and 14 feet in depth, while the eastern segment is shown with a depth varying between 5 and 10 feet. The San José Lagoon, named at that time as Laguna de Cangrejos, was fringed by mangroves, the biggest stand found to its north. Extensive marshes appeared to the northwest and southeast of the lagoon. The lagoon was depicted as not exceeding 9 feet in depth (O'Daly, 1776) (Figure 1-3).

Figure 1-3. Close up look of Study Area as depicted on map drafted in 1776 by Juan de Villalonga, Ramón de Villalonga and Thomas O'Daly (Sepúlveda, 1989).

By the time the O'Daly map was completed, many areas previously occupied by fresh water wetlands and marshes adjoining the SJBE had begun to be gradually converted into agricultural use. Urban development started to become an important factor in the transformation of uplands located north of the CMP. The area, known at that time as Cangrejos-Santurce, took in the population that could not be accommodated in the already densely populated area of the San Juan Islet (Sepúlveda & Carbonell, 1988).

In 1899, the United States government conducted an investigation on Puerto Rico's aquatic resources and fisheries, which included observations and field sampling work at the CMP (Evermann, 1900). The study's findings described the CMP as follows:

> *With the cutter, Messrs. Evermann, Moore, Marsh, and Wilson went to the head of the harbor, then up Martin Peña Inlet some 4 miles to beyond the railroad bridge and the military road. This inlet is from 30 to 150 ft wide, 2 to 10 ft deep, and extends through low-tide flats covered with a dense growth of low mangrove bushes. The water was more or less stained with vegetable juices and the bottom was usually of black mud or mixed mud and broken shells. The only fishes seen were a few young mullets. Beginning a few rods above the mouth of the inlet and continuing well toward the railroad bridge we found the mangrove stems thickly covered with the shells of the small native oyster (a form of Ostrea virginica). The majority of these shells were alive, though many, particularly those highest on the stems, were dead. On these stems we also found many small barnacles, an occasional Mytilus exustus, and groups of bryozoans, and among the stems were a good many small crabs and an occasional individual of a larger species with red back and white claws (Goniopsis cruentata).*

> *At one place on this inlet the low ground or mangrove swamp is quite narrow on the south side and a considerable hill of cherty limestone rises from near the water's edge. In this hill are three or four small caves in which a few bats were found, apparently all of one species, Artibeus perspicillatus.*
>
> *During the subsequent days spent at San Juan other trips were made up this inlet and the boat dredge was used at several places. The bottom, however, proved quite barren, and very little life of any kind was found. Fishes were extremely rare and mollusks and crustaceans were scarcely less so. Among the mangroves several specimens of water birds were seen, the kingfisher (Ceryle alcyon), brown pelican (Pelecanus fuscus), great blue heron (Ardea Herodias), little blue heron (Ardea caerulea), little green heron (Ardea virescens), a species of rail and a sandpiper. On the shore a number of land birds were seen, among them the American redstart (Setophaga ruticilla), a fly-catcher called pitirre by the natives (Tyrannus dominicensis), summer yellow-bird (Dendroica petechia ruficapilla), a vireo (Vireo calidris), and several others which we did not know and of which no specimens were obtained.*

In 1915, a third bridge was completed with a new railway servicing the steam train that circled Puerto Rico and ended in the port area of what is Old San Juan. It crossed the CMP west and next to the tram bridge that had been built in 1880, very close to the area where the Martín Peña Bridge is presently found (Morrison, 2012; Sepúlveda, 2003) (Figure 1-4). These structures signaled the beginning of profound changes in the surrounding mangrove and open water landscape of the CMP.

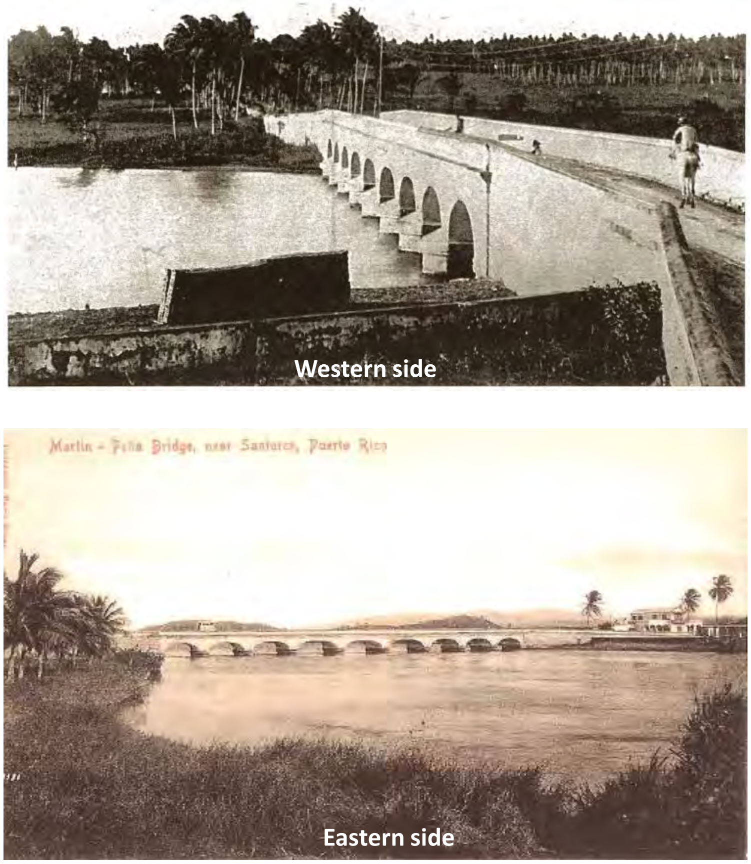

Figure 1-4. Photos of western and eastern sides of masonry bridge over the CMP (circa, 1890s)

1.4.1.1 Filling and settlements in the CMP

In the late 1910s and early 1920s, most mangroves associated to the SJB and the San Antonio Channel, especially those that used to be found where the Puerto Nuevo Port facilities stand today, were filled or used as disposal sites for the material dredged from the San Juan Harbor Project. The development of this port and storage facilities affected or eliminated more than 80 percent of the original mangrove acreage that was found in this area. In addition, the western half of the CMP was dredged and straightened to improve navigation between the SJB and the Hato Rey Ward.

During the 1920s, the government built 260 houses in Barrio Obrero, a workers' neighborhood, thus starting encroachment towards the mangrove forests at the northeastern area of the CMP, delimited by what today is the Rexach Avenue (Sepúlveda, 2003). In 1927, Puerto Rico's Legislature authorized the sale of mangrove lands, erroneously associated with the propagation of malaria mosquitos, with the condition that these were drained and filled. This action officially allowed the extensive filling process that took place in the mangroves and open waters of the CMP during the following decades (Legislatura de Puerto Rico, 1927).

Hurricanes San Felipe and San Ciprián, two of the worst in Puerto Rico's recent history, destroyed agricultural production and left thousands of people homeless in 1927 and 1932, respectively. These events, compounded by the later downfall of the sugar cane industry, force thousands of people from rural communities to flee and migrate to San Juan in search of a living. Many of these migrants informally settled around the CMP by building their homes on stilts, and afterwards, by depositing vegetative material, garbage, and debris into the swampland until it became firm enough to support the makeshift homes they built from salvaged wood and corrugated tin.

An aerial photograph of 1936 shows a 200- to 400-foot-wide natural channel in the eastern half of the CMP, as well as the first settlements in the area (USACE, 2004) (Figure 1-5). Mangrove forests immediately east of the Ponce de León Avenue and south of the CMP were eliminated to build houses, in what is known today as the Parada 27 neighborhood. The same can be observed in the mangroves north of the channel, east of the Ponce de León Avenue, in what are today the Barrio Obrero-Marina neighborhood and the western half of the Buena Vista-Santurce neighborhood. By the end of the 1930s, the limestone hills or "mogotes", found at both shorelines of the CMP and east of the Barbosa Avenue Bridge, began to be mined for producing construction aggregates and as a source of material to fill the adjoining mangroves. By 1948, informal settlements replaced all of the mangrove swamps along the north shore of the CMP and on the eastern half of its southern shore.

The western half of the CMP experienced the same process, especially in its northern shorelines. By the mid-1940s, all of the mangroves in this area were filled for the construction of housing in what would be called the Buenos Aires and Marruecos neighborhoods.

Most, if not all of the housing on former mangrove forests was built without basic utilities such as a sanitary sewer system, resulting in discharges of untreated sewage directly into the CMP, or indirectly, as in the case of older dwellings built on uplands, through the combined storm and sewer system that serviced the Santurce-Cangrejos area, north of the CMP. These communities lacked proper access to other public services, such as garbage collection. Residents disposed of their refuse in the channel or used it as fill material to expand their properties (SJBEP, 2000). Eventually, the Municipality of San Juan contributed to the process with fill material and built a storm sewer system in the communities at the eastern half of the CMP.

During the 1950s, the Municipality of San Juan, with federal assistance, implemented urban renewal policies and initiated an intense eviction project to eliminate all the neighborhoods established over mangroves on the north shore of the western CMP. The project displaced thousands of residents to public housing projects. Displacement policies continued through the early 1980s with the use of eminent domain in the Tokyo community of Hato Rey.

Between 1984 and 1988, the AcuaExpreso ferry mass transit project (originally known as "Agua-Guagua") was developed with federal assistance, and inaugurated in March 1991. As part of this project, the western half of the CMP was dredged and bulkheaded with a 10-foot-deep by 200-foot-wide channel to allow navigation by ferryboats (Fagerburg, T. L., 1998). The Enrique Martí Coll Linear Park was built on top of the bulkhead. Between the late 1990s and the early 2000s, a new bridge for the Tren Urbano rail system was built over the western CMP, between the Muñoz Rivera Avenue and the Ponce de León Aveenue bridges.

Most of the area formerly occupied by the displaced communities along the western CMP was eventually redeveloped with parks, government facilities, a sports complex, the José Miguel Agrelot Puerto Rico Arena and numerous residential and commercial structures. Most housing units targeted mid to high-income families (Figure 1-5).

Several maintenance dredging works have been conducted in the western CMP during the 1990s and 2000s. Mangroves have reestablished along both shorelines of this western segment of the CMP, the biggest stands found in its southern banks. Flow and water quality have also slightly improved in that segment (USACE, 2004). To protect this area from further urban encroachment, it was designated in 2003 as a Natural Reserve.

In contrast, in 2004 the eastern segment of the CMP was described as follows:

> *A 1962 aerial photograph of the eastern half of the CMP shows a reduced canal width, no more than 200 ft, with dense urban development all the way to the edge of both banks. A 2000 aerial photograph shows, in the remaining 2.2 miles of unimproved eastern segment of the channel a minimum canal width near the bridges, a very dense urban development all the way, and a completely filled up canal, which is impeding water flow between the San José Lagoon and the San Juan Bay.*

Today, the canal's ability to convey flows has been almost completely blocked as a result of siltation, trash and debris accumulation, and structure encroachments along the eastern segment. Recent subsurface investigations in the canal and both banks along the eastern half of Caño Martín Peña found trash and debris up to 9 ft below the surface. As a result of the progressive clogging, there is very little tidal exchange between the San José Lagoon and the San Juan Bay and the water quality is very poor (USACE, 2004).

Source: ENLACE & Puerto Rico Planning

Figure 1-5. Historic and recent conditions of the CMP

The eight communities located at the eastern half of the CMP still remain. The lack of adequate infrastructure, including absence of sanitary sewers, storm sewers full of sediments and debris, narrow streets and alleys, poor quality of public spaces and few water dependent recreation opportunities, as well as inadequate housing, characterize large areas of these communities.

The unsanitary and unsafe conditions experienced by the inhabitants of the eight communities living near the eastern CMP have prompted a concerted effort to restore its ecological functions and values. In 2001, the eight communities adjacent to the CMP created the G-8, Inc., a grassroots nonprofit organization, while the ENLACE Project flourished as an entity that brings together the community, the private sector and the government around the CMP-ERP, among other environmental justice and comprehensive development initiatives according to PR Law 489-2004. The CMP Land Trust was created under this law as an innovative land titling initiative, intimately related to the new regularization approach and the maritime terrestrial zone (public domain lands) adjacent to the CMP were also delimited by the DNER.

These initiatives have resulted in the relocation of 500 families that lived along the eastern CMP shoreline, the construction of new sewer systems for the Barrio Obrero Marina and the Cantera Peninsula neighborhoods, the creation of recycling microbusinesses, an environmental awareness program, and several debris clean-up activities, among others. In 2007, a new bridge at Barbosa Avenue was built with much higher clearance over the eastern CMP than the previous one to allow for the navigation of barges and other machinery needed as part of the CMP-ERP.

1.4.2 San José Lagoon

Many of the negative alterations affecting the CMP have also been made to the San José Lagoon, significantly reducing the ecological health of this section of the SJBE, and the system as a whole. One of the most significant impacts has been the dredging of about 17 percent of the San José Lagoon, increasing its original volume by about 30 percent (Ellis, 1976). The San José Lagoon, which had a natural average depth of 6 feet, not exceeding 8.2 feet, began to be dredged as a source of sand and fill material by the late 1950s (Ellis, 1976; Conde-Costas, 1987). During the 1960s, the eastern part of the lagoon was dredged to as much as 35 feet in depth (Conde-Costas, 1987) to obtain fill material for the area north of the San Antón Creek and for the site where the Laguna Gardens high rise residential complex was later built (Ellis, 1976). The area north of the San José Lagoon, north of the Cantera Península, was also dredged for fill material to depths ranging from 20 to 25 feet (Conde-Costas, 1987). The dredged material was used to fill the construction site for Las Margaritas Public Housing Project (Ellis, 1976). All of these dredging works resulted in the creation of seven artificial depressions in the Lagoon.

Dense salt or brackish water entering the San José Lagoon flows underneath the fresh water discharged by streams and storm water pumping stations. In deep areas of the lagoon, tidal currents and wind action are often not sufficient to produce mixing between these two water masses and the water stratifies (Ellis, 1976). Once this stratification occurs, oxygen exchange between the surface and the bottom is not possible, which impairs water quality and living resources. Anaerobic or oxygen-depleted zones trap nutrients and, through various chemical reactions, also become a source of more nutrients. Excess nutrient loading from this and other sources leads to the formation of a dense algae population. Although these populations produce oxygen during daylight, at night they consume oxygen, further decreasing the ability of the lagoon to sustain life. The nutrients accumulating in these pits produces eventual algae blooms, which are suspected to be the main cause for the occasional overnight fish kills in the San José Lagoon (SJBEP, 2000).

Increased sediment runoff and nutrient inputs, especially from direct and indirect sewage discharges coming from the CMP have, in turn, increased water turbidity to the extent that benthic primary production is no longer possible in many locations of these lagoons and the channel itself. Water quality is extremely poor in many areas of this waterbody due to eutrophication and fecal coliform bacteria contamination. Solid waste management is still a problem within the CMP as a result of inadequate disposal and waste collection.

All these water quality impairments in the San José Lagoon have been compounded by very limited water exchange with the ocean. The dredging works in the Suárez Canal during the 1960s helped increased tidal influence in this lagoon. However, any effects which those works had were offset by the dredged pits made about the same time in the San José Lagoons and in the Suárez Canal itself. As previously stated, the dredged pits increased the original volume of the San José Lagoon by more than 30 percent, increasing as well the time it takes to renew their waters. This condition has worsen even further due to the filling and accumulation of debris in the eastern CMP during the last decades, blocking and eliminating the lagoon's natural connection with the ocean through the channel and the SJB. Fish and wildlife habitat loss and degradation have been especially pervasive in this section of the SJBE, as a result of these impacts (SJBEP, 2000).

The filling of those areas surrounding the San José Lagoon has also changed its mangrove coverage. The San José Lagoon, with the exception of its northern shorelines, is either denuded or has a narrow strip of mangroves. In 1994, the Teodoro Moscoso Bridge was inaugurated, crossing the San José Lagoon from north to south. A small island or mudflat was created close and northeast of the bridge's toll station, as mitigation for the unauthorized disposal of debris into the lagoon during the bridge's construction. The mitigation project did not succeed since wind and the lagoon's currents rapidly eroded the mudflat.

At present, the CMP has little to no apparent ability to convey flows into and out of San José Lagoon, as it has been nearly completely blocked. Clogging of the CMP has resulted in little to no tidal exchange between SJB, located west of the CMP, and the San José Lagoon (Bunch et al., 2000; Cerco et al., 2003; USACE, 2004).

1.5 CONTEXT

For more than 50 years, different Commonwealth and Federal government administrations have discussed the need to dredge and channel the eastern portion of the CMP in order to achieve the ecological restoration of the water bodies that make up the SJBE system, as well as to improve the socioeconomic and living conditions of the communities adjacent to the CMP.

The SJBE system has provided valuable resources to the residents and visitors of the SJMA for centuries. It is an irreplaceable natural, recreational, and economic resource. More than a million people live within the SJBE drainage basin, in eight of the most populated municipalities of Puerto Rico. Population density within the Municipality of San Juan is 7,968 inhabitants per square mile (PRCS, 2012). The SJBE's land surface is dominated by an urban and constructed cover (80%), 11 percent is surface water, and 8 percent is forests, wetlands, and green areas. Despite this low percent of natural land cover, one third of Puerto Rico's remaining mangrove forests lie within the SJBE.

The System comprise critical infrastructure that is essential to the Island's economy. The SJB has one of busiest container ports on the east coast of the United States and one of the largest port facilities in the Caribbean. More than 80 percent of all imported materials entering Puerto Rico are transported through the SJB. This Bay is also the port-of-call of dozens of cruise ships lines, receiving more than 1.2 million of their passengers per year. Moreover, the Luis Muñoz Marín International Airport is the main gate to and from Puerto Rico and other Caribbean islands, with over 8 million passenger loadings per year. The natural beauty and ecological diversity of the SJBE also support tourism and water-based recreational activities, which generate significant revenue (SJBEP, 2000).

Notwithstanding, urban growth resulted in the exploitation, degradation, and destruction of many of this estuary's ecosystems, functional values, and natural services. The main impacts to the SJBE system include a lack of flushing capacity, uncontrolled urban expansion, water pollution, illegal sewage discharges, and aquatic debris, among many others. These are all direct results of past human settlements and uses and of the need to increase public awareness, education, and involvement (SJBEP, 2000).

1.5.1 San Juan Bay Estuary System

Recognizing the continued threats facing the SJBE system, the Governor of Puerto Rico nominated it for the USEPA's National Estuary Program (NEP) on April 16, 1992. The NEP is a place-based program established under Section 320 of the 1987 Clean Water Act Amendments, addressing the need to protect and restore the water quality and ecological integrity of 28 estuaries across the United States. With inclusion in the NEP, the SJBE was designated as an "estuary of national significance" (SJBEP, 2000).

The SJBE system is unique when compared to other NEP in the United States. It is the only program located in a tropical geographic region and outside the main continental area. Its tropical nature is evidenced by the diversity of habitats and species within the estuary, with over 160 species of birds, 19 reptiles/amphibians, and 300 wetland plant species, including endangered, threatened, endemic, and rare species. Its multiple openings increase the influences on and from nearby coastal zones (SJBEP, 2000).

On August 2000, the San Juan Bay Estuary Program (SJBEP) completed the Comprehensive Conservation and Management Plan (CCMP) for the SJBE. The SJBE's CCMP is a long -term plan containing 49 specific targeted actions designed to address: (1) water and sediment quality; (2) habitat, fish, and wildlife; (3) aquatic debris; and (4) public education and involvement solutions to the estuary's priority environmental problems. Six actions related to water and sediment quality improvements were identified as high priority or "urgent", as they "deserve immediate attention and should be initiated as soon as possible or within 0 to 5 years after CCMP's approval" (CCMP, 2000). Three are directly related to the CMP-ERP:

Action WS-2: Relocate families living adjacent to the CMP

Action WS-5: Improve flow in the CMP

Action WS-6: Fill artificial depressions at the Suárez Canal and at the San José, and La Torrecilla lagoons.

1.5.2 Caño Martín Peña Special District

On 2002, the Puerto Rico Planning Board (PRPB) created the CMP Special District (District) and later, in 2006, approved the District's Land Use and Comprehensive Development Plan (District's Plan). ENLACE, the non-Federal Sponsor, is responsible for the District's Plan implementation, which includes the following seven communities: (1) Barrio Obrero (West and San Ciprián), (2) Barrio Obrero-Marina, (3) Buena Vista- Santurce, (4) Parada 27, (5) Las Monjas, (6) Buena Vista-Hato Rey, and (7) Israel- Bitumul (see Figure 1-6).

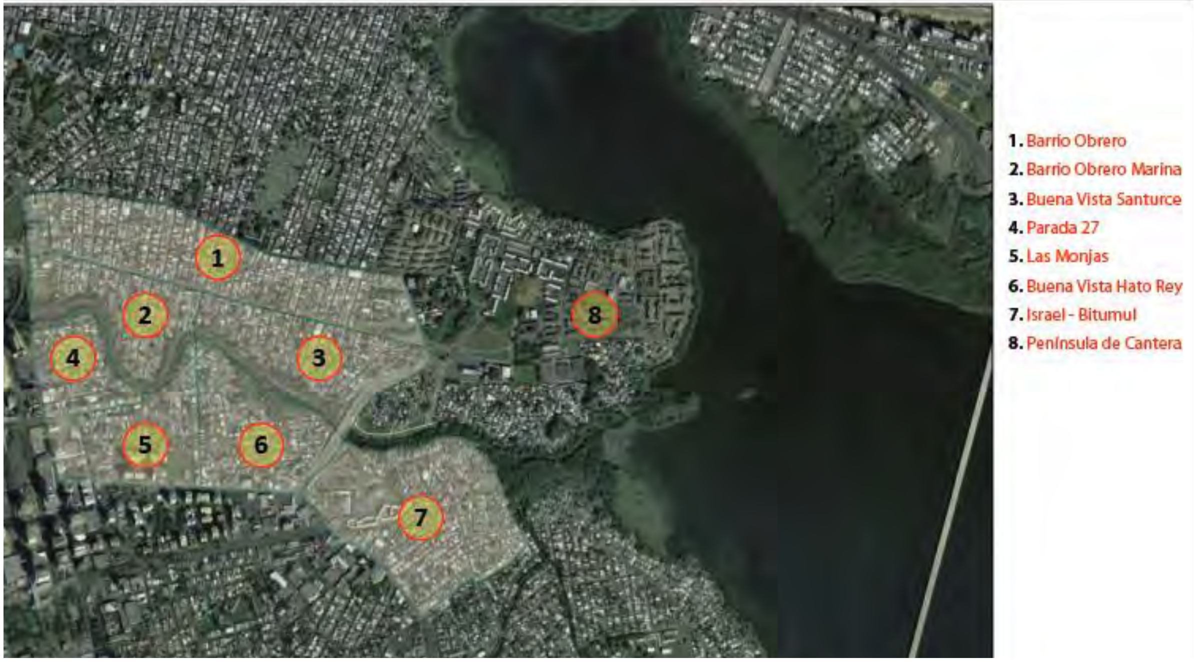

Figure 1-6. Location of each of the communities adjacent to the eastern CMP (Shaded communities are part of the District)

Due to previously established public policies, the community of Península de Cantera is not part of the District. Notwithstanding, Península de Cantera participates through the G8[1] and benefits from the implementation of the District's Plan. It is in charge, however, of implementing its own Comprehensive Development Plan as well as relocating many of the families in the community, as part of the CMP-ERP.

The District's Plan, which is backed by Puerto Rico Law No. 489-2004, focuses its vision, goals, and policies on four principal areas: (1) environment, (2) socioeconomic development, (3) institutional capacities, and (4) mobility, transportation, and tourism development. The CMP-ERP addresses the District's Plan issues pertaining to environmental improvements, specifically the CMP's dredging, channelization, and ecosystem restoration. The CMP-ERP is only one of the principal elements of the Plan's strategies, which also integrate the design and implementation of a number of environmental, infrastructure, housing development, family relocation, urban revitalization, land tenure, and socioeconomic development strategies before, during, and after the channel's dredging and restoration phase.

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[1] The G8 is the organization comprising the eight communities adjacent to the CMP: (1) Barrio Obrero (West and San Ciprián), (2) Barrio Obrero-Marina, (3) Buena Vista- Santurce, (4) Parada 27, (5) Las Monjas, (6) Buena Vista-Hato Rey, (7) Israel- Bitumul, and (8) Península de Cantera.

1.6 NEED

Ecological restoration of the eastern CMP is needed to increase its flow conveyance, in order to induce and facilitate water exchange in the San José Lagoon, and thus restoring hydraulic connectivity, as well as improving natural habitat conditions in the SJBE. As previously described, the eastern CMP has little to no apparent ability to convey tidal and other flows into and out of the San José Lagoon. This current hydrological and hydraulic state of the CMP has resulted in the following hardships:

- Water quality degradation;
- Natural habitat degradation; and
- Ongoing health and flood risks to the adjacent communities.

Those areas that used to be open water in the eastern CMP closer to the San José Lagoon are currently transitioning into emergent wetlands and uplands, as water hyacinths give way to other aquatic weeds and more terrestrial species. The water quality within the eastern CMP and its adjacent water bodies has been repeatedly shown to be very poor as a result of the channel's reduced flushing capacity, the loads of untreated sanitary discharges, and stormwater runoff received daily (Kennedy et al., 1996; Webb and Gómez-Gómez, 1998; SJBEP, 2000; Otero, 2002; EQB, 2008). Due to the channel's decreased flushing and deteriorated water quality, the existing natural habitat associated to wetlands, forests, and benthos is also significantly degraded.

The Commonwealth of Puerto Rico has invested and will continue to invest a considerable amount of public funds in solving the many housing, infrastructure, and social problems affecting the eastern CMP and its surrounding communities. Notwithstanding, without the collaboration of Federal assistance for this ERP, it is expected that the CMP and the SJBE system will continue to deteriorate. The lack of action would ultimately lead to a complete blockage of the channel and the segregation of this estuary of national importance. As a direct result, increased degradation to water quality and fish and wildlife habitats will continue to occur throughout this segment of the SJBE, and eventually, to the rest of the estuarine system. Area inhabitants will continue to experience social stresses associated with substandard living conditions, deteriorated air and water quality, frequent flooding events, and associated public health hazards.

The CMP-ERP represents a unique ecosystem restoration opportunity. Its dredging would remove most sediment deposited along the eastern CMP and would induce circulation of ocean water across the estuary. It will significantly enhance water quality and fish and wildlife habitats in the SJBE system. The proposed restoration may also create new recreation, navigation, and tourism opportunities for the SJMA and Puerto Rico.

1.7 RELATED ENVIRONMENTAL DOCUMENTS

This Draft EIS is the most significant and recent planning effort towards the restoration of the ecological functions and values of the SJBE system through improvements in its water and habitat quality. The CMP-ERP has a history of related environmental documentation that served as guidance and reference in the development and analysis of this Draft EIS. The following documents were used as the principal sources of information:

Hydrodynamic and Water Quality Model Study of San Juan Bay Estuary (2000). A hydrodynamic and water quality model study of SJBE for use in determining effective alternatives for water quality improvement and predicting the impacts of future development, was conducted by the U.S. Army Engineer Research and Development Center in Vicksburg, MS, from January 1996 through May 1999. Management alternatives considered included methods to increase system flushing and reduce pollutant loadings. Ten sets of simulations were run to assess the impact that proposed remediation management strategies would have upon water quality. Scenario 1a was a base condition (including approved maintenance dredging of the San Juan Harbor navigational channels and flood control channel dredging for the Puerto Nuevo River) against which the other nine would be judged. Scenario 1b involved dredging the eastern CMP to 50 feet wide and 3 feet deep; scenario 1c consisted of widening the eastern CMP to 150 feet and to a depth of 9 feet below the water surface. Scenario 2 simulated filling all San José Lagoon artificial dredge pits down to a depth of 6 feet below the water surface. Scenario 3 consisted of removing the constriction at the Ramón Baldorioty de Castro Expressway Bridge on the Suárez Canal by widening to 100 feet and deepening to 12 feet below the water surface. Scenario 4 simulated the same conditions as in Scenario 3, plus the installation of a tide gate. Scenario 5a included the removal of unsewered loadings into the CMP. Scenario 5b simulated loading reductions into the San José Lagoon by removing discharges from the Baldorioty de Castro pump station. Scenario 6a combined scenarios 1c, 5a and 5b. Scenario 6b combined scenario 6a plus scenario 2. Scenario 6b, involving dredging the Eastern CMP to 150 feet wide and 9 feet deep, among other improvements, was determined to be the most cost-effective alternative for improving water and sediment quality in the SJBE (Villanueva, E., et al., 2000; Bunch, Cerco, Dortch, Johnson, and Kim, 2000).

Dredging of Caño Martín Peña, Project Design Report and Environmental Impact Statement (2001). This report and EIS was prepared by USACE's Planning Division (Jacksonville District) under the Support for Others Program, at the request of the DNER. All alternatives proposed dredging the existing CMP following its current alignment, beginning at the San José Lagoon and extending for about 11,600 feet to end west of the Luis Muñoz Rivera Aveenue Bridge. USACE's 2001 Design Report also evaluated three alternatives for the disposal of CMP's dredged material, which included: ocean disposal, land disposal, and in-bay disposal. The study recommended in-bay disposal to be used to fill two of the largest artificial deep holes/pits located at San José Lagoon. In 2002, the USACE further evaluated the in-bay disposal alternative through the CAD design study developed by the Engineer Research and Development Center (ERDC).

Draft Environmental Site Assessment, Phase I, Martin Peña Channel Rehabilitation (2002). Prepared by the PRHTA to comply with Puerto Rico's Environmental Public Policy Act.

Design of Contained Aquatic Disposal (CAD) Pits for Martín Peña Canal, San Juan, Puerto Rico (2002). Described the results of a design for a constructed CAD pit as a dredged material disposal option in the San José Lagoon. The study was conducted by the Environmental Laboratory of the USACE ERDC, Waterways Experiment Station (WES), Jacksonville District.

Draft Environmental Impact Statement (2003). Prepared by the ENLACE Project and the PRHTA to comply with Puerto Rico's Environmental Public Policy Act.

Reconnaissance Report, Section 905(b) (WRDA 86) Analysis, Caño Martín Peña Ecosystem Restoration (2004). The USACE prepared this report to demonstrate its interest in actively participating in the cost shared feasibility phase study for the CMP. The report evaluates the ERP based on previous studies and determined potential costs associated to its implementation, which would serve for planning purposes.

Feasibility Report for the CMP Ecosystem Restoration (2014, in progress). As part of the development of this Draft EIS, a Feasibility Report (FR) was developed concurrently. The purpose of the FR is to evaluate the economic feasibility of the CMP-ERP and to support funding requests to the United States Congress for the project's implementation.

Technical Reports. In addition, over 30 technical reports were elaborated to build the baseline and comparative data and information required for the Draft EIS's analysis. The most relevant of these technical reports are included as Appendices or are referenced in the corresponding text. The following list provides an overview of some of the most relevant technical reports which supported the development of this Draft EIS:

- Existing Wildlife Habitat Technical Memorandum
- Essential Fish Habitat Assessment
- Sports Fisheries Studies Technical Memorandum
- Ecosystem Benefits Evaluation / Estimate of Ecosystem Habitat Units
- Water and Sediment Quality Studies Technical Memorandum
- Hydrodynamic-Water Quality Modeling Efforts Technical Memorandum
- Hazardous, Toxic, and Radioactive Waste Assessment Documentation
- Geotechnical Studies
- Dredged Material Management Plan
- Recreation Resources Assessment
- Aesthetic Studies and Resource Assessment

- Cultural and Historic Resource Study
- Air Quality Study
- Reconnaissance Report – Finca La Marina and the Suárez Canal Dredge Pit Restoration

1.8 DECISIONS TO BE MADE

At this stage, it is been proposed to encapsulate the dredged sediments for CAD disposal in geotextile bags, which would reduce dramatically the exposure of the sediment to the surrounding waters; therefore, it is highly unlikely that the porewater concentrations for the constituents of concern exceed relevant criteria. Testing results, would inform the specific methods and materials to be used which may confirm the need to use the proposed geotextiles, type of geotextile pore size and continued need for capping, in order to select the most appropriate method for disposal and containment at the PED stage.

Selecting the source of the capping material is another decision to be made. Although quarry sand has been identified as a potential source, other alternatives are being evaluated as an acceptable source for the sand cap, such as dredged sediments from the San José Lagoon and recycled glass. These analyisis would be developed in further detail in future stages of the planning process. A brief alternatives' analysis of dredge material capping sources is provided in Chapter 2. Notwithstanding, a more in-depth alternatives and impacts analysis for the dredge material capping source should be established.

Decisions to be made may also include the barge navigation route that would be used to transport the dredged sediments and debris through the San José Lagoon for final disposal.

2.0 ALTERNATIVES

The USACE and the non-Federal Sponsor (ENLACE) are proposing the environmental restoration for the Caño Martín Peña. The proposed action would address the water quality and habitat improvements directly related to the CMP and the San José Lagoon by restoring hydraulic connectivity between these two waterbodies. For the CMP-ERP to meet this specific goal, the following conditions must take place, regardless of the selected alternative:

- The widening and dredging of the eastern segment of the CMP to reestablish the tidal flow and circulation in the CMP and its connectivity between the SJB and the San José Lagoon;
- The improvement and/or construction of adequate sanitary sewer and stormwater systems to areas with deficient or non-existing services to eliminate discharges of untreated sewage directly into the CMP;
- The increase in mangrove coverage in the SJBE water bodies to create and enhance fish and wildlife habitat in the CMP and the SJBE, through an ecosystem restoration process that promotes a healthy benthic community in the San José Lagoon as well as mangrove growth within the margins of the CMP.

A Project Delivery Team (PDT) consisting of the non-Federal Sponsor (ENLACE), USACE, and consultant personnel was assembled to conduct the USACE six step planning process. ENLACE convened a Technical Committee (TC) comprised by Federal and Commonwealth natural resources agencies to assist them with conducting the Draft integrated FR/EIS as part of the public engagement process. The plan formulation process for the CMP-ERP builds directly on these previous planning and design efforts:

- SJBEP Comprehensive Conservation and Management Plan for the SJBE (2000)
- USACE Dredging of Caño Martín Peña, Project Design Report and Environmental Impact Statement, Jacksonville District (2001)
- USACE Reconnaissance Report Section 905(b) Analysis, Caño Martín Peña, Puerto Rico Ecosystem Restoration (2004)
- PRHTA Comprehensive Development and Land Use Plan for the Caño Martín Peña Special District (2004)

The PDT defined the ecological problems and restoration opportunities in the Project Area, inventoried the existing conditions, and forecasted future conditions that would take place without any Federal action. This information was used to develop problem, opportunity, constraint statements and planning objectives. A performance measure was identified for each objective as a mean to evaluate plan effectiveness and compare plan alternatives.

Once the PDT established the set of viable management measures, four alternative plans were formulated, including the No-Action Alternative. These plans were described and analyzed in detail and compared against each other to gauge effectiveness in meeting the various objectives of the planning process. The PDT developed these alternatives and selected a preferred one to present to the public as the Tentatively Selected Plan (TSP). The remainder of this section provides greater detail on the process conducted to reach this conclusion. If, after public scrutiny, the TSP is still deemed as the plan that best meets the planning objectives, then it would be designated as the National Ecosystem Restoration (NER) Plan recommended by the PDT.

2.1 MANAGEMENT MEASURES

Management measures were initially developed and screened to address the CMP-ERP's planning objectives. These can be a feature (a structural element) or an activity (a nonstructural action) that can stand alone or be combined with other management measures to form alternative plans. These measures were derived from a variety of sources including prior studies, the NEPA public scoping process (further detailed in Chapter 6 of this document), and the TC. For the CMP_ERP, four categories of management measures were created: Channel Dredging, Beneficial Use of Dredged Material, Mangrove Planting Bed Construction and Non-Structural Measures.

2.1.1 Channel Dredging

In order to increase the connectivity and tidal access within the SJBE and also restore benthic habitat and the mangrove root community, a connection must be re-established between SJB and the San José Lagoon. The construction of a new channel outside of the historic alignment is not feasible due to the high density of housing in the area and topography (higher elevations), so dredging of the existing channel of the CMP would be a necessary feature for any structural alternative that is formulated.

Two types of channel cross sections were considered for the Project Channel, an hybrid design and a rectangular cross-section. The hybrid design would require a sloped bank in the Project Channel, which is not feasible because of the potential to affect Project's performance. While a rectangular channel with steel sheet pile was the selected structural treatment for the vertical edge to prevent erosion. Channel configuration alternatives are discussed in section 2.3.

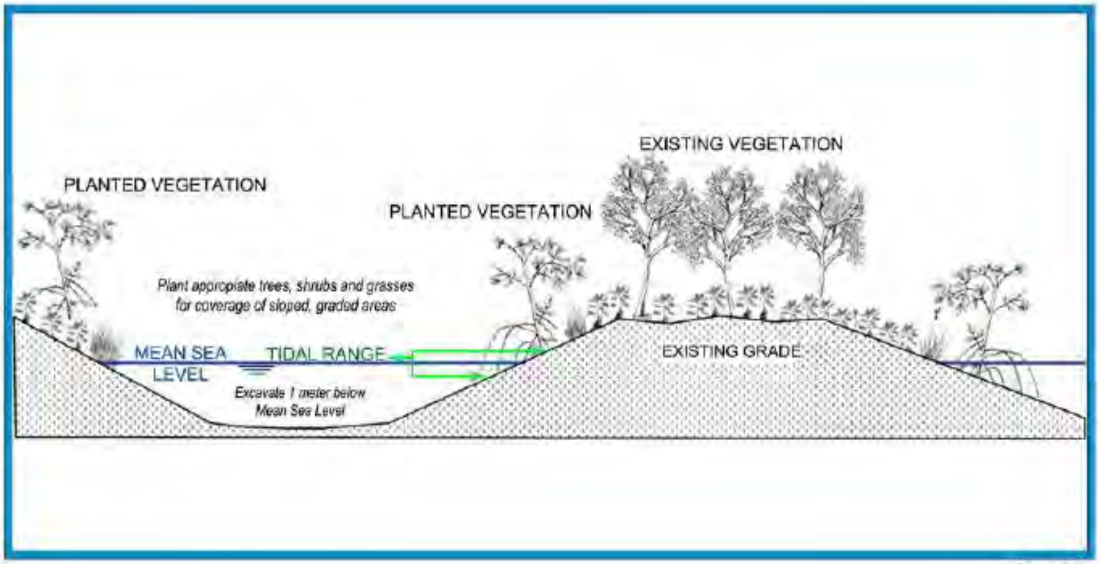
2.1.2 Beneficial Use of Dredged Material

Several possibilities were considered for this measure: expanding existing islands/habitat, constructing new diked or undiked islands, and constructing new marsh areas. These sites would be completely exposed to weather events, and given the high likelihood of experiencing future tropical events, there could be a significant risk of containment failure. As a result, all of these measures were eliminated from further consideration due to possible environmental impacts and acting conversely to project objectives.

Given this situation, dredged material disposal options were developed and screened in order to determine the preferred dredged material disposal site for all channel configuration alternatives, as further discussed in section 2.2.5.

2.1.3 Mangrove Planting Bed Construction

Dredging would affect existing mangrove wetlands, albeit of extremely low functional quality, within the construction area. Mangrove wetlands could be re-established in areas along a dredged canal. The north and south slopes of the channel above the sheet pile would be graded to receive tidal influence and then planted with appropriate mangrove species: *Rhizophora mangle* (red mangrove), *Avicennia germinans* (black mangrove), *Laguncularia racemosa* (white mangrove), and the associated species *Conocarpus erectus* (buttonwood). Microtopography would be added to diversify habitat (see Figure 2-1).



Source: Atkins

Figure 2-1. Conceptual mangrove restoration microtopography for the CMP

The flow of water from the channel to the mangrove planting beds would be facilitated by building hydraulic connections, or windows, in the bulkhead at regular intervals. The sill depth of the window would be set at mean low water so that tidal exchanges are facilitated to the mangrove beds. The width of the planting beds would vary depending upon the land availability, but in general would extend from the channel wall to the line of public domain, excluding only areas set aside for recreation elements. The minimum width for mangrove fringes would be approximately 32 feet on either side of the CMP, as recommended by Fischer and Fischenich (2000). This measure was retained. Mangrove restoration would include 34.48 acres of wetlands.

2.1.4 Non-structural Measures

As an aquatic ecosystem restoration project, there are no non-structural measures for the dredging of the CMP. Non-structural measures related to structure acquisitions and relocations within the public domain boundary (and confines of the Federal project) have been retained and included in the development of alternatives, as well as activities outside of the project that would be conducted by the non-Federal Sponsor. Overall the non-structural measures considered and used in the development of alternatives include structure acquisition and relocation, community education, and increased enforcement of illegal dumping.

- Structure acquisition and relocation would be considered in all action alternatives under the Federal project. There are a substantial number of residential buildings that have been constructed within the Project Area (within the Public Domain limit), including within the actual footprint of the pre-existing channel. Acquisition and demolition of these structures would be necessary for any restoration of tidal flow, and the families would need to be relocated. There are a total of 434 residential structures that would be acquired and 390 relocations that would occur as part of the Project.
- ENLACE has an extensive community education program that focuses on explaining the benefits of restoration to the CMP, and preventing future harm to the watershed. Along with ENLACE, the community has also banded together to erect barriers to prevent illegal dumping. These areas are patrolled by the residents to ensure that future dumping and degradation of the CMP does not occur. The USACE does not have authority to implement and/or cannot enforce these two measures; however, they would be necessary in conjunction with any alternative that is selected.

2.2 ADDITIONAL PROJECT FEATURES

2.2.1 Channel Bulkhead

A cantilevered steel sheet pile wall with no tie-backs and a concrete cap would be used as the channel bulkhead for all the channel configuration alternatives. The channel bulkhead would be aligned along the sides of a dredged and restored CMP waterway. The cantilevered installation method would allow for the least ground disturbance of all the methods commonly available. Selection criteria and process is discussed in the Engineering Appendix.

2.2.2 Erosion Control Measures

Preliminary hydrologic modeling for seven different channel configurations indicated that if the channel dredging measure was implemented, erosion control features would be necessary to protect the CMP channel from scouring, and to protect existing bridges and shoreline stabilization structures in the western CMP, such as sheet piles (Atkins, 2012e). Three erosion control features were formulated, evaluated and retained for this purpose: articulated concrete mats (ACM), riprap and weir.

- ACM – Would be required to provide scour protection for any high velocity dredged channel configurations. The soils in the CMP channel are predominantly hard silts and clays at a depth of 10 to 15 feet below the existing bottom, and these soils could be subject to scour at velocities greater than approximately 4 ft/s. Table 2-1 provides within-channel bottom velocities that could be produced by the different channel dimensions. All configurations, except 75 x 10 feet, are considered wide enough to slow within-channel velocities to an acceptable rate, and a 100-foot-wide channel would be the most marginal that could be acceptable. A 75-x-10-foot configuration would require ACM to prevent channel scouring.

Table 2-1. Maximum bottom velocities that could be produced by channel dimensions

Channel Dimensions (ft wide x ft deep)	CMP Bottom Velocity (ft/s)
(75 x 10)	4.22
(100 x 10)	4.09
(125 x 10)	3.95
(125 x 15)	3.45
(150 x 10)	3.85
(150 x 15)	3.13
(200 x 10)	3.13

- Riprap – Riprap would be a necessary measure for protection along any structures such as bridges.
- Weir – Initial hydrologic analysis for the project determined that a weir would be necessary to slow velocities in the western end of the CMP for all proposed channel dimensions. A main project constraint for the proposed project is that the plan should not damage the shoreline and sheet pile structures in the downstream western CMP area. During recent years, three bridges and shoreline stabilization projects have been constructed in the western CMP, and these structures were not designed with a wider, higher velocity CMP channel in mind. Preventing erosion is essential to maintaining a functional project as any effects to the structures in the western CMP could require a major construction and cost for repairs in the future, affecting funding for general channel maintenance. In order to evaluate this constraint, western CMP velocities were calculated and evaluated for the potential to damage bridges and sheet pile structures. The velocities, ranging from 2.20 in the 75 x 10 channel to 4.09 in the 200 x 10 channel were considered unacceptable and thus a weir was required for each alternative. The weir would reduce the depth of the channel on the entrance of the western bridges channel to 6.5 feet. Since it would reduce water velocities in the CMP, the weir should also ease installation of turbidity controls.

2.2.3 Recreational Features

All channel configurations would have recreational features as part of their design. The linear nature of the project area provides recreational uses for all eight neighboring communities; careful placement of these measures throughout the project area is intended to protect the investment in ecosystem restoration by facilitating appropriate uses of the area after it is constructed. This approach facilitates the creation of larger, uninterrupted restored ecosystem, allows for easy access for project maintenance, and discourages improper and unmanaged uses of the area. It also aids education programs in increasing the environmental stewardship of this urban wetland.

The recreation plan would consist of three types of recreation access areas, which would allow for major recreational use in some areas and median use in others. These are a linear park, recreation access parks and recreation parks (see Figure 2.2).

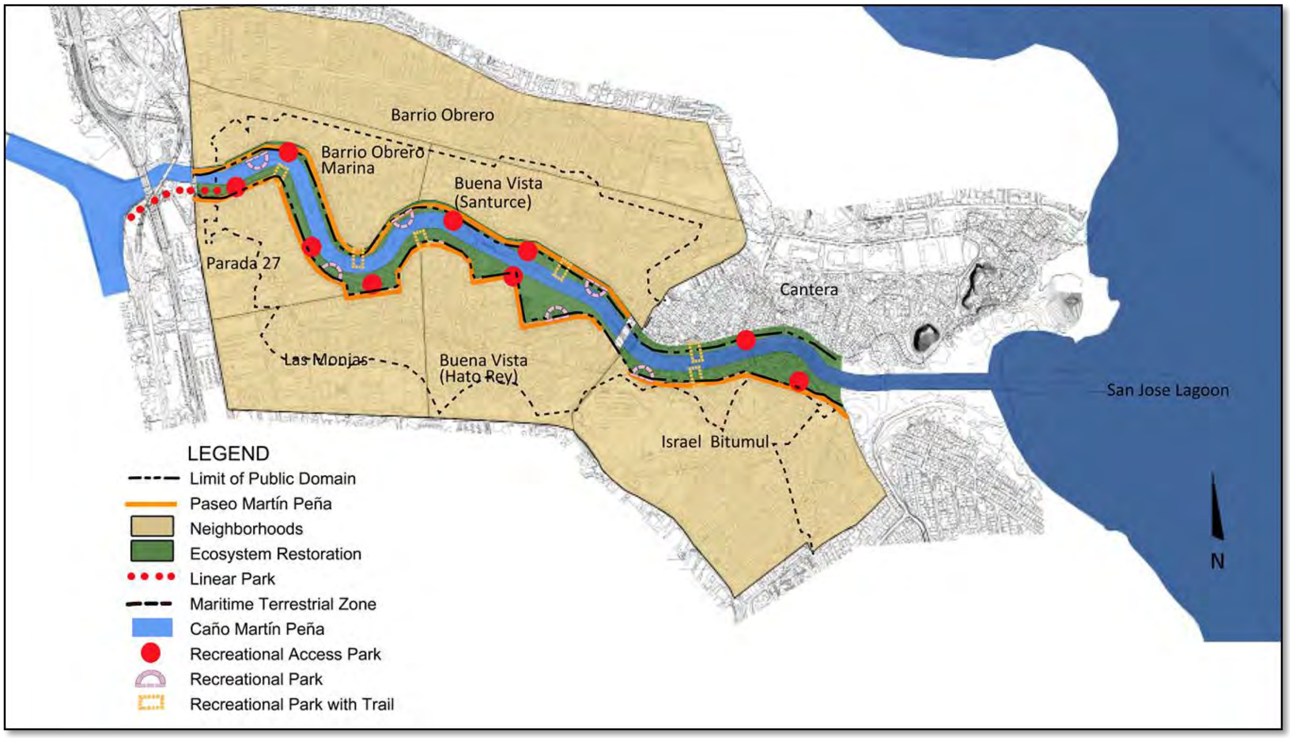


Figure 2-2. Proposed Federal Recreation Plan

- Linear Park- Would consist of a trail, walk, and/or footbridge that extends the existing Enrique Marti Coll linear park located to the western CMP. It would be constructed over the sheet pile bulk head in the eastern CMP (with the mangrove fringe between the linear park trail and the Paseo), and would be located on the southern side of the CMP, extending past the western bridges in the project area and terminating at the first recreation access area in the Parada 27 community. The area would include educational signs about the restored ecosystem. A gate and fence, or wall, would be placed along the CMP for safety and to discourage the disposal of materials into the CMP.
- Recreation Access Park- Nine recreation access parks would provide visual openings through mangrove forest to the CMP, providing a strong community connection at these strategic locations. Each would have educational signs on the ecosystem restoration project,

proper use of the recreational area, and educational facts about the restored ecosystem. A gate and fence, or wall, would be placed along the CMP for safety and to discourage the disposal of materials into the CMP. These parks would provide for navigation access to the CMP.

- Recreation Parks - Would be smaller in scale than the proposed recreational access park, and would be scaled to accommodate fewer people for passive recreation. The natural mangrove forest will serve as a backdrop; the twelve recreation parks would be strategically located along the Paseo del Caño walkway corridor to serve immediately adjacent blocks. In six of the recreation parks, a trail would be built through the forest to allow access to the CMP. They would also have educational signs. A gate and fence, or wall, would be placed along the recreational park and CMP, where applicable, for safety and to discourage the disposal of materials into the CMP. (Refer to the Recreation Plan Appendix for more details.)

2.2.4 Maintenance Dredging Requirements

Sediment transport from surrounding uplands, the San José Lagoon, and the existing western channel are expected to deposit up to 1.5 inches yearly (in/yr) in the Project Channel. Due to the self-cleaning channel velocities, most of the shoaling is expected to be concentrated at either end of the proposed channel outside of the dredged Project Channel footprint. The high channel velocities at the transition to the western CMP indicate that shoaling in that area would be minimal. Shoaling in San José Lagoon at the outlet of the CMP and within the extended channel is of greater concern, with accumulations of up to 35,000 cubic yards (cy) annually expected to be deposited in flood-tide shoals. It is noted that this estimate is based on a conservative 2003 estimate that developed sedimentation rates in the vicinity of the CMP, but did not account for mitigating factors such as improved tidal flow through the CMP, which may serve to disperse the sediments into lower energy environments (Moffat and Nichol, 2003). This estimate is therefore considered very conservative.

These shoals should be monitored to ensure that the CMP outlets remain unobstructed for tidal flows; if shoaling begins to reduce tidal exchange, maintenance dredging would be required. As the shoaling material is expected to be uncontaminated, disposal of these sediments is not expected to require CAD or upland disposal. The material would be loaded into scows and transported to the San Juan ODMDS or to the artificial dredged pits left in the San José Lagoon for their restoration, as proposed under the SJBE Program CCMP, for unconfined open water disposal. All necessary Regulatory permits would be secured at that time. It is assumed that maintenance dredging activities would occur on a 5-year cycle.

2.2.5 Dredged Material Disposal Management

The bottom of the CMP is mainly composed of peat, organic clays, and silts of varying thickness within the proposed dredge footprint. Native sediments are covered by sludge, trash, and debris that have accumulated over the last six decades. As such, it is estimated that trash and debris would make up approximately 10 percent of the total material to be dredged from the CMP.

Five dredged material disposal alternatives were evaluated to identify a preferred plan for its disposal: CAD, Landfill Disposal, Permanent Upland Disposal (PUD), Ocean Disposal, and Onsite Disposal. All the disposal options are dependent on dredging of the existing CMP channel.

Disposal options were eliminated for a number of reasons, including: insufficient capacity at the site; extent of sediment and solid waste mixing; engineering/infrastructure considerations such as proximity next to flowing water or insufficient roadways; impacts to adjacent communities by noise or air pollution or by undiluted containment of solid waste; elimination of subaqueous, benthic habitat within the estuarine system; and exposure to wind and wave action that could cause failure of containment.

This elimination process resulted in the selection of the San José Lagoon CAD site for the disposal of dredged sediments, and landfill disposal for solid waste only. San José Lagoon CAD site is the option that most contributes to the ecosystem restoration goal since it allows a beneficial use of the sediments, and thus, is the most complete sediment management option. Prior to the disposal of the dredged sediments, additional water quality and sediment testing, such as bioassays, would be conducted, in accordance with Section 404 of the Clean Water Act. This is in order to confirm the sediments suitability to be disposed within the San José Lagoon CAD site.

The Humacao Regional Landfill, which is located approximately 32 miles from the CMP-ERP site, is the preferred solid waste disposal site for the dredged debris because of the higher certainty it affords to receive all the trash and debris that would be originated from this project.

Table 2-2 displays the different Dredged Disposal Management Options and the reasons for their elimination or further consideration.

Table 2-2. Summary of Elimination of Dredged Material Disposal Options

Dredged Material Disposal Options	**Insufficient capacity**	**Extent of Sediment and Solid Waste Mixing**	**Engineering/infrastructure considerations**	**Impacts to adjacent communities**	**Elimination of benthic habitat**	**Exposure to current or wind and wave action**	**Discussion**
Suárez Canal CAD (sediment and small pieces of debris)	**X**		**X**			**X**	Eliminated due to insufficient capacity at the location. In addition, it would require containment of the material behind a sheet pile bulkhead that would be exposed to currents and possible wave action during storms and tropical events.
Los Corozos Lagoon CAD pit disposal (sediment and small pieces of debris)	**X**			**X**			Eliminated due to insufficient capacity within the pits at the location. In addition, the pits are immediately adjacent to the shoreline, which would likely interfere with the adjacent communities, docks and navigation, and other shoreline activities.
Lagoon level bottom capping/ containment (sediment and small pieces of debris)					**X**	**X**	Was eliminated due to the potential impact to an area of rare island habitat, and other options could be utilized to avoid these detrimental effects.
San José Lagoon CAD with geotextile containment (sediment and small pieces of debris)							There is sufficient capacity, and impacts to habitat would be extremely low. These areas would be protected from most wave action, and impacts to existing communities would be lower than the Los Corozos option. This was retained as an option as further explained.
Landfill disposal (sediment and solid waste)			**X**	**X**			Eliminated due to the insufficient capacity in existing landfills within the San Juan area to accommodate the entire volume of sediment and solid waste. Disposal in existing landfills elsewhere on the island is not feasible due to engineering considerations, costs and environmental impacts such as noise, traffic, and air quality due to the large number of trucks that would be constantly traveling to and from the site.
Landfill disposal (solid waste only)							Would require a much smaller capacity that is available at current landfills in the San Juan area. The material would need to be transported to a staging area and trucked to a landfill. There would be some noise and air concerns with the dump truck traffic, but levels (and duration of impacts) would be more acceptable than those associated with the disposal of both sediment and solid waste. Was retained as an option, but would need to be combined with a sediment disposal option to be viable.

Table 2-2, concluded

Dredged Material Disposal Options	**Insufficient capacity**	**Extent of Sediment and Solid Waste Mixing**	**Engineering/infrastructure considerations**	**Impacts to adjacent communities**	**Elimination of benthic habitat**	**Exposure to current or wind and wave action**	**Discussion**
Permanent Upland Disposal (sediment and small pieces of debris)				**X**			Would require the acquisition and construction of a new area for single use upland disposal, essentially a new private landfill. This was retained as an option pending Section 404 testing of the dredged material. However, this is not warranted at the present time based on the results of several technical studies, thus it was not selected as the preferred alternative. Any PUD would need to be located within 10-miles of San Juan (and the project site), an area that is densely populated. A screening analysis was conducted of over 60 upland sites to identify potential PUD sites. Several potential sites have sufficient acreage and configurations to accommodate the volume of dredged material from the project. However, the PUD alternative was less acceptable than San José Lagoon CAD. It would result in significant amounts of heavy truck use through the San Juan area and secondary roads and neighborhoods to reach the upland disposal site(s). The impacts to infrastructure as well as associated noise, air quality, and community impacts would be significant and controversial.
Ocean disposal (sediment only)		**X**					Section 103 testing would need to be completed and approved for use of the San Juan Ocean Dredged Material Disposal Site (ODMDS). Preliminary testing of the sediment has indicated ocean disposal could be a viable option; however, after coordination with the USEPA, it was determined that sediment mixed with small pieces of solid waste/debris would not be suitable for ocean disposal. After analysis of the existing geotechnical information associated with the dredged material, a conservative apportionment was determined such that, for planning purposes, 55% of the dredged material would be pure sediment, while 45% would be a mixture of sediment and solid waste. At such a ratio, the effort to transport the sediment/solid waste mixture to an approved landfill coupled with the cost to mobilize for ocean disposal would exceed Project's authorized cost. Environmental impacts would include noise, traffic, infrastructure and air quality impacts associated with the hauling of dredged material. As a result, this was not retained as an option.
Onsite Disposal	**X**		**X**	**X**			Would consist of placement of dredged material within upland areas outside of the planned channel. It was not retained as an option due to impacts such as: a reduction in the amount of onsite mangrove restoration that could occur, the elimination of available lands for recreation opportunities, the requirement of additional acquisition and demolition of structures, as well as more relocations if impacts to recreation were to be avoided. In addition, sediment would likely be stockpiled high on the banks and capped, leading to aesthetic impacts by creating large berms along each side of the CMP. The local sewer and drainage system would also likely need to be modified to account for the changes in land contours and elevation.

Larger, easily accessible pieces of debris that may be found at the surface, such as remains of discarded automobiles and refrigerators, would be collected using hydraulic excavators. Collected debris would be loaded onto trucks, where accessible to uplands, and then transported to a municipal landfill. Dewatering is not expected to be necessary since solid waste would air dry during transportation to the landfill.

A barge-mounted mechanical clamshell dredge would be used to widen and deepen the CMP, and would place dredged material into dump scows. Trash would be separated from the dredged sediments by a metal sieve that overlays the dump scow opening where the dredged material would be placed after being dredged. The sieve allows the sediments to fall into the hull of the scow while the trash and debris remains on top, and can then be collected and removed to an awaiting debris barge. Sediments hauled on dredge scows are typically dewatered via gravity into the surrounding waters at the site of the dredging operation.

The debris barge would then navigate to a staging/management area for further processing and rehandling of the trash and debris for eventual overland transport of the material to a municipal or private landfill. Trash and debris recycling is a non-viable option due to the labor-intensive nature of collection, washing for removal of sediments, and separation into the various recyclable groups.

2.2.5.1 Staging area

Numerous sites surrounding the CMP, the San José and Los Corozos Lagoon, and the Suárez Canal were considered for the staging and dredged material management area. Nonetheless, many of the available lands are estuarine and marine wetlands and therefore are unsuitable sites to construct a temporary staging and dredged material management area. Urban locations within the Study Area could also be considered as potential sites for a staging and dredged material management area, but these sites would have to be cleared and require the relocation of homes and/or businesses to make room for the staging operations. These processes could result in diverse environmental, social, and economic impacts, such as air emissions (carbon and hydrogen sulfide), traffic congestion, increased noise levels, potential localized degradation of water quality, degraded aesthetics, indirect impacts to recreation, further community displacement, and substantial increase in project costs.

An identified site is a 35-acres property at the eastern end of the Project Area, located between the east bank of the San José Lagoon and the Ciudad Deportiva Roberto Clemente (CDRC) sport complex. The CRDC is a recreational complex owned and operated by a non-profit organization. It occupies 304 acres in the Municipality of Carolina, on the outskirts of San Juan, consisting of baseball, football, and soccer fields, a swimming pool, tennis courts, training facilities, and meeting rooms.

Within the previously disturbed 35-acre parcel at CDRC, there is a 6 acres parcel on the southeast shore of San José Lagoon, that could be used as the staging and dredged material management site for the CMP-ERP. The parcel is composed of 5 acres of upland and 1 acre of wetland.

This site has enough capacity to accommodate portable facilities including trailers, offices, and access to the San José Lagoon. The temporary dock for the barges for loading/unloading the dredged material to be transported to the landfill would be built by the construction contractor,as well as a temporary access road for the trucks to pick up the trash and debris or bring the construction materials to be used in the installation of the sheet pile walls.

The temporary pier/dock can be built as a pontoon system, and would not require special reinforcement or protection given the low energy environments within the San José Lagoon. No dredging would be required within the lagoon to provide for a barge access channel to the pier/dock, since water depths immediately adjacent to the shoreline of the San José Staging and dredge material management area are sufficient to allow fully loaded shallow-water barges to navigate safely to the constructed pier/dock. These deeper depths are a result of dredged pits being in close proximity to the staging and management area shoreline. In addition, access to the pier/dock areas may require the partial removal of mangroves along the shorelines of the staging and management area. It is expected that the construction contractor will coordinate with the Municipality of Carolina and resource management agencies, prior to selecting the final site for the dock/pier area to ensure impacts to the mangroves are kept to a minimum.

Since the vicinity of the dredged material management site has been used in the past as a temporary minor staging area for debris and trash, it is anticipated that terrain preparation for truck access and traffic should not represent any concern. Processing of dredged debris, along with other construction related support activities at this area, would be a continuous operation throughout most of the dredging operations. The collected trash and debris would then be transported by truck to the Humacao Regional Landfill.

An upland staging area near the four western bridges would be used to temporarily stockpile and transfer the collected solid waste excavated during the dredging process for activities related to the installation of the weir in the western end of the Project Channel. Equipment and materials would be staged on floating barges. After the construction of the weir, and once the dredging from the eastern portion of the Project Channel opened the CMP, the temporary coffer dam would be removed, and the stockpiled solid waste would be placed into shallow-draft barges for transport to the CDRC staging area. At the CDRC staging area, the material would be off-loaded, placed into trucks, and hauled for disposal at the Humacao Regional Landfill.

2.2.5.2 San José Lagoon CAD site

As presented in the Bailey et al. (2002) report, the artificial depressions (pits) within the San José Lagoon were analyzed to potentially serve as CAD sites for the CMP dredged sediments not encapsulated with geotextile containers. These pits are identified as San José 1 (SJ1), San José 2 (SJ2), San José 3/4/5 (SJ3/4/5), and another identified as Los Corozos (LLC). Any combination of these artificial depressions could serve as potential CAD site for the CMP-ERP's dredged sediments (see Figure 2-3).

Figure 2-3. Staging Area at CDRC

These four man-made depressions found within, or adjacent, to the Project Area have been identified as sources of water quality problems in the CCMP for the SJBE (SJBEP, 2000 p. 96). Filling these man-made depressions has been recommended as one of the most cost-effective alternatives for improving the water and sediment quality in the Project Area (USACE, 2000; SJBEP, 2000). In fact, the SJBEP's CCMP identified the filling of all these pits as a priority and urgent action needed to improve the water quality and habitat conditions of the entire estuarine system (Action WS-6) (SJBEP, 2000). Therefore, the use of the CAD alternative is attractive because it would give the dredged material a beneficial reuse.

Bailey et al. (2002) concluded that 2 feet of clean sand are necessary to maintain a physical barrier between contaminated dredged sediments to be disposed at the CAD pits and the benthic community above (USACE, 2002). This 2-foot sand cap would contribute in preventing the release of contaminants at concentrations above water quality standards. In addition, an analysis of the currents and water circulation occurring in the lagoon was performed and it was established that the energy within the lagoon and around the CAD sites is low, which means there is a very low risk of erosion of the cap within the CAD sites.

In the report, Bailey et al. (2002) also analyzed the long-term pore water flux from the three CAD sites due to consolidation following the mechanical disposal of dredged material and its capping with clean sand. The cumulative flux for the CAD sites is large enough to displace at least two pore volumes in the caps (nearly five pore volumes for LLC cap). However, it was concluded that the pore water flux through the cap decreases significantly in 2 to 3 years and virtually goes to zero in about 5 years. Therefore, if constructed correctly, no long-term adverse water quality impacts from contaminants are anticipated from the CAD sites. The organic contaminants have limited mobility and are predicted to move a maximum of only about 15 cm (0.5 foot) into the cap. Moreover, in addition to the capping material, the CMP-ERP's dredged sediments would be encapsulated in geotextiles.

Surface areas and total and existing storage volume capacities for the evaluated pits are summarized in Table 2-3. For the San José Lagoon artificial pits, a –16-foot top-of-fill was selected to ensure uncontrolled dredged and cap sediments spill over into adjacent pits does not occur. For the LLC pit, a –6-foot top-of-fill was selected to ensure the dredged and cap sediments do not protrude above the natural bottom depth.

Table 2-3. Surface Areas and Existing Capacity of Each Artificial Pit

Artificial Dredged Pit	Existing (Max) Floor Depth (ft)	Fill Depth (ft)	Surface Area (square ft)	Existing Pit Capacity (cy)*
SJ1	–27	–16	897,190	260,516
SJ2	–27	–16	956,000	245,450
SJ3/4/5	–24	–16	1,591,070	275,373
LCC	–18	–6	1,624,865	166,210
Total Capacity of Combined San José and Los Corozos Lagoon Pits				947,549

* Existing pit capacity in cubic yards (CY) based on bathymetric study references: (USACE, 1996).

The required storage volume for placing all of the bulked dredged sediments is 814,000 cy. The total existing capacity for the six artificial pits is sufficient to receive the bulked dredged sediments volume. However, additional capacity of approximately 86,000 cy would be needed to allow for the geoencapsulated sediments to be capped with 2 feet of clean sediments. This additional capacity can be achieved by modifying the depth and/or width of the artificial pits by excavating sediments from within the pits.

Based upon a CAD analysis performed by the USACE ERDC in 2002 for the CMP-ERP, sand is the recommended sediment to be used as the capping material. However, since the availability of sand for capping material is limited, the best combination of pits to modify was determined based upon an objective to minimize the amount of capping material needed. The combination of SJ1 and SJ2 (prior to expansion) resulted as the alternative that would need the least amount of capping material.

Modification of the SJ1 and SJ2 pits would entail excavating the pits to their original borrow depths of –32 and –30 feet, respectively. Existing side slopes would be maintained for stability purposes as the SJ1 and SJ2 pits are deepened. The geoencapsulated-dredged sediments would be placed within the modified pits to a fill elevation of –18 feet. The placed geoencapsulated dredged sediments would be capped with 2 feet of clean sand to an unconsolidated fill depth of –16 feet. SJ1 and SJ2 would provide the capacity necessary for disposal and capping of the dredged sediments, without adversely affecting the tarpon-feeding zone at the –6-foot halocline interface.

The existing capacities for SJ1 and SJ2 to the –16-foot fill depth are 260,516 cy and 245,450 cy, respectively, for a total capacity of 505,966 cy. The revised capacities of the modified SJ1 and SJ2 pits to the –16-foot fill depth are estimated in 880,000 cy for the dredged sediments and 198,347 cy for the capping material, for a total of 1,078,347 cy. This provides sufficient capacity to place the 814,000 cy of dredged sediments and the 198,347 cy sand cap with an excess capacity of 66,000 cy. Therefore a total of 506,381 cy of sediments would need to be excavated from the SJ1 and SJ2 pits to acquire the total capacity required to place the geoencapsulated dredged sediments and capping material within the two pits.

It is assumed that the excavated pit material is clean and therefore is suitable for unconfined open water disposal. If the excavated pit material was suitable for use for the sand cap, then 198,347 cy less sediments need be placed in SJ 3/4/5/LC. If the excavated pit material is not suitable for use for the sand cap, it would be placed in SJ 3/4/5/LC. 64,798 cy would not be accommodated and would consume the majority of the 66,000 cy of excess capacity in the SJ1/2 pits.

2.2.5.2.1 Disposal site capping source alternatives

Since the dredged sediments would be encapsulated in geocontainers prior to placement in the pits, other clean sediment could possibly be used as capping material in lieu of clean sand. Commercial sand availability is a problem in the San Juan Metropolitan area due to the limited geological resources. An early source of consideration was one of the remaining mogotes at the Península de Cantera. This source was dismissed because the surrounding area is densely populated, truck access is very difficult and mining and transportation would cause significant disturbances to nearby residents. Other alternatives evaluated as acceptable sources for capping are discussed in Table 2-4.

Table 2-4. Acceptable sources for capping material

Mine sand from the bottom of the San José and Los Corozos Lagoons	The presence of the silica sand in the north portion of the lagoon is an indication that there may be a presence of sand elsewhere in the system. Two borings from geotechnical investigation revealed sand layers: 8 feet and 17 feet in thickness, respectively. However, additional geophysical sub-bottom profile survey would have to be conducted to identify and quantify the potential layers of sand available in the system. In addition, the quality of the sand needs to be tested. Dredging within the Lagoon could occur without creating new pits. Dredging areas could be managed for minimum impacts by making the dredging of the sand as shallow as possible and then filling the depressions with material from different sources, including the sediments coming from the San Antón and Juan Méndez creeks, as well as the sediments removed to make space in the SJ1/SJ2 pits. In order to reduce the impact of the sand removal, the operation would be managed by a small hydraulic cutter head, which would reach only the areas where the sand is available in the geologic profile. The sand removed would be pumped or deposited directly to the new SJ1 and SJ2. This alternative is the least environmentally risky operation since it only requires activities from the water and away from any area of concern including homes, business, roads, or habitat areas. The use of sand in the lagoon is not weather dependent, except for during big storms or hurricanes. However, the dredging of this sand has brought up concerns with the local sponsor, ENLACE, their TC, and regulatory agencies. After a series of meetings with ENLACE, this alternative source continues to be a concern because new depressions may adversely affect habitat or other parts of the ecosystem.
SJB Sand Source	The potential for sand to be available from the SJB is limited, but may be found at its entrance (USEPA, 1982; USACE, 1982), at La Esperanza Península (USACE, 1999), and/or with maintenance dredged material within San Juan Harbor (USACE, 2002). Depending on the location and characteristics, some geotechnical data may be needed as part of the sediment source analysis. Other testing and permitting for the quantities needed for the cap would also be needed. The sandy material could be dredged with a clamshell and barged to the CAD sites, or hydraulic dredged and pumped directly to the CAD site.
Boca of the Cangrejos-Torrecilla Lagoon Sand Source	This may be available by dredging the marina located within the Torrecilla Lagoon. The amount of sediments at the marina is currently not known and would require testing and permits. This site is at approximately 5 miles of the San José Lagoon (one way). The sandy material could be dredged with a clamshell, trucked and barged (rehandled) to the CAD sites, or hydraulic dredged, and pumped directly to the CAD site. Transport operation would involve crossing public and private properties, roads and navigable channels, which would temporarily and adversely impact traffic, air quality and noise quality within the affected communities.
Commercially Purchased (Upland Quarry) Sand Source	The capping material would be purchased commercially from a private borrow site and transported to staging area and then to the final disposal site. Private sources of sand are available in northern Puerto Rico (See Engineering Appendix). Based on the estimated 198,347 cy of clean sand that would be needed for the cap, approximately 13,223 truckloads would be needed using 15-cy (20-ton) dump trucks to transport the sand from the quarry to the loading site (approximately 35 miles one way). The sand could be stock piled at the CRDC 5 upland acres (without modifying CDRC). Access to the water would be also an important component, since the trucks would have to get close enough to the water so that they can either offload directly onto scows or into a storage area where a pipeline would be connected to transport the sand. The rate of supply is not clear, a factor that can determine the rate of capping in the lagoon. The source would also have to be tested regularly for quality assurance. The transportation of sand would have to be coordinated with the local Police Department for safety issues, traffic controls, and security concerns, as well as per the potential environmental concerns that the spills of sand coming from the trucks can create in the streets. Finally, the recreational activities at the CDRC would have to be considered during the operation, which can also cause delays in the operation, while the operation to remove the solid waste would have been concluded by the time the sand for capping operation is needed, so it is anticipated that these two activities are not going to interfere with each other.

Recycled Glass Converted to Sand	This alternative was presented by one of the members of ENLACE's TC. ENLACE has been discussing this alternative with the Puerto Rico Environmental Quality Board (PREQB). The use of recycled glass as a supplement to natural sand is an alternative that could potentially reduce sand mining costs, as well as its environmental impacts. In addition, it could become an Island- wide glass recycling and public engagement initiative in favor of the restoration of the SJBE, the CMP, and its adjacent water bodies. The use of this material as capping source would have to be tested to determine the size of the grains that would be necessary, in addition to chemical contents, presence of potential contaminants, among other. Recycled glass has been studied as a potential source for beach nourishment in Broward County, in the State of Florida. Geotechnical comparisons of sand and glass cullets (grain, size distribution, color, carbonate content, and grain angularity) concluded that both were found to be geologically compatible. The samples were also analyzed for fecal coliform, enterococci bacteria, lead, mercury, semi-volatile organics, petroleum hydrocarbons, and total salt, and the contaminants were found to be within the acceptable regulatory limits specified for sand. Aquarium tests were also conducted to determine any adverse impacts for lower invertebrates, as an indicator of potential impacts to higher vertebrates (Foye, Burton and Gutner, 2005). Based on the demonstration project's initial findings, using recycled glass cullet for beach nourishment was technically feasible because of its physical and chemical similarities and publicly accepted. Final project implementation phase was not achieved due to lack of public funding sources, as indicated by the staff of Broward County in June 2012 to ENLACE.

After studying available alternatives for capping source material, quarried sand was identified as the preferred, due to the possibility that the excess material to be removed from the SJ1/2 pits may not be suitable capping material. However, if suitable sand is found in the excess material proposed to be removed from the SJ1/2 pits to increase their capacity, it would be utilized because is the most readily accessible and logistically viable cap material source for the SJ1 and SJ2 CAD sites. However, if it is definitively determined through future investigations that there is no longer sufficient quantity of sand remaining in the pits, then an upland quarry site would be a reasonable secondary alternatives for cap material sand sources.

Environmental studies are recommended during the PED to determine whether recycled glass and/or dredged material from SJ1 and SJ2 can be used as an alternative to upland quarry sand. Due to present uncertainties in logistics, regulatory compliance, and ecological suitability, this option has not been recommended as part of the TSP. If further analysis during PED proves that this option is more reliable, cost efficient, and ecologically preferable, ground glass could be recommended to meet part or all of the cap sand requirements.

2.3 CMP CHANNEL CONFIGURATION ALTERNATIVES

Channel geometric configuration alternatives vary by width, depth, shoreline, and channel bottom treatment. The hydraulic characteristics for each alternative were evaluated in detail in the Hydrodynamic and Water Quality Modeling Efforts Technical Memorandum (Atkins, 2011a). All channel configuration alternatives presented follow the same centerline and have the same length. They are all rectangular channels except where they pass under bridges, where the channel shallows and widens to the span of the abutments. They all have similar sheet pile support, mangrove planting bed construction, erosion control measures and recreational features. In addition, all would have the same characteristics entering the San José Lagoon and under the western bridges.

San José Lagoon Entrance Channel: Since the San José Lagoon is shallower than the proposed depth of the alternative channels, each alternative utilizes a trapezoidal channel section with 5 to 1 side slopes that extends ~4,300 feet into San José Lagoon. The entrance channel's width would be the same as the main channel alternatives.

Western bridges channel: Similarly, the proposed channel alternatives transitions to wider and shallower channel configurations at the José Celso Barbosa Avenue Bridge, and from the Ponce de León Avenue Bridge to the channel terminus west of the Luis Muñoz Rivera Avenue Bridge (western bridges channels). The channel section under the Ponce de León Avenue Bridge, the Tren Urbano Guideway, and the Luis Muñoz Rivera Avenue Bridge (western bridges channels) widens to 115 feet with a depth of 6.5 feet, with riprapped side slopes and a paved channel bottom.

2.3.1 Channel Dimensions

Several considerations were identified that limited channel widths to distances between 75 and 200 feet, and channel depths to 10 feet. These factors included: geotechnical, hydrodynamics, scour potential, dredging volumes, mangrove restoration, recreation, navigation, and constructability.

2.3.1.1 Width

Greater than 200 feet wide: Mangrove restoration is an essential element of the project. The project is being conducted with the confines of the public domain and the area available for restoration is extremely limited. There has been substantial public participation in the project and there is a strong desire to maintain the overall aesthetics of the CMP, which includes wetland areas that have historically existed along the canal. Channel designs with smaller widths would allow for more mangrove restoration potential than those designs with greater widths.

Additionally, recreation is an important secondary element of the project, and is needed to maintain water dependent recreational opportunities in the highly urbanized area. Channel designs with smaller widths provide more area for recreational elements than those designs with greater widths. Continued navigational access is essential for public acceptance of the proposed project, and elimination of recreation in the area would be viewed as a secondary project impact. As a result of these factors, channel widths greater than 200 feet were not considered for the proposed project.

Less than 75 feet wide: A restored CMP would provide for recreational and some commercial navigation, primarily small vessels, travelling between SJB and San Jose Lagoon. The waterway should be wide enough to allow for safe two-way passage of vessels while also considering the mooring of vessels along possible bulkheads and marginal wharves. Channel footprints at least 75 feet wide would be the minimum necessary to ensure safe navigation through any restored CMP channel.

Constructability is also of concern in determining channel design, as two barges would be required to work side-by-side during the operation. These barges would need enough room for maneuverability to pass one another, and wider channel footprints would allow more space for these construction vessels to operate.

Another factor in restricting channel widths to those 75 feet or greater is the ability of the area to mimic natural conditions since much smaller dimensions would not reflect prior conditions. During public coordination, members of the community expressed an opinion for the CMP to be restored nearest to historical conditions as possible, making dimensions at least 75 feet wide more acceptable.

Conclusion: As a result of these factors, channel widths greater than 200 feet were eliminated from consideration due to loss of restoration potential and recreational impacts. Widths less than 75 feet were eliminated due to navigational safety, constructability and ability to mimic historic conditions.

2.3.1.2 Depths

Less than 10 feet deep: For channel depths, geotechnical issues and secondary impacts were primary considerations.[2] In regards to geotechnical considerations, the CMP and channel banks contain solid waste from the surface to –10 feet. Thus, channel depths less than 10 feet could leave behind waste in the proposed channel's side slopes and bottom, which could work loose over time and be released into the estuary.

Greater than 10 feet deep: There are portions of the CMP channel, notably near the eastern end, adjacent to the San José Lagoon, where limestone can be found at depths of –10.5 feet. In these areas, it is likely that substantial rock removal through blasting and disposal would have to be considered for parts of the channel. As this project site is within a highly-urban setting, substantial amounts of blasting would likely violate the constraint of avoiding secondary impacts within the communities adjacent to the CMP.

Conclusion: As a result of these conditions, depths less than 10 feet were eliminated due to the likelihood that solid waste be carried downstream and into other aquatic habitat. Depths greater than 10 feet were also eliminated because these would likely require blasting, violating a primary project constraint.

2.3.2 Initial Array of Alternatives

After the bracketing analysis, five combinations of widths and depths were chosen for an Initial Array: 75 x 10, 100 x 10, 125 x 10, 150 x 10 and 200 x 10. The mangrove planting bed measure and all four non-structural measures were combined with each width and depth combination. Additionally, erosion control and recreational features were added to each alternative as appropriate. All measures contain riprap and a weir, and the 75 x 10 alternative contains an articulated concrete mat due to the higher velocities (see Table 2-5).

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[2] All elevations and depths referenced are relative to mean lower low water (mllw) at the NOAA tide station number 9755371 in the SJB, unless otherwise noted.

Table 2-5. Description of Channel Configuration Alternatives

Alternative	Description
75 ft wide by 10 ft deep Rectangular Paved	This alternative has a 75-ft-wide by 10-ft-deep rectangular cross section. The side walls are supported by steel sheet pile and the channel bottom is paved with an articulated concrete mat.
100 ft wide by 10 ft deep Rectangular	This alternative has a 100-ft-wide by 10-ft-deep rectangular cross section. The side walls are supported by steel sheet pile and the channel bottom is earthen.
125 ft wide by 10 ft deep Rectangular	This alternative has a 125-ft-wide by 10-ft-deep rectangular cross section. The side walls are supported by steel sheet pile and the channel bottom is earthen.
150 ft wide by 10 ft deep Rectangular	This alternative has a 150-ft-wide by 10-ft-deep rectangular cross section. The side walls are supported by steel sheet pile and the channel bottom is earthen.
200 ft wide by 10 ft deep Rectangular	This alternative has a 200-ft-wide by 10-ft-deep rectangular cross section. The side walls are supported by steel sheet pile and the channel bottom is earthen.

2.3.3 Screening of Larger Channel Alternatives

Benefits for the CMP-ERP are directly related to water flow, which controls differences in residence time and tidal range. With respect to benefits derived from the various channel alternatives, there is a significant benefit to the San José Lagoon once the CMP channel is widened to 75 feet due to tidal amplitude, or volume of water flowing into and out of the lagoon. Increasing channel widths to 100 feet, 125 feet, 150 feet, and 200 feet would progressively result in additional, albeit marginal, benefits as a result of the increased water flows and reduced water residence times.

The model could only run in increments of 3 feet, hence the differences between descriptions of model runs as they relate to alternatives (9 feet) versus tables that identify alternatives being considered (10 feet). Velocities in 10-foot-deep channels would be slightly higher than those modeled 9-foot-deep channels (see Table 2-6).

Table 2-6. Channel Configuration Comparisons

	Channel Configuration (depth by width)						
	3 by 33*	**9 by 75**	**9 by 100**	**9 by 125**	**9 by 150**	**9 by 175**	**9 by 200**
Area (ft^2)	99	675	900	1,125	1,350	1,575	1,800
Hydraulic Conveyance	184.2	2,530.4	3,487.2	4,450.0	5,416.1	6,384.0	7,353.3
Residence Time (days)	16.90	3.9	3.9	3.9	3.9	3.9	3.9
Benthic Index Score	1.55	2.84	2.84	2.84	2.84	2.84	2.84
Max. Bot. V-CMP-East (fps)	1.25	4.22	****4.09**	****3.95**	3.85	3.52	3.13
Max. Bot. V-CMP-West (fps)	0.74	****2.20**	2.80	3.25	3.65	3.89	4.09
Tide Range (feet)	0.33	1.36	1.61	1.75	1.85	1.96	2.05

* Modeled configuration for existing conditions.
** [note to be provided]

Once a weir is included in channel alternatives, water flow is restricted for all alternatives in the Initial Array to the level identified for the 75-x-10-foot channel. This results from the fact that water flow in the CMP is tidal and peaks every 12 hours before reversing direction. As a result, large accumulations of flow or head beyond the channel restriction or weir do not occur. This is different than flow in a riverine system not influenced by tides, as water flow would normally be traveling in one direction and the restricting channel would raise the head upstream from a channel constriction, thereby raising water flow. As a result, the flow and thus benefits resulting from larger alternatives with a weir is essentially identical to the flow and benefits identified for the 75-x-10-foot alternative, and larger, costlier alternatives would not be cost effective as they would produce the same benefits as smaller, cheaper alternatives.

Additionally, alternatives with smaller channel configurations would not require as many difficult Real Estate actions as larger alternatives. Once the project footprint becomes larger than that in Alternative 3 (125-x-10-foot channel), additional acquisitions and relocations become necessary. This would increase Project’s costs substantially, but moreover, the main dilemma with implementing one of the larger channel configurations would be acceptability. Many families have lived within the neighborhoods adjacent to the CMP for generations, and significant negotiation is necessary to implement even a smaller alternative plan. Implementation of a larger alternative could cause significant delays in the project and would likely be rejected by the local community.

Results: As a result of the larger channel alternative screening analysis, the 175- and 200-foot-wide channel alternatives were eliminated from further consideration due to costs and public acceptability. The 75-x-10, 100-x-10, and 125-x-10-foot channel alternatives were retained to carry forward into a Final Array.

2.3.4 Final Array of Alternative Plans

The Final Array of Alternative Plans consisted of the No-Action Alternative Plan, Alternative Plan 1 (75 x 10), Alternative Plan 2 (100 x 10), and Alternative Plan 3 (125 x 10). The following sections provide a more thorough description of each alternative plan. All these channel alternatives, except for the No Action Alternative, would have the same mangrove planting bed measure, non-structural measures, recreational features, erosion control measures, a riprap and a weir. In addition, all would have the same dredged material disposal management.

2.3.4.1 No Action Alternative Plan

No further Federal actions would be implemented under the No Action Alternative. The lack of tidal flushing, degraded water quality, and increased potential for flooding would continue to affect the greater SJBE. The environmental conditions would continue to have socioeconomic impacts upon residents, commercial and recreational fishing, tourism, and land values within the communities and the entire region.

As part of the No-Action Alternative, ENLACE would undertake other elements of the CDLUP, but would not continue with the demolition of existing structures within the Public Domain Limit of the CMP Project Area, and the associated relocation of families. The overall ecological restoration benefits offered by the CMP-ERP would not be achieved. Moreover, as confirmed by the hydrodynamic and water quality model of the SJBE system, the No-Action Alternative would lead to further environmental degradation of the entire SJBE (Atkins, 2011a).

2.3.4.2 Alternative Plan 1 – 75-Foot Channel Width, 10-Foot Depth

Total construction time for Alternative Plan 1 is approximately 27 months, including mobilization, site preparation, construction, and demobilization.

Channel: Alternative Plan 1 consists of dredging approximately 2.2 miles of the eastern end of the CMP to a width of 75 feet and a depth of 10 feet, with slight variations in channel width and depth at the four bridges in the western portion of the CMP, the Barbosa Bridge, and terminus of the eastern CMP with the San José Lagoon (see Figure 2-4). A barge-mounted mechanical clamshell dredge would be used to widen and deepen the CMP, and would place dredged material into dump scows. Of the 680,000 cy of mixed materials, screens would separate solid waste debris (estimated at 68,000 cy) from sediments. It is estimated that the dredged debris would make up 10 percent of the total material to be dredged from the CMP, and the dredged sediments would bulk up to 126 percent of their in situ volume.

The walls of the channel would be constructed with vertical concrete-capped steel sheet piles with hydrologic connections to the surrounding lands. The sill depth of the window would be set at mean low water so that tidal exchanges are facilitated to the mangrove beds.

A weir would be constructed at the western end of the project area to protect the structural integrity of the existing four bridges in the western portion of the CMP. The dimensions of the weir (115 feet x 6.5 feet) would replicate the cross sectional area of the rest of the channel configuration (75 feet x 10 feet), which would prevent scour around bridges, bulkheads, and other marine structures west of the project area by providing a transition area to reduce unacceptable bottom velocities between the project area and the adjacent channel. The weir would be constructed with an articulated concrete bottom.

Alternative Plan: 75 Foot Channel Width, 10 feet deep

Sources: Atkins, ENLACE & Puerto Rico Planning Board

Figure 2-4. Alternative Plan 1 – 75-Foot Channel Width, 10-Foot Depth

Erosion Control: Articulated concrete mats would be placed along the entire length of the dredged channel bottom to mitigate for high channel velocities that would occur in the CMP. This feature is expected to prevent scour along the bottom of the channel, which may threaten the stability of the sheet pile walls and increase sedimentation. Riprap would be placed at the four bridges.

Disposal: Materials within the Caño Martín Peña include various types of solid waste, debris, and other materials. Such materials will require further testing prior to and/or during project construction, as appropriate, in accordance with an agreed sampling plan. If the testing determines that any materials contain hazardous substances at levels that are not suitable for unregulated disposal, they will be managed in accordance with the applicable laws and regulations of the relevant regulatory agencies. Solid waste debris would be transported from the staging area to the Humacao Regional Landfill site, which is located approximately 32 miles from the CMP-ERP site. A 6-acre parcel at CDRC would be outfitted as the staging area, including a dock for loading/unloading the dredged material to be transported to the landfill.

After screening and removal of solid waste debris, the remaining sediments would be transported in barges to the San José Lagoon CAD pits. Approximately 574,200 cy of in situ sediments would be encapsulated in geotextile containers, disposed within the SJ1/SJ2 CAD sites up to −18-foot elevation and capped with the selected material up to −16 feet. Approximately 37,800 cy of in situ sediments would be used to complete the sheet pile construction and mangrove bed restoration (see Figure 2-5).

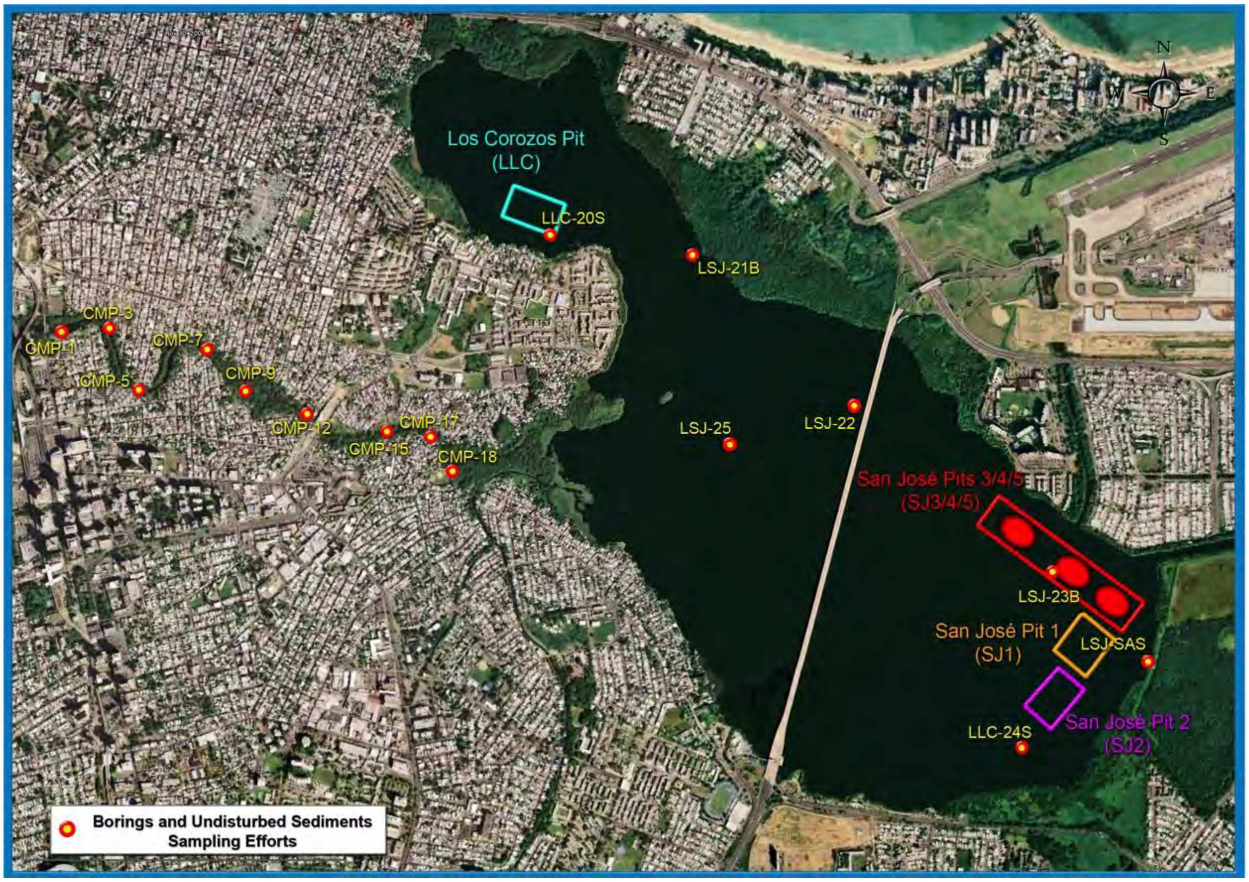

Figure 2-5. Artificial Pits at the San José Lagoon

Mangrove Restoration: Approximately 34.46 acres of wetlands would be disturbed for construction activities, including 33.46 acres within the CMP and 1 acre at the CDRC staging area. Restoration of the disturbed mangrove fringe would be accomplished by grading the site to between 0 foot MLLW and 2 feet above MLLW, and planting with native vegetation. The width of the planting beds would vary depending upon the land availability, but in general would extend from the channel wall to the limit of the CMP's maritime terrestrial zone, excluding only areas set aside for recreation elements. Four species of mangrove would be considered for use in the mangrove planting beds depending on micro topography and the associated levels of tidal inundation, period, and salinity. After dredging and construction of mangrove planting beds, the CMP would consist of 20.42 acres of open water and 39.62 acres of mangrove wetland.

Non-Structural Measures: There are no non-structural measures for the dredging of the CMP. Other measures included: the acquisition of 434 residential structures and 390 relocations within the confines of the Federal project. Other measures outside of the Federal project to be implemented by the non-Federal sponsor are the enforcement of illegal dumping, stormwater and sewage improvements, and community education.

2.3.4.3 Alternative Plan 2 – 100-Foot Channel Width, 10-Foot Depth

Like Alternative 1, total construction time for Alternative Plan 2 is approximately 27 months.

Channel: Alternative Plan 2 consists of dredging approximately 2.2 miles of the eastern CMP to a width of 100 feet and a depth of 10 feet. As previously described, there would be slight variations in channel width and depth at the 4 bridges in its the western portion, the Barbosa Bridge, and terminus of the CMP with the San José Lagoon (see Figure 2-6).

The walls of the channel would consist of vertical concrete-capped steel sheet piles with hydrologic connections to the surrounding lands. The sill depth of the window would also be set at mean low water so that tidal exchanges are facilitated to the mangrove beds. Riprap would be placed at the four bridges.

Like Alterntaive 1, a barge-mounted mechanical clamshell dredge would be used to widen and deepen the CMP channel, and would place dredged material into dump scows. Of the 762,000 cy of mixed materials, screens would separate solid waste debris (estimated at 76,200 cy) from sediments. Under this alternative, it is also estimated that the dredged solid waste debris would make up 10 percent of the total material to be dredged from the CMP, and the dredged sediments would bulk up to 126 percent of their in situ volume. Solid waste debris would also be transported by barge to a staging area for subsequent landfill disposal. Sediments would be transported by barge for disposal at the SJ1 and SJ2 CAD pits.

Erosion Control: This alternative would also feature a weir at the western end of the project area for mitigating water flows into the adjacent waterways and to protect the structural integrity of the four bridges. The dimensions of the weir (115 x 6.5 feet) would replicate the cross sectional area of Alternative 1 (75 x 10 feet), and would prevent scour around bridges, bulkheads, and other marine structures west of the project area by providing a transition area to reduce unacceptable bottom velocities between the project area and the adjacent channels. Like Alternative 1, the weir would be constructed with an articulated concrete bottom, while the remainder of the eastern CMP would be earthen bottom.

Disposal: This alternative would follow the same debris and dredged material plan from Alternative 1. Approximately 648,000 cy of in situ sediments would be placed in the SJ 1/2 CAD sites and approximately 37,800 cy of in situ sediments would be used to complete the sheet pile construction and mangrove bed restoration.

Figure 2-6. Alternative Plan 2 – 100-Foot Channel Width, 10-Foot Depth

Mangrove Restoration: This alternative would also impact the same acreage of mangrove as the previous alternative. Restoration of the disturbed mangrove fringe would be accomplished following the same procedure described for the previous alternative. After dredging and construction of mangrove planting beds, the eastern CMP channel would consist of 25.57 acres of open water and 34.48 acres of mangrove wetland.

Non-Structural Measures: These measures would be the same as for Alternative 1.

2.3.4.4 Alternative Plan 3 – 125-Foot Channel Width, 10-Foot Depth

Total construction time for Alternative Plan 3 is also expected to take approximately 27 months, including mobilization, site preparation, construction, and demobilization.

Channel: Alternative Plan 3 consists of dredging approximately 2.2 miles of the eastern CMP to a width of 125 feet and a depth of 10 feet, with slight variations in channel width and depth at the four bridges in its western portion, the Barbosa Bridge, and terminus of the channel with the San

José Lagoon (see Figure 2-7). Similar to Alternatives 1 and 2, a barge-mounted mechanical clamshell dredge would be used to widen and deepen the CMP, and would place dredged material into dump scows. Of the 872,000 cy of mixed materials, screens would separate solid waste debris (estimated at 87,200 cy) from sediments. Dredged solid waste debris would also make up 10 percent of the total material to be dredged from the CMP, and the dredged sediments would bulk up to 126 percent of their in situ volume. Like the previous alternatives, solid waste debris would be transported by barge to the staging area for subsequent landfill disposal. Sediments would also be transported by barge for disposal at the SJ1/2 CAD sites.

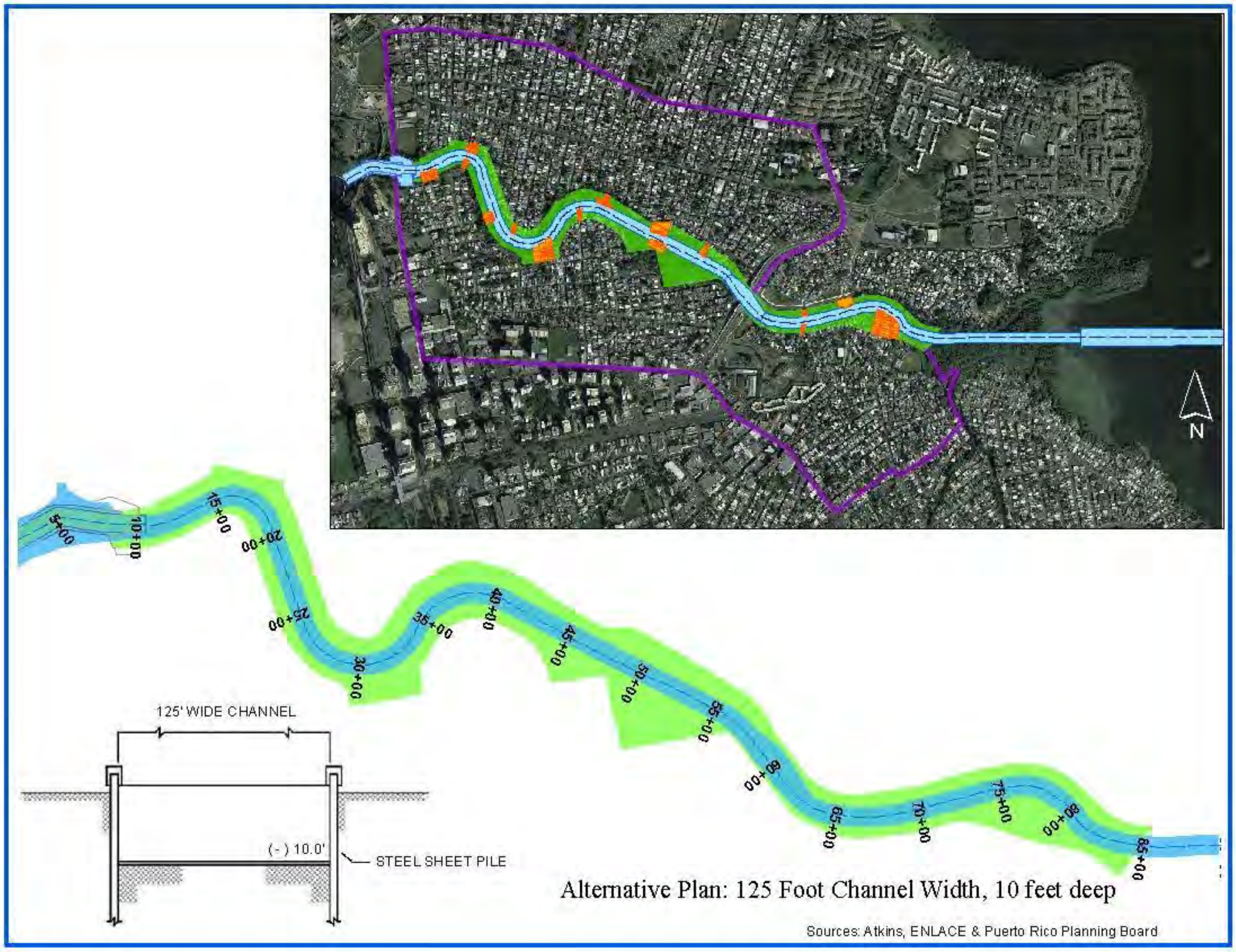

Figure 2-7. Alternative Plan 3 – 125-Foot Channel Width, 10-Foot Depth

The walls of the channel would also be constructed with vertical concrete-capped steel sheet piles with hydrologic connections to the surrounding lands. Sill depth of the window would also be set at mean low water as well, so that tidal exchanges are facilitated to the mangrove beds.

Erosion Control: Like Alternatives 1 and 2, a weir would be constructed at the western end of the project area to mitigate water flows into the adjacent waterways, in addition to the need to protect the structural integrity of the four bridges in the western portion of the eastern CMP. It would share the same dimensions and features as the previous alternatives.

Disposal: This alternative would follow the same debris and dredged material plan from Alternatives 1 and 2. However, under this alternative, approximately 747,000 cy of in situ sediments would be placed in the SJ1/2 CAD sites.

Mangrove Restoration: This alternative would also impact the same acreage of mangrove as the previous alternatives. Restoration of the disturbed mangrove fringe would be accomplished following the same procedure described for the previous alternatives. After dredging and construction of mangrove planting beds, the eastern CMP would consist of 30.97 acres of open water and 29.08 acres of mangrove wetland.

Non-Structural Measures: These measures would be the same as for Alternatives 1 and 2.

2.4 EVALUATION OF FINAL ARRAY OF ALTERNATIVE PLANS

The final array of alternatives were screened using: (1) an ecological uplift assessment for each alternative against the Planning Objectives presented in Section 1.3, (2) costs, and (3) Principles and Guidelines (P&G) Criteria (completeness, effectiveness, efficiency, and acceptability).

2.4.1 Benefit evaluation: Planning objectives

Ecosystem restoration is one of the primary missions of the USACE Civil Works program. The USACE objective in ecosystem restoration planning is to contribute to national ecosystem restoration (NER). Contributions to NER are increases in the net quantity and/or quality of desired ecosystem resources. Measurement of NER is based on changes in ecological resource quality as a function of improvement in habitat quality and/or quantity and expressed quantitatively in non-monetary habitat units (HU).

In order to calculate HU, performance metrics were developed from project planning documents, and relationships and hypotheses developed in the Conceptual Ecological Model (CEM). The CEM displays relationships demonstrating that the planned CMP-ERP would result in expanded connectivity to habitat for fish and fisheries, improved tidal flow and circulation within the SJBE system, and improved water quality and conditions. These parameters were then associated with the appropriate attributes of the Project's objectives: fish habitat, benthic habitat, and the mangrove root community (Atkins, 2015a). Results are summarized in Table 2-7.

Table 2-7. Summary of Net Average Annual Habitat Units for the Models

Project Condition	Planning Objective 1 Fish Habitat	Planning Objective 2 Benthic Index	Planning Objective 3 Mangrove Habitat	Total
No Action	0	0	0	0
75-foot-wide Alternative	5,050.93	294.54	787.69	6,133.16
100-foot-wide Alternative with weir	5,055.98	294.54	782.66	6,133.17
125-foot-wide Alternative with weir	5,061.27	294.54	777.37	6,133.17

Source: Atkins, 2015a.

Fish Habitat: Planning objective 1 aims to improve fish habitat in the SJBE system by increasing connectivity and tidal access to estuarine areas. Currently, fish within SJB cannot directly access the mangroves, seagrass meadows, and open water habitats of San José Lagoon, the Suárez Canal, Torrecillas Lagoon and Piñones Lagoon, just as fish within those waterbodies cannot directly access the habitats afforded by SJB. Due to the current condition of the CMP, there is essentially no tidal exchange between SJB and the San José Lagoon (i.e. the eastern and western sides of SJBE system) creating essentially two estuary systems connected independently to the ocean waters by inlets.

It is expected that the restoration of the CMP would benefit fisheries outside of these water bodies by allowing easier access to the variety of fish habitat (e.g. open water, seagrass meadows, hard bottom, mangrove fringes) found throughout the newly inter-connected waters of the entire SJBE system (Atkins, 2015a).

Benthic Habitat: The second objective is the restoration of benthic habitat in San José Lagoon by increasing dissolved oxygen in bottom waters and improving the salinity regime to levels that support native estuarine benthic species.

Benthic habitat is evaluated using an index originally developed for the SJBEP to report on the status and trends of the health of the SJBE and its individual component water bodies. The Benthic Index (BI) combines information on benthic community diversity, the presence or absence of pollution-tolerant benthic taxa, and the presence or absence of pollution-sensitive taxa (PBS&J 2009). The BI is designed to increase as beneficial factors increase (e.g. species richness, species evenness, and presence of pollution-sensitive taxa). Conversely, if species richness and/or evenness decline and the proportion of pollution-tolerant taxa increases, the BI would decline. An extensive database on benthic species composition by Rivera (2005) was used to produce BI scores throughout SJBE. In the original report (PBS&J, 2009) it was determined that BI scores in the SJBE were the lowest in the CMP followed by the San José Lagoon, and that distance from the Atlantic Ocean, used as a surrogate for tidal influence, was a better predictor of BI scores than water depth.

The HU score is based upon the project performance and the maximum spatial extent of the area of San José Lagoon that would benefit from the opening of the CMP (702 acres).

Mangrove Root Community: Another Project's objective is to increase the distribution and population density and diversity of native fish and aquatic invertebrates in the mangrove community by improving hydrologic conditions in the SJBE.

The Sport Fisheries Study (Atkins, 2011b) includes an assessment of the red mangrove prop root community within the CMP and within zones in designated distances away from the CMP. It was found that the numbers and diversity of the attached (e.g., mussels and oysters) and mobile (e.g., crabs) organisms found on the roots increased from the CMP and western San José Lagoon out to Torrecillas Lagoon, thus providing an indicator of water quality improvement that would likely respond to the improvements provided by the opening of the CMP. Through this preliminary study, a significant relationship was found between the number of crabs found on mangrove prop roots and distance from the CMP. This relationship uses the connectivity of habitat described above for fish habitat.

2.4.2 Tentatively Selected Plan

The Final Array was further evaluated using the P&G Criteria: completeness, effectiveness, efficiency, and acceptability. Also, a Cost Effectiveness and Incremental Cost Analysis was performed. (See section 5.3 in the FR for a detailed description).

Table 2-8 summarizes the results of each evaluation metric against each Alternative Plan and demonstrates that: (1) each alternative equally achieves Planning Objectives, and results in significant improvements to the natural and human communities in the region of the CMP and the SJBE; (2) each action alternative is complete, effective, and acceptable and (3) Alternative Plans 1 and 3 are not cost effective (efficient), whereas Alternative Plan 2 is cost effective (efficient).

Results: Alternative Plan 2 has been selected as the TSP for the CMP-ERP. The TSP meets the Projects objectives, is both cost effective and a best buy, and has been demonstrated to be more acceptable to state and local agencies as well as the public. The plan is also compatible with all applicable laws and policies.

Alternative Plan 2 implementation or construction is proposed or expected to last between October 2018 and December 2020. However, project construction may be sequenced in order to get some sites within the Project Area worked in advance.

Table 2-8. Comparison of Alternative Plans

Evaluation Metric	No Action Alternative Plan	Alternative Plan 1 (75-x-10-ft Channel)	Alternative Plan 2 (100-x-10-ft Channel)	Alternative Plan 3 (125-x-10-ft Channel)
Planning Objective 1 (Changes in Habitat Units for Fish Habitat in the SJBE)	There is no net change in habitat units of fish habitat over the planning horizon	A net increase of 5,050.9 AAHUs of fish habitat in comparison to the No Action Alternative.	A net increase of 5,056.0 AAHUs of fish habitat in comparison to the No Action Alternative.	A net increase of 5,061.3 AAHUs of fish habitat in comparison to the No Action Alternative.
Planning Objective 2 (Changes in Benthic Habitat Units)	There is no net change in benthic habitat area over the planning horizon.	A net increase of 294.54 benthic AAHUs in comparison to the No Action Alternative.	A net increase of 294.54 benthic AAHUs in comparison to the No Action Alternative.	A net increase of 294.54 benthic AAHUs in comparison to the No Action Alternative.
Planning Objective 3 (Changes in Habitat Units for Mangrove Habitat in the SJBE)	There is no net change in habitat units for mangrove habitat over the planning horizon	A net increase of 787.7 AAHUs of mangrove habitat in comparison to the No Action Alternative.	A net increase of 782.7 AAHUs of mangrove habitat in comparison to the No Action Alternative.	A net increase of 777.4 AAHUs of mangrove habitat in comparison to the No Action Alternative.
Cost Effectiveness/ Incremental Cost Analysis	N/A	$1,510 annual cost/ annual habitat unit. Not as cost effective as Alternative Plan 2, which has the same benefits for a lower average cost per unit.	$1,420 annual cost / annual habitat unit. Cost effective. No other alternative plan produces the same benefits for lesser costs.	$1,480 annual cost/ annual habitat unit. Not as cost effective as Alternative Plan 2, which has the same benefits for a lower average cost per unit.
P&G Criteria: Completeness	Not complete.	Complete.	Complete.	Complete
P&G Criteria: Effectiveness	Not effective. Does not meet project objectives.	Meets the project objectives.	Meets the project objectives.	Meets the project objectives.
P&G Criteria: Efficiency	Cost effective and a best buy.	Not cost effective.	Cost effective and a best buy.	Not cost effective.
P&G Criteria: Acceptability	Not acceptable.	Acceptable.	More Acceptable.	Most Acceptable.

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3.0 AFFECTED ENVIRONMENT

3.1 CLIMATE

3.1.1 Temperature and Precipitation

The National Weather Service's Luis Muñoz Marín (LMM) International Airport automated weather station, collects data on rainfall and temperature that is representative of the Project Area's climatic conditions. It is located close to an elevation of 9 feet, at approximately 0.53 mi. northeast of the San José Lagoon. The LMM Station reports an average annual precipitation of 56.35 inches (in.). The lowest average monthly precipitation is reported in March, with 1.95 in., while the highest average monthly precipitation is in November, with 6.35 inches of rain.

A recent study reported a positive trend of increasing annual rainfall for the San Juan Metropolitan Area (SJMA) between 1955 and 2009 (Méndez-Lázaro, Nieves-Santiago, and Miranda-Bermúdez, 2014). The winter months of January and February had an increase in monthly rainfall, although winter is normally a dry season in the Puerto Rico. Regarding dry days, an annual decreasing trend was found, also specifically in winter. Heavy rains were found to be more common in summer and fall in accordance with the hurricane season, whereas the most intense rainfall episodes tended to occur in spring.

The average annual temperature in the LMM International Airport automated weather station is approximately 27.3°C (81.1°F), the average low annual temperature is approximately 24.1°C (75.4°F), and the average high annual temperature is approximately 30.4°C (86.7°F). The coldest month of the year is January, with an average monthly temperature of 25.3°C (77.6°F), although both January and February have an average low monthly temperature of 22.2°C (72.0°F). The hottest month is August, with an average monthly temperature of 28.7°C (83.7°F), although both, August and September, have an average high monthly temperature of 31.8°C (89.2°F) (see Table 3-1).

Table 3-1. Summary of average annual and monthly temperature, rainfall and humidity for the LMM International Airport Automated Weather Station

NCDC 1981-2010	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average High (°F)	83.2	83.7	84.9	86.2	87.5	88.9	88.7	89.2	89.2	88.4	85.9	83.9	86.7
Average Low (°F)	72.0	72.0	72.9	74.4	76.3	77.7	78.1	78.2	77.8	76.9	72.2	73.4	75.4
Average Rain (in.)	3.76	2.39	1.95	4.68	5.90	4.41	5.07	5.46	5.77	5.59	6.35	5.02	56.3
Humidity	75	71.5	69	69	72	71	73	73.5	73	73.5	74.5	74.5	72.5

Source: National Climatic Data Center. (2011). Monthly Station Normals of Temperature, Precipitation, and Heating and Cooling Degree Days 1981--2010, Puerto Rico. National Oceanic and Atmospheric Administration.

Puerto Rico's temperature for 2050 is expected to increase 0.8°C (33.44°F) due to climate change (PRCCC, 2013). Puerto Rico is warming up and extreme heat events in San Juan are increasing in both intensity and frequency (Méndez-Lázaro, et al., 2015). Although there is a lot of uncertainty in the magnitude of precipitation changes in the Caribbean, current evidence suggests a decrease in annual precipitation for Puerto Rico (PRCCC, 2013). Extreme precipitation events are expected to occur more frequently, resulting in more rain falling in less time.

3.1.2 Wind Speed and Wind Direction

The prevailing or average wind direction in the Project Area is from the East (E) – Northeast (NE), with an average wind speed of 8.3 miles per hour (mph), based on the average annual wind direction and speed climatic data of San Juan (Atkins, 2012f) (see Table 3-2).

Table 3-2. Average monthly wind direction and speed (mph) in the San Juan Area

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Wind Direction	E	ENE	ENE	ENE	ENE	ESE	E	E	E	ESE	E	ENE	-
Wind Speed	8.3	8.7	9.1	8.8	8.3	8.9	9.6	8.7	7.5	6.6	7.4	8	8.3

Source: Atkins, 2012g.

3.2 GEOLOGY

Puerto Rico's geology can be divided into two broad formations belonging to rocks of volcanic or sedimentary origin. Those of sedimentary origin consist mostly of limestone, and are normally found underlying the northern part of the Island and sections of the southern coastal plains.

The coastal plain of the SJMA shows a surficial geology dominated by lagoon and estuarine environments, covered by fluvial and eolian deposits that have dictated the geomorphologic evolution of this region. Estuary areas are characterized by low-lying flat land that has evolved to its present conditions by erosion, deposition, compaction, and subsidence, all of which are still active.

The Project Area in the eastern half of the CMP consists of middle Tertiary limestone in sporadic outcrops, mostly forming prominent hills, locally known as "mogotes". On top of the limestone lies the upper Tertiary and Quaternary coastal, lagoon, fluvial and eolian sediments, mainly from the late Pleistocene and Holocene, which cover older deposits (Pease & Monroe, 1977). This area's geology is characterized by a middle Tertiary Aymamón limestone formation (Tay), composed of a light pale, very porous fossile ferous, massive to thick limestone beds (Alemán, 2010; Lugo et al., 2001). In the CMP, east of the José Celso Barbosa Bridge, limestone can be found at depths as shallow as 10.5 feet (Atkins, 2011f).

A few surficial karst features or outcrops still remain as "mogotes", two of which are found in the northeastern banks of the CMP, and in the western shore of the San José Lagoon, in the form of two small islands locally known as Guachinanga and Guachinanguita. Although the maximum exposed thickness for the Aymamón formation is mentioned by Pease and Monroe (1977) to be 32.8 feet, there are other older limestone formations below this unit, which control the structure of the regional area.

Overlying the limestone are late Tertiary and Pleistocene deposits. The late Tertiary deposits consist of older alluvial units (Qtt) composed of weathered clay, silt, and sandy sediments that include fragments of the Mucabarones sand and the relicts of the San Sebastian Formation from the Oligocene age. The thickness of this formation appears to be greater than 328 feet. Fragments from the older alluvial deposits can also be found. The Pleistocene deposits correspond to the alluvial fans deposits (Qf), which include reworked rocks and sediments from older formations formed of weathered clay, silt and sandy sediments. They consist of mottled red and light gray deposits and are the sediments forming the banks of the CMP and some of the submerged areas in the San José Lagoon.

Finally, swamp deposits and alluvium are the most recent deposits in the area. Swamp deposits (Qs) consist mostly of sandy muck, clayey sand, and peats in areas with very organic sediments associated with low energy estuary environments and mangrove areas. These deposits have been intensively and artificially filled within the CMP. The alluvium deposits (Qa) are made up of recent fluvial sands, clays and sandy clays. Thickness of this formation a few miles west of the CMP was reported to be 66 feet.

3.3 SOILS

The native soils close to the Project Area’s water bodies belong to three main soil associations as described by the USDA Natural Resources Conservation Service (NRCS). Soils originally found close to the shores of the CMP corresponded to the Almirante-Vega Alta-Matanzas association. These have been described as formed by transported materials, deep, gently sloping to sloping, well drained on terraces and alluvial fans of the coastal plain (Boccheciamp, 1978).

Soils encountered during soils surveys conducted in the CMP were almost entirely organic silt and clay layered with peat. Minor amounts of silty sand were present near its western end. The soil materials were very soft, with very low bearing strength to depths of 25 to 30 feet or more beneath the channel centerline. Soils of the CMP are predominantly hard silts and clays at a depth of 10 to 15 feet below the existing bottom.

Today, most of the soils in the eastern CMP have been severely altered and are mainly composed of artificial fill consisting of sand, limestone and volcanic rock. The superior soil layers in those areas once occupied by wetlands or open water, where substandard housing has been established, also include a combination of debris, rip-rap, rubble, household waste, trees and vegetation, discarded furniture, abandoned cars, metal and other waste, accounting for 10 percent or more of the soil composition (Atkins, 2011f). In some areas, the thickness of this material can exceed 10 feet below the surface. Most areas now covered by artificial fill are underlaid by swamp deposits.

In contrast, soils in the San José Lagoon are predominantly sands and have been excavated due to their value as fill. There are scattered patches of swamp deposits consisting of sandy muck and clayey sand generally underlaid by peat formed by mangrove swamps, such as those found along the northern, eastern and southeastern shores of the San José Lagoon (Boccheciamp, 1977; 1978).

Soils in the eastern shore of the San José Lagoon north of the Quebrada San Antón creek have been classified as Made land (Md). These have been altered by earthmoving operations during the past (Boccheciamp, 1977). Most of the sediments that were dredged from the Suárez Canal when it was deepened and widened during the 1960s were deposited in these areas. Vegetation, however, has reestablished itself in this location during the last three decades.

3.4 HYDROLOGY

The CMP connects the San Juan Bay (SJB) and the San José Lagoon across a 3.75 mile tidal channel (see Figure 1-1). Maximum elevations along the CMP's northern watershed are approximately 100 feet-MLLW, and street slopes are approximately of 4 percent. Elevations along the communities located south of the canal are gentler, with maximum elevations of approximately 33 feet-MLLW and street slopes averaging 1 percent (Atkins, 2013b).

Historically, the waterway of the CMP had an average width of at least 200 feet and a depth between 6 and 8 feet. It was used as an inland route to navigate the north coast of the Island within the Study Area. Today, the eastern CMP has an approximate length of 1.89 mi., up to its outlet to the San José Lagoon. The widest, open water section of the eastern CMP has approximately 131.2 feet, about 285.4 feet east of the Ponce de León Avenue running over the Martín Peña Bridge. Water depth in the eastern CMP ranges from approximately 3.94 feet, about 328 feet west of the Barbosa Avenue Bridge, to basically none. The latter is located east of the Barbosa Avenue Bridge, where mangroves and other vegetation have grown over sediments, refuse and other debris deposited or used as fill material over the past decades (Webb and Gómez-Gómez, 1998).

The San José Lagoon is divided into two sections named Los Corozos Lagoon to the northwest and the San José Lagoon, to the southeast. These have a combined surface area of approximately 1,129 acres (SJBEP, 2000). For this Draft EIS, both are referred to as the San José Lagoon. There is no direct connection between this lagoon and the ocean. Ocean waters have access to it across the Suárez Canal, which connects to La Torrecilla Lagoon. The connection provided through the Suarez Canal, however, is constricted in its middle section, where the Román Baldorioty de Castro Expressway Bridge crosses the canal. La Torrecilla Lagoon connects to the ocean through the Boca de Cangrejos outlet.

The San José Lagoon receives fresh water discharges and runoff from two major urbanized creeks: Juan Méndez, in its southwestern end, and San Antón, in its southeastern shore. Several small drainage canals, both unpaved and paved, discharge into the southern shores of the lagoon. A relatively large unpaved drainage canal coming from the LMM International Airport, exits into the northeastern corner of the lagoon. In addition, it receives significant fresh water inputs from two storm water pump stations that discharge into its northern shores. The first services the Villamar residential community and is operated by the Municipality of Carolina. The second, managed by the Puerto Rico Department of Natural and Environmental Resources (DNER), services a rather large area, and receives combined sewer overflows from the Luis Lloréns Torres public housing project, the Villa Palmeras community, and a section of the Román Baldorioty de Castro Expressway (Road PR-26) (Atkins, 2013b).

The natural average depth of the San José Lagoon was 6 feet, and it did not exceeded 8.2 feet (Ellis, 1976; Conde-Costas, 1987). The lagoon was dredged for sand and fill mining between the late-1950s and 1960s, altering about 17 percent of its bottom surface and, as a result, several artificial depressions or dredged pits are found today.

The dredged pit at the northwestern section of the San José Lagoon (i.e. Los Corozos Lagoon) is known to have an approximate depth of 17.5 feet. Other two dredged areas can be distinguished. The first depression extends from the outlet of the Suárez Canal, towards the northwest and parallel to the lagoon's shores, until halfway to the Teodoro Moscoso Bridge. This area consists of three dredged pits, with depths varying from approximately 15 to 28.4 feet. The second depression is found south of the Suárez Canal outlet, extending along the southeastern shore of the lagoon, next to the Quebrada San Antón creek's outlet. It consists of two dredged pits; approximately 28.4 feet to 32 feet deep. It is worth noticing that, while the bottom of one of these pits was originally measured to be 32 feet deep, recent measurements show that this depth was reduced to 27 feet, and that at least three other of these pits have been partially filled since the last bathymetric survey in 1996 (see Figure 3-1).

The sedimentation rate analysis performed by Moffatt & Nichol Engineers in 2003 estimated an in-fill rate of 1.53 in/yr for the San José Lagoon, due to the low-energy waters and the dredged pits. While rates in other lagoons in the SJB system range from 0.09in/yr to 0.24 in/yr. Within the CMP's outlet at San José Lagoon, the sedimentation rate was estimated at 6.7 feet per year (ft/yr), which is due to sediment discharges from the Quebrada Juan Méndez creek.

The 2.3 mile long Suárez Canal, located southeast of Luis Muñoz Marín International Airport, connects the San José and La Torrecilla lagoons. It receives runoff from part of the airport and the Los Angeles development. La Torrecilla Lagoon, located east of the airport, discharges into the Atlantic Ocean through Boca de Cangrejos and receives runoff from the urban watershed of the Blasina Canal. La Torrecilla Lagoon actually connects to Piñones Lagoon through the Blasina Canal via the Piñones Channel, which is located 850 meters upstream of Blasina's mouth at La Torrecilla Lagoon.

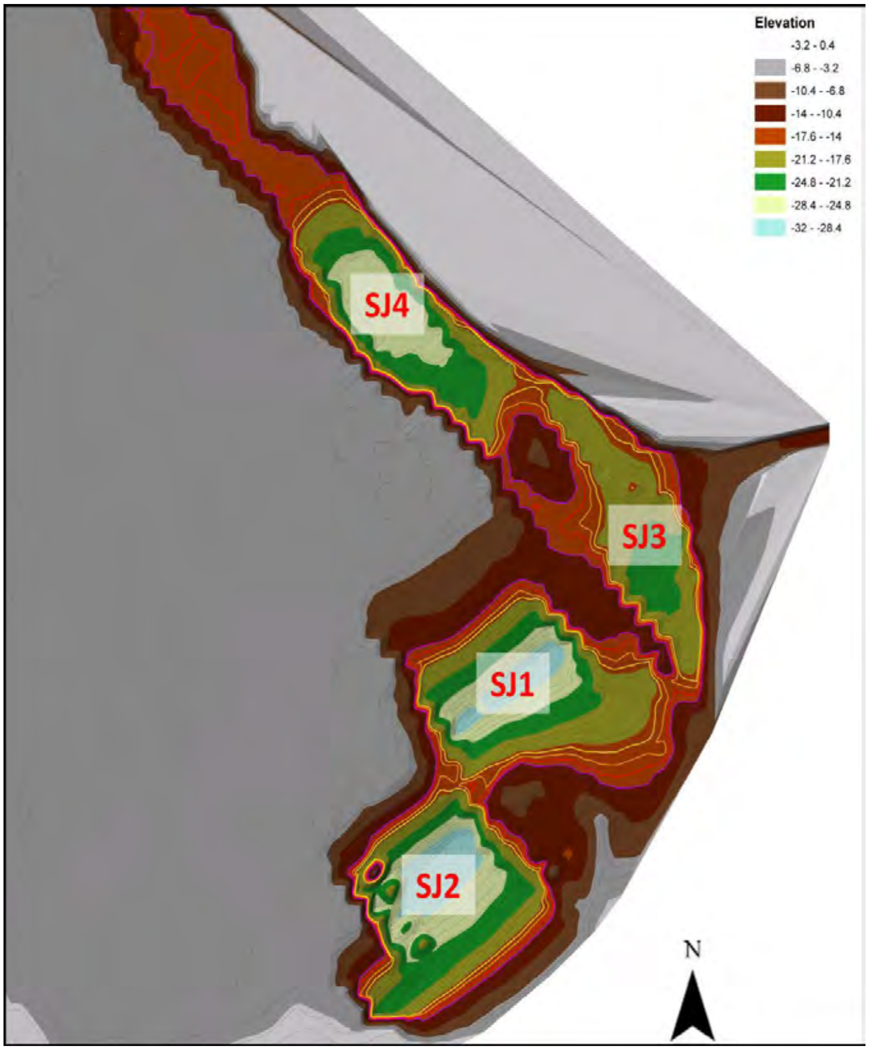

Figure 3-1 San José Lagoon Existing (1996) Pit Bathymetry (elevations in feet)

On the other hand, tides in the Study Area have a mean range of 1.10 feet and a diurnal range of 1.58 feet. The highest observed water level in this station was 2.785 feet Mean Lower Low Water (MLLW) in 1998, while the lowest was -1.085 feet.[3] Tides in the Study Area are mixed semidiurnal with two highs and two lows of unequal height every day. The tidal range between the mean elevation of the lower of the two waters and the mean of the higher of the two high waters is 19.2 in. The magnitude of daily tidal oscillations varies within the SJBE and is controlled primarily by the hydraulic characteristics of the channels and the surface areas of each waterbody. According to Webb and Gómez-Gómez (1998), tidal oscillations in the San José Lagoon, for example, are limited to about 1.97 in. They also reported that it is common for river and storm-water discharges to dominate tidal flow patterns in the SJBE, especially in waterbodies such as the CMP and the San José Lagoon with restricted connections to the open ocean.

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[3] The tidal station referenced for the CMP-ERP is the La Puntilla station, number 9755371. It is located across the San Juan Bay at the U.S. Coast Guard Station on La Puntilla, latitude 18° 27.5' N, longitude: 66° 6.9' W, NOAA Chart #25670.

At present, the CMP has no apparent ability to convey flows into and out of San José Lagoon, as it has been nearly completely blocked as a result of siltation, accumulation of household and construction debris, and the encroachment of housing and other structures. Due to the clogging of the CMP, there is little to no tidal exchange between the SJB (located to the west of the CMP) and the San José Lagoon (Bunch et al., 2000; Cerco et al., 2003; USACE, 2004). Under existing conditions, the average residence time of waters within San José Lagoon is estimated at 16.9 days.

3.4.1 Runoff & Floods

Historically, low lying areas along the CMP have been subject to frequent floodings. Sources of flooding include: urban runoff from rain events over the CMP, Barrio Obrero, and Hato Rey. Existing storm inlets along Borinquen and Rexach avenues are frequently clogged with sediment, garbage, and runoff that fails to enter these inlets and continues south along the streets until it reaches CMP. Flood waters flow along the Juan Méndez Creek on the southeastern end of the CMP. Flood waters also include a much attenuated storm surge through the SJB to the west of the CMP and/or the Suárez Canal into San José Lagoon, to the east of the CMP.

The existing storm sewer system was designed more than 35 years ago, and it most likely does not comply with current regulations and requirements (Atkins, 2013b). In addition, the storm sewer's hydraulic capacity has been compromised by an unknown amount of sanitary sewage that enters the combined system (Atkins, 2013b).

According to the NOAA Atlas 14, published in October 26, 2006, the rainfall depth for a 100-year event in the study area is 1.96 in. for a half hour period, and 11.43 in. for a 24 hour period.

Because drainage areas adjacent to the eastern CMP are heavily urbanized, stormwater runoff tends to reach the eastern CMP quickly and in large quantities. Time of concentration[4] along adjacent basins to the eastern CMP varies from 10 to 45 minutes, while the curve number is 98[5] (Atkins, 2013b), which implies small drainage areas and mostly impermeable surface. This results in peak discharges along the drainage basins adjacent to the CMP that range from 92 ft^3/s for a 2-year event, to 1,108 ft^3/s for a 100-year event. The total runoff volume to reach the eastern CMP for a 24 hour and 0.5 in. rainfall event is estimated to be 897,000 ft^3 (Atkins, 2013b).

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) a large portion of the CMP channel banks are located within a flood prone area with 100-year base flood elevation of 5.9 feet. The 100 year floodplain extends up to 1,150 feet south and up to 1,800 feet north from the channel. These base flood levels are influenced by the storm surges at the San José Lagoon and the SJB. Due to the CMP's lack of conveyance to manage stormwater

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[4] The time of concentration is the time required for a drop of water falling on the most distant point of the watershed to influence discharge at the watershed exit.

[5] Curve Number represents the runoff potential within a watershed and is estimated based on soil type (hydrologic soil group), land use and Antecedent Moisture Condition (AMC).

discharges, the communities bordering it frequently suffer flooding events, not only under major rainfall (e.g. 100-yr or 50-yr rainfall), but also from minor and more frequent rainfall (e.g. 2-yr, 5-yr, or 10-yr rainfall).

On the other hand, it is expected that sea level rise (SLR) is going to impact drainage and flood levels in the Study Area. The lands adjoining the eastern CMP and the San José Lagoon are leveled, and thus, their drainage capacity is limited. The effects of SLR would start to become more noticeable as outflows from the area's storm sewer system begin to be restricted and, eventually, overrun or permanently flooded by the progressively increasing levels of these two water bodies.

3.5 WATER AND SEDIMENT QUALITY

The Study Area's water quality has been significantly altered from its natural state. In places, the SJBE is hypereutrophic or overwhelmed with nutrients, has anoxic or oxygen-lacking bottom waters, its sediments contain heavy metals, trace elements, and organic compounds; and receives raw-sewage from combined storm sewer overflows and direct discharges from housing along parts of its perimeter (Kennedy et al., 1996; Webb, R.M.T. and Gómez-Gómez, 1998; SJBEP, 2000; PREQB, 2008). Pollutant loadings impacts from land use activities have been compounded by the modification of the estuary's hydraulic properties through the dredging and filling of most of its waterbodies.

3.5.1 Water Quality

Datasets collected by the SJBEP in 2008 and 2009 in three stations located within the CMP and the San José Lagoon show high nutrient levels, low concentrations of dissolved oxygen (DO), high turbidity, and high concentrations of fecal coliform (Atkins, 2011l).[6] Recent surface water samples by the USEPA and the SJBE Program have revealed fecal coliform counts ranging from 2,100 colonies per 100 ml of water to 2,000,000 colonies per 100 ml of water. These concentrations indicate that CMP waters have from 10 to 10,000 times the permitted standard for indirect contact with water according to the PREQB. The maximum standard permitted by the PREQB for indirect contact is 200 fecal coliforms (PREQB, 2010). Fecal coliforms in the water may signify the potential presence and risk of contracting diseases transmitted through warm bodied animal waste. Levels of *Enterococci* bacteria have been reported at 11,000 colonies per 100 ml of water and up to 1,200,000 colonies per 100 ml of water. The maximum permitted standard for *Enterococci* bacteria for indirect water contact is 35 colonies per 100 ml of water. Colony levels surpass the permitted standard over 35,000 times. These findings reveal the presence of microbes indicative of human contagious diseases. *Enterococci* are more precise indicators of pollution of human waste origin.

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[6] The most appropriate dataset for assessing the current status of water quality is from the SJBEP, while the most appropriate dataset for assessing trends (if any) in water quality is from station 50049820 from the USGS. Other water quality sampling efforts present several limitations to be used in water quality status and trends determinations since these were collected for different purposes (i.e., calibration of water quality models, investigation of potential problems, etc.), and/or are only available for specific sites and time periods.

The levels of *Enterococci* bacteria are the most worrisome pollution parameter with regards to its public health risks. Finding these significant levels of colonies confirms the presence of direct human waste pollution.

Webb and Gomez-Gomez (1998) found ammonia concentrations up to 2.3 milligrams per liter (mg/L) (as nitrogen) and orthophosphate concentrations of 0.22 mg/L (as phosphorus), as well as anoxic conditions within the CMP water column. Water quality data from these stations are consistent with most of the other water quality sampling efforts conducted during the last decades in the CMP and the San José Lagoon, which reported seldom compliance with Federal and local water quality standards (SJBEP, 2000) (see Table 3-3). The source of these impairments can be related to reduced flushing, wastewater loads from direct and indirect untreated sewage discharges, urban storm runoff, subsurface seepage in areas littered with household waste, and direct household waste dumping (Webb and Gómez-Gómez, 1998).

Table 3-3. Percent of values that exceeded PREQB's standards or SJBEP proposed criteria in the CMP and San José Lagoon during the months of November 2009 to August 2010

Location	DO (mg / l)	Turbidity (NTU)	pH (SU)	Secchi Disk (Inches)	TKN (mg / l)	NOx (mg / l)	TP (mg / l)	Chl-a (µg / l)	BOD (mg / l)	Fecal Coliform Bacteria (# /100 ml)
CMP	100	20	0	7	75	0	0	25	25	100
LSJ 1	30	60	0	60	100	0	0	100	33	100
LSJ 2	30	30	0	80	100	0	0	66	33	100

Source: Atkins, 2011l.

CMP's waters seem to have a strong influence on the San José Lagoon's waters in terms of DO2. However, waters in the San José Lagoon can be just as likely, if not more prone than those from the CMP, to exceed proposed guidance criteria for turbidity, Total Kjeldahl Nitrogen and chlorophyll-a (Atkins, 2011l). Reduced tidal flushing in this lagoon is compounded by urban runoff and other wastewater loadings leading to limited light penetration and eutrophic conditions. Fecal coliform bacteria levels in the CMP, nevertheless, are still much higher than those values found in the San José Lagoon (Atkins, 2011l).

Reduced water circulation or exchange with ocean waters, in turn, may have exacerbated water column stratification in the San José Lagoon, where two well defined salinity layers exist. Although acceptable DO2 levels exist in areas that are, approximately, shallower than 4 feet or 6 feet, hypoxic to anoxic conditions are characteristic of those deeper below the pycnocline[7] (Atkins, 2011b). As a result, surface waters have a salinity of 5 to 18 parts per thousand (ppt), while waters with a salinity of 18 to 30 ppt are found below this stratification layer (Atkins, 2011b). This has been

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[7] Boundary or stratification layer that separates two liquid layers of different densities.

determined to be a long-term condition due to the lack of water exchange within the San José Lagoon that significantly affects the number and diversity of fish and other aquatic resources, and that is worsen by the raw sewage and other polluted discharges still taking place.

Unpublished data from the SJBEP that is to be used to establish water quality trends in the CMP, showed that for the period between 2008 and 2013, water quality had improved based on samples collected at the CMP station, although it was still deemed very poor (Jorge Bauzá, personal communication – April 29, 2014). Limited improvements could have been the result of a new sanitary sewer system that was built for a sector of the Cantera community during said period and that, until recently, used to discharge its untreated sewage directly into the eastern end of the CMP. This data, however, seem to indicate that a reduction in pollutant loads was not enough to offset a general trend towards poorer water quality in the San José Lagoon, overall (Jorge Bauzá, personal communication – May 1, 2014). This may be due to limited circulation or reduced water renewal in the San José Lagoon, a condition that has become worst as the eastern CMP has become almost completely clogged since the late 1990s.

On the other hand, the USGS water quality station (500495280), located at the San José Lagoon near its confluence with the CMP, collects data from the 1970s, allowing to assess long-term water quality trends (Atkins, 2011l). Some of the water quality parameters (temperature, DO2, nitrogen, phosphorus) appear to be trending over time, while others are highly variable (specific conductance), as discussed below:

- Water temperatures at this location appear to be trending upwards. Perhaps due to issues related to climate change, but more likely due to localized factors such as the increasing isolation of waters in the San José Lagoon as the CMP has closed over time, and the heat island effects due to the surrounding and increasing urban landscape.
- Levels of DO2 in the San José Lagoon exhibit a pattern that appears to reflect both, an overlying trend of a reduction in the maximum levels recorded, as well as an increase in the minimum levels recorded, when comparing values from the late 1990s to present versus values in the 1970s and 1980s. These data are suggestive of a situation of reductions in levels of phytoplankton biomass in the San José Lagoon over time, as elevated levels of phytoplankton would be expected to bring about both DO2 higher high values (through elevated rates of photosynthesis) as well as lower low values (through greater respiration rates). A stabilization of these DO2 values over time suggests that at least this portion of San José Lagoon might be experiencing reduced levels of eutrophication, even if the average DO2 concentration has declined over time (Webb and Gómez-Gómez, 1998).
- There is some evidence of a potential downward trend in values of total nitrogen in San José Lagoon over the past few decades. There is also a very strong downward trend of total phosphorus concentrations at this site, perhaps reflecting improvements in wastewater treatment previously noted at various locations throughout the SJBE watershed (Webb and Gómez-Gómez, 1996 and 1998; Webb et al., 1998). In addition, household detergents have phase out the use of phosphates in recent years. As such, phosphorus inputs, even those coming from untreated wastewaters, could have also diminished, helping this downward

trend in total phosphorous concentrations. Perhaps associated with declining levels of phosphorus concentrations at this site, there is evidence of improved water clarity as well. This positive trend would be expected if phytoplankton biomass was at least partially limited by phosphorus availability, which has decreased at this same location. Unfortunately, there is not a long-term record of chlorophyll-a at this same location, so potential trends in phytoplankton levels are inferred from the reduction in phosphorus, the positive trend in water clarity, and the apparent pattern of more moderate levels of DO2 (lower highs and higher lows) at this site in western San José Lagoon.

- Specific conductance has been highly variable over time, and no clear pattern exists to suggest an overall monotonic trend. However, low values during the late 1990s and early 2000s appear to be lower than the lowest values recorded in the 1970s to 1980s possibly showing the isolation and reduced inflow of ocean waters due to the increasing constriction in the CMP.

Combined, these sources of information suggest that prior activities to ratchet back on point source discharges, discussed in Webb and Gómez-Gómez (1998), and the partial elimination of direct sewage discharges from the Cantera community into the eastern CMP, have already brought about some improvements in certain water quality parameters for at least this portion of the San José Lagoon, momentarily. The ongoing and reduced ecological integrity of San José Lagoon, despite substantial reductions in pollutant loads, appears to be mostly due to salinity stratification and the development of hypoxic conditions (low levels of dissolved oxygen) in waters deeper than 4 to 6 feet (Atkins 2011b).

3.5.2 Sediment Composition and Quality

Sediments are materials carried and settled at the bottom of rivers, harbors, and lakes. Typical sediments are a mix of fine soil particles from runoff and wind erosion mixed with decomposing organic material. In urban and farming areas sediment may include manmade materials like petroleum products, pesticides, and metals. The typical sediment is a mixture of clay and silt that may contain traces of minerals, heavy metals (silver, arsenic, cadmium, chromium, copper, mercury, nickel, lead, zinc), pesticides, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and may have an hydrogen sulfide (H_2S) smell (or like rotten egg smell). In some cases, sediments may also have traces of petroleum products and ammonia.

Fill material within the CMP comprises a mix of sediment and solid waste. Solid waste is any discarded material, abandoned, inherently waste-like, and not excluded by law. It is estimated that solid waste would make up approximately 10 percent of the total material to be dredged in the CMP. In some sites, the thickness of this material exceeds 10 feet below the surface (Atkins, 2011l).

The estimated in-fill rate within the CMP's outlet at San José Lagoon is 6.7 feet per year (ft/yr). Discharges in the lower reaches of the Juan Méndez Creek are the primary contributor of sediments deposited within the channel's outlet. On the other hand, the sedimentation rate for the entire CMP was estimated to be 1.5 in. per year. Illegal filling and combined sewer discharges have been identified as the primary sources for sedimentation in the entire CMP.

The sediments that characterize the first 10 feet of the CMP eastern half are generally formed of soft to very soft black organic mud, clays and silts with some lenses of sandy material. The sediments that characterize the first 40 feet of the channel banks show a large range of geotechnical conditions, from soft to very soft black organic mud, clays, silts with some lenses of sandy material, consistent with the channel, then become stiff sandy clays and stiff silty clays, sandy gravels and clayey gravels. Silica sands swamp and alluvium appear to be most unconsolidated deposits in this region of the eastern CMP channel. Gravels, cobbles and boulders may be present east of the Barbosa Avenue Bridge (Atkins, 2011l).

At one sediment core analyzed in the northwestern section of the San José Lagoon (i.e. Los Corozos Lagoon), superficial sediments 0 to 10.2 in. were found to be dark green, organic-rich, mud with abundant shell fragments, and made up of 1% gravel, 4% sand, 59% silt and 36% clay, by weight percent (Webb, R.M.T. and Gómez-Gómez, 1998). Superficial sediments have been described at another core studied in the San José Lagoon as being poorly consolidated, dark grey organic rich mud with abundant shell fragments. Their grain has been found to be 10% gravel, 12% sand, 38% silt, and 40% clay by weight percent (Webb, R.M.T. and Gómez-Gómez, 1998). These have also been reported as being generally made up of 32% sand, 48% silt and 20% clay. Sediments with the highest sand (48%) and lowest clay (11%) content have been found closer to the outlet of the CMP, while those with the highest silt content are closest to the Suárez Canal outlet (Negrón-González, 1988).

Sediment quality tests are generally useful to characterized overall environmental trends within a waterbody. When undisturbed, bottom sediments cores can provide a sequence of those water quality and aquatic biota conditions present during different time frames.

Sediments sampled over the years in the CMP and the San José Lagoon can be characterized as severely degraded, being generally anoxic, with more than normal high organic content due in part to wastewater loads and reduced tidal flushing, as evidenced by previous environmental documents related to the SJBE (eg. EA, EIS, survey reports, and management plans). These conditions are more severe in the CMP and in the artificial dredged pits found in the San José Lagoon (Atkins, 2011b).

The artificial dredge pits and the lack of overall water conveyance in the San José Lagoon are two factors that may have acted as a sediment trap, explaining in part the average total organic carbon (TOC) concentrations sampled. The hydrologic characteristics leading to the high TOC values registered could have been compounded even further by the wastewater loads discharges affecting the CMP and the San José Lagoon. Even if this is the case, it is important to clarify that coastal sediments experiencing no anthropogenic inputs are substantially loaded by organic compounds due to natural processes common to coastal areas in Puerto Rico, namely organic production by mangroves and plankton in coastal lagoons (Otero & Meléndez, 2011).

Webb and Gómez-Gómez (1998) measured the concentrations of seven trace metals in sediment core samples in the SJBE representing deposition time periods of 1925-1949, 1950-1974, and 1975-1995. Analytical results revealed that only mercury and lead concentrations had increased in the most recent sediment strata (1975-1995), compared to levels in older sediment strata. The highest concentrations of mercury and lead were homogeneous throughout the SJBE, lead levels varied with location from an average of 370 µg/g, in samples collected from San José Lagoon, to concentrations ranging from 20 to 50 µg/g, in samples collected at the remaining sampling stations.

Polychlorinated Biphenyls (PCBs), DDT, lead and mercury, were the most abundant contaminants encountered in bottom sediments in the SBJE (SJBEP, 2000). Bis (2-ethylhexyl phtahalate), a common plasticizing agent, was encountered in CMP's bottom sediments in concentrations up to 20,000 micrograms per kilogram (mg/kg). Webb and Gómez-Gómez (1998) found significant levels of PCBs, organochlorine pesticides and semi-volatile organic compounds. They found a total PCB concentration in excess of 450 µg/g in the CMP and the San José Lagoon.

More recently, CMP elutriate samples statistics for the measurable organic and inorganic parameters and corresponding water quality criteria listed by PREQB (2010), and NOAA's SQuiRTs screening levels were analyzed (Atkins 2013d).[8] For several of the parameters, sediment screening levels were not available (e.g. TOC, ammonia, aroclor 120, chromium trivalent, chromium VI, cyanide, TPH DRO, TPH ORO, TPH GRO, and total solids). For those with screening levels, concern in the CMP was identified for: anthracene, antimony, arsenic, copper, dieldrin, lead, mercury, selenium, silver and zinc; as well as other pesticides and various other compounds. The percent of exceedances of the minimum screening criteria were calculated in order to identify if any of the ten sediment sampling sites collected in a previous Water and Sediment Quality Study conducted by Atkins (2011l) had consistently elevated concentrations.[9] For each site, the number of parameters with values exceeding, the TEL or AET was calculated and a percent exceedance was determined and results are presented in Table 3-4 and Table 3-5.

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[8] SQuiRTs provide multiple screening levels or concentrations for estuarine and marine sediments that are used for comparative purposes.

[9] In 2010, Atkins prepared a report reviewing existing water quality data from 2009 and 2010 and comparing the sediment and porewater data from 2000 and 2004 to NOAA's Office of Response and Restoration Screening Quick Reference Tables (SQuiRTs).

Table 3-4. USACE CMP Sediment Concentrations (Bailey et al., 2002) with corresponding NOAA SQuiRTs levels

Parameter	CMP Sediment Concentration (mg/kg)	NOAA-SQuiRTs Values (mg/kg)							
		T20	TEL	ERL	T50	PEL	ERM	AET	EcoTox EqP
2-Methylnaphthalene	0.0863	0.021	0.0202	0.07	0.128	0.201	0.67	0.064	
Acenapththylene	<.032	0.014	0.00587	0.044	0.14	0.128	0.64	0.071	
A-Endosulfan	<0.00265							0.0029	
Aldrin	0.00523							0.0095	
Anthracene	0.0703	0.034	0.0469	0.0853	0.29	0.245	1.1	0.28	
Antimony Total	1.17	0.63			2.4			9.3	
Arsenic	12.4	7.4	7.24	8.2	20	41.6	70	35	
B-Endosulfan	<.0053							0.014	
Benzo(a) Pyrene	0.3	0.069	0.0888	0.43	0.52	0.763	1.6	1.1	
Benzo(a)anthracene	0.302	0.061	0.0748	0.261	0.466	0.693	1.6	0.96	
Benzo(b)fluoranthene	0.548	0.13			1.107			1.8	
Benzo(g,h,i) Perylene	0.595	0.067			0.497			0.67	
Benzo(k) Fluoranthene	0.173	0.07			0.537			1.8	
Cadmium	9.59	0.38	0.68	1.2	1.4	4.21	9.6	3	
Chlordane	<.0265		0.0026	0.0005		0.00479	0.006	0.0028	
Chromium	47.5	49	52.3	81	141	160	370	62	
Chrysene	0.463	0.082	0.108	0.384	0.65	0.846	2.8	0.95	
Copper	181	32	18.7	34	94	108	270	390	
Dibenz(a,h)Anthracene	0.299	0.019	0.00622	0.0634	0.113	0.135	0.26	0.13	
Dieldrin	0.0203	0.00083	0.00072	0.00002	0.0029	0.0043	0.008	0.0019	
Fluoranthene	0.941	0.119	0.113	0.6	1.034	1.494	5.1	1.3	
Fluorene	0.0703	0.019	0.0212	0.019	0.114	0.144	0.54	0.12	0.54
Heptachlor	<.00265							0.0003	
Heptachlor Epoxide	<.00265	0.0006				0.00274			
Indeno(1,2,3-c,d) Pyrene	0.509	0.068			0.488			0.6	
Lead Total	281	30	30.24	46.7	94	112	218	400	
Mercury	2.44	0.14	0.13	0.15	0.48	0.7	0.71	0.41	
Methoxychlor	<.0265							0.019	
Naphthalene	0.0554	0.03	0.0346	0.16	0.217	0.397	2.1	0.23	0.48
Nickel	32.3	15	15.9	20.9	47	42.8	51.6	110	
Phenanthrene	0.158	0.068	0.0867	0.24	0.455	0.544	1.5	0.66	
PPDDD	0.013		0.00122	0.002		0.0781	0.02	0.016	
PPDDE	0.0379		0.00207	0.0022		0.374	0.027	0.009	
PPDDT	0.0237		0.00119	0.001		0.00477	0.007	0.012	
Pyrene	1.08	0.125	0.153	0.665	0.932	1.398	2.6	2.4	
Selenium	1							1	
Silver	3.4	0.23	0.73	1	1.1	1.77	3.7	3.1	
Sulfide	696							4.5	
Toxaphene	<.0265		0.0001					0.028	
Zinc	1050	94	124	150	245	271	410	410	

Source: Atkins, 2013. Note: Cells highlighted in yellow denote exceedances of various criteria. Cells with light shading denote instances where minimum detection limit is higher than the screening criteria.

Table 3-5. CMP sediment sample statistics for the measurable organic and inorganic parameters and corresponding NOAA-SQuiRTs values

Parameter	MDL (mg/kg)	Statistics (mg/kg)			NOAA-SQuiRTs Values (mg/kg)						
		n	Average	Maximum	T20	TEL	ERL	T50	PEL	ERM	AET
TOC	0.5	10	35.8	62.7							
Ammonia	6	10	73.2	19							
Antimony Total	0.45	10	0.5	0.5	0.63			2.4			9.3
Aroclor 1260	0.02	10	0.02	0.0							
Arsenic Total	0.25	10	6.6	14.6	7.4	7.24	8.2	20	41.6	70	35
Beryllium Total	0.01	10	0.01	0.01							
Cadmium Total	0.05	10	0.7	1.3	0.38	0.68	1.2	1.4	4.21	9.6	3
Chromium- Total	2.5	10	24.0	51.4	49	52.3	81	141	160	370	62
Chromium-trivalent	0.1	10	24.0	51.4							
Chromium VI	1	10	1.0	1.0							
Copper Total	1	10	45.7	105	32	18.7	34	94	108	270	390
Cyanide Total	0.3	10	0.3	0.5							
Lead Total	1.6	10	68.0	155	30	30.24	46.7	94	112	218	400
Mercury Total	0.02	10	0.5	1.1	0.14	0.13	0.15	0.48	0.7	0.71	0.41
Nickel Total	0.4	10	7.8	13	15	15.9	20.9	47	42.8	51.6	110
Selenium Total	0.5	10	1.04	2.3							1
Silver total	0.1	10	1.5	2.4	0.23	0.73	1	1.1	1.77	3.7	3.1
TPH DRO	4	10	320	652							
TPH GRO	.015	10	0.1	0.7							
TPH ORO	4	10	2287	4502							
Zinc total	0.25	10	230	678	94	124	150	245	271	410	410
Thallium Total	0.5	10	0.7	1.3							
Sulfide	0.2	10	573	1240							4.5
Di-n-butyl phthalate	.005	10	0.1	0.6							0.058
Total Solids %	0.01	10	0.01	0.01							

Source: Atkins, 2013.

Note: Yellow highlighted cells indicate screening values that were exceeded by the maximum value reported.

Channel and lagoon sediment results from the 2011 monitoring event were compared to the toxicity characteristic values of hazardous waste and their disposal, including those for groundwater protection. These and other analytical methods used suggested that hazardous concentrations of lead may be present in the Eastern CMP sediments. [10]

3.5.2.1 Sediment quality and fish and blue crab tissue contamination

Analysis of seven trace metals in tissues of blue crab, mojarra fish and false mussel in the San José Lagoon indicated moderately elevated levels of mercury (Pérez et al. 1999; Rodríguez Sierra & Jiménez, 2002). However, mercury concentrations in some samples approached or exceeded the Food and Drug Administration's (FDA) action level for human consumption of 1 µg/g in edible fishes. Similarly, lead concentrations were moderately high with some samples exceeding FDA action level of 0.5 µg/g. Sampling locations showing action-level exceedances appeared to correspond to areas with high potential for receiving human derived pollution.

Acevedo-Figueroa et al. (2006) examined trace metals in San José Lagoon and found concentrations of mercury, lead and zinc above the effective range median (ERM) level that predict toxic effects to aquatic organisms.[11] These authors calculated the metal to aluminum enrichment factor for these and other metals to determine if the source of the pollutants was anthropogenic. They found evidence of anthropogenic pollutant loads for some of the San José Lagoon sampling sites. Data analyzed within that report also showed evidence of contamination of sediments within the San José Lagoon.

In 2011, Otero and Meléndez published a report commissioned by the SJBEP to assess sediment, fish and blue crab tissue contaminants within the estuary system as the basis for the development of a long-term environmental indicator program. Contaminant concentrations in bottom-sediment samples were compared against the Threshold Effects Level (TEL) and the Probable Effects Level (PEL) for marine sediments.[12] The concentrations of trace metals in sediments at the stations sampled that coincide with those of previous studies were compared to qualitatively evaluate if

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[10] Channel and lagoon sediment results from the 2011 monitoring event were compared to the toxicity characteristic values of hazardous waste under 40 CFR 261.24, the Universal Treatment Standards (Land Disposal Restrictions for hazardous waste) under 40 CFR 268.48, and the CERCLA Regional Screening Levels for groundwater protection. This evaluation of existing analytical data provided a scientific basis for estimating approximate locations and concentrations of affected sediment areas within the CMP-ERP project area and disposal locations. Approximate toxicity characteristic leaching procedure (TCLP) values were calculated from the 2011 data using the approved method described in EPA Method 1311. When a waste is 100 percent solid as defined under the TCLP method, then the results of the total constituent analysis may be divided by twenty to convert the total results into a maximum leachable concentration. Dry weight samples were not reviewed during this initial screening, and since the Method 1311 calculation is performed on wet samples in this TM analysis, the determined TCLP values serve only as a rough estimate. Screening of the total metals concentrations via EPA Method 1311 suggested that hazardous concentrations of lead may be present in the canal sediments.

[11] The ERM level is the sediment quality guideline that represents the concentration above which adverse effects frequently occur to aquatic organisms.

[12] The TEL represents an estimate of the concentration below which adverse effects only rarely occur in biota. The PEL is an estimate of the concentration above which adverse effects frequently occur in biota.

changes in those stations had occurred. They concluded that increments in trace metals had occurred in the sampling station in the eastern outlet of the CMP, towards the San José Lagoon (7MPSJ). With the exception of mercury in the station found southeast in the San José Lagoon (17SJ), all other stations in this lagoon and the CMP showed an increase for this parameter from previous levels. Concentrations for the remaining trace metals had not changed or were lower at those remaining stations in the San José Lagoon and that immediately west of the eastern half of the CMP (Otero & Meléndez, 2011).

This research also found that except for bis (2-ethylhexyl phthalate), organic analytes were not detected in sediment samples. Bis was found at concentrations of 1,510 and 333 μg/kg in station 6MP and 17SJ, respectively, at the CMP and the San José Lagoon. The concentration at station 6MP falls midway between the TEL and PEL for this compound. None of the targeted organic analytes, including PAHs, chlordanes and DDTs, exceeded their respective PEL values indicating that detrimental effects to biota are not probable. In addition, PCB data obtained from this report suggested that concentrations in sediments have not reached levels of contamination likely to cause widespread detrimental effects (Otero & Meléndez, 2011). This study also compared the concentrations of contaminants of concern sampled in fish and crab-tissue against USEPA default Screening Values (SV). The SV for each chemical contaminant is defined as the concentration of the chemical in fish and shellfish tissue that is of potential public health concern (USEPA, 2004).

Arsenic, copper, selenium, zinc and mercury were detected in fish tissue in those sampling stations at the mid-section of the CMP (6MP-A and 6MP-B) (i.e. Acuaexpreso Ferry Terminal), the area next to the outlet of the CMP to the San José Lagoon (7MPSJ), the northwest section of the San José Lagoon (i.e. Los Corozos Lagoon) (8SJ-C), and the area in the San José Lagoon next to the outlet of the Suárez Canal (10-CS). Antimony, lead, and thalium were detected in samples at station 6MP-A. Cadmium was not detected in the fish tissues analyzed. Arsenic exceeded the USEPA Cancer Risk 10^{-4} level at station 6MP. Overall, these results suggest low accumulation of the target trace metals in fish tissue sampled at the CMP and the San José Lagoon stations (Otero & Meléndez, 2011).

Pesticides found by Otero and Meléndez (2011) in fish tissue samples in the CMP and the San José Lagoon were mostly DDT and its degradation products, as well as chlordane related products. Chlordane, endrin aldehyde, lindane and total PCBs, based on aroclor equivalents, were found in the easternmost station of the San José Lagoon (10CS) and in the station found in the middle of the CMP (6MP-B). Chlordane was detected in fish tissue at concentrations approaching the USEPA screening value for subsistence fishers (14 μg/kg) at stations 10 CS (13.80 μg/kg) and 6MP (12.20 μg/kg). Total PCBs were also found in fish tissue samples at the station located in the western part of the San José Lagoon, next to the CMP's outlet, at concentrations (92.2 μg/kg) exceeding the USEPA screening value for recreational fishers (20 μg/kg). PAHs were not detected in fish tissue (see Table 3-6).

Table 3-6. Concentrations of contaminants of concern sampled in fish tissue from selected sampling stations at the CMP and the San José Lagoon

METAL	Sampling Stations and Concentrations (in milligrams per kilogram (wet weight))				
	6MP-A	6MP-B *	7MPSJ	8SJC	10-CS
Antimony	0.012J	<0.0042	<0.0039	<0.0044	<0.0043
Arsenic	0.21	0.47	0.19	0.25	0.19
Copper	0.26J	0.26J	0.26J	0.25J	0.24J
Lead	0.012J	<0.011	<0.0096	<0.011	<0.011
Selenium	0.30	0.26	0.32	0.31	0.31
Thallium	0.018J	<0.011	<0.0099	<0.011	<0.011
Zinc	9.5	9.3	13.6	13.4	11.4
Mercury	0.024	0.023	0.014J	0.028	0.017J

Source: Otero and Meléndez, 2011. Notes: <= Concentration below the method detection limit. J: Estimated value for the analyte is below the Laboratory Reporting Limit but above the method detection limit. *Field duplicate of Sample 6MP-A.

Similar to fish tissue, Otero and Meléndez (2011) detected arsenic, copper, selenium, zinc and mercury in blue crab tissue collected at all stations in the CMP and the San José Lagoon. Silver was also detected in all crab tissue samples in contrast with fish tissue. The concentration of arsenic exceeded the USEPA Cancer Risk 10^{-4} level in all stations. Content of arsenic in blue crabs and fish tissue correlated significantly, suggesting that environmental variation in the SJBE influence the arsenic content in these species. DDTs and Alpha-BHC were the only pesticides residue detected in crab tissue at the San José Lagoon.

3.6 AIR QUALITY

Currently, no monitored counties outside the continental United States, including the Municipality of San Juan, violate the proposed eight hour ozone National Ambient Air Quality Standards NAAQS[13]. The major producers of air emissions in the Municipality of San Juan are highway and off-

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[13] The Clean Air Act (CAA) regulates air emissions from area, stationary, and mobile sources. The CAA requires the USEPA to establish National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. The CAA establishes two types of NAAQS. Primary standards, define the maximum levels of air quality considered necessary, with an adequate margin of safety, to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards define the maximum levels of air quality considered necessary to protect public welfare, including the protection against decreased visibility, and damage to animals, crops, vegetation, and buildings. Air quality is generally considered acceptable if pollutant levels are less than or equal to these established standards on a continuing basis.
The USEPA has set NAAQS for seven principal pollutants, called "criteria" pollutants. They are carbon monoxide (CO), nitrogen dioxide (NO2), ozone (O3), lead (Pb), inhalable particulate matter (PM) with an aerodynamic diameter less than or equal to a nominal 10 microns (PM10), fine particulate matter with an aerodynamic diameter less than or equal to a nominal 2.5 microns (PM2.5), and sulfur dioxide (SO2). The CAA also requires the USEPA to assign a designation to each area regarding compliance with the NAAQS results for the ambient air quality monitoring data in that area. The USEPA categorizes the level of compliance or noncompliance with each criteria pollutant as follows: Attainment: area currently meets NAAQs; Maintenance: area currently meets the NAAQs, but has previously been out of compliance and Nonattainment: area currently does not meet the NAAQs.

highway vehicles, marine vessels, airplane exhaust fumes, and those emissions produced by the Puerto Rico Electric Power Authority's (PREPA) Puerto Nuevo Power Plant Station. Area sources contribute to PM, VOC and SO_2 emissions. A summary of 2002 emissions for the Municipality of San Juan, the most recent data available from the USEPA database (USEPA, 2011a) is presented in Table 3-7. The Municipality of San Juan is in attainment or unclassifiable with all the NAAQs (Atkins, 2012f).

Table 3-7. Summary of 2002 Air Emissions Inventory for the Municipality of San Juan (tons per year)

Source Category	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Area	246	497	222	63	1,351	1,885
Highway Vehicles	49,051	4,244	118	84	219	4,467
Off-Highway Vehicles	35,660	2,864	307	295	322	3,083
Aircraft	376	4	7.6	5	0.4	15
Marine Vessels	821	4,324	136	133	648	59
Total	86,154	11,933	790	580	2,540	9,509

Source: USEPA, 2011.

Hydrogen sulfide traces have been reported during field studies for this Draft EIS, as well as by community residents living close to the eastern CMP (Atkins, 2012f). Hydrogen sulfide, which is a colorless gas, with an unpleasant or offensive, rotten-egg odor at low concentrations, besides occurring naturally in certain instances, is also a product of the decomposition of sulfur- containing matter in oxygen deprived environments, such as those found in many wetlands. The specific gravity of hydrogen sulfide makes it heavier than air, so it remains in the environment for longer periods of time and affects smaller stature populations with more ease, such as children. The gas can remain in the environment for about 18 hours (USEPA, 2003 as cited in Atkins 2012g). Hydrogen sulfide rapidly oxidizes and dissolves in water to form sulfurous and sulfuric acids, potentially contributing to the production of acid rain.

Hydrogen sulfide can be toxic at low concentrations when inhaled, in addition to causing strong irritation when in contact with the eyes and mucous membranes. Exposure at low concentrations may cause headache, conjunctivitis, sleeplessness, and pain in the eyes. Among the biggest chronic exposure effects is difficulty breathing, in particular vulnerable populations such as asthmatics, and other negative effects to the respiratory system. Other potential effects are lethargy, lack of coordination, headaches, loss of short-term memory and motor dysfunction due to an affected nervous system (ATSDR, 2006).

Hydrogen sulfide in the eastern CMP ambient air may be a cause of concern, since significant concentrations have been found within some of the sediments samples. Recent air samples by the USEPA (2011) in areas near or on the CMP revealed concentrations of hydrogen sulfide between 0.002 parts per million (ppm) and 0.062 ppm. The reference concentration for chronic inhalation of the hydrogen sulfide (RfC) is 0.002mg/mg^3 or 0.001 ppm (USEPA, 2003 as cited in Atkins 2012g). This is the reference value used for chronic exposure among children. Chronic exposure is defined as contact with a substance over a long period of time (over a year). All of the samples in referenced places exceeded the minimum RfC levels acceptable for inhalation of the contaminant in a chronic exposure situation.

The USEPA has not established a NAAQS for hydrogen sulfide. However, the American Conference on Governmental Industrial Hygienists (ACGIH), which is responsible for the determination of Threshold Limit Values (TLVs), has set the TLV for hydrogen sulfide at 10 ppm. TLVs are doses that, based on available data, have no evident harm to most workers who are exposed based to it on a conventional 8-hour workday and 40-hour workweek. This time-weighted average allows for a Short-Term Exposure Limit of up to 15 ppm for a period less than 15 minutes.

The U.S. Occupational Safety and Health Administration (OSHA) have established permissible concentrations of hydrogen sulfide. These include an acceptable ceiling concentration of 20 ppm based on an 8-hour work shift and an acceptable maximum peak of 50 ppm. Thus, an employee's exposure to hydrogen sulfide may not exceed 20 ppm at any time during an 8-hour shift, except once for a 10-minute period, during which the concentration may be as high as 50 ppm.

3.7 NOISE

The Study Area is found within a densely populated region with residential, recreational, commercial and industrial elements. In the Project Area, vehicular traffic, commerce and industry all contribute to background noise. A heavy rail train and two four-lane highways are found in or close to the western half of the CMP. A four-lane avenue cuts through the middle of the eastern half of the CMP. Further, the Project Area lies under one of the principal approach vectors for all aircrafts landing at the LMM International Airport.

A study conducted in 2004, averaged L_{eq} and L_{10} noise values over a 24-hour period based on data from 14 noise stations in San Juan (Alicea-Pou et al., 2004). [14] According to the Puerto Rico Environmental Quality Board Regulation No. 8019, L_{10} noise levels should not exceed 50–75 dB,

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[14] The Commonwealth of Puerto Rico Noise Contamination Control Regulation, No. 8019 of 2011, establishes that no person shall deliver or allow the emission of any sound, which when crossing the site sound originator property boundary, exceeds the parameters in dB (A) established for each of the designated zones. Commonly used noise measures include the L_{eq}, or equivalent level, which is a measure of the central tendency of the noise over time, and the L_{10}, which is the noise value, exceeded 10% of the time. L_{10} is typically used for road traffic noise because it corresponds well with close proximity to busy roads as well as more rural situations.

depending on whether it occurs in residential, commercial, industrial, or quiet areas. This study indicated that values of nearly 68 dB are exceeded 10 percent of the time.

Noise levels measured in four of the eastern CMP communities as part of a 2003 traffic study ranged from 76.3dB (night time) to 80.4 dB (daytime). These values indicate relatively high ambient noise levels (CMA, 2003) (see Table 3-8).

Table 3-8. Sound levels in communities in or adjacent to Eastern CMP

WARD	DAYTIME SOUND LEVEL DB(A)	NIGHTIME SOUND LEVEL DB(A)
Las Monjas, Bo. Obrero Marina	79.6	75.7
Buena Vista Hato Rey and Buena Vista Santurce	79.8	75.9
Israel y Bitumul	80.2	76.3
Cantera	80.4	76.5

Source: CMA, 2003.

3.8 SOLID WASTE

Solid waste is any discarded material, abandoned, inherently waste-like, and not excluded by law such as domestic sewage. All waste classified as solid waste are regulated by the Resource Conservation and Recovery Act (RCRA) and in Puerto Rico is also regulated by the Puerto Rico Solid Waste Management Regulation. RCRA excluded waste are regulated by different laws. An example is domestic waste that is regulated under the Clean Water Act.

Materials within the Caño Martín Peña include various types of solid waste, household waste, Construction and Demolition (C&D) debris, and other materials, which will require further testing prior to and/or during their removal, as appropriate, in accordance with an agreed sampling plan to determine whether any materials contain hazardous substances at levels that are not suitable for unregulated disposal.

These findings are supported by several previous studies and investigations, including:

- A 1997 Preliminary Site Characterization of the CMP that was prepared by Roy F. Weston, Inc. for the USACE;
- An Environmental Site Assessment report prepared by ECG, Inc. for the USACE in 1998,
- A Draft Phase 1 Environmental Site Assessment prepared by CMA Architects and Engineers, LLP. for the Puerto Rico Highway and Transportation Authority in 2002; and
- A 2011 Initial Assessment prepared by PBS&J for the CMP-ERP feasibility study.

Household waste is any material, garbage, trash, sanitary waste derived from single and multiplefamily residences, hotels and motels, bunkhouses, ranger stations, crew quarters, campgrounds, picnic grounds, and day-use recreation areas. Bulky wastes such as household appliances, furniture, large auto parts, trees, branches and stumps are all considered household waste.

C&D materials consist of the debris generated during the construction, renovation, and demolition of buildings, roads, and bridges. C&D debris often contain larger, heavy materials, such as concrete, asphalt, wood, metals, glass, and salvaged building components. Disposal of C&D debris is only regulated to the extent that solid waste landfills must follow a few basic standards outlined at 40 CFR parts 257.

3.8.1 Hazardous Waste

Hazardous Radioactive Toxic Waste (HTRW) is a solid waste with a listed hazardous substance, is listed as a hazardous waste, or presents characteristics of ignitability, corrosivity, reactivity, or toxicity and is not considered a household waste. Some wastes are excluded by law from being a hazardous waste. Household waste including Household Hazardous Wastes (HHW) are excluded from being classified as hazardous waste under 40 CFR 261.4(b)(1). HHW are leftover household products that may contain corrosive, toxic, ignitable, or reactive ingredients. Examples are paints, cleaners, fluorescent light bulbs, oils, batteries, automotive products, and pesticides. Segregation of HHW from the municipal waste is encouraged but not required by law. HHW are classified as household waste independent of the chemical composition.

Dredged material, as defined by 40 CFR 323.2(d), is any material dredged from Waters of the U.S. and sediments proposed for management under Sections 404 of the Federal Water Pollution Control Act (33 U.S.C.1344) and 103 of the Marine Protection, Research, and Sanctuaries Act (MPRSA) of 1972 (33 U.S.C. 1413).

Under the definition of HTRW in USACE Engineering Regulation 1165-2-132, dredged materials and sediments beneath navigable waters, including those that contain CERCLA hazardous substances or RCRA hazardous wastes, qualify as HTRW only if they are within the boundaries of a site undergoing a CERCLA response action or on the National Priorities List (NPL). Neither condition is considered applicable to the Project Area. Further, under USEPA's hazardous waste exclusion for dredged material under RCRA, 40 C.F.R § 261.4(g), "dredged material that is subject to the requirements of a permit that has been issued under 404 of the Federal Water Pollution Control Act (33 U.S.C. 1344) or section 103 of the Marine Protection, Research, and Sanctuaries Act (MPRSA) of 1972 (33 U.S.C. 1413) is not a hazardous waste." Therefore, the solid waste and sediments from beneath the Waters of the United States within the Project Area would not be considered HTRW. It is recognized that there may be disagreement as to the extent of the characterization of Waters of the United States as it applies to the CMP-ERP Project Channel at the time of this report development.

As part of the CMP-ERP studies, an Initial Assessment (IA) was performed to identify indicators of potential HTRW or waste issues (Atkins, 2014b). This report was conducted in conformance with the scope and limitations of the American Society of Testing and Materials (ASTM) Practice E1527-05, and in accordance with ER 1165-2-132. Environmental issues within the ASTM standard are referred to as "Recognized Environmental Conditions" (RECs) in connection with the study area. The term RECs, as defined in ASTM E1527-05, refers to the presence or likely presence of any *hazardous substances or petroleum products* on a *property* under conditions that indicate an existing release, a past release, or a *material threat* of a release of any *hazardous substances or petroleum products* into structures on the *property* or into the ground, ground water, or surface water of the *property*. The term includes *hazardous substances or petroleum products* even under conditions in compliance with laws.

The IA performed for the Study Area to identify potential HTRW problems and to provide recommendations relied on existing information, observations made trough database research, site visits, aerial photographs and the review of available historical documentation (Atkins, 2014b). The site description for this HTRW IA is divided into two areas: Project area and Study area.

Standard Environmental Record Sources: The following Federal and Commonwealth's regulatory database reports were reviewed:

- Federal National Priority List (NPL);
- Federal Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS) Database;
- Federal Resource Conservation and Recovery Act (RCRA) Corrective Actions List (CORRACT);
- Federal RCRA Treatment, Storage, or Disposal List (RCRA-TSD);
- Federal RCRA Generators List (RCRA-G);
- Federal Emergency Response Notification System (ERNS) list;
- State-equivalent CERCLIS/State Hazardous Waste Sites (SHWS);
- State Underground Leaking Storage Tank List (LUST);
- State Voluntary Cleanup Sites (VCS);
- Other ascertainable records such as RCRA non-generators, which do not presently generate hazardous waste.

A total of seven records were identified within the Study Area with the various regulatory agency database searches and none were found for the Project Area. The seven database records are associated with the following six facilities or locations in the Study Area.

- Two CERCLIS sites: R. Maldonado Pesticide Warehouse: 0.54 mile south-southeast from CMP; and American International Plaza: ±0.68 mile west-southwest from CMP;

- One LUST site: Citibank N.A. - Hato Rey: ±0.68 mile west-southwest from CMP.
- Two underground storage tank (UST) facilities: Rod-Rodder Services, Inc.: ±0.38 mile south-southeast from CMP; and Rosa Elena Jiménez (residential): ±0.49 mile south from CMP.
- Two RCRA Nongenerator sites: Texaco PR Inc.: ±0.37 mile south from CMP; and Rod-Rodder Services, Inc.: ±0.38 mile south-southeast from CMP.

Site Reconnaissance: Several site visits were performed to document conditions within the CMP. Based on the Project Area's land use history and transformation, and its current conditions, there are essentially two types of solid waste found within the material in the project channel: Household Waste (HW) and Construction and Demolition (C&D) materials. In addition, is expected that most of the sediment is found in the lower layer in the bottom and center of the channel and that most of the solid waste is on the banks of the former channel.

Within the Project Area, the potential of hazardous substances appears to be minimal. This assessment has revealed no evidence of RECs in connection with the Project Area, except for the following, including their associated potential environmental impacts in the Project Area (see Table 3-9).

Table 3-9. RECs and Associated Potential Environmental Impact to the Project Area

RECOGNIZED ENVIRONMENTAL CONDITION(REC)	POTENTIAL ENVIRONMENTAL IMPACT
Unidentified solid waste disposal adjacent and within the CMP	Low
White goods and automobile parts disposed adjacent to CMP	Low to Moderate
Presence of pesticide warehouse within 0.54 miles of CMP Project Area	Moderate
Maritime transportation traffic on western portion of the CMP	Low
± 92 potential unmapped listings, based on type of record	Low

User Provided Information: A review of previous reports and studies conducted on nearby areas for other USACE-sanctioned projects that required dredging and material disposal did not find cause of concern for HTRW, even though elevated levels of contaminants were found from water samples.

A Preliminary Site Characterization of the CMP prepared by Roy F. Weston, Inc. for the USACE in 1997 states that:

> *Solid waste disposal represents the most significant problem related to the canal. Local dumping of household waste and construction and demolition debris has resulted in terraces restricting the canal channel and allowing further development of the area. The management of these solid wastes would be subject to RCRA Subtitle C or Subtitle D regulation, depending on the types of waste encountered.*

The report further states that waste accumulation within the CMP consists of two types: 1) primary waste disposal points and 2) transport of waste by tidal currents and the subsequent deposition due to sinking or accumulation. The first type generally contains large volumes of household items, wood debris, concrete, white goods, furniture, engine parts, and rubbish and are mostly associated with local dwellings or easy point of access. The second type consists mostly of plastic garbage bags containing household refuse or discarded items with a lesser buoyancy than water, such as furniture, refrigerators, and bottles.

Chemical analysis and geotechnical testing was done from sediment and water samples collected from the CMP (10 samples), adjacent lands (5 samples), and the San José Lagoon (5 samples). The tests revealed elevated concentrations of mercury and lead, as well as lesser concentrations of other compounds. Several wastewater and stormwater outfalls were observed across the sampling site. Contaminant levels were similar across the CMP and the San José Lagoon.

The CMP Environmental Site Assessment report prepared by ECG, Inc. for the USACE in 1998 also echoes many of the findings in the 1997 Preliminary Site Characterization. Chemical analysis was performed on 10 soil samples and 10 water samples from the CMP. The Report states the following regarding its findings on the CMP:

> *Although unsightly and highly unsanitary, solid waste material within the organic rich clay layer is non-hazardous. Upland disposal should not pose a threat to environmental integrity or human health and safety.*

The report also deemed the waste layer and surrounding area as non-hazardous, based on its thorough soil and groundwater sampling and analysis. Regarding water and sediment quality, the chemical analysis revealed that, besides barium, no other contaminant form the sample reached detection levels. Also, no leachable contaminants were found in the CMP. Waste found in the CMP is classified as household waste, solid waste, and construction debris. Examples include wood debris, household trash, locally used needles, concrete debris, metal debris, and tires, among others.

The CMP Draft Phase 1 Environmental Site Assessment prepared by CMA Architects and Engineers, LLP for the PRHTA in 2002, sheds further light on the matter. Major findings from the report include:

- The main sources of pollution in the CMP are the accumulation of filling material and debris for residential construction purposes and untreated wastewater discharges at the site;
- Filling material and debris used for residential construction purposes may lead to the presence of asbestos containing materials and lead-based paint, the sedimentation of heavy metals and other chemicals into the channel sludge at the bottom;

- The severity of the water quality in the CMP is mainly due to low levels of dissolved oxygen and the presence of organic pollutants; and
- Several illegal dumping sites were found around the CMP.

Besides the findings presented on these reports, studies conducted on nearby areas for other USACE-sanctioned projects that required dredging and material disposal did not find cause of concern for HTRW, even though elevated levels of contaminants were found from water samples. The 1984 Survey Report for the Puerto Nuevo River Flood Control Project states that elevated levels of contaminants were found in the waters of the project site. Solid waste and sediments were was also found at the site. However, these were not deemed hazardous and would be disposed at the ocean in the USEPA-approved ocean disposal site north of San Juan, pursuant to Section 103 of the CWA.

In section III.A.5 of the 1983 Agua-Guagua EIS (known today as AcuaExpreso) it is stated that the western CMP has been plagued by water quality problems, mostly due to the construction of structures over the water, untreated wastewater discharges, and garbage and debris disposal. Elevated levels of contaminants were also found from water samples taken in this area. Even though contaminants were found in the western CMP, the report stated that dredged material would be preferably disposed at the ocean (given that requirements of Section 103 of the CWA were met), while non-dredging waste would be disposed in the municipal dump.

Results: Based on the Project Area's condition there is no evidence of RECs in connection with the CMP. Possible exceptions to the aforementioned statement are the nondescript solid waste content (e.g. substances remaining within bottles), discarded appliances, and equipment that are evident at the ground surface. In accordance with the USACE's ER 1165-2-132, there is no evidence of HTRWs within CMP. Although there is evidence of historical REC supporting either past or ongoing contamination to the Study Area (in accordance with ASTM E1527-05) the potential for HTRWs within the CMP Project Area appears to be minimal. The solid waste found within the Study Area may include C&D and HW. These materials, however, are not considered HTRW.

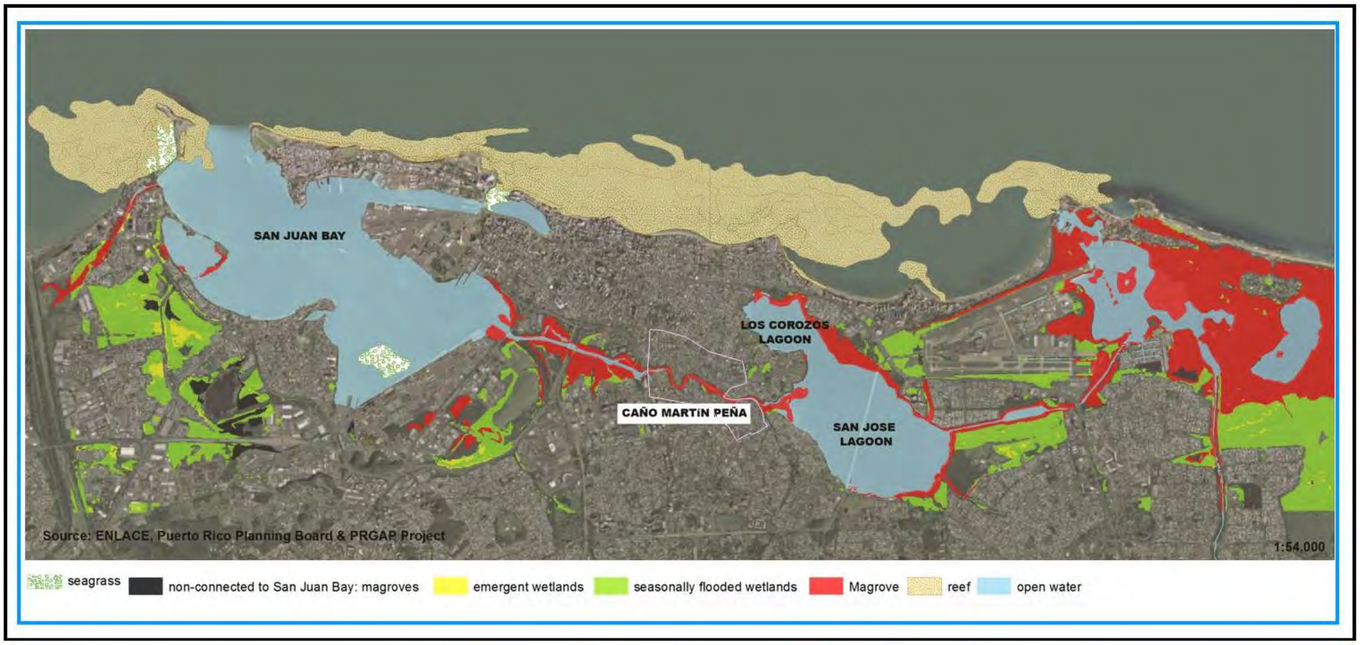
3.9 HABITATS

The SJBE natural landscape and that of its surroundings has been significantly altered; first, by agriculture and cattle ranching, and later, by urban encroachment. A significant part of its vegetated wetlands, open waters, and benthic communities, have been either dredged, drained or filled, severely limiting or hampering tidal influence and water exchange, all of which have been further compounded by raw sewage and other pollutant discharges. Its habitats functions and values, even though degraded, are still considered very important for fish and wildlife resources, when compared to other areas in Puerto Rico.

The Study Area habitats are very diverse, exemplified by 26 land cover classes based on climate, geology, topography, hydrology and land use history. These include, among others, sandy, gravy, and rocky shorelines, mangroves and herbaceous non-saline wetlands, moist alluvial, riparian, calcareous or non-calcareous shrublands and woodlands, as well as young to mature secondary evergreen and semi-deciduous forests (Gould et al., 2007).

Some of these habitats, such as mangroves, have been included within some of the 51 palustrine, estuarine or marine wetlands and deepwater habitats that have been classified in the Study Area by the US Fish and Wildlife Service (USFWS), or the 15 benthic habitat types identified by the NOAA (Kendall et al., 2001; Cowardin, et al., 1979).[15] Coral communities and seagrass beds, for example, are two of the benthic habitat types that have been classified in the Study Area by the USFWS and NOAA (see Figure 3-2).

Those habitats in the Project Area that are expected to experience the most notable or significant effects from the proposed CMP-ERP are the ones described in detail in this Draft EIS in order to simplify and facilitate their understanding. Overall, these can be classified into two broad categories: surface habitats and submerged habitats. Mangroves have been included in both categories, although differencing for its corresponding surface and submerged zones.



Source: ENLACE, Puerto Rico Planning Board & PRGAP Project

Figure 3-2. Habitats in the Study Area

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[15] NOAA's National Ocean Service acquired aerial photographs for the nearshore waters of Puerto Rico and the U.S. Virgin Islands in 1999. These images were used to create maps of the region's coral reefs, seagrass beds, mangrove forests, and other important marine habitats. Mapped areas encompass the insular shelf between the shoreline and shelf edge except where turbidity prevented visualization of the bottom. Twenty-one distinct benthic habitat types within eight zones were mapped directly into a geographic information system (GIS) using visual interpretation of orthorectified aerial photographs.

3.9.1 Surface Habitats

Surface habitats have been generally classified as part of the subtropical moist forest life zone, the most extensive of the six life zones found in Puerto Rico, based on the Holdridge's model (Ewel, J.J. & Whitmore, J. L., 1973). [16] Miller and Lugo described the vegetation of this life zone as one characterized by trees up to 66 feet tall, with rounded crowns, where many of the woody species are deciduous during the dry season, and epiphytes are common but seldom completely cover branches and trunks (Miller, G.L., and A.E. Lugo, 2009). Uplands and wetlands are two basic surface habitats in the Project Area that can be distinguished based on substrate water saturation, soil parental origin and forest succesional stage.

3.9.1.1 Uplands

3.9.1.1.1 Karst forest

This habitat is found in the upland portion of the two limestone outcrops, locally known as Guachinanga and Guachinanguita islets, found close to the western shore of the San José Lagoon. Karst forest is the smallest of all surface habitats in the Project Area.

The karst forest found in Guachinangua Islet exhibits most of the physical features, from top to bottom, of a haystack hill or "mogote". Miller and Lugo (2009) has described the vegetation at the ridgetop of "mogotes" as being of a small height and diameter, where it is rocky, with little soil but a fair amount of accumulated dry organic matter on the top layer, and where plants express morphological features typical of warmer and dryer conditions, such as having small, hard (i.e. sclerophyllous) leaves, many of which are spiny or with dense pubescence (i.e. "hairy"). Forest vegetation at the base of a "mogote" is much taller, with larger diameter trees having larger, less thick leaves, not sclerophyllic, where soil is deeper and moister.

Seventy nine (79) plant species have been identified in upland areas within Guachinanga, of which 65 are native, 13 exotic and 1 endemic. Some of the native vegetation at the top and slopes of Guachinanga include trees such as the pigeon plum (*Coccoloba diversifolia*), gumbo limbo (*Bursera simaruba*), white bully (*Sideroxylon salicifolium*), *Calophyllum brasiliense*, and leadwood (*Krugiodendron ferreum*). At the base of Guachinanga, other native species include the white cedar (*Tabebuia heterophylla*), the bayrum tree (*Pimenta racemosa*), as well as the exotic mango tree (*Mangifera indica*), the tamarind (*Tamarindus indica*) and the Spanish lime (*Melicoccus bijugatus*); the latest three are indicative of human activities in the past (INCICO y Corporación Proyecto Península de Cantera, 2009).

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[16] The Holdridge's classification system uses a combination of parameters such as latitudinal region, altitudinal belt, humidity province, mean annual precipitation and mean annual biotemperature to characterize forests.

In Guachinanguita, 4 species of upland plants have been documented, 3 of which are native and 1 is exotic. These include *Bunchosia glandulosa*, the pigeon plum (*Coccoloba diversifolia*) and the bay-leaved caper (*Cynophalla flexuosa*) (INCICO y Corporación Proyecto Península de Cantera, 2009).

3.9.1.1.2 Young secondary forest

The dominant vegetation in this habitat are exotic species that have been either planted (e.g. fruit and ornamentals) or established by natural dispersion on moist soils that are mostly made up of fill material deposited during the past decades. In the Project Area, this habitat is found on uplands, in the "backyards" of some of the substandard dwellings built in the historic footprint of the eastern CMP's open waters and wetlands, and at the CDRC staging area.

Some of the exotic tree species found in this habitat along the Eastern CMP include the Spanish lime (*Melicoccus bijugatus*), the monkey pod (*Pithecellobium dulce*), the Indian almond (*Terminalia catappa*), the coconut palm tree (*Cocos nucifera*), *Peltophorum pterocarpum*, and royal poinciana (*Delonix regia*). Native trees include the Puerto Rico royal palm (*Roystonea borinquena*), *Calophyllum brasiliense*, and the gregorywood (*Bucida buceras*) (Atkins, 2011c).

The young secondary forest at the CDRC staging area is dominated by an almost pure stand of the exotic tall albizia (*Albizia procera*) (Atkins, 2011c).

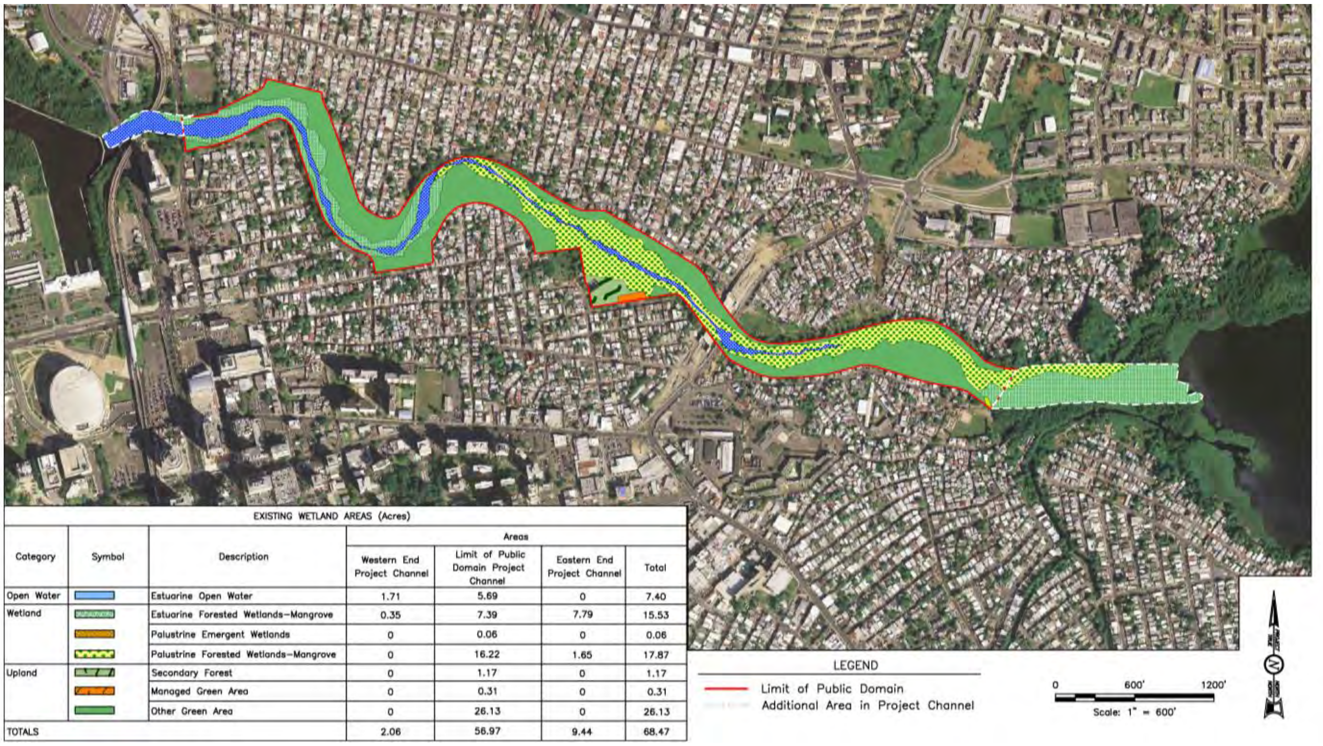
3.9.1.2 Wetlands

Within the eastern CMP, there are 7.39 acres of estuarine forested wetlands, 16.22 acres of palustrine forested/emergent wetlands, and 0.06 acres of palustrine emergent wetlands. The ensuing discussion will delve deeper on the characterization of these wetlands (see Figure 3-3).

3.9.1.2.1 Marshes

Marshes have been defined in the Project Area as wetlands dominated by nonwoody, emergent vegetation, and include species such as coco yam or wild taro (*Colocasia esculenta*) para grass (*Urochloa mutica*) climbing dayflower (*Commelina diffusa*), Mexican crowngrass (*Paspalum fasciculatum*) and the darkeye morninglory (*Ipomoea tiliacea*). Based on the Cowardin classification (1979) these can be classified as palustrine wetlands.

Marshes are located between the mangroves and the dwellings found at the north bank of the easternmost section of the CMP (Atkins, 2011c). This area is permanently flooded or remains very saturated for extended periods of time, mostly as a result of urban runoff and wastewaters discharges draining on a daily basis from the adjoining communities lacking a storm and a sanitary sewer system.



EXISTING WETLAND AREAS (Acres)

Category	Symbol	Description	Areas			
			Western End Project Channel	Limit of Public Domain Project Channel	Eastern End Project Channel	Total
Open Water	🟦	Estuarine Open Water	1.71	5.69	0	7.40
Wetland	▨	Estuarine Forested Wetlands–Mangrove	0.35	7.39	7.79	15.53
	🟧	Palustrine Emergent Wetlands	0	0.06	0	0.06
	🟨	Palustrine Forested Wetlands–Mangrove	0	16.22	1.65	17.87
Upland	▨	Secondary Forest	0	1.17	0	1.17
	▨	Managed Green Area	0	0.31	0	0.31
	🟩	Other Green Area	0	26.13	0	26.13
TOTALS			2.06	56.97	9.44	68.47

Figure 3-3. Existing Wetland Areas

3.9.1.2.2 Mangrove forest

Mangroves are characterized by woody vegetation growing in permanently flooded to very saturated, organic rich soils, influenced by tides. Based on the Cowardin classification (1979) these can be classified as estuarine and palustrine wetlands.

The dominant tree species in mangroves are the red mangrove (*Rhizophora mangle*), the white mangrove (*Laguncularia racemosa*) and the black mangrove (*Avicennia germinans*). Other species that are found at the landward, less saline and water saturated soils in this habitat, such as those transitioning into young secondary forests include: the portia tree (*Thespesia populnea*) and the exotics Indian almond and the coconut palm tree. The golden leatherfern (*Achrosticum aureum*) can also be observed growing among mangrove trees in those sites where water and soil salinity is low, especially next or in transition towards marshes (Atkins, 2011c). A small stand of dragonsblood tree (*Pterocarpus officinalis*) has been identified close to the southeastern end of the eastern CMP, associated to the outlet of the Juan Méndez creek.

Mangrove forests in the Project Area are found along most of the eastern CMP banks, and especially in its eastern most end, where a relatively big stand exists. It is also found fringing most of the San José Lagoon, including the shorelines of the CDRC staging area, as well as the Guachinanga and Guachinanguita islets.

Mangrove forests in the Project Area can be classified as basin forests, based on their physiographical characteristics, (Lugo and Snedaker, 1974). Martínez, Cintrón and Encarnación (1979) reported that this type of mangrove forest is characterized by sheet flows over wide areas of very small topographic relief. The dominant species of mangroves are the white and black mangroves, although where the sheet flows converge into channels, the banks of these become lined with red mangroves.

3.9.1.2.3 Floating vegetation

This habitat is present in those sites within the eastern CMP channel that are permanently flooded and clogged, and thus with very little to no current, where waters are deep enough to prevent the establishment of rooted vegetation associated to mangrove forests or marshes. Instead, free floating vegetation has developed, although confined to the top or surface layer of the water column where salinity levels are at their lowest. The dominant species are the exotic common water hyacinth (*Eichhornia crassipes*), the lesser duckweed (*Lemna aequinoctialis*) and the water lettuce (*Pistia stratiotes*) (Atkins, 2011c).

The biggest mat of floating vegetation, however, is found at the southwestern shores of the San José Lagoon, south of the Eastern CMP's outlet, associated to the outlet of the Juan Méndez Creek. At this site, floating vegetation has accumulated due to the general prevailing winds and water currents that have pushed much of this free floating vegetation, and concentrated it at this section of the San José Lagoon. Floating vegetation can also be found within the outlet of the San Antón creek, at the southeastern corner of the San José Lagoon, immediately south of the CDRC staging area.

3.9.2 Submerged Habitats

Submerged or benthic habitats are those that support plants and animals on or in the bottom of water bodies, also known as the benthos. Differences in these habitats are dictated by the chemical and physical characteristics (e.g. salinity) of the substrate and the water column. To facilitate their analysis, submerged habitats in the Study Area have been classified into two general categories: estuarine and marine.

It is important to consider that the submerged habitats that have been individually classified within the Study Area are part of an overall seascape where separation of habitats for most management purposes is extremely difficult. Although many species spend their entire life almost exclusively in one of these habitats (e.g. hardgrounds - corals or cnidarians), for others, its use is not constant. Many species of fish, for example, spend their early life stages in mangroves or coastal lagoons and later migrate to the ocean, in order to inhabit seagrass beds or coral reef to complete their adult stage (ontogenetic migration). In addition, submerged habitats rely or depend on many of the services or functions provided by each other. For example, mangroves produce a tremendous amount of leaf litter or detritus that is exported and then used, among others, by organisms associated to seagrass beds. Coral reefs, in turn, help reduce wave energy, which allows the establishment of seagrass beds and mangrove forests close to the shore. Management of individual submerged habitats, as a result, must consider the overall seascape in order to conserve key ecological functions and relationships necessary for their sustenance (Atkins, 2015a; Appeldoorn, R. S., Ruíz, I. and F. E. Pagán, 2011; Pittman, S.J., C. Caldow, S. Davidson Hile, and M.E. Monaco. 2007; Pittman, S.J., C. Caldow, S. Davidson Hile, and M.E. Monaco, 2006).

3.9.2.1 Estuarine

Estuarine submerged habitats include those communities that are tidally or permanently flooded and attached to mangrove roots, those associated to the water column and other benthic communities at the bottom of the eastern CMP and the San José Lagoon.

The existing high sedimentation rates, presence of toxins within the sediments, low DO levels, and salinity stratification within the eastern CMP and/or the San José Lagoon do not provide a healthy ecosystem for benthic organisms (e.g., infauna, meiofauna, epifauna) or organisms relying upon the estuarine water column (e.g., fish and invertebrates) (PREQB, 2008; Otero, 2011; SJBE, 2000; Kennedy et al., 1996). Benthic habitats in and around the eastern CMP are highly degraded due to the contaminant loads and reduced tidal flushing, which result in limited light penetration, poor water quality, and anoxic, highly organic sediments. In the San José Lagoon, those areas that are shallower than four to six feet such as its outer periphery and Los Corozos Lagoon section are somewhat typical of other coastal lagoons in Puerto Rico, with deeply colored, mesohaline or brackish waters (salinity of 5 to 18 ‰) that support a variety of organisms. Those areas that are deeper than four to six feet in the San José Lagoon do not present viable habitat for flora and fauna due to hypoxic to anoxic conditions, especially in those areas where the artificial dredged pits are found.

3.9.2.1.1 Mangrove prop roots

Mangrove prop root habitat is found among those areas that are tidally inundated, either seasonally or permanently, among the aerial roots of black and white mangrove (i.e. pneumatophores) and those of red mangrove. Atkins (2011b) reported that the majority of organisms identified within the red mangrove prop root encrusting community in the CMP, the San José and Los Corozos lagoons, the Suárez Canal, and La Torrecilla Lagoon were the Mollusca (mussels, oysters and gastropods), Crustacea (barnacles) and Annelida (polychaete worms) phyla.

In the phyla Crustacea and Annelida, a decreasing trend in percent cover was evident along a gradient related to distance from the Ocean, from Zone A to Zone C, with no individuals found in Zones D, E, and F (see Figure 3-4). In essence, barnacles and polychaetes, which were abundant on the red mangrove prop roots in La Torrecilla Lagoon (Zone A) and the Suárez Canal (Zone C), were not found on those examined in San José Lagoon (Zone E) nor the CMP (Zone F). In the phylum Mollusca, the greatest coverage was in the Suárez Canal (Zone C) and numbers declined moving toward both the La Torrecilla and San José lagoons. Presently, a single species of bivalve, the false mussel (*Mytilopsis domingensis*), dominates the areal coverage of the mangrove roots and other hard substrates (e.g. seawalls and rip-raps) found at shallow depths throughout the lagoons and parts of the Suárez Canal.

Figure 3-4. Mangrove prop root habitat sampling segments (Atkins, 2011b)

Sponges were only found in La Torrecilla Lagoon, which is closest to the source of tidal flushing. Stations located farther from the tidal flushing (Zones B, C, D, E, and F) had no sponges living in the red mangrove prop roots (Atkins, 2011b).

Polychaetes were only found closer to the source of tidal flushing (at Zones A, B and C). Stations located farther from the tidal flushing (Zones D, E, and F) had no Polychaete worms living in the red mangrove prop roots. Ascidians (phylum Cordata) were only found closest to the source of tidal flushing at La Torrecilla Lagoon (Zone A). Stations located farther from the tidal flushing (Zones B, C, D, E, and F) had no Ascidians living in the red mangrove prop roots (see Figure 3-5).

In summary, species abundance and diversity (important indicators of healthy habitats) of the encrusting community of red mangrove prop roots is higher in La Torrecilla Lagoon (closest to the Atlantic Ocean), becomes less diverse and less abundant within the San José Lagoon (farthest from the flushing source), and is non-existent or severely limited within the CMP. This could be related to low dissolved oxygen as well as with salinity concentrations.

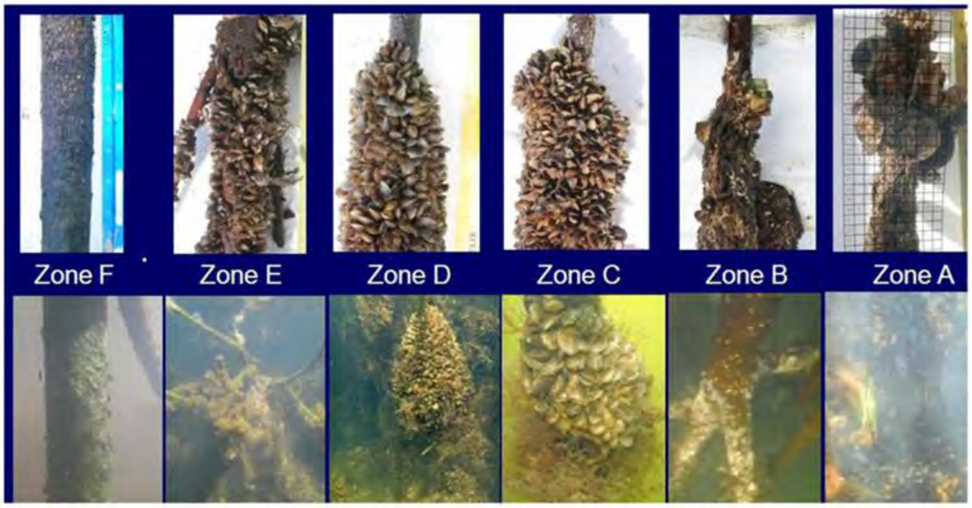


Figure 3-5. Mangrove prop root habitat fouling community in various portions of the SJBE (Atkins 2011b).

Poor water quality has been found to be especially pervasive in mangrove basin forests such as those in the Project Area, when compared to other types of mangrove forests. Martínez, Cintrón and Encarnación (1979) reported that in basin forests where weak but constant fluxes occur, there is oxygenation, nutrient transport, remineralization and there is no accumulation of toxic substances like H_2S and salts. In stagnant basins there is oxygen depletion; mineralization and nutrient recycling is slowed down and salt may accumulate in the sediments. A greater proportion of the gross productivity must be utilized by the system to provide for root ventilation (production of pneumatophores) and to survive at the higher salinity levels. Thus less energy is available for growth. As such, some basin forests may be subjected to higher natural stresses, and therefore be more sensitive to additional stressors.

3.9.2.1.2 Water column

Studies on phytoplankton and zooplankton composition in the eastern CMP and the San José Lagoon are very limited. Negrón-González (1986) reported that plankton diversity in the San José Lagoon was not diverse, and limited to 15 genera. Based on a study conducted in 1974, he informed that chlorophytes (i.e. green algae) was the most common group (61%), followed by diatoms (i.e. algae) (25%), cyanophytes (i.e. cyanobacteria) (17%), euglenophytes (i.e. flagellate protist) (4%) and dinoflagellates (1%). The most genera (7) belonged to diatoms. The most abundant genera throughout the year was that of Chlamydomonas (i.e. unicellular green algae) (54%), otherwise, Oocystis (i.e. predominantly fresh water green algae) (7%) and Oscillatoria (i.e. unbranched filamentous cyanobacteria) (8%). Other genera included Anabaena (i.e. nitrogen-fixing filamentous cyanobacteria), Anacystis (i.e. cyanobacteria), and Geminella (i.e. algae). The most dominant group through most of the year was cyanobacteria.

Periodic episodes of massive fish kills in the San José Lagoon during the past 40 years have been associated to poor water quality conditions related to excess nutrient inputs and lack of circulation, which have led to algae blooms, and in turn, to lethal, high dissolved ammonia and low dissolved oxygen concentrations (Webb and Gómez-Gómez, 1998). Three of the latest significant fish kill episodes were reported in October of 2009, October 2013, and May 2014. The October 2013 event was thoroughly studied by the SJBE Program, and was determined to be related to a *Spirulina* cyanobacteria bloom (Bauza, J., June 3, 2014, personal communication).

Negrón-González (1986) also reported that nauplius (i.e. crustaceans) constituted the dominant group of zooplankton larvae in the San José Lagoon, followed by cyclopoids (i.e. copepods) and rotifers (i.e. mostly microscopic, multicellular animals). Blue crabs (*Callinectes sp.*), mojarra (*Diapterus sp.*), snooks (*Centropomus sp.*) and tarpon (*Megalops atlanticus*) are some of the common nekton, as well as the most sought out species that are fished in the San José Lagoon.

The artificial dredged pits in the San José Lagoon appear to be important habitats for tarpon possibly due to the aggregation of food sources along the haloclines (salinity stratification layers) that occur within the dredged holes. Phytoplankton and zooplankton tend to accumulate at haloclines which, in turn, attract fish and crabs that prey upon the plankton. Larger fish can be attracted to these concentrations of small fish and crabs, which may be one of the reasons that tarpon are often caught within the deeper waters over the dredge pits. It is likely that tarpon take advantage of these haloclines, hiding in the darkness below this layer, to prey upon suitable-sized organisms that congregate or come to feed at these features. Tarpon may not be able to feed in this manner in the more shallow regions of the San José Lagoon, where water masses are not sufficiently deep below the halocline (Atkins, 2011b).

3.9.2.1.3 Benthos

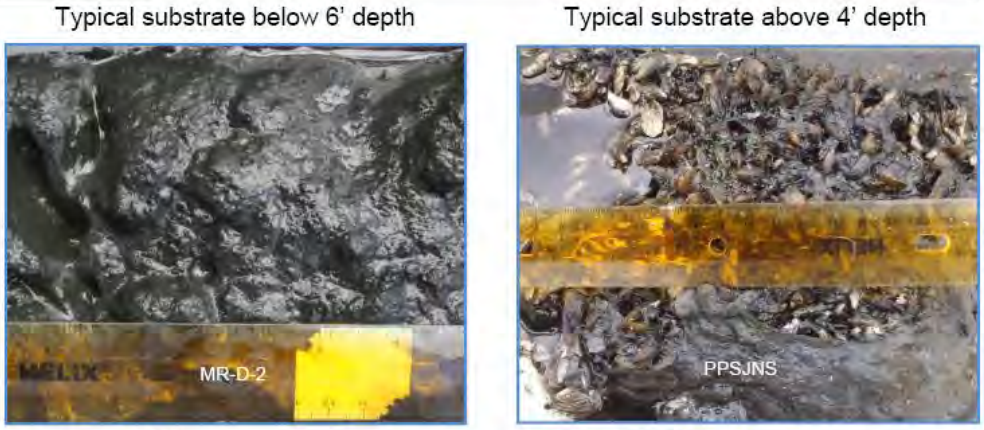
A number of benthic characterization studies have been undertaken in the Study Area (PBS&J, 2009; Kendall, M.S., et al., 2001; Rivera, 2005). The black, organic-rich sediments, with a strong hydrogen sulfide odor, and the lack of any significant floral or faunal communities provide, together, strong evidence of an ecologically unhealthy environment at water depths greater than four to six feet in the San José Lagoon.

Rivera (2005) found 599.3 acres of this bare mud benthic habitat in this waterbody. He also estimated the presence of a “reef” consisting of the false mussel (*Mytilopsis domingensis*) over an area of 66.7 acres in the San José Lagoon. He hypothesized that this mussel reef is a “large source of food for the Lagoon” and provides a water filtering function “which must help maintain the water quality” of an otherwise worst condition than presently found.

PBS&J (2009) collected twenty-nine sediment samples in shallow water depths (less than 3.05 m or 10 feet deep) in the San José Lagoon. Blue-green algae were found on the surface of ten of the sediment sites. Live mussel reefs were identified at seven of the locations, all in water depths less than 5 feet. Associated with the mussel reefs were polycheate worms, penaeid shrimp, fish and blue crabs (e.g. *Callinectes sp.*). In all of the shallow water sediment samples, the majority of the sediments consisted of organic, black unconsolidated material with shell fragments. Detritus was also identified in several of the samples. All samples had a strong hydrogen sulfide odor, indicating the long-term absence of dissolved oxygen. These shallow water conditions indicate that deeper than five feet sediments have the potential to support benthic communities if the water quality above is improved.

As with the mangrove prop root habitat, benthos macrofauna follows a general pattern of reduced diversity and abundance along a gradient from La Torrecilla Lagoon to Suárez Canal, to the San José, to the CMP. In general, sponges, crabs, worms and mussels become less abundant to absent along a gradient from the eastern end of the Suárez Canal, along the San José Lagoon and into the CMP.

In summary, the results of the benthic habitat survey conducted by PBS&J (2009) indicate that diverse and healthy biological communities are restricted to the shallowest (less than four feet) regions of the San José Lagoon, where salinity stratification does not occur, and where sufficient levels of DO exist. These are the conditions that support a healthy fishery, particularly for the smaller species that make-up the catch for sustenance fishermen in the Lagoons (Atkins, 2011b). However, at the minimal dissolved oxygen conditions found in waters deeper than four feet in this waterbody, the presence of hydrogen sulfide in the sediments is a strong indicator that the water layer above the sediments is also hydrogen sulfide laden (see Figure 3-6).



Date: 1/21/2011
Sample: MR-D-2
Location: San José Lagoon, mangrove sampling area D
Depth: 7.5 feet
Cover: Bare (no cover organisms)
Other: None
Substrate: Organic sediment & detritus

Date: 1/27/2011
Sample: PPSJNS
Location: San José Lagoon, south of northeast artificial deep pit
Depth: 3 feet
Cover: Mussel reef & blue-green algae
Other: Errant polychaete worms
Substrate: Crushed shells, organic sediment

Figure 3-6. Typical benthos in the San José Lagoon (PBS&J, 2009)

3.9.2.2 Marine

Marine submerged habitats are those that are part of the ocean water column and benthic communities near shore, north of the SJBE.

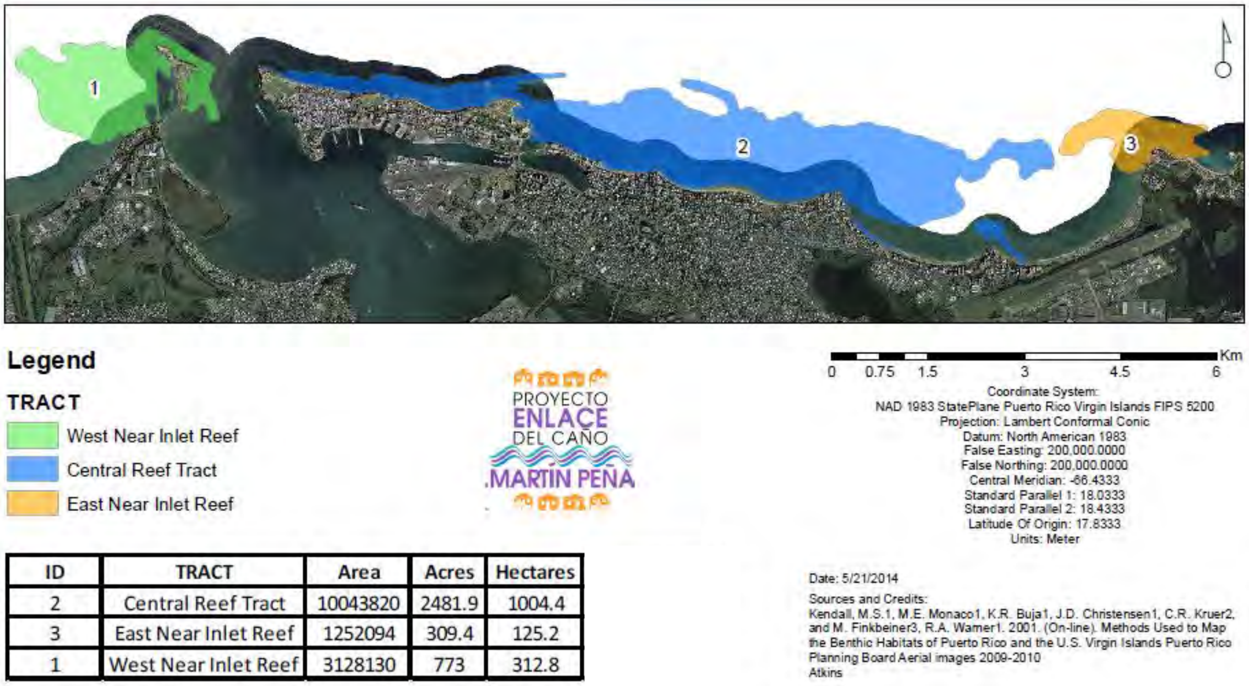
3.9.2.2.1 Near shore water column and benthos

The Study Area benthic habitats north of the SJBE have been delineated by the NOAA, based on interpretation of aerial photos from 1999 (Kendall et al., 2001). Benthic habitats were classified as colonized bedrock, colonized pavement, linear reef, macroalgae, patch reef, sand, scattered coral/rock in unconsolidated sediment and seagrass (see Figure 3-7).

Colonized bedrock was defined as exposed bedrock contiguous with the shoreline that has coverage of macroalgae, hard coral, gorgonians, and other sessile invertebrates that partially obscures the underlying rock. Colonized pavements are flat, lowrelief solid carbonate rock with coverage of macroalgae, hard coral, gorgonians, and other sessile invertebrates that are dense enough to partially obscure the underlying carbonate rock. Linear coral reefs are linear coral formations oriented parallel to the shore or the shelf edge. Patchy macroalgae were described as discontinuous macroalgal patches with coverage values reaching approximately 50 percent or more in some areas, but with breaks in coverage that are too diffuse or irregular, and result in isolated patches. Patch reef are clustered patch reefs that individually are too small or are too close together to map separately. Sand is coarse sediment typically found in areas exposed to currents or wave energy. Scattered coral and rock in unconsolidated sediment and seagrass was defined as primarily sand or seagrass bottom with scattered rocks or small, isolated coral heads that are too small to be delineated individually (i.e., smaller than individual patch reefs). Patchy seagrass are discontinuous seagrass with breaks in coverage that are too diffuse or irregular, or result in isolated patches of seagrass that are too small to be mapped as continuous seagrass (Kendall et al., 2001).

Several detailed benthic surveys, although for very narrow, long corridors or transects, have been conducted for the submarine installation of various fiber optic cables in the shallow, coastal waters north of the SJBE, in the vicinity of Isla Verde and El Condado (CSA Architects & Engineers, LLP, 2014; Environmental Resources Management [ERM], 2013; Glauco A. Rivera & Associates, 2011; Coll Rivera Environmental, 2005). Some of the benthic communities identified include sand plains, algal associations, seagrass beds and colonized hardgrounds. These are inhabited, accordingly, by seagrasses and algae (e.g. turf, coralline, fleshy), sessile and motile macro invertebrates such as poriferans (i.e. sponges), cnidarians (e.g. hydrozoans, zoanthids, soft and hard corals), mollusks and echinoderms (ERM, 2013; Glauco A. Rivera & Associates, 2011). The distribution, extent and species composition of each of these habitats varies along the Study Area’s nearshore waters (CSA Architects & Engineers, LLP, 2014; ERM, 2014; Glauco A. Rivera & Associates, 2011; Kendall, M.S., et al., 2001).

The most prominent marine benthic feature in the Study Area is a narrow, discontinuous linear or fringing "reef" consisting of corals covering fossil sand dunes (i.e. eolianites) trending in an east-west direction and extending, in some sites, up to 0.9 miles off shore. In some areas, the fossil sand dunes rise above the water, forming small, rocky islets (e.g. Isla de Cabra, Peñon de San Jorge, Isla de Piedra, Isla Verde, and Isla Cancora) (Caribbean Fisheries Management Council [CFMC], 2004).



Coordinate System:
NAD 1983 StatePlane Puerto Rico Virgin Islands FIPS 5200
Projection: Lambert Conformal Conic
Datum: North American 1983
False Easting: 200,000.0000
False Northing: 200,000.0000
Central Meridian: -66.4333
Standard Parallel 1: 18.0333
Standard Parallel 2: 18.4333
Latitude Of Origin: 17.8333
Units: Meter

Date: 5/21/2014

Sources and Credits:
Kendall, M.S.1, M.E. Monaco1, K.R. Buja1, J.D. Christensen1, C.R. Kruer2, and M. Finkbeiner3, R.A. Warner1. 2001. (On-line). Methods Used to Map the Benthic Habitats of Puerto Rico and the U.S. Virgin Islands Puerto Rico Planning Board Aerial images 2009-2010
Atkins

ID	TRACT	Area	Acres	Hectares
2	Central Reef Tract	10043820	2481.9	1004.4
3	East Near Inlet Reef	1252094	309.4	125.2
1	West Near Inlet Reef	3128130	773	312.8

Figure 3-7. Reef habitat north of the SJBE, within the Study Area (Atkins, 2015a)

Species zonation has been observed in the Study Area's fringing reefs. Intense wave actions, light penetration, currents along the shore and sediment abrasion generated by lateral transport are some of the factors that control coral reef development and distribution (ERM, 2013; Glauco A. Rivera & Associates, 2011; Miller and Lugo, 2009).

Turf, coralline and fleshy algae inhabit the reef and its surroundings; the most common or dominant species been *Halimeda* spp., *Dictyota* spp., *Amphiroa* spp., *Acanthophora spicifer* and *Sargassum* spp. Giant barrel sponges (i.e. *Xetospongia muta*), branching vase sponges (e.g. *Callyspongia vaginalis*), tube shape sponges (e.g. *Aplysina* spp.) and ball shape sponges (e.g. *Ircinia campana*) are also quite conspicuous. *Plexaura* spp. is generally the dominant soft coral, although others species can be found (e.g. *Eunicea* spp., *Gorgonia* spp.) (ERM, 2013; Glauco A. Rivera & Associates, 2011).

Most of the hard coral species identified grow in platy or encrusting forms, or as small domes. The most common species observed include the great star coral (*Orbicella cavernosa*), the maze coral (*Meandrina meandrites*), the mustard hill coral (*Porites astreoides*), the lettuce coral (*Agaricia* *agaricites*), the massive starlet coral (*Siderastrea siderea*), and the symmetrical brain coral (*Diploria strigosa*). Others include the domed star coral (*Dichocoenia stokesii*) and the mountainous star coral (*Orbicella faveolata*) (ERM, 2013; Glauco A. Rivera & Associates, 2011).

Low cover percentage of both soft and hard coral groups in the Study Area corresponds with data from other similar surveys in Puerto Rico and the general status of coral communities in the Caribbean (Glauco A. Rivera & Associates, 2011; García-Sais, et al. 2008). However, those reefs close and west of the Boca de Cangrejos outlet, in the Isla Verde area, have been significantly stressed or affected from sedimentation due to extensive dredging and organic pollution coming from La Torrecilla Lagoon, and probably, from other waterbodies in the SJBE (e.g. Canal Suárez, San José Lagoon and the CMP) that have been also impacted by these same activities (CFMC, 2004). This is evident by a remarkably high frequency of hard coral colonies been impacted by Black Band Disease, which suggests poor water quality, which could also be acting as a vector for pathogenic organisms (Coll Environmental, 2005).

Some of the macroinvertebrates that had been observed inhabiting the Study Area's reef community include the white encrusting zoanthid (*Palythoa caribaeorum*), the octopus (*Octopus vulgaris*), the long spindled sea urchin (*Diadema antillarum*), the rock boring urchin (*Echinometra lucunter*), the spiny lobster (*Panulirus argus*) and the cushioned star (*Oreaster reticulatus*) (ERM, 2013; Glauco A. Rivera & Associates, 2011).

Many of the species reported for the linear reef can also be observed growing in the "lagoon" found between the rear or backreef zone and the beach shoreline. The habitats found in this general area include large sand flats, rodoliths, hardbottom substrates, dispersed rocky patch reefs, seagrass beds and macroalgal plains. The four seagrass species reported for Puerto Rico, the seaturtle grass (*Thalassia testudinum*), the manatee grass (*Syringodium filiforme*), the paddle seagrass (*Halophila decipiens*) and the shoalweed (*Halodule wrightii*) have been observed; the latest close to the Boca de Cangrejos outlet. The West Indian fighting conch (*Strombus pugilis*), the queen conch (*Strombus gigas*) and the green sea urchin (*Lytechinus variegatus*) have been documented in this habitat within the Study Area (ERM, 2013; Glauco A. Rivera & Associates, 2011).

3.10 FLORA AND FAUNA RESOURCES

The SJBE system is home to a very rich biodiversity. Approximately, 160 bird species, 8 amphibian species, 12 reptile species, 124 fish species, and 300 wetland plant species, including others of special concern (i.e. rare, endemic, threatened or endangered), have been documented in this region (SJBEP, 2000).

Those flora and fauna species that have been documented in the CMP and the San José Lagoon are the ones considered for analysis in this Draft EIS. It should be noted, however, that other species observed within the Study Area other than the Project Area, could well be found, even if these have not been officially documented. This is very likely due to the capacity of many fauna species to move across the widely distributed mangrove forests in the SJBE. Such is the case, for example, with those bird species inhabiting the CMP. A considerable number of the bird species documented in the CMP were observed in the mudflats once found in its western end. For this Draft EIS, these species have been included as found in the eastern half. Nevertheless, an effort has been made to distinguish or identify those that have a higher probability of being found within the Project Area.

3.10.1 Flora

In eastern CMP, Atkins (2011c) identified 152 species of vascular plants, among 61 plant families. Of the plant species, 68 (44.7%) are introduced to Puerto Rico and 84 (55.3%) are native to the island (see Table 3-10). There were no Federally-listed terrestrial flora species (nor Commonwealth) found during the survey in the eastern CMP and at the CDRC staging area.

Table 3-10. Some of the terrestrial Flora Identified in the Eastern CMP

SCIENTIFIC NAME	COMMON ENGLISH NAME	FAMILY	ORIGIN
Dalbergia ecastaphyllum	coinvine	Papilionoideae	Native
Delonix regia	flamboyant	Caesalpinioideae	Introduced
Dieffenbachia maculata	spotted dumb cane	Araceae	Introduced
Dieffenbachia seguine	dumb cane	Araceae	Native
Digitaria ciliaris	southern crabgrass	Poaceae	Native
Echinochloa polystachya	creeping river grass	Poaceae	Native
Echinocloa colona	jungle rice	Poaceae	Introduced
Eleocharis mutata	scallion grass	Cyperaceae	Native
Eleocharis cellulosa	Gulfcoast spikerush	Cyperaceae	Native
Eleusine indica	Indian goosegrass	Poaceae	Introduced
Enterolobium cyclocarpum	Elephant ear tree	Fabaceae	Introduced
Erythrina poeppigiana	Mountain immortelle	Papilionoideae	Introduced
Eugenia monticola	Birdcherry	Myrtaceae	Native
Euphorbia heterophylla	Mexican fireplant	Euphorbiaceae	Native
Ficus citrifolia	Wild bayantree	Moraceae	Native
Ficus elastica	Rubber tree	Moraceae	Introduced
Ficus lancifolia	N/A	Moraceae	Introduced
Gossypium hirsutum	Upland cotton	Malvaceae	Introduced
Hydrocotyle umbellata	Dollarweed	Umbelliferae	Introduced
Ipomoea tiliacea	Choisy	Convolvulaceae	Native
Ixora ferrea	Palo de hierro	Rubiaceae	Native
Jatropha curcas	Barbados nuts	Euphorbiaceae	Introduced
Lagerstroemia speciosa	Queen’s Crape-myrtle	Lythraceae	Introduced
Laguncularia racemosa	White mangrove	Combretaceae	Native
Lemna perpusilla	Minute duckweed	Lemnaceae	Native
Leucaena leucocephala	White leadtree	Lamiaceae	Introduced
Livingstonia chinensis	Chinese fan palm	Arecaceae	Introduced
Ludwigia octovalvis	Mexican primrose-willow	Onagraceae	Native
Malachra capitata	Brazil jute	Malvaceae	Native
Malpighia emarginata	Barbados cherry	Malpighiaceae	Native
Mangifera indica	Mango	Anacardiaceae	Introduced

SCIENTIFIC NAME	COMMON ENGLISH NAME	FAMILY	ORIGIN
Megathyrsus maximus	Guinea grass	Poaceae	Introduced
Melanthera aspera	"Yerba de cabra"	Asteraceae	Native
Melicoccus bijugatus	Spanish lime	Sapindaceae	Introduced
Merremia umbellata	Hogvine	Convolvulaceae	Native
Mimosa pellita	Lollipop mimosa	Mimosoideae	Introduced
Mimosa pudica	Sensitive plant	Mimosoideae	Native
Momordica charantia	Balsampear	Cucurbitaceae	Introduced
Morinda citrifolia	Indian mulberry	Rubiaceae	Introduced
Murraya exotica	Chinese box	Rutaceae	Introduced
Musa paradisiaca	Banana tree	Musaceae	Introduced
Muntingia calabura	Strawberry tree	Elaeocarpaceae	Native
Nephrolepis multiflora	Asian swordfern	Polypodiaceae	Native
Nephrolepsis exaltata	Boston swordfern	Polypodiaceae	Native
Neptunia plena	Water dead and awake	Fabaceae	Native
Ochna jabotapita	Bird's eye bush	Ochnaceae	Introduced
Oeceoclades maculata	Monk orchid	Orchidaceae	Introduced
Paspalum conjugatum	Hilograss	Poaceae	Native
Paspalum fasciculatum	Mexican crowngrass	Poaceae	Native
Paspalum millegrana	"Paja brava"	Poaceae	Native
Paulinnia pinnata	Sweet gum	Sapindaceae	Native
Peltophorum pterocarpum	Yellow poinciana	Fabaceae	Introduced
Persea americana	Avocado tree	Lauraceae	Introduced
Petiveria alliacea	Guinea henweed	Phytolaccaceae	Introduced
Philodendron radiatum	-	Araceae	Introduced
Phyla nodiflora	Turkey tangle fogfriut	Verbenaceae	Native
Phyllanthus acidus	Malay gooseberry	Euphorbiaceae	Introduced
Phyllanthus juglandifolius	"Gamo de casta"	Euphorbiaceae	Native
Pimenta racemosa	Bayrum tree	Myrtaceae	Native
Piper aduncum	Spiked pepper	Piperaceae	Native
Pithecellobium dulce	Monkeypod	Mimosoideae	Introduced
Psidium guajava	Guava	Myrtaceae	Native
Pterocarpus officinalis	Bloodwood	Papilionoideae	Native
Ptychosperma macarthurii	Macarthur palm	Arecaceae	Introduced
Pueraria phaseoloides	Kudzu	Papilionoideae	Introduced
Ravenala madagascariensis	Traveller's palm	Musaceae	Introduced
Rhizophora mangle	Red mangrove	Rhizophoraceae	Native
Rhynchospora nervosa	Beak rush	Cyperaceae	Native
Ricinus communis	Castor oil	Euphorbiaceae	Introduced
Roystonea borinquena	Royal palm	Arecaceae	Native
Roystonea regia	Cuban royal palm	Arecaceae	Introduced
Ruellia brittoniana	Mexican petunia	Acanthaceae	Introduced
Ruellia tuberosa	Minnieroot	Acanthaceae	Introduced
Saccharum officinarum	Sugarcane	Poaceae	Introduced
Sansevieria trifasciata	Snake plant	Liliaceae	Introduced
Schefflera actinophylla	Umbrella tree	Araliaceae	Introduced
Senna alata	Emperor's candlestick	Caesalpinioideae	Introduced
Senna bicapsularis	Christmasbush	Caesalpinioideae	Native

SCIENTIFIC NAME	COMMON ENGLISH NAME	FAMILY	ORIGIN
Senna siamea	Casod tree	Caesalpinioideae	Native
Serjania polyphylla	Basketwood	Sapindaceae	Native
Sesbania sericea	Papagayo	Papilionoideae	Introduced
Sida acuta	Common wireweed	Malvaceae	Native
Sida rhombifolia	Arrowleaf sida	Malvaceae	Native
Sideroxylon salicifolium	White bully	Sapotaceae	Native
Solanum torvum	Turkey berry	Solanaceae	Native
Sorghum halepense	Johnson grass	Poaceae	Introduced
Spathodea campanulata	African tulip	Bignoniaceae	Introduced
Spondias dulcis	June plum	Anacardiaceae	Introduced
Sterculia apetala	Panama tree	Sterculiaceae	Introduced
Syngonium podophyllum	Arrowhead plant	Araceae	Introduced
Syzygium jambos	Malabar plum	Myrtaceae	Introduced
Tabebuia heterophylla	White cedar	Bignoniaceae	Native
Tamarindus indica	tamarin	Caesalpinioideae	Introduced
Terminalia catappa	Indian almond	Combretaceae	Introduced
Thespesia populnea	Portia tree	Malvaceae	Native
Tillandsia Sp.	Tilansia	Bromeliaceae	Native
Triumfetta semitriloba	Sacramento burbark	Tiliaceae	Native
Typha domingensis	Southern cattail	Typhaceae	Native
Veitchia merrillii	Christmas palm	Arecaceae	Introduced
Wedelia trilobata	Wedelia	Asteraceae	Native
Zantedeschia aethiopica	Cala lilly	Araceae	Introduced
Zoysia matrella	Manila grass	Poaceae	Introduced

Source: Atkins, 2011c.

In the benthic, nearshore waters north of the SJBE and within the Study Area, 37 algae species and 4 seagrass species have been identified (CSA Architects & Engineers, 2014; ERM, 2013; Glauco A. Rivera & Associates, 2011; Coll Rivera Environmental, 2005) (see Table 3-11).

Table 3-11. Benthic flora identified in nearshore waters north of the SJBE, within the Study Area

ALGAE		
Acanthophora spicifera	*Dictyosphaeria* spp.	*Padina sanctae-crucis*
Amphiroa spp.	*Galaxaura oblongata*	*Penicillus* spp.
Asparagopsis taxiformis	*Gracilaria* spp.	*Sargassum* spp.
Avrainvillea spp.	*Halimeda incrassata*	*Scinaia complanata*
Bryothamnion triquetrum	*Halimeda discoidea*	*Trichogloea* spp.
Caulerpa cupressoides	*Halimeda monile*	*Udotea cyathiformis*
Caulerpa mexicana	*Halimeda opuntia*	*Udotea* spp.
Caulerpa prolifera	*Halimeda* spp.	*Wrightiella blodgettii*
Caulerpa racemosa	*Halymenia floresia*	Unidentified chlorophyta
Caulerpa sertularioides	*Hypnea* spp.	Unidentified phaeophyta
Chondria spp.	*Laurencia* spp.	Unidentified rhodophyta
Codium isthmocladum	*Neomeris annulata*	
Dictyopteris spp.	*Padina gymnospora*	
SEAGRASSES		
Halodule wrightii	*Syringodium filiforme*	
Halophila decipiens	*Thalassia testudinum*	

Source: CSA Architects & Engineers, 2014; ERM, 2013; Glauco A. Rivera & Associates, 2011; Coll Rivera Environmental, 2005.

3.10.1.1 Invasive Flora

The cayeput tree (*Melaleuca quinquenervia*), originally from Australia and introduced as an ornamental, is known to aggressively invade freshwater herbaceous wetlands outside its natural range. Although not properly found in the Project Area, it has been recorded growing in pure stands, covering several acres south of the Suárez Canal, east of the Project Area.

The exotic water hyacinth (*Eichhornia crassipes*) is found in the juncture between the CMP and the San José Lagoon, and at the outlets of the Juan Méndez and San Antón Creeks. It grows in fresh to extremely low saline or brackish waters. Originally from South America, it was introduced as an ornamental. The water hyacinth is a very fast growing plant, with populations known to double in as little as 12 days. Infestations of this weed block waterways, limiting boat traffic, swimming and fishing. Water hyacinth also prevents sunlight and oxygen from reaching the water column and submerged plants. Its shading and crowding of native aquatic plants dramatically reduces biological diversity in aquatic ecosystems (Atkins, 2013f).

3.10.2 Fauna

In the Project Area, 133 species of birds, 8 amphibian, 9 reptiles, and 27 fish and have been documented (Atkins, 2012a; INCICO & Expediciones Península, 2011; Atkins, 2011c; Rivera-Herrera, 1996). In the eastern CMP and the CDRC staging area, 127 fauna species among 59 families have been identified (Atkins, 2011c). Of these, 91 are birds species classified within 19 families; 6

are amphibian species classified within 3 families; 9 are reptilian species classified within 5 families, and 3 are mammal species classified within 3 families.

In the benthic, nearshore waters north of the SJBE and within the Study Area, 9 sponge species, 14 soft coral species, 41 hard coral species and 49 macroinvertebrate species have been identified (CSA Architects & Engineers, 2014; ERM, 2013; Glauco A. Rivera & Associates, 2011; Coll Environmental, 2005) (see Table 3-12).

Table 3-12. Benthic fauna documented in nearshore waters north of the SJBE, within the Study Area

SPONGES		
Agelas spp.	*Cinachyra* spp.	*Ircina* spp.
Aplysina spp.	*Geodia neptuni*	*Neofibularia nolitangere*
Callyspongia vaginalis	*Ircina campana*	*Xetospongia muta*
SOFT CORALS		
Briareum asbestinum	*Gorgonia ventalina*	*Plumapathes* spp.
Ellisella spp.	*Muricea* spp.	*Pseudoplexaura* spp.
Erythropodium caribaeorum	*Muriceopsis flavida*	*Pseudopterogorgia* spp.
Eunicea spp.	*Plexaura homomalla*	*Pterogorgia guadalupensis*
Gorgonia flabellum	*Plexaurella* spp.	
HARD CORALS		
Acropora cervicornis	*Eusmilia fastigiata*	*Montastraea cavernosa*
Acropora palmata	*Favia fragum*	*Mussa angulosa*
Acropora prolifera	*Helioceris cucullata*	*Mycetophyllia aliciae*
Agaricia agaricites	*Isophyllia rigida*	*Mycetophyllia ferox*
Agaricia fragilis	*Isophyllia sinuosa*	*Oculina difusa*
Agaricia humilis	*Leptoseris cucullata*	*Porites astreoides*
Agaricia lamarcki	*Madracis decactis*	*Porites porites*
Colpophyllia natans	*Meandrina meandrites*	*Scolymia* spp.
Dendrogyra cylindrus	*Millepora alcicornis*	*Siderastrea radians*
Dichocoenia intersepta	*Millepora complanata*	*Siderastrea siderea*
Dichocoenia stokesii	*Millepora squarrosa*	*Stephanocoenia intersepta*
Diploria clivosa	*Montastraea annularis*	*Stylaster roseus*
Diploria labyrinthiformis	*Montastraea faveolata*	*Tubastraea coccinea*
Diploria strigosa	*Montastraea franksi*	

MACROINVERTEBRATES		
Aurelia aurita	*Eucidaris tribuloides*	*Pinna carnea*
Acanthopleura granulata	*Hermodice carunculata*	*Plectreurys conifera*
Actinoporus elegans	*Holothuria mexicana*	*Sabellastarte magnifica*
Alpheus spp	*Isostichopus badionotus*	*Scyllarides aequinoctialis*
Bispira brunnea	*Lima scabra*	*Sepioteuthis sepioidea*
Carpilius corallinus	*Linckia guildingii*	*Spirobranchus giganteus*
Cassis flammea	*Lytechinus variegatus*	*Stenophus hispidus*
Charonia variegata	*Mytrax sculptus*	*Stichodactyla helianthus*
Cinetorhynchus manningi	*Octopus briareus*	*Strombus costatus*
Cittarium pica	*Octopus vulgaris*	*Strombus gigas*
Clypeaster subdepressus	*Ophionereis reticulata*	*Tripneustes ventricosus*
Condylactis gigantea	*Opiothrix suensoni*	*Viatrix globulifera*
Condylactis helianthus	*Oreaster reticulatus*	annelids
Cyphoma gibbosum	*Palythoa caribaeorum*	Diogenid-hermit crab
Diadema antillarum	*Panulirus argus*	Ophiuroid-brittle star
Echinometra lucunter	*Panulirus guttatus*	
Echinometra viridis	*Percnon gibbesi*	

Source: CSA Architects & Engineers, 2014; ERM, 2013; Glauco A. Rivera & Associates, 2011; Coll Rivera Environmental, 2005.

3.10.2.1 Invasive Fauna

Three introduced species that have the potential to alter mangrove habitats or that could prey on native fauna species have been sighted on a regular basis in most of the Study Area, including the Project Area.

The small Indian mongoose (*Herpestes javanicus*) was originally introduced from Asia between 1877 and 1879 to control rats in sugar cane fields. Today, it is Puerto Rico's most detrimental predator on ground-nesting birds and lizards (Weaver and Schwagerl, 2009). This species is known to occur in a wide variety of habitats including dry forest, disturbed dry forest, scrub, grasslands, cattle pastures, cane fields, urban areas, woodlands, montane wet forests, and rain forests (Gould, et al. 2007). Mongoose populations are greatest in coastal grassy areas where fresh water is available and low in forested areas (Pimentel, 1955). The mongoose is entirely diurnal and can swim and climb trees, although it rarely does so. It does not voluntarily enter water deeper than about 2 in. (Nellis and Evarard, 1983). The Small Indian Mongoose is an opportunistic feeder that is known to eat reptiles, amphibians, birds, invertebrates, plants, seeds, fruits and carrion (Nellis and Small 1983 as cited in Gould, et al. 2007). In Puerto Rico, reptiles and insects form the bulk of its diet (Pimentel, 1955).

The green iguana (*Iguana iguana*), originally introduced as a pet, is a large and widely distributed arboreal lizard, found from México and the Caribbean, to northern Argentina in South America. It has become established in Puerto Rico, mostly found in coastal areas, although it can also be found in higher elevations near streams and rivers. A study conducted by Carlo and García (2008) to examine the distribution, abundance patterns, and ecological and social impacts of this species in the SJBE ecosystem concluded that green iguanas clump in mangrove trees found in disturbed areas, especially near edges and urban settlements. These also fed nonrandomly on mangrove species, and clearly preferred black mangrove (*Avicennia germinans*) when available. According to the authors, the combined effects of spatial clumping at the local and landscape scale resulted in a concentration of iguana herbivory in already disturbed mangrove stands, causing high defoliation and mortality rates for mangroves where iguanas aggregate near edges and urban settlements.

A study conducted by the SJBEP in 2010 concluded that the spectacled caiman is widely distributed within the SJBE watershed. In the Project Area, it is found in greater numbers at the outlet of the Juan Méndez Creek (SJBEP, 2010). The spectacled caiman (*Caiman cocodrilus*) is native to Central and South America and was probably introduced into Puerto Rico as a result of released or escaped pets in the 1960s. This species has become established in the Island and now occurs in parts of the northern coastal plain and other localities. Because the ecology and natural history of *Caiman crocodilus* has not been studied in Puerto Rico, its effects on local biodiversity are not known. However, there are reasons for concern because the spectacled caiman has been reported to prey on numerous vertebrates and invertebrates, is aggressive and dangerous to humans, and serve as vector of foreign pathogens and/or diseases. The spectacled caiman is a highly adaptable species, found in virtually all lowland wetland and riverine habitats throughout its range, although generally preferring areas of still water, such as lakes, ponds and marshes, as well as slower-flowing rivers (Ross, 1998 as cited in SJBEP, 2010). It can also tolerate a reasonable degree of salinity (Web Crocodilian Species List, 2009, as cited in SJBEP, 2010).

Dogs, cats, rats and mice are other introduced mammal species found in the Study Area. When found in considerable numbers, these can have an impact on native wildlife, mostly as predators of reptiles and birds.

3.10.2.2 Fish

3.10.2.2.1 Caño Martín Peña and San José Lagoon fish species

A total of 124 fish and one (1) crustacean (*Callinectes sp.*) species have been identified as part of the nekton (free swimming) found in the SJBE (Rivera-Herrera, 1996; Yoshiura & Lilyestom, 1999). The following table provides a subset list of 82 fish species that have been found in the CMP and the San José Lagoon, as informed by Rivera-Herrera (1996), and in the San José and La Torrecilla lagoons, as reported by Yoshiura & Lilyestrom (1999). Seventeen (17) of these species have been classified and included by the CFMC in it's the Reef Fish Management Plan (CFMC, 2004) (see Table 3-13).

Table 3-13. Fish species found in the CMP, the San José and La Torrecilla lagoons

SCIENTIFIC NAME	SPANISH COMMON NAME	ENGLISH COMMON NAME	REEF FISH FMP*
Abudefduf saxatilis	Sargento mayor	Sergeant major	✓
Ablennes hians	Agujón sable	Flat needlefish	
Achirus lineatus	Suela listada	Lined sole	
Anchoa hepsetus	Manjúa listada	Striped anchovy	
Anchoa spinifer		Spicule anchovy	
Anchovia clupeoides	Hachudo	Zabaleta anchovy	
Anisotremus virginicus	Burro payaso	Porkfish	✓
Archosargus rhomboidalis	Sargo amarillo	Sea bream	✓
Bairdiella ronchus	Ronco rayado	Ground drummer	
Bairdiella sanctaeluciae	Ronco caribeño	Striped croaker	
Bothus ocellatus	Chueco playón	Eyed flounder	
Caranx crysos	Cojinúa	Blue runner	✓
Caranx latus	Jurel blanco	Horse-eye jack	✓
Cetengraulis edentulus	Bocónn	Atlantic anchoveta	
Centropomus ensiferus	Róbalo espinoso	Swordspine snook	
Centropomus parallelus	Robalito	Fat snook	
Centropomus pectinatus	Róbalo prieto	Tarpon snook	
Centropomus undecimalis	Róbalo blanco	Common snook	
Chaetodipterus faber	Chabela	Atlantic spadefish	✓
Citharichthys arenaceus	Lenguado arenero	Sand whiff	
Conodon nobilis	Ronco canario	Barred grunt	
Diapterus auratus	Mojarra guacha	Irish ponpano	
Diapterus rhombeus	Mojarra de estero	Rhomboid mojarra	
Diodon hystrix	Puerco espín	Porcupine fish	✓
Elops saurus	Banano	Ladyfish	
Eucinostomus argenteus	Mojarra plateada	Spotfin mojarra	
Eucinostomus gula	Mojarra española	Silver jenny	
Eucinostomus harengulus	Mojarra costera	Tidewater mojarra	
Eucinostomus havana	Majarrita manchada	Bigeye mojarra	
Eucinostomus jonesii	Mojarra flaca	Slender mojarra	
Eucinostomus lefroyi	Mojarra pinta	Mottled mojarra	
Eucinostomus melanopterus	Mojarra bandera	Flagfin mojarra	
Eugerres plumieri	Mojarra plateada	Striped mojarra	
Gambusia affinis	Gupi	Mosquito fish	
Gerres cinereus	Mojarra blanca	Yellowfin mojarra	

SCIENTIFIC NAME	SPANISH COMMON NAME	ENGLISH COMMON NAME	REEF FISH FMP*
Gobioides broussonnetii	Esmeralda de río	Violet goby	
Gobiomorus dormitor	Guavina bocón	Bigmouth sleeper	
Gobionellus oceanicus	Esmeralda de mar	Highfin goby	
Gymnothorax funebris	Morena verde	Green moray	✓
Haemulon album	Ronco jallao	Margate	✓
Haemulon chrysargyreum	Ronco boquichica	Smallmouth grunt	
Haemulon flavolineatum	Ronco condenado	French grunt	✓
Haemulon parra	Ronco blanco	Sailors choice	
Haemulon plumierii	Ronco arará	White grunt	✓
Haemulon sciurus	Ronco amarillo	Bluestriped grunt	✓
Haemulon steindachneri	Ronco latino	Latin grunt	
Labrisomus nuchipinnis	Sapito cabezón	Hairy blenny	
Lophogobius cyprinoides	Gobio gallo	Crested goby	
Lutjanus analis	Pargo criollo	Mutton snapper	✓
Lutjanus cyanopterus	Pargo cubera	Cubera snapper	
Lutjanus griseus	Pargo mulato	Gray snapper	✓
Lutjanus jocu	Jocú	Dog snapper	✓
Lutjanus synagris	Biajaiba	Lane snapper	✓
Megalops atlanticus	Sábalo	Tarpon	
Micropogonias furnieri	Verrugato	Whitemouth croaker	
Mugil curema	Lisa blanca	White mullet	
Mugil liza	Lebrancho	Liza mullet	
Myrophis punctatus	Safío pecoso	Speckled worm eel	
Oligoplites saurus	Zapatero	Leatherjack	
Ophioscion adustus	-	Snake croaker	
Opisthonema oglinum	Machuelo	Atlantic thread	
Oreochromis mossambicus	Tilapia mosambica	Mozambique tilapia	
Poecilia vivipara	Gupi mino	Top minnow	
Polydactylus virginicus	Barbu	-	
Pomadasys corvinaeformis	Ticopa gris	Roughneck grunt	
Pomadasys crocro	Ticopa	Burro grunt	
Rypticus saponaceus	Jabonero grande	Greater soapfish	✓
Sardinella aurita	Sardina española	Spanish sardine	
Scomberomorus regalis	Cero	Painted mackerel	
Scorpaena plumieri	Escorpión negro	Spotted scorpionfish	
Sphoeroides spengleri	Tamboril manchado	Bandtail puffer	
Sphoeroides testudineus	Tamborial rayado	Checkered puffer	

SCIENTIFIC NAME	SPANISH COMMON NAME	ENGLISH COMMON NAME	REEF FISH FMP*
Sphyraena barracuda	Picúa	Great barracuda	
Stegastes diencaeus	Chopita miel	Longfin damselfish	
Stegastes planifrons	Chopita amarilla	Threespot damselfish	
Strongylura timucu	Agujón timucú	Longjaw	
Tilapia rendalli	Tilapia	Redbreast tilapia	
Trachinotus carolinus	Pámpano amarillo	Florida pompano	
Trachinotus falcatus	Pámpano	Permit	
Trachinotus goodei	Palometa	-	
Trichiurus lepturus	Sable	Atlantic cutlassfish	
Tylosurus crocodilus	Agujón lisero	Houndfish	
Umbrina coroides	Roncador	Sand drum	

*FMU: Species included as part of the Reef Fish Management Unit, as classified by the CFMC.

3.10.2.2.2 Near shore waters fish species

A total of 126 species of fish have been identified in the marine, coastal waters found north of the SJBE (CSA Architects & Engineers, LLP, 2014; ERM, 2013; Glauco A. Rivera & Associates, 2011). Seventy six (76) of these species have been classified and included by the CFMC in it's the Reef Fish Management Plan (CFMC, 2004). Twenty (20) of these have been also found either in the CMP, the San José Lagoon and/or La Torrecilla Lagoon. The red hind, the yellowtail snapper, the banded butterfly fish and the foureye butterfly fish are managed by the CFMC (see Table 3-14).

Table 3-14. Fish species found in nearshore waters north of the SJBE, within the Study Area

SCIENTIFIC NAME	SPANISH COMMON NAME	ENGLISH COMMON NAME	REEF FISH FMP*
Abudefduf saxatilis	**Sargento mayor**	**Sergeant major**	✓
Abudefduf taurus	Sargento	Night sargent	
Acanthostracion polygonia	Chapín	Honeycomb cowfish	
Acanthostracion quadricornis	Chapín	Scrawled cowfish	
Acanthurus bahianus	Barbero	Ocean surgeonfish	✓
Acanthurus chirurgus	Barbero rayado	Doctorfish	✓
Acanthurus coeruleus	Barbero azul	Blue tag	✓
Amblycirrhitus pinos	Rayadito	Redspotted hawkfish	✓
Anchoa lyolepis	Anchoa mulata	Dusky anchovy	
Anisotremus virginicus	**Burro payaso**	**Porkfish**	✓
Apogon maculatus	Cardenal manchado	Flamefish	✓
Atherinomorus stipes	Cabezote	Hardhead silverside	

SCIENTIFIC NAME	SPANISH COMMON NAME	ENGLISH COMMON NAME	REEF FISH FMP*
Aulostomus maculatus	Trompeta del Atlántico	Trumpetfish	✓
Balistes vetula	Cochino	Queen triggerfish	✓
Bodianus rufus	Pez perro español	Spanish hogfish	✓
Bothus lunatus	Lenguado lunado	Peacock flounder	✓
Calamus calamus	Pez de pluma	Saucereye porgy	
Calamus pennatula	Bajonao plateado	Pluma porgy	✓
Cantherhines macrocerus	Lija de lunares blancos	Whitespotted filefish	✓
Cantherhines pullus	Lija colorada	Orangespotted filefish	
Canthigaster rostrata	Tamboril narizón	Sharpnose puffer	✓
Caranx crysos	**Cojinúa**	**Blue runner**	✓
Caranx latus	**Jurel blanco**	**Horse-eye jack**	✓
Caranx ruber	Cojinúa carbonera	Bar jack	✓
Carcharhinus perezii	Tiburón coralino	Caribbean reef shark	
Cephalopholis cruentata	Cherna enjambre	Graysby	✓
Cephalopholis fulva	Cabrilla roja	Coney	
Chaetodon capistratus	Mariposa ocelada	Foureye butterflyfish	✓
Chaetodon ocellatus	Mariposa perla amarilla	Spotfin butterflyfish	✓
Chaetodon sedentarius	Mariposa parche	Reef butterflyfish	
Chaetodon striatus	Mariposa arrayada	Banded butterflyfish	✓
Chromis cyanea	Cromis azul	Blue chromis	✓
Chromis insolata	Cromis sol	Sunshinefish	
Chromis multilineata	Cromis prieto	Brown chromis	
Clepticus parrae	Doncella mulata	Creole wrasse	
Coryphopterus	Gobio con brida	Bridled goby	
Coryphopterus personatus	Gobio enmascarado	Masked goby	
Dasyatis americana	Raya americana	Southern stingray	
Decapterus macarellus	Antonino caballita	Mackerel scad	
Diodon holocanthus	Pez erizo	Balloonfish	
Diodon hystrix	**Puerco espín**	**Porcupine fish**	✓
Echeneis naucrates	Rémora rayada	Sharksucker	
Echidna catenata	Morena cadena	Chain moray	✓
Elacatinus evelynae	Gobio tiburoncito	Sharknose goby	
Epinephelus guttatus	Cabrilla colorada	Red hind	✓
Equetus lanceolatus	Payasito obispo	Jacknife-fish	✓
Equetus punctatus	Payasito punteado	Spotted drum	✓
Ginglymostoma cirratum	Tiburón gata	Nurse shark	
Gramma loreto	Loreto	Royal gramma	✓

SCIENTIFIC NAME	SPANISH COMMON NAME	ENGLISH COMMON NAME	REEF FISH FMP*
Gymnothorax funebris	**Morena verde**	**Green moray**	✓
Gymnothorax moringa	Morena manchada	Spotted moray	
Gymnothorax vicinus	Morena amarilla	Purplemouth moray	
Haemulon aurolineatum	Ronco jeníguaro	Tomtate	✓
Haemulon carbonarium	Ronco carbonero	Caesar grunt	
Haemulon flavolineatum	**Ronco condenado**	**French grunt**	✓
Haemulon macrostomum	Ronco español	Spanish grunt	
Haemulon parra	**Ronco blanco**	**Sailors choice**	
Haemulon plumierii	**Ronco arará**	**White grunt**	✓
Haemulon sciurus	**Ronco amarillo**	**Bluestriped grunt**	✓
Halichoeres bivittatus	Doncella rayada	Slippery dick	
Halichoeres garnoti	Doncella cabeciamarilla	Yellowhead wrasse	✓
Halichoeres maculipinna	Doncella payaso	Clown wrasse	✓
Halichoeres poeyi	Doncella ojinegra	Blackear wrasse	
Halichoeres radiatus	Doncella azulada	Puddingwife	✓
Harengula humeralis	Sardina de ley	Redear herring	
Heteropriacanthus	Catalufa espinosa	Glasseye snapper	
Holacanthus ciliaris	Angel reina	Queen angelfish	✓
Holacanthus tricolor	Chabelita tricolor	Rock beauty	✓
Holocentrus adscensionis	Candil de vidrio	Squirrelfish	✓
Holocentrus rufus	Candil rufo	Longspine squirrelfish	✓
Hypleurochilus bermudensis	Borracho de barras	Barred blenny	
Labrisomus nuchipinnis	**Sapito cabezón**	**Hairy blenny**	
Lachnolaimus maximus	Pez perro	Hogfish	✓
Lactophrys bicaudalis	Chapín pintado	Spotted trunkfish	✓
Lactophrys triqueter	Chapín común	Smooth trunkfish	✓
Lutjanus apodus	Cají	Schoolmaster	✓
Lutjanus analis	**Pargo criollo**	**Mutton snapper**	✓
Lutjanus griseus	**Pargo mulato**	**Gray snapper**	✓
Lutjanus jocu	**Jocú**	**Dog snapper**	✓
Lutjanus synagris	**Biajaiba**	**Lane snapper**	✓
Malacanthus plumieri	Matajuelo blanco	Sand tilefish	✓
Megalops atlanticus	**Sábalo**	**Tarpon**	
Melichthys niger	Negrito	Black durgon	✓
Microspathodon chrysurus	Chopita de cola	Yellowtail damselfish	✓
Monacanthus ciliatus	Lija de clavo	Fringed filefish	
Mulloidichthys martinicus	Chivo amarillo	Yellow goatfish	✓

SCIENTIFIC NAME	SPANISH COMMON NAME	ENGLISH COMMON NAME	REEF FISH FMP*
Myrichthys ocellatus	Safío ocelado	Goldspotted eel	✓
Myripristis jacobus	Candil barreado	Blackbar soldierfish	✓
Neoniphon marianus	Carajuelo mariano	Longjaw squirrelfish	
Ocyurus chrysurus	Colirubia	Yellowtail snapper	✓
Ophioblennius atlanticus	Blenio	Redlip blenny	✓
Ophioblennius macclurei	Blenio bembirrojo	Redlip blenny	
Opistognathus aurifrons	Bocón cabeza amarilla	Yellowhead jawfish	✓
Pempheris schomburgki	Barrendero	Glassy sweeper	
Pomacanthus arcuatus	Gallineta café	Gray angelfish	✓
Pomacanthus paru	Gallineta negra	French angelfish	✓
Priacanthus arenatus	Catalufa toro	Bigeye	✓
Prognathodes aculeatus	Mariposa narigona	Longsnout butterflyfish	
Pseudupeneus maculatus	Chivo manchado	Spotted goatfish	✓
Pterois volitans	Pez león	Lion fish	
Rypticus maculatus	Jabonero albipunteado	Whitespotted soapfish	
Scarus iseri	Loro listado	Striped parrotfish	
Scarus taeniopterus	Loro princesa	Princess parrotfish	✓
Scarus vetula	Loro reina	Queen parrotfish	✓
Scorpaena grandicornis	Escorpión plumeado	Plumed scorpionfish	
Scorpaena plumieri	**Escorpión negro**	**Spotted scorpionfish**	
Serranus annularis	Serrano naranja	Orangeback bass	✓
Serranus baldwini	Serrano linterna	Lantern bass	✓
Serranus tabacarius	Jácome	Tobaccofish	✓
Serranus tigrinus	Serrano arlequín	Harlequin bass	✓
Sparisoma aurofrenatum	Loro manchado	Redband parrotfish	✓
Sparisoma chrysopterum	Loro verde	Redtail parrotfish	✓
Sparisoma radians	Loro dientuso	Bucktooth parrotfish	
Sparisoma rubripinne	Loro coliamarilla	Redfin parrotfish	✓
Sparisoma viride	Loro brilloso	Stoplight parrotfish	✓
Sphoeroides spengleri	**Tamboril manchado**	**Bandtail puffer**	
Sphyraena barracuda	**Picúa**	**Great barracuda**	
Stegastes adustus	Chopita prieta	Dusky damselfish	
Stegastes fuscus	Damicela	Dusky damselfish	
Stegastes leucostictus	Chopita de cola	Beaugregory	
Stegastes partitus	Chopita bicolor	Bicolor damselfish	
Stegastes planifrons	**Chopita amarilla**	**Threespot damselfish**	
Stegastes variabilis	Chopita cacao	Cocoa damselfish	
Synodus intermedius	Lagarto manchado	Sand diver	✓

SCIENTIFIC NAME	SPANISH COMMON NAME	ENGLISH COMMON NAME	REEF FISH FMP*
Thalassoma bifasciatum	Cara de cotorra	Bluehead wrasse	✓
Xyrichtys splendens	Doncella de lunar	Green razorfish	

Source: CSA Architects & Engineers, 2014; ERM, 2013; Glauco A. Rivera & Associates, 2011. *FMP: Species included as part of the CFMC Reef Fish Management Plan. Species in bold have been also found either in the CMP, the San José Lagoon and/or La Torrecilla Lagoon.

3.10.2.2.3 Invasive fish

The invasive red lionfish (*Pterois volitans*), although not documented in the CMP and the San José Lagoon, has been found at the Boca del Morro outlet and the Boca de Cangrejo outlet in the SJB and La Torrecilla Lagoon, respectively, and in the near shore reefs within the Study Area (CSA Architects & Engineers, 2014; ERM, 2013; Glauco A. Rivera & Associates, 2011). It is native from the Western and Central Pacific and Western Australia. The initial confirmed lionfish sighting in the United States occurred in 1985, off Dania Beach, Florida; today, it is fully established as a aquarium escapee throughout the Southeast United States, the Caribbean Sea, and much of the Gulf of Mexico, and reported as the first marine reef fish invasive species to this region (Morris, 2012).

Lionfish have broad diet and can inhabit various marine and near shore habitats. As such, have the potential to affect the structure and function of many Atlantic marine communities- from the sea surface to depths exceeding 1,280 feet, and across habitats ranging from coral and hardbottom to artificial reefs, mangroves, seagrass beds and even brackish estuaries (Zachary, Nichols & Layman, 2014; Morris, 2012).

Higher densities of lionfish have been found in deeper reefs (33-98 feet) than in other shallow habitats (e.g. seagrass beds, mangroves, sheltered reefs), which may suggest a preference on the former (Brightman-Claydon, Calosso and Traige, 2012). However, these and other authors have found evidence that demonstrate that lionfish can feed, colonize and thrive in mangrove habitats; at least as opportunistic forages, as this species can tolerate broad salinity concentrations (Zachary, Nichols and Layman, 2014; Pimiento, Nifong, Hunter, Monaco and Silliman, 2013; Barbour, Montgomery, Adamson, Díaz-Ferguson, and Silliman, 2010).

Morris (2012) reported that lionfish may trigger cascading impacts through their disruption of the food web due to its consumption of herbivorous fishes that could reduce the functional role of herbivores in keeping algae in check, a process known to be important for the health of coral reefs. Lionfish may also compete for resources — principally food and space — with economically important species, such as snapper (Lutjanids) and grouper (Epinephelids); may occupy similar habitats and consume similar prey to many species of native fish predators and macroinvertebrates, and competition with this invasive species may affect the behavior, distribution, growth, survival, and, ultimately, population size of these ecologically similar native species (Morris, 2012).

3.11 SPECIES OF SPECIAL CONCERN

3.11.1 Federally Listed Species

In the study area, there are four federally listed species of flora and 15 species of fauna under the Endangerd Species Act (ESA). Table 3-15 shows those federally listed species that have been found in the municipalities of the Study Area (i.e. Cataño, Guaynabo, San Juan, Carolina and Loíza), as identified by the USFWS in the Caribbean Endangered Species Map as well as other sources. None of these, however, have been found in the Project Area.

3.11.1.1 Flora

According to the The USFWS Caribbean Endangered Species Map (2012)[17], federally listed plant species include:

- 2 threatened, *Schoepfia arenaria* and *Stahlia monosperma*; and
- 2 endangered, *Banara vanderbiltii* and beautiful goetza (*Goetzea elegans*).

All have been documented in the Study Area, but none of these are found within the Project Area.

3.11.1.2 Fauna

Reptiles: Four federally listed reptiles have been documented in the Study Area, but none within the Project Area: 1 threatened, Green sea turtle (*Chelonia mydas*); and 3 endangered, Leatherback sea turtle (*Dermochelys coriacea)*, Hawksbill sea turtle (*Eretmochelys imbricata)* and the Puerto Rican boa *(Epicrates inornatus).* Indeed, of the four species of seaturtles known to inhabit Puerto Rican waters, three have been reported in the nearshore waters at the Study Area. Juvenile green and hawksbill turtles may be found off the northern shore of Puerto Rico, associated with rafts of *Sargassum.*

Mammals: One federally endangered marine mammal has been documented in the Study Area. The Antillean manatee (*Trichechus m. manatus*), could be found west of the Project Area, at the juncture between the western half of the CMP and the Puerto Nuevo River Channel.

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[17] The USFWS Caribbean Endangered Species Map (2012) provides the latest official reference for the identification of general locations (municipalities) where federally listed species, according to the Endangered Species Act (ESA), may be found. This publication presents the best available information, although it does not represent the absolute distribution of a particular species since additional sightings may occur.

Birds: The federally endangered yellow-shouldered black bird (*Agelaius xanthomus*) has been documented in the Study Area mangroves; the closest to the Project Area has been at the western half of the CMP. Federally threatened species such as the roseate tern (*Sterna d. dougallii*) and the red knot (*Calidris canutus)* were also sighted with other shorebirds on the mudflats that once existed in the western end of the CMP, at its outlet to the SJB.

Corals: Seven threatened coral species inhabit the nearshore marine waters in the Study Area. All identified in marine waters, north of the SBJE. Two belong to the *Acropora* genus: elkhorn coral (*A. palmata)* and the staghorn coral (*A. cervicornis)*; three to the *Orbicella* genus: Lobed star coral *(O. anularis),* Mountainous star coral (*O. faveolata)* and Knobby star coral (*O. franksi*), along with the rough cactus coral (*Mycetophyllia ferox) and the* Pillar coral *(Dendrogyra cylindrus*).

Critical habitat for *A. palmata* and *A. cervicornis* has been designated and include nearshore reefs within the Study Area, north of the SJBE, as well as other coastal areas around the Island with suitable requirements for these to thrive (e.g. heavy surf, clear-low nutrient ocean-water salinity conditions). As a result, none of these species are found in the CMP or the San José Lagoon.

Table 3-15. Federally threatened and endangered listed species in the Study Area

SCIENTIFIC NAME	COMMON NAME (ENGLISH / SPANISH)	GROUP	STATUS	GENERAL DISTRIBUTION	DESCRIPTION
FLORA					
Banara vanderbiltii	No common name/ Palo de Ramón	Plant	E	Karst and volcanic forests	Originally reported in the early twentieth century in the "mogotes" adjacent to the CMP. This species, however, has not been documented ever since in this vicinity, probably eliminated due to limestone and fill mining, and the consequent destruction of these "mogotes" during the mid-decades of that century. It is believed to no longer persist in this area (USFWS, 2014).
Goetzea elegans	Beautiful goetzea/Matabuey	Plant	E	Karst forests	Trees were planted immediately west of the San José Lagoon as part of a restoration project conducted by the SJBEP during the early 2000s, in an upland buffer strip between the mangrove fringing the lagoon and a local road adjoining Las Margaritas Public Housing Project, in the Cantera community.
Schoepfia arenaria	No common name/ No tiene nombre común	Plant	T	Karst and coastal forests	Originally reported in the early twentieth century. Was first documented in the sandy coastal thickets north of the San José Lagoon, but it has not been recorded ever since in that area.
Stahlia monosperma	No common name/ Cóbana negra	Plant	T	Coastal forests	Trees were planted immediately west of the San José Lagoon as part of a restoration project conducted by the SJBEP during the early 2000s, in an upland buffer strip between the mangrove fringing the lagoon and a local road adjoining Las Margaritas Public Housing Project, in the Cantera community.
FAUNA					
Chelonia mydas	Green sea turtle / Peje blanco	Reptile	T, CH	Nearshore waters	Found in marine habitats. Inhabits and feeds on seagrass beds. Have been reported in the nearshore waters at the Study Area. It is highly improbable for sea turtles to use or be present in the CMP and the San José Lagoon given that it does not provide habitat conditions for nesting or their sustenance.
Dermochelys coriacea	Leatherback sea turtle / Tinglar	Reptile	E, CH	Ocean waters	Is a pelagic species. There are records of *D. coriacea* nesting in the sandy beaches that are also part of the Study Area (CSA Architects & Engineers, LLP, 2014; ERM, 2013; Glauco A. Rivera & Associates, 2011; CFMC, 2004). Leatherback marine turtles approach the north shore of Puerto Rico during their nesting season (March-June) and may be present in offshore waters during this time, but basically spend the rest of their adult lives as a pelagic species in deep waters of the Atlantic Ocean. Has been reported in the nearshore waters at the Study Area. It is highly improbable for sea turtles to use or be present in the CMP and the San José Lagoon given that it does not provide habitat conditions for nesting or their sustenance.
Eretmochelys imbricata	Hawksbill sea turtle / Carey	Reptile	E, CH	Nearshore waters	Found in coral reefs and other hard bottom communities. Has been sighted foraging in the rocky shores of Boca del Morro, at the outlet of SJB, as well as in the nearshore coral reefs within the Study Area. Highly improbable in the CMP and the San José Lagoon.

SCIENTIFIC NAME	COMMON NAME (ENGLISH / SPANISH)	GROUP	STATUS	GENERAL DISTRIBUTION	DESCRIPTION
Epicrates inornatus	Puerto Rican boa / Boa puertorriqueña	Reptile	E	Forested hills	No Puerto Rican boas (*Epicrates inornatus*) have been reported in the Project Area. Although suitable but limited habitat for this boa exists in the remaining haystack hills or "mogotes" found close to the eastern CMP, these have been isolated for many years due to urban encroachment. The latest may have become a physical barrier that could have limited this species dispersal into other forested areas nearby, resulting in no reports of its presence in the mangroves fringing the channel.
Trichechus m. manatus	Antillean manatee / Manatí	Mammal	E	Nearshore waters	Has been documented in ocean waters within the Study Area. It has been observed in the SJB and the estuary portion of the Puerto Nuevo River and ranges freely between marine and freshwater habitats. This species has specific habitat requirements that include adequate feeding areas, freshwater drinking sources and areas protected from surf and wind where they can rest. Manatees are herbivores that feed opportunistically on a wide variety of marine, estuarine, and freshwater plants, including submerged, floating, and emergent vegetation, including: cord grass, algae, turtle grass, shoal grass, manatee grass, eel grass, water hyacinth, water lettuce and other plant types, some of which are found within the Project Area. In addition, there are a number of freshwater sources, such as stormwater discharges and those from the Juan Méndez and San Antón creeks, that discharge into the San José Lagoon and that this species could use for drinking, although not suitable due to their poor quality. However, access is limited through the La Torrecilla Lagoon at the Boca de Cangrejos outlet; more so through the mid-section of the Suárez Canal where the Baldorioty De Castro's Bridge pilings severely restrict flow. There is no access for manatees into or through the Eastern CMP. As a result, it is extremely unlikely for manatees to be found in those sections of the Project Area where the proposed construction activities would take place within the Eastern CMP and the San José Lagoon.
Agelaius xanthomus	Yellow-shouldered black bird / Mariquita	Bird	E	Coastal forests	Occurs regularly, but only locally, along the southwestern coast of Puerto Rico and on Mona Island. It is decidedly uncommon elsewhere. The species is found primarily in mangroves and arid scrublands, foraging both in trees and on the ground, feeding on insects, seeds and nectar. Is critically endangered mostly due to nest parasitism, but also as a result of expansive habitat loss. Other threats include mongoose and rat predation (Raffaele et al., 1998). In the Study Area, it has been reported in Las Cucharillas Marsh and in the Piñones-Vacía Talega-Torrecillas complex; the latter has suitable, ample habitat for this species. Was documented at the western half of the CMP in the early 1980s, (Rivera Herrera, 1996). Habitat loss from severe urban encroachment, the improper disposal of household waste and predation by rats, could have deterred its presence in the Eastern CMP and the San José Lagoon, where no sightings have been reported.

SCIENTIFIC NAME	COMMON NAME (ENGLISH / SPANISH)	GROUP	STATUS	GENERAL DISTRIBUTION	DESCRIPTION
Sterna dougallii	Roseate tern / Palometa	Bird	T	Coastal waters and wetlands	This West Indies subspecies of the roseate tern is found in coastal areas, harbors and lagoons, nesting in a sand or coral scrape, or in a rock depression, usually in colonies on an offshore cay. The Virgin Islands and islets off southwestern Puerto Rico support the largest population of roseate tern in the tropical Atlantic (Raffaele et al., 1998). The subspecies has been documented in the Piñones-Vacía Talega-Torrecillas complex, at the eastern end of the Study Area. In the early 1980s, it was sighted with other terns, gulls and shorebirds on the mudflats that once existed in the western end of the CMP, at its outlet to the SJB (Rivera Herrera, 1996). This tern subspecies has not been reported in the eastern CMP or the San José Lagoon. Poor water quality (i.e. low DO) and its detrimental effect over fish populations, low water transparency which difficult visibility, and thus, fish capture opportunities, present marginal to poor feeding habitat conditions for this species in these two water bodies.
Calidris canutus	Red knot / Playero gordo	Bird	T	Tidal saltflats and mudflats	Found in the Study Area. This species, considered one of the longest distance migrants in the animal kingdom. Depends on horseshoe crabs' eggs for the energy it needs to make its twice-yearly trips between South America and the Canadian Arctic. Thus, as crab populations decline due to harvest by the fishing and biomedical industries, so do the red knot's. The bird is also threatened by habitat destruction and climate change. It is generally rare through the West Indies in September and October during its southbound migration. It apparently flies long distances between stops, many birds likely overflying the region. It is generally found in sandy tidal flats (Raffaele et al, 1998). In the early 1980s, it was sighted with other shorebirds on the mudflats that once existed in the western end of the CMP, at its outlet to the SJB (Rivera Herrera, 1996). It has not been sighted since then in the Study Area. Its occurrence in the Project Area is unlikely due to the absence of proper habitat conditions to support its presence.
Acropora palmata	Elkhorn coral / Coral cuerno de alce	Coral	T	Nearshore waters	Found in the Study Area, north of the SJBE. Was formerly the dominant species in shallow water reefs 3 to 16 feet deep throughout the Caribbean, forming extensive, densely aggregated thickets (stands) in areas of heavy surf. Coral colonies prefer exposed reef crest and fore reef environments in depths of less than 20 feet., although isolated corals may occur to depths of 65 feet. Over the last 10,000 years, this species has been one of the three most important Caribbean corals contributing to reef growth and development, providing essential fish habitat.[18]
Acropora cervicornis	Staghorn coral / Coral cuerno de ciervo	Coral	T	Nearshore waters	Found in the Study Area, north of the SJBE. The staghorn coral is also another of the three most important Caribbean corals in terms of its contribution to reef growth and fish habitat found in reefs within the Study Area. This species occur in back reef and fore reef environments from 1 to 100 feet deep. The upper limit is defined by wave forces, and the lower limit is controlled by suspended sediments and light availability.[19]

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[18] http://www.nmfs.noaa.gov/pr/species/invertebrates/elkhorncoral.htm

[19] http://www.nmfs.noaa.gov/pr/species/invertebrates/staghorncoral.htm

SCIENTIFIC NAME	COMMON NAME (ENGLISH / SPANISH)	GROUP	STATUS	GENERAL DISTRIBUTION	DESCRIPTION
Dendrogyra cylindrus	Pillar coral/Coral pilar	Coral	T	Nearshore waters	Found in the Study Area, north of the SJBE. Has been reported in most reef environments, although in some regions it appears to be absent in nearshore hard bottoms, nearshore patch reefs, and backreef environments and more common on forereef spurand-groove habitats. It has been reported in water depths ranging from 6.6 to 82.0 feet.
Mycetophyllia ferox	Rough cactus coral/Coral cactus áspero	Coral	T	Nearshore waters	Found in the Study Area, north of the SJBE. Has been reported to occur in shallow reef environments, in water depths ranging from 16.4 to 98.4 feet.
Orbicella annularis	Lobed star coral/Coral estrella	Coral	T	Nearshore waters	Found in the Study Area, north of the SJBE. *Orbicella* spp. are a common, often dominant component of Caribbean mesophotic reefs suggesting the potential for deep refugia (Smith et al., 2010 as cited in Brainard et al., 2011). The lobed star coral (*O. annularis*) has historically been one of the primary reef framework builders of the western Atlantic and Caribbean, ranging in depths from 3.3 to 98.4 feet, and has been considered a highly plastic species with multiple growth forms ranging from columnar, to massive, to platy.
Orbicella faveolata	Mountainous star coral/Coral Estrella laminar	Coral	T	Nearshore waters	Found in the Study Area, north of the SJBE. Has been reported in most reef habitats, often the most abundant coral found between 32.8 and 65.6 feet, in forereef environments, but also found between 1.6 to 131.2 feet.
Orbicella franksi	Knobby star coral/Coral Estrella masivo	Coral	T	Nearshore waters	Found in the Study Area, north of the SJBE. Occupies most reef environments, and has been reported from water depths ranging from 16.4 to 164.0 feet. It tends to have a deeper distribution than the other two species in the *Orbicella* complex.

Table legend: E: Endangered / T: Threatened / CH: Critical Habitat

Sources: ERM, 2013; USFWS, 2012; NOAA, 2014.

3.11.2 Commonwealth Listed Species

The DNER has designated 39 species of special concern under the Regulation for Threatened and Endangered Species of the Commonwealth of Puerto Rico (Reg. 6766). These include nineteen (19) species listed under ESA, in addition to other nine (9) species that have been designated as threatened, endangered or critically endangered by the DNER. The remaining eleven (11) species have been designated or classified under other categories. (see Table 3-16).

Two species of seahorses, listed as a threatened are found in the Study Area, but none in the Project Area. These are the lined seahorse (*Hippocampus erectus*) and the longsnout seahorse (*Hippocamus reidi*). There are 12 species of listed birds: one species is listed as endangered, Masked duck (*Nomonix dominica*); 3 are listed as threatened, Ruddy duck (*Oxyura jamaicensis*), White-cheeked pintail (*Anas bahamensis*) and Caribbean coot (*Fulica caribaea*); 3 are listed as critically endangered, West Indian whistling duck (*Dendrocygna arborea*); the Snowy plover (*Charadrius alexandrinus)*, and the Peregrine falcon (*Falco peregrinus*); 1 is listed as low risk, the Puerto Rican vireo (*Vireo latimeri*); and 4 species are listed as data deficient due to lack of data on its population status: Grasshopper sparrow (*Ammondramus savanarum*), Black cowled oriole (*Icterus dominicensis*), Least tern (*Sterna a. antillarum*) and White-crowned pigeon (*Patagioenas leucocephala*).

Other data deficient species is the reptile, Puerto Rican slyder (*Trachemys s. stejnegeri*) that can be found in the Study and Project areas. Likewise, two species of crustaceans are listed as data defficient, the Fiddler crab (*Uca sp.)* and the Mangrove tree crab (*Aratus pisonii*). Three other species of crab are listed as low risk: the Mangrove root crab (*Goniopsis cruentata*), the Common land crab (*Cardisoma guanhumi*) and the Swamp ghost crab (*Ucides cordatus*). The description and occurrence of these Commonwealth listed species is included in table 3-16.

3.11.2.1 Other Commonwealth critical elements[20]

There are 3 species of plants identified as critical elements (i.e., of special concern) by the DNER: *Ceiba pentandra, Coccoloba rugosa and Guaiacum officinale* (see Table 3-17). These are found immediately adjacent or within the Project Area. *C. pentandra, C. rugosa* and *G. officinale* are planted immediately west of the San José Lagoon, in uplands between the mangroves fringing the lagoon and a local road adjoining Las Margaritas Public Housing Project, in the Cantera community, where the SJBEP conducted a restoration project during the early 2000s. Individuals of *C. rugosa* have been found in upland at the Guachinanga islet (INCICO and Corporación Proyecto Península de Cantera, 2009).

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[20] The PRDNER maintains a list of critical elements that includes species important to the Puerto Rican heritage or some endemics that, although very abundant, are considered critical elements, besides those federally or locally listed species.

Table 3-16. Additional species listed by the Commonwealth of Puerto Rico reported in the Study Area

SCIENTIFIC NAME	COMMON NAME (ENGLISH/ SPANISH)	GROUP	STATUS	GENERAL DISTRIBUTION	DESCRIPTION
Hippocampus spp.	Sea horses / Caballitos de mar	Fish	T	Marine	These are two species of seahorses reported for Caribbean waters, although uncommon to rare (Humman, 1994). These use gorgonians branches, seagrass leaves as holdfasts, and occasionally can be seen floating free over seagrass, reefs, and in sargasum. Individuals have been reported in the Study Area, within the Condado Lagoon, where seagrasses and coral communities are present. These might also be found in nearby ocean waters north of SJBE where suitable habitat conditions exist. As such, it is improbable that seahorses inhabit the CMP and the San José Lagoon, since habitat requirements are not available.
Ammondramus savanarum	Grasshopper sparrow / Gorrión chicharra	Bird	DD	Savannas	Is a secretive, small bird and year-round resident. It has been documented at the eastern and western ends of the Study Area, in Las Cucharillas Marsh and the Piñones-Vacía Talega-Torrecillas complex, respectively, where suitable habitat such as marshes and pastures with tall grasses abound (Raffaele et al., 1998). With the exception of a small and limited weedy field adjoining the southeastern, landward side of the San José Lagoon, between the mangroves and an adjoining state road (PR-8) this type of habitat is not found in the Project Area. As a result, there is no record for this species in the Project Area and its occurrence is unlikely.
Nomonix dominica	Masked duck/Pato dominico	Bird	EN	Ponds	Has been documented in the Study Area, but only in the Piñones-Vacía Talega-Torrecillas complex (Rivera-Herrera, 1996). It is a rare native species that frequents thick, aquatic vegetation in fresh water swamps and canals (Raffaele et al., 1998). These same habitat characteristics are found in the southern and eastern sections of the Piñones-Vacía Talega-Torrecillas complex, where seasonal ponds and drainage canals exist (SJBEP, 2000). The outlets of the Juan Méndez and San Antón creeks flowing into the San José Lagoon tend to accumulate floating vegetation, although these covered a relatively small surface area. Besides been estuarine or brackish in nature, this area is also more of an open water habitat. The lack of historical records and proper habitat characteristics could explain the absence of this species in the Project Area.

SCIENTIFIC NAME	**COMMON NAME (ENGLISH/ SPANISH)**	**GROUP**	**STATUS**	**GENERAL DISTRIBUTION**	**DESCRIPTION**
Oxyura jamaicensis	Ruddy duck/Pato chorizo	Bird	T	Coastal lagoons	Has been reported in a man-made fresh water lagoon at Las Cucharillas Marsh, within the Study Area (Rivera-Herrera, 1996). Native to Puerto Rico, it is a diving duck, found predominantly in deep, open freshwater bodies but also in brackish lagoons (Raffaele et al., 1998). Even though the San José Lagoon presents, at the least, marginal habitat requirements for this species, its low water quality and overall poor natural condition may have precluded the ruddy duck from the Project Area. There is no record for this species in the Project Area.
Dendrocygna arborea	West Indian whistling duck/ Chiriría antillana	Bird	CR	Coastal lagoons	Native to Puerto Rico, is a rare and local species. Its decline appears primarily due to habitat destruction, hunting, and to a lesser extent, introduced predators. Flocks are observed most regularly in early evening flying form mangroves or freshwater swamps where they roost during the day to nocturnal feeding grounds which include stands of the royal palm (*Roystonea borinquena*) and agricultural fields. Its habitat includes also wooded swamps, lagoons and uplands (Raffaele et al., 1998). Has been reported in Las Cucharillas Marsh and the Piñones-Vacía Talega-Torrecillas complex, where a matrix of mangroves, lagoons, swamps (*Pterocarpus offinalis*), fresh water ponds, marshes and grasslands of considerable size and in close connection can still be found (SJBEP, 2000; Rivera Herrera, 1996). The overall degradation of forested wetlands in the Project Area due to urban encroachment and improper household waste disposal, in addition to the resulting fragmentation of the natural landscape and high numbers of introduced predators (e.g. rats and cats), may have been enough of a cause for the absence of a single record for this species in this area, even though there seems to be at least marginal habitat characteristics to sustain its presence.
Charadrius alexandrinus	Snowy plover/ Playero blanco	Bird	CR	Sand, mud, salt flat	In the Study Area, it was found in the early 1980s at the western end of the CMP, in the mudflats that once existed at the channel's outlet to the SJB (SJBEP, 2000; Rivera Herrera, 1996). It inhabits, primarily, beaches and lagoon borders with extensive salt flats. None of these habitat requirements are found in the eastern CMP and the San José Lagoon, possibly explaining the reason why no snowy plovers have ever been recorded to this date (Raffaele et al., 1998).

SCIENTIFIC NAME	COMMON NAME (ENGLISH/ SPANISH)	GROUP	STATUS	GENERAL DISTRIBUTION	DESCRIPTION
Anas bahamensis	White-cheeked pintail / Pato quijada colorada	Bird	T	Coastal swamps	In the Study Area, it is found in Las Cucharillas Marsh and the Piñones-Vacía Talega-Torrecillas complex. In the early 1980s, it was reported at the western half of the CMP (Rivera Herrera, 1996). Locally uncommon in the Island, it is a surface feeder, primarily on fresh water, but also salt ponds (Raffaele et al., 1998). Low water quality, depth and overall poor natural condition may have deterred its presence in the eastern CMP and the San José Lagoon, from which there are no records of its presence.
Icterus dominicensis	Black cowled oriole/ Calandria	Bird	DD	Forested areas	Has been reported at the Study Area, in the western half of the CMP and the Piñones-Vacía Talega-Torrecillas complex, but not in eastern CMP and the San José Lagoon (Rivera Herrera, 1996). This endemic species is found in forests, forest edges, woodlands and gardens from the coast to mid-elevations in the mountains, particularly where palms are available for nest sites. It feeds on fruits, insects, flowers and nectar, often on the undersides of palm fronds (Raffaele et al., 1998). Has been heavily affected by bird parasitism and may be in decline.
Falco peregrinus	Peregrine falcon/ Halcón peregrino	Bird	CR	Coast	This species is decidedly uncommon to rare, and a local non-breeding winter resident throughout the West Indies primarily from October to April. Peregrine falcons are found in offshore cays and rocks, wetlands, and sometimes inland, including high buildings and church steeples, hunting for seabirds, shorebirds, waterfowl and rock doves (*Columba livia*), among other birds these can prey, accordingly (Raffaele et al., 1998). It has been recorded in Las Cucharillas Marsh, the Piñones-Vacía Talega-Torrecillas complex, and flying over the CMP and the San José Lagoon (INCICO & Expediciones Península, 2011; Rivera Herrera, 1996). Was de-listed from Federal regulations on October, 2006 due to its population recovery (71 Federal Register 60563). However, it is still classified as CR by the Commonwealth's government.

SCIENTIFIC NAME	COMMON NAME (ENGLISH/ SPANISH)	GROUP	STATUS	GENERAL DISTRIBUTION	DESCRIPTION
Vireo latimeri	Puerto Rican vireo/ Bienteveo	Bird	LR	Forested areas	Has been observed in the Study Area in Las Cucharillas Marsh, in the mangroves of the Piñones-Vacía Talega-Torrecillas complex where it is common, and in the western half of the CMP. It has also been documented in the eastern CMP (Atkins, 2011c; Rivera Herrera, 1996). This endemic species avoids open areas and is found in forests of all types and at all elevations, including mangroves, dry coastal scrub, moist limestone hills and wet mountain forests, including shade coffee plantations. It is most common in the haystack hills of the north coast and in the more heavily forested valleys among the hills of the south coast of the Island. Puerto Rican vireos forages at all levels, but more frequently near the ground. It feeds primarily on insects, but eats some plant matter (Raffaele et al., 1998). As such, habitat in the eastern CMP and the San José Lagoon is of poor to marginal conditions due to overall environmental degradation (e.g. improper household waste disposal, high numbers of introduced predators such as rats and cats, etc.), may be limiting the presence of the species in this area.
Sterna a. antillarum	Least tern/ Gaviota chica	Bird	DD	Coast	Its habitat includes coastal areas, harbors and lagoons. It is a generally common, but local breeding resident in the Greater Antilles. The least tern race inhabiting the West Indies also breeds on both coasts of the United States where some local populations are considered endangered. While human disturbance and introduced predators have doubtless impacted the West Indian population, the limited information available on the bird’s status in the Caribbean does not warrant this tern being classified as threatened (Raffaele et al., 1998). In the Study Area, the least tern has been observed in the San Juan Bay, the Piñones-Vacía Talega-Torrecillas complex, and the western half of the CMP. In has also been observed flying over the San José Lagoon (INCICO & Expediciones Península, 2011; Rivera Herrera, 1996). Poor water quality (i.e. low DO) and its detrimental effect over fish populations, low water transparency which difficults visibility, and thus, fish capture opportunities, present marginal to poor feeding habitat conditions for this species in the eastern CMP and the San José Lagoon.

SCIENTIFIC NAME	COMMON NAME (ENGLISH/ SPANISH)	GROUP	STATUS	GENERAL DISTRIBUTION	DESCRIPTION
Patagioenas leucocephala	White-crowned pigeon / Paloma cabeciblanca	Bird	DD	Coastal forests	Is a highly gregarious, arboreal species typically occurring in flocks, primarily on coastal woodlands and mangroves when breeding, but also well inland into the mountains as they follow available food resources in the non-breeding season. It is a locally common resident remaining year-round in Puerto Rico. Formerly abundant through most of its range, this species has declined dramatically due to habitat loss, severe over-hunting, harvesting of nestlings for food and introduced predators (Raffaele et al., 1998). In the Study Area, the species has been reported in the Piñones-Vacía Talega-Torrecillas complex, as well as in the San José Lagoon (INCICO & Expediciones Península, 2011; Rivera-Herrera, 1996). Urban encroachment and overall habitat degradation could be significant factors that have discouraged or limited its presence in the eastern CMP and the San José Lagoon.
Fulica caribaea	Caribbean coot/ Gallinazo antillano	Bird	T	Swamp, marsh	Is an uncommon and local year-round resident in Puerto Rico, primarily found in open freshwater bodies where it dives profficiently. This species has apparently diminished greatly throughout the West Indies because of hunting, habitat degradation and due to introduced predators (Raffaele et al., 1998). In the Study Area, this species has been located in Las Cucharillas Marsh, the Piñones-Vacía Talega-Torrecillas complex, and the San José Lagoon (INCICO & Expediciones Península, 2011; Rivera- Herrera, 1996). Less than marginal habitat conditions in the San José Lagoon, to even poorer in the CMP due to low water quality and overall natural degradation could presently be discouraging or severely limiting Caribbean coots in these two water bodies.
Trachemys s. stejnegeri	Puerto Rican slyder/ Jicotea	Reptile	DD	Waterbodies	Found in fresh (i.e. rivers, streams, creeks, ponds and drainage channels) and brackish (i.e. lagoons) waterbodies all around the coast, mostly at low elevations, although some populations have also been reported in the Island's interior. The species, however, is restricted to those waterbodies with abundant aquatic plants and soft soils in their banks. With the possible exception of the SJB, the Puerto Rican slyder can be sighted in the rest of the Study Area, where it is quite common, including the CMP and the San José Lagoon. This fresh water turtle has been affected by loss or degradation of habitat and the predation of its eggs by the introduced mongoose. Other introduced predators that may be affecting the Puerto Rican slyder include the spectacled caiman (León, A. and R. L Joglar, 2005). The main reason for concern is habitat competition and possible hybridization with the Red-eared slyder (*Trachemys scripta elegans*) an exotic, fresh water turtle introduced as a pet that has been successfully established in the Island.

SCIENTIFIC NAME	**COMMON NAME (ENGLISH/ SPANISH)**	**GROUP**	**STATUS**	**GENERAL DISTRIBUTION**	**DESCRIPTION**
Uca sp.	Fiddler crab/ Cangrejo violinista	Crab	DD	Mangroves	Very few sites in the Project Area, especially within the CMP, display the faunal communities typically associated with mangrove wetlands due to the huge amount of fill material, scrap and trash deposited. Virtually absent are the fiddler crabs of the genus *Uca*, the mangrove crabs of the genus *Goniopsis*, *Aratus* and *Ucides*, and the land crab of the genera *Cardisoma*. This condition, although much less severe, is still apparent in the San José Lagoon. Mangrove forests and other vegetated areas are more extensive in this lagoon when compared to that of the eastern CMP, providing more fauna habitat and refuge from the encroaching urban landscape. However, low water quality is still pervasive. Although classified as low risk by the Commonwealth government, and thus, not listed as threatened or endangered, it is worth noticing that these crab species are staples for egrets, herons and other wetland dwellers, contributing to the overall food web, and as a result, are an essential component of the mangrove forest ecosystem.
Goniopsis cruentata	Mangrove root crab/ Cangrejo de mangle	Crab	LR	Mangroves	
Aratus pisonii	Mangrove tree crab/ Juey de mangle	Crab	DD	Mangroves	
Cardisoma guanhumi	Common land crab/ Juey común	Crab	LR	Coastal wetland	
Ucides cordatus	Swamp ghost crab / Juey pelú	Crab	LR	Mangroves	

Source: DNER Regulation for Threatened and Endangered Species of the Commonwealth of Puerto Rico, No. 6766.

Table legend: DD: Data deficient / EN: Endangered / T: Threatened / CR: Critically Endangered / LR: Low Risk)

Table 3-17. Species identified as critical elements by the DNER in the Study Area

SCIENTIFIC NAME	COMMON NAME (ENGLISH / SPANISH)	GROUP	STATUS	GENERAL DISTRIBUTION	DESCRIPTION
Ceiba pentandra	Silk-cotton tree/ Ceiba	Plant	CE	Forest, riverbanks	*C. pentandra* is a tree native to tropical America. In Puerto Rico, it is more abundant in the dry south, generally found in forests on hillsides and river banks, at lower elevations.
Coccoloba rugosa	Tree / Ortegón	Plant	CE	Karst, coastal forests	*C. rugosa* is an endemic, small tree, local and uncommon in moist coastal and lower Cordillera forests, including the karst region.
Guaiacum officinale	Lignum vitae/ Guayacán	Plant	CE	Forest, thickets	*G. officinale* is a tree native to tropical America. In Puerto Rico, is normally found in woodlands, thickets, on plains and hillsides, at lower elevations, in the dry southern and southwestern region of Puerto Rico.

Source: DNER. List of Critical Elements under the Natural Heritage Program. 2008.

Table legend: CE: Critical element.

3.12 LAND USE AND INFRASTRUCTURE

3.12.1 Land Use

The Study Area is located within the SJMA, whose population and urban landscape is the densest and most developed in Puerto Rico, respectively. The lands adjoining the eastern CMP and the San José Lagoon are characterized by two general or broad types of land use: (1) high density urban development and (2) open waters and green areas.

High density urban development corresponds to those communities surrounding the eastern CMP. Those areas are characterized by substandard housing built on top of what were originally mangrove forests and open waters of the CMP. In the eastern CMP, green areas are mostly restricted to a narrow strip of mangroves that have grown intermingled on top of debris used to fill its wetlands and open waters. Mangrove forests of variable width are found fringing the shores of the San José Lagoon. An upland secondary forest is found in the CDRC staging area. While open waters in the Project Area include the San José Lagoon and a small section of the eastern CMP.

Four natural areas within the Study Area have been protected in recognition of their extraordinary biological value: Las Cucharillas Marsh Nature Reserve, the Caño Martín Peña Nature Reserve (western half), the Piñones State Forest Nature Reserve and the Isla Verde Reefs Nature Reserve. In addition, and although not geographically defined by the CFMC, the SJBE, including the Project Area, can be considered as a Habitat Areas of Particular Concern (HAPC) since estuaries have been generically identified as such due to their importance as nursery grounds for commercially important fish species.

3.12.2 Infrastructure

Several critical infrastructure components of the SJMA are found in the Project Area, such as highway bridges, regional water transmission lines and trunk sewers, among others.

3.12.2.1 Bridges

There are four bridges crossing the eastern CMP (see Figure 3-8):

- The Luis Muñoz Rivera Avenue Bridge carries two lanes of traffic from Luis Muñoz Rivera Avenue and three lanes of traffic from Fernández Juncos Avenue in the southbound direction, as well as a dedicated northbound bus lane. Curb and gutter with sidewalks exist on both sides of the south approach and along Fernández Juncos Avenue to the north. No sidewalks are currently provided on the bridge. The total bridge deck is 80.1 feet wide. The total bridge length is 810 feet, as measured between the face of the abutments. Existing vertical clearance measures approximately 10.5 feet (HDR, 1999, as cited in Atkins 2014b). The bridge has two piers within the channel. It shows evidence that additional lanes have been added to its structure. Also evident are signs of considerable deterioration (Atkins 2014b).

Figure 3-8. Location of bridges in the Project Area

- The Tren Urbano railway carries the Puerto Rico Department of Transportation and Public Works heavy rail system, serving the municipalities of San Juan, Bayamón and Guaynabo. The portion of the railway over the CMP includes three spans varying in length from 89.24 feet to 157.45 feet. Clearances above the water surface are more than 40 feet. The guideway is supported by cylindrical concrete columns on concrete pile caps.

- The Juan Ponce de León Bridge (Martin Peña Bridge) carries Highway 25 traffic in the northbound direction, with a dedicated southbound bus lane. This is a historic bridge built in 1939. It is 55.4 feet wide and carries four northbound lanes with a raised sidewalk and a pedestal and decorative rail type barrier on both sides. The structure is comprised of five spans for a total length of 241 feet as measured between the face of the abutments. Existing vertical clearance measures approximately 10.2 feet (HDR, 1999 as cited in Atkins, 2013b).

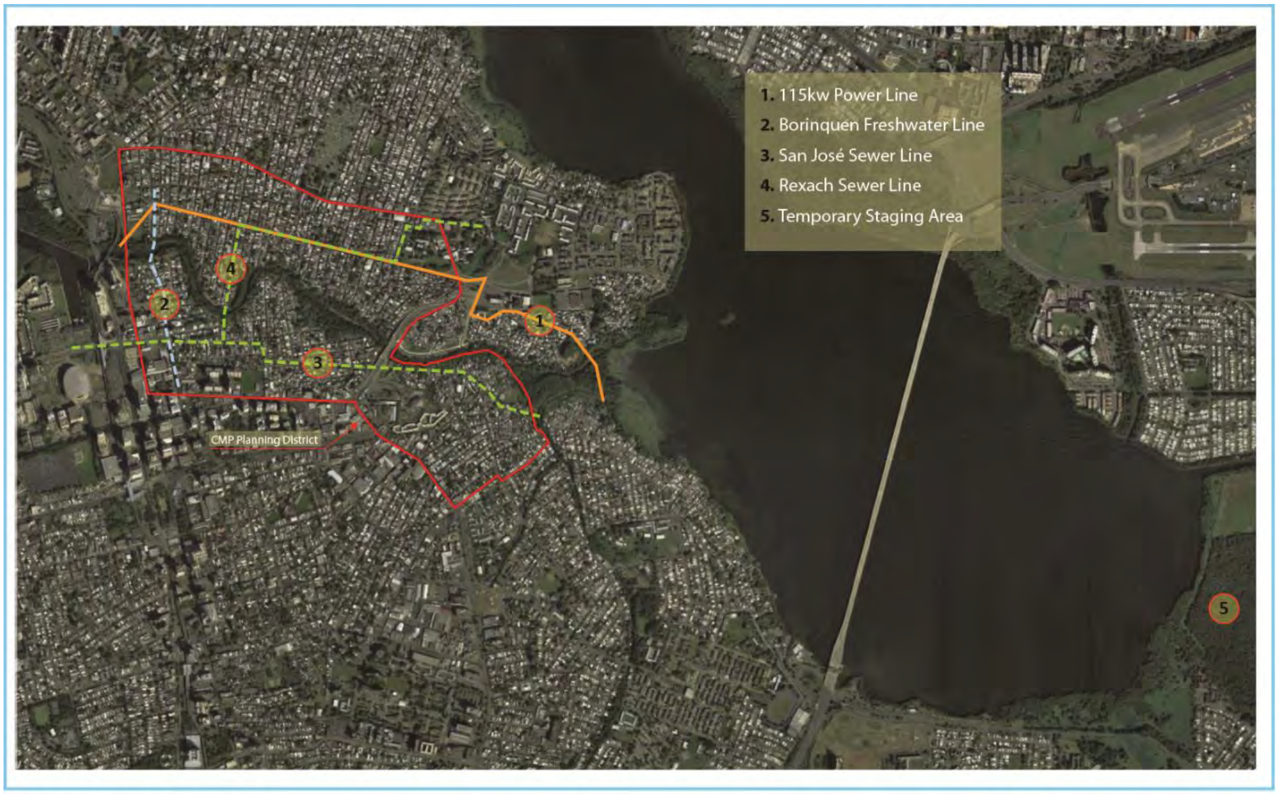
- The Barbosa Avenue Bridge carries Highway 27 traffic in both the northbound as well as the southbound direction. It was constructed in 2007, immediately west of its predecessor. The bridge is 79.9 feet wide and has two lanes and a sidewalk in each direction, plus one bike lane. The structure is comprised of three spans for a total length of 355.6 feet, as measured between the face of the abutments. Its highest point is elevation 35.5 feet.

The Martí Coll Linear Park is part of a 1 mile long raised pedestrian walkway connecting the Hato Rey financial district to the Parque Central Sport Complex in Santurce. The structure is an 8 foot-wide concrete walkway with metal railing supported on concrete piles running along the improved section of the CMP western segment. The structure is outside of the CMP-ERP limits but immediately adjacent. The Teodoro Moscoso Bridge spans over the San José Lagoon.

3.12.2.2 Wastewater and stormwater

A segment of the San José trunk sewer, approximately 656 feet, runs from east to west within the adjoining eastern CMP. It is a 66 in. diameter sewer pipe and one of the principal San Juan area trunk sewers. This trunk sewer conveys wastewater from Trujillo Alto, Santurce, Barrio Obrero, Isla Verde, and Hato Rey to the Puerto Nuevo Wastewater Treatment Plant.

The Rexach trunk sewer is also one of the main San Juan area trunk sewers and conveys wastewater from areas such as Isla Verde, Santurce, and Barrio Obrero, to the San José trunk sewer. The Rexach trunk sewer flows from north to south along Street 13 of the Barrio Obrero-Marina community, crosses the eastern CMP, and continues along the Luna Street of the Parada 27 community until it connects to the San José trunk sewer. The Rexach Trunk Sewer has a diameter of 48 inches when it crosses the CMP and is encased in concrete. The crown of the trunk sewer in the CMP is at an elevation of 7.5 feet below MLLW. The design and relocation of the Rexach Trunk Sewer is ongoing and will be completed prior to the dredge of the CMP (see Figure 3-9).



Source: ENLACE & Puerto Rico Planning Board

Figure 3-9. Water and energy infrastructure

The Borinquen water transmission line is a 36-in. diameter pipe traveling from south to north along the Uruguay and Gardel Streets of the Parada 27 community, crossing the eastern CMP, and continuing on Argentina Street of the Barrio Obrero-Marina community. The transmission line has only 3 feet of cover where it crosses the Eastern CMP. The design and relocation of the Borinquen Water Transmission Line is ongoing and will be completed prior to the dredge of the CMP.

The majority of stormwater flowing towards the eastern CMP is runoff that arrives either from overland flow from streets and yards from the adjacent communities or as discharges from storm sewers. The Rexach Avenue flood control pump station, operated by the Municipality of San Juan, services the Buena Vista-Santurce community. It discharges into the northern shore of the eastern CMP, west of the Barbosa Avenue Bridge.

Similar to the storm sewer infrastructure, many of the streets within the eastern CMP limits contain underground sanitary sewer collection piping. About 40 percent of dwellings in, or neighboring, the eastern CMP lack a sanitary sewer system, and thus, discharge directly or indirectly, through storm sewers, into the eastern CMP (ENLACE, 2004) (see Figure 3-10).

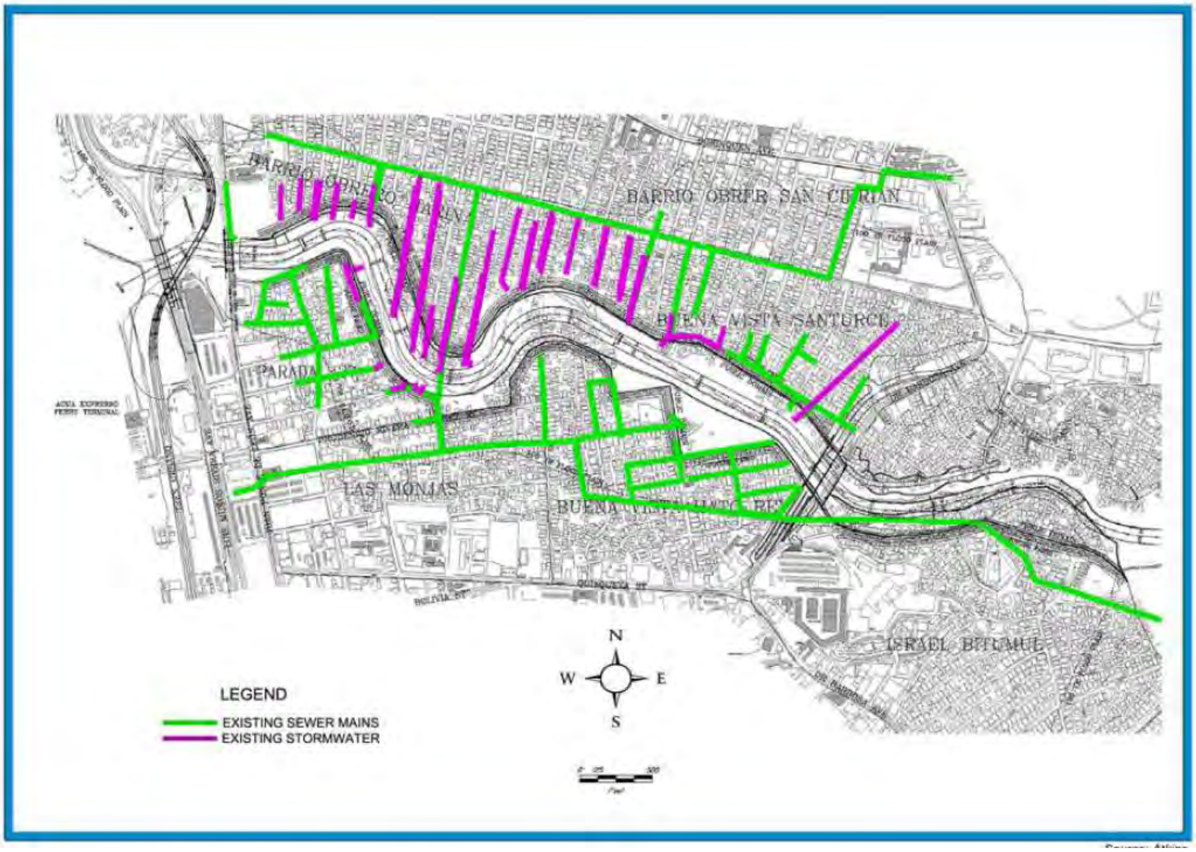


Figure 3-10. Some of the existing sanitary and stormwater sewers servicing the communities in Eastern CMP.

3.12.2.3 Energy

A 115-kV overhead transmission line runs from a substation near the Tren Urbano railway. It then runs east via Rexach Avenue, crossing the Eastern CMP close to its outlet at the San José Lagoon. In this latest section, a support tower is found on the north bank of the Eastern CMP, in the Cantera Peninsula area. Most of the transmission system infrastructure is old and in poor condition.

The 115-Kv overhead transmission line has been relocated as a component of the CMP-ERP. Works included raising the height of the line sixty feet in the section crossing the CMP close to the San José lagoon, to allow the passage of the dredging machinery.

3.13 SOCIOECONOMICS

Selected socioeconomic characteristics are presented for the study area as discussed in the following sections: (1) communities adjacent to the eastern CMP and (2) communities surrounding the San José Lagoon (see Figure 3-11).

Figure 3-11. Communities adjacent to the Project Area

3.13.1 Communities adjacent to the eastern CMP

The communities adjacent to the CMP dredging site include Península de Cantera, Barrio Obrero San Ciprián, Buena Vista Santurce, Barrio Obrero Oeste, Parada 27, Las Monjas, and Buena Vista Hato Rey. Table 3-18 summarizes the socioeconomic characteristics of these communities.

Table 3-18. Selected socioeconomic characteristics

	Península Cantera	Barrio Obrero - San Ciprián	Buena Vista Santurce	Barrio Obrero Oeste	Parada 27 - Las Monjas	Buenas Vista - Hato Rey	Israel - Bitumul	All communities	Puerto Rico
Population	7,399	1,363	4,221	2,449	1,968	1,994	4,026	23,420	3,725,789
Pop. density (people/km^2)	8,109	7,473	10,264	11,244	5,949	8,761	8,898	8,775	419
Households	2,756	602	1,744	1,040	823	807	1,622	9,394	1,376,531
Occupied housing units	87.8%	87.6%	81.3%	80.8%	87.6%	81.6%	84.2%	84.8%	84.1%
Population with college degree (%)	4%	7%	8%	4%	10%	7%	6%	6%	20%
Median household income ($)	$10,505	$10,737	$10,459	$15,159	$10,555	$10,498	$15,536	$12,268	$18,791
Households with income below poverty level	72%	46.9%	57.1%	54.5%	52.0%	64.7%	41.6%	59.0%	47.5%

Source: 2010 American Community Survey, Census Bureau.

Population: There are approximately 23,420 inhabitants (Census, 2010) in the communities adjacent to the CMP dredging site, representing about 6 percent of San Juan's population. Population density (8,775 people/km^2) is very high; more than twice that of San Juan (3,417) and more than twenty times higher than Puerto Rico's (419). Communities with the highest population density are Barrio Obrero Oeste (11,244), followed by Buena Vista-Santurce (10,264).

Household Income: Median household income for communities adjacent to the eastern CMP is $12,268, which is considerably lower from Puerto Rico's median household income ($18,791). Most households fall below the poverty level (59%), quite higher than San Juan's rate (37%) and Puerto Rico's rate (47.5%). More than 72 percent are below the poverty level in Península de Cantera community.

Education: Only 6 percent of the residents of the communities adjacent to the eastern CMP have completed college degree, which is significantly lower than the value measured for Puerto Rico (20%). Parada 27/Las Monjas is the community with the largest proportion of residents with a college degree (10%), followed by Buena Vista Santurce (8%).

Housing: Communities adjacent to the eastern CMP have a slightly higher housing occupancy rate (84.8%) than Puerto Rico's (84.2%). However, the occupancy rate in Barrio Obrero Oeste (80.8%), Buena Vista Santurce (81.3%), and Buena Vista Hato Rey (81.6%) is lower than Puerto Rico's.

3.13.2 Communities surrounding San José Lagoon

Communities surrounding the San José Lagoon have very heterogeneous characteristics, as seen in the following table. Embalse San José has the highest population density. The occupation of the housing units in these communities is between 73 to 89 percent.

Population with college degree significally ranges between 13 percent at Playita and 59 percent at Villamar. The lowest median household income is in Playita and the highest corresponds to Laguna Gardens and Villamar, both in Carolina. Playita also reports 100 percent of its households with income below poverty level, while Laguna Gardens and Villamar report 26 percent each (see Table 3-19).

Table 3-19. Selected socioeconomic characteristics

	Playita	Embalse San José	Villa Prades	Los Ángeles	Laguna Gardens	Villamar
Population	1,158	2,025	790	1,017	1,867	720
Pop. density (people/km^2)	9,160	11,289	3,804	10,471	5,959	1,054
Households	498	770	309	407	921	355
Occupied housing units	75%	80%	89%	89%	73%	73%
Population with college degree (%)	13%	37%	37%	51%	56%	59%
Median household income ($)	$10,197	$15,548	$20,043	$30,024	$40,092	$40,092
Households with income below poverty level	100%	97%	85%	43%	26%	26%

Source: 2010 American Community Survey, Census Bureau.

3.14 HUMAN HEALTH AND SAFETY

The communities adjacent to the eastern CMP are subject to conditions that adversely affect their health, safety and quality of life. Their unplanned and informal settlement pattern as well as their high population density, greatly increases potential damages from floods. Since these communities are settled almost immediately adjacent to the eastern CMP, in low-level areas, they are not only vulnerable to flooding under major rainfall (e.g. 100-yr or 50-yr rainfall), but are also vulnerable to floods resulting from minor and more frequent rainfall (e.g. 2-yr, 5-yr, or 10-yr rainfall).

Hurricane Irene is the most recent tropical storm event whose trajectory directly impacted Puerto Rico. On August, 2011, this hurricane made its way and caused damage throughout the Island, including the communities adjacent to the eastern CMP. Water from the channel reached homes, businesses, and streets, damaging property. Besides property losses and damages, flooding in businesses resulted in income losses for many of the residents, while damages at schools resulted in additional government expenditure in repairs, maintenance, and management, as well as extended periods of class suspensions.

Flooding situation becomes critical because of the high residence time and significant amount of untreated sewage water that is also discharged to the CMP, causing the flood waters to be contaminated with extremely high bacterial concentrations, far exceeding established water quality standards. Communities adjacent to the CMP have experienced multiple flooding events in the past that have resulted in damages, loss of property, and health risk increase because of exposure to polluted waters.

Gastroenteritis is an important health problem, principally caused by exposure to waters polluted with fecal waste pathogens. In 2011, a study was conducted to measure the level of gastrointestinal symptoms in the communities adjacent to the eastern CMP, and to examine if there was a correlation between documented symptoms and flood events. The study found that these communities had a higher prevalence of gastroenteritis symptoms and those exposed to flood waters (whether it entered their home or just reached the street) were twice as likely to develop gastrointestinal symptoms than residents not exposed to flood waters (Ponce School of Medicine and Health Sciences, 2011).

Another study conducted in 2012, documented the prevalence of dermatitis (skin infections) and asthma for the population under 18 years in the communities adjacent to the eastern CMP (Community Laboratory of the University of Puerto Rico, 2013). The study's objective was to research if there was a correlation between asthma and dermatitis cases and distance from residence to the CMP. Although not statistically significant, the study shows that residents closer to the eastern CMP have a higher likelihood of suffering from one of the conditions focused on in this study. Children under five years living in the communities adjacent to the eastern CMP have double the prevalence of asthma than that reported for the island of Puerto Rico and atopic dermatitis rates for children within the eastern CMP communities was over 10 percent higher than the 24.8 percent rate reported for that age group in previous studies (see Table 3-20).

Table 3-20. Common Health Conditions found in the Eastern CMP Neighborhoods

Condition	CMP Prevalence	Puerto Rico Prevalence[1]	Eastern CMP Population	Existing Population Affected
Gastroenteritis	31%	21%	18,074	5,603
Asthma (children under 5 years old)	44.5%	22%	1,046	465
Dermatitis (children 5-9 years old)	35.3%	24.8%	958	338

Source: Ponce School of Medicine (2011); UPR, 2013.

More recently a Health Impact Assessment (HIA) conducted by the Icahn Mount Sinai Medical School (2014) concluded that there are higher levels of chronic and acute diseases among residents of the communities adjacent to the eastern CMP, than among the general population of Puerto Rico, which may be attributable to the deteriorated environmental conditions of the CMP.

Poor water and sediment quality reported in the eastern CMP has raised concern that aquatic organisms might be contaminated, although there is very limited human consumption of fish from the CMP. Indeed, on August 1999, the DNER and the PREQB issued a public advisory recommending that fish and other organisms (e.g. blue crabs) from the CMP, the San José Lagoon, La Torrecilla Lagoon and the Suarez Canal not be consumed, based on concerns that these might be contaminated based on the poor water and sediment quality. Signs were placed in the surroundings of these water bodies to inform the general public about the advisory (SJBEP, 2000).

3.15 CULTURAL RESOURCES

Archival research, field investigations and informal consultations with the State Historic Preservation Office (SHPO) and the Institute for Puerto Rican Culture (IPRC) have been conducted to determine the cultural, historic and archeological resources value of the eastern CMP and the San José Lagoon.

The Martín Peña Bridge is the only known structure of cultural importance found in the eastern CMP. Built in 1939, it is characterized by its *art deco* design. It was included in the National Register of Historic Places (08000856) by SHPO on August 27, 2008. It was also declared an historic monument by the Commonwealth's government on August 15, 2007. This bridge is the latest of many built on or in the immediate vicinity of the eastern CMP, to service the main access road between Old San Juan and mainland Puerto Rico for nearly four centuries. This site is also where one of the most important military battles in Puerto Rico's history took place, when the Spaniards and the local militia helped repelled invading English forces in 1797.

At present, no previously recorded sub-aquatic prehistoric cultural resources have been identified in eastern CMP and the San José Lagoon, and there is no historic evidence of smaller marine vessels encountered. It is important to note, however, that the investigations conducted in the immediate vicinity of the Martín Peña Bridge have been limited due to restricted access and pollution in the channel. Therefore, it may be possible to encounter remains from the old bridges constructed in the area since the sixteenth century, as well as materials associated to the fishing corrals and trash middens from the first settlements built during the early twentieth century.

Any archeological resources that may exist in the eastern CMP and the San José Lagoon have suffered extensive impacts and modifications (e.g. fill, trash, dredging), which have likely already depreciated their historical integrity (Atkins, 2011d). Nonetheless, SHPO has stated that the possibility of encountering submerged cultural remains within the CMP and the rest of the Project Area still exists, and is considered to be high. It concluded that the accumulation of household and construction debris deposited within the Eastern CMP since early in the twentieth century could be considered an archeological site.

3.16 RECREATION

Tarpon (*Megalops atlanticus*) sport fishing is possibly the most important water dependent recreational activity in the inner waterbodies of the Project Area, focusing in the artificial dredged pits along the southern shore of the San José Lagoon and those in Los Corozos Lagoon as well (Atkins, 2011b). Several sport fishing charter boating companies run successful business operations based on this species, considered one of the best in the Caribbean, even luring tourists to the Island for this specific purpose. This catch-and-release fishery is an important income generator in San José Lagoon, generating over 1,200 half-day fishing trips, mainly with out-of-town visitors (Yoshiura and Lilyestrom, 1999 as cited in Atkins, 2011b).

Also, there is a small boating operation launched from the Cantera Península, which provides sightseeing tours of the San José Lagoon and those lagoons farther to the east within the SJBE. In the northern shore of the Cantera Península there is a makeshift dock and boat ramp that provides access to the San José Lagoon and it is operated by Los Laguneros Fishermen Association. Other makeshift boat ramps and small docks are found in other areas of the San José Lagoon. Some of these are frequently used to deploy jetskis and other small vessels to navigate east towards La Torrecilla Lagoon and to gain access to the ocean. In the San José Lagoon, the Teodoro Moscoso Bridge, is also used for an international race known as the World's Best 10k, held every February.

Recreational opportunities in the Eastern CMP are impaired and unsafe compared to the restored section of the western CMP. In the eastern segment of the CMP, except for the three bridges crossing the channel, there are no formal access points through which residents may gain access for fishing or bird watching activities.

Other recreational facilities close to the Project Area, but not within it are: the Roberto Clemente Sports Complex (CDRC), found east of the San José Lagoon; the Adolfo Dones linear park, found next to the southeastern shores of the San José Lagoon; and the Rebekah Colberg sports complex, found west of the Teodoro Moscoso Bridge.

Beside the abovementioned activities, existing recreational opportunities close to the CMP and the San José Lagoon are limited to various basketball courts, a few solitary backboards and three fairly new and small playgrounds, as presented in Table 3-21.

Table 3-21. Existing Recreational Resources in the communities found along Eastern CMP

WARD	FACILITY	LOCATION
Bo. Obrero – San Ciprián	Basketball-volleyball court	Albert Einstein School
Bo. Obrero – Marina	Basketball-volleyball court	Santiago Iglesias Pantin School
	Basketball-volleyball court	St. 10 Sur
Buena Vista Santurce	Basketball-volleyball court	El Faro St.
	Basketball-volleyball court	William St.

Table 3-21, cont'd

WARD	FACILITY	LOCATION
Cantera	Basketball-volleyball court	Barbosa Avenue y Calle San Miguel
	Baseball field	Colegio San Juan Bosco
	Sport Center	Colegio San Juan Bosco
	Sport Center	Constitución St.
	Basketball-volleyball court	Los Padres St.
	Football field	Colegio San Juan Bosco
	Recreational Association	Santa Elena St.
Parada 27	Linear park and boat ramp	San José St.
	Basketball-volleyball court	San José St.
	Multi use court	Santiago Iglesias St.
Las Monjas	Basketball-volleyball court	Emilio del Toro School
	Basketball-volleyball court	Quisqueya St.
	Baseball field	Dolores St.
Buena Vista Hato Rey	Basketball-volleyball court	#3 St.
Israel-Bitumul	Basketball-volleyball court	Juanita García Peraza School
	Basketball-volleyball court	Alcaniz St.
	Baseball field	Alcaniz St.

3.17 AESTHETIC RESOURCES

In contrasts with the green views provided by the mangroves and other vegetation fringing the western half of the CMP, the eastern CMP aesthetic value is severely compromised by urban encroachment, and the disposal of garbage, debris and other refuse. Its foul smelling waters further discourage its enjoyment.

The San José Lagoon offers a scenic oasis within the urban landscape encompassing this section of the Project Area due, in part, to the access and views provided by the Teodoro Moscoso Bridge, which crosses the lagoon from north to south. Where mangroves still fringe the lagoons, the views offer a pleasant contrast against the urban backdrop of the densely populated SJMA.

4.0 ENVIRONMENTAL CONSEQUENCES

This section presents an evaluation of the potential environmental impacts of each of the four alternatives: the No Action Alternative, the Tentatively Selected Plan (TSP, originally Alternative 2), the Alternative 1 and Alternative 3, for both, the Project Area and the Study Area, as defined in Section 1.2. An impact is defined as a change to the human or natural environment as a result of an action. Impacts can be beneficial or adverse and can be permanent or long lasting (long term) or temporary and of short duration (short term). An impact is a direct result of an action, which occurs at the same time and place or an indirect result of an action, which occurs later in time or in a different place and is reasonably foreseeable. Impacts can vary in degree from a slightly noticeable change to a total change in environment.

Impacts are based on significance criteria. National Environmental Policy Act (NEPA) Regulations adopted by the Council on Environmental Quality (CEQ) (40 C.F.R. 1500–1508), define significance based on the twin criteria of context and intensity (40 C.F.R. 1508.27). Significance criteria developed for the affected resource categories, and for many of the categories, are necessarily qualitative in nature. Quantitative criteria can be established when there are specific numerical limits established by regulation or industry standard. These criteria are based on existing regulatory standards, scientific and environmental documentation, and/or professional judgment. Technical reports with detailed analyses are referenced as appropriate to avoid redundancy in the Draft EIS.

Impacts are considered adverse unless identified as beneficial. The analyses presented here for the environmental consequences consider context and intensity with respect to significant impacts to resources, based on the data available for each resource. Cumulative effects are addressed in Section 4.18. If the impact is significant, it might be reduced or not. Unless otherwise indicated, no compensatory action is required. Potential effects are detailed within this section and summarized in Table 4-1.

Table 4-1. Summary of Environmental Consequences

Resource	NO ACTION ALTERNATIVE No changes to existing condition along CMP	TENTATIVELY SELECTED PLAN (TSP) 100-foot-wide x 10-foot-deep channel	ALTERNATIVE 1 75-foot-wide x 10-foot-deep channel	ALTERNATIVE 3 125-foot-wide x 10-foot-deep channel
Climate	The abnormal levels of hydrogen sulfide and methane presently produced in the Eastern CMP, the latest considered a greenhouse gas, would continue or even worsen. More extreme precipitation events mean that flooding in the Eastern CMP and the San José Lagoon would be exacerbated under the present condition of reduced drainage and conveyance of waters.	All alternatives have the potential to release hydrogen sulfide and methane as the dredged material is removed, transported, and managed for final disposal. Also during construction, all of these would result in the combustion of fossil fuel emissions due to the use of machinery, vehicles and vessels. The alternatives could provide benefits toward reducing the effects of climate change. An increase in vegetation and open water areas in the Eastern CMP would help offset expected increases in average temperatures. In addition, the alternatives would initially, at least, reduce flooding from significant or extreme rain events due to the CMP improved water conveyance capacity. The relocation of structures and families currently located in flood prone areas related to the Eastern CMP would also help reduce their exposure to this risk.		
Geology	No impacts are expected to the Project Area's geology.	Rock outcrops may be encountered at depths of -10.5 feet at the eastern end of the Project Channell. However, with a proposed channel depth above -10.5 feet, and slightly adjusting the channel's configuration to maintain the design cross section, no impacts are anticipated.	Changes are the same as those described for the TSP. Underlying geology would not change and would not be compromised as a result of Alternative 1.	The wider cross section (125 feet) of the proposed channel could require the excavation of limestone rock. The remnants of a small karst hill or "mogote" are found in the Eastern CMP, north of its eastern end, and relatively close to what would be the proposed channel alignment. As such, impacts to geology could result.
Soils	Impacts to soils would continue due to past disposal of household waste, rock and other debris used as fill material within the Eastern CMP. Soils would continue to include debris, which along the Eastern CMP may reach depths more than 10 feet below land surface. These would continue to be a source of concern due to their impact on soil structure, composition and the flora and fauna that could be directly or indirectly in contact with it.	Approximately 762,000 cubic yards (cy) of material, including 76,200 cy of debris would be removed. Substrate, at the Project Channel behind the sheet pile, would be left without garbage and thus under a suitable condition that would promote its colonization by sediment boring organisms (e.g. crabs, etc.) and mangrove.	Approximately 680,000 cy of materials, including 68,000 cy of debris would be removed. Alternative 1 would have less beneficial effects than those described for the TSP and Alternative 3. It would leave 8,200 cy or 19,200 cy of debris within the soils at both banks of the Eastern CMP, when compared to the TSP and Alternative 3, respectively.	Approximately 872,000 cy of materials, including 87,200 cy of debris would be removed. Alternative 3 would have more benefits than the TSP and Alternative 1, but it would also have a larger impact on soils adjacent to the CMP because of its larger construction footprint.

Resource	NO ACTION ALTERNATIVE No changes to existing condition along CMP	TENTATIVELY SELECTED PLAN (TSP) 100-foot-wide x 10-foot-deep channel	ALTERNATIVE 1 75-foot-wide x 10-foot-deep channel	ALTERNATIVE 3 125-foot-wide x 10-foot-deep channel
Hydrology	Continued disruption of historic hydrologic connection between San José Lagoon and San Juan Bay. Constricted CMP would continue to exacerbate flooding in the watershed due to flashy runoff and poor drainage. Under existing conditions, the average residence time of water in San José Lagoon is estimated at 16.9 days. At present, average tidal range for the San José Lagoon, is 0.33 foot, reflecting the influence of the filled CMP. Inadequate drainage would continue to cause flooding. Frequent floods would continue to occur and would disrupt normal residential daily life, business operations, and provision of essential services like education in flood-prone schools. Low elevations in communities preclude adequate stormwater. Over 4,700 structures would continue to be under flood risk.	Model (CH3-WES) results indicate restored CMP would significantly improve (reduce) residence time and water quality in the CMP and lagoons without adverse impacts to the study area. Residence time for the San José Lagoon would be reduced from 16.9 days to approximately 3.9 days. Flows would not exceed 3 f/s (typically 2 f/s) to avoid channel scour. Vertical concrete-capped steel sheet piles, with hydraulic connections to mangrove wetlands would line the channel for erosion control and channel stability.	Significant improvements to hydrologic connections and associated tidal influence and residence time, water quality, and flooding attenuation. Residence time would be 3.9 days.	Alternative 3 would also result in significant improvements to hydrologic connections and associated tidal influence and residence time, water quality, and flooding attenuation. Residence time for this alternative would be reduced to 3.9 days.

Resource	NO ACTION ALTERNATIVE No changes to existing condition along CMP	TENTATIVELY SELECTED PLAN (TSP) 100-foot-wide x 10-foot-deep channel	ALTERNATIVE 1 75-foot-wide x 10-foot-deep channel	ALTERNATIVE 3 125-foot-wide x 10-foot-deep channel
Water Quality and Sediments	Adverse impacts to existing water and sediment quality are anticipated to persist and may worsen. Areas deeper than -4 to -6 feet would continue to exhibit stratification, low DO, and poor benthic habitat and would not be improved.	Restoring hydraulic conveyance and tidal influence would significantly improve water circulation and water quality in San José Lagoon by reducing salinity stratification and improving DO levels in shallow (<6 feet) water. Water quality improvements are also anticipated due to reduced waste and stormwater runoff and flooding. Temporary short term adverse impacts would occur to water quality as a result of dredging and sewage discharge elimination construction works by PRASA (if done concurrently). In addition, temporary short term (2 years) adverse impacts would occur to water quality as a result of construction activities. Dredging and sediment disposal activities works would result in short term localized deterioration of water quality. This impact would be minimized and contained through the use of sediment control and containment measures, such as the use of turbidity curtanins, the use of geotextile tubes or bags to encapsulate dredged sediments and further capping of these with 2 feet of sand to prevent leaching of contaminants into ground and surface waters. Capping the dredged material would reduce potential for contaminant leaching into the water column by >95 percent.	Significant improvements to water quality, almost similar to those described under the TSP. However, articulated concrete mats would need to be placed along the entire length of the dredged channel under Alternative 1 to control erosion, prevent scour, and protect sheet pile walls. During construction, BMPs would be used to minimize short-term and long-term sedimentation, erosion, turbidity, and total suspended solids (TSS), the same as for the TSP.	Significant improvements to water quality, almost similar to those described under the TSP. Like the TSP and Alternative 1, BMPs would also be used to minimize short-term and long-term sedimentation, erosion, turbidity, and total suspended solids (TSS).

Resource	**NO ACTION ALTERNATIVE** **No changes to existing condition along CMP**	**TENTATIVELY SELECTED PLAN (TSP)** **100-foot-wide x 10-foot-deep channel**	**ALTERNATIVE 1** **75-foot-wide x 10-foot-deep channel**	**ALTERNATIVE 3** **125-foot-wide x 10-foot-deep channel**
Water Quality and Sediments, cont.		BMPs (i.e. turbidity controls) and construction of a weir at the western end of the project would minimize short-term and long-term sedimentation, erosion, turbidity, and total suspended solids (TSS). Dredged sediments from the Eastern CMP would be used to partially fill two excavated sand pits. Three artificial pits would be partially filled with dredged sediments from the San José Lagoon. These two actions would further reduce water renewal time in the San José Lagoon, and significantly reduce water quality impairments in the deepest areas of this water body caused precisely and in part by their unnatural depth.		
Air Quality	The No Action Alternative would allow abnormal levels of hydrogen sulfide and methane presently produced in the Eastern CMP to continue or even worsen due to the lack of water flow and excacerbated decomposition of organic material trapped in this water body.	Emissions from construction activities would result in minor short-term impacts in the immediate vicinity and no significant impacts to ambient air quality are anticipated once construction is complete. Dredging would increase emissions < 1 percent over the emissions inventory for existing sources in the San Juan area. These emissions are not anticipated to exceed National Ambient Air Quality Standards (NAAQS) during dredging; therefore attainment status would not be affected. Chronic exposure is unlikely due to relocation of residential housing prior to construction. Development and implementation of a H_2S monitoring program during dredging operations is recommended. During dredging, gas releases are expected and a plan is recommended to manage/mitigate any release of H_2S. Confirmed, high concentrations of H_2S would require aggressive management efforts that may include: (1) temporary relocation (evacuation) of individuals anticipated to be impacted, (2) In situ chemical treatment of the sediments to sequester the H_2S or convert it into a less harmful substance, (3) Collection and scrubbing of the air at the site of sediment disturbances to sequester hydrogen sulfide, (4) Air collection and delivery to safe zone above ground or middle of the San José Lagoon where dilution/dispersal can occur safely. The management plan should address health and safety of the public, the construction workers and equipment subject to H_2S related corrosion and recommend personal protective equipment, such as respirators and/or other oxygen assistance gear, and monitoring equipment and procedures. Education and training regarding H_2S poisoning would be provided for workers.		

Resource	NO ACTION ALTERNATIVE No changes to existing condition along CMP	TENTATIVELY SELECTED PLAN (TSP) 100-foot-wide x 10-foot-deep channel	ALTERNATIVE 1 75-foot-wide x 10-foot-deep channel	ALTERNATIVE 3 125-foot-wide x 10-foot-deep channel
Noise	No significant adverse impacts are anticipated since no new activities would occur.	No long term significant impacts to surroundings are anticipated from any of the project alternatives. Dredge operations typically have noise level between 58 and 70 dB at a distance of 50 feet from the source, less than ambient noise in San Juan, and may occur for 2 years. During construction, a localized deterioration of noise quality is anticipated from heavy-equipment, demolition, and pile driving. Dredging activities could result in short-term displacement of seabirds and shorebirds, but they are expected to resume normal use of the Project Area when project is completed. Demolition of the dwellings that are located within the public domain areas would generate noise and dust. Effects from these may be characterized as nuisance conditions, yet on sensitive populations, such as children and the elderly, asthma and nervousness may result in significant impacts to local residents. Noise and construction vibration from heavy machinery and pile driving equipment may adversely impact sensitive equipment. A vibration and noise mitigation plan is recommended to address structures with sensitive equipment (i.e. precision instruments), monitoring vibrations during construction, and implement mitigation measures such as installation of temporary sound barriers in critical areas. Other measures may include mandating the use of heavy equipment that is less likely to create noise and vibration issues.		
Solid Waste	Analytical methods used to characterized sediment quality have suggested that hazardous concentrations of lead may be present in the Eastern CMP. However, no evidence on HTRWs has been found in the Project Area. No additional impacts are anticipated without the project.	Materials within the Cano Martin Pena include various types of solid waste, debris and other materials. Such materials would require further testing prior to and/or during project construction, as appropriate in accordance with an agreed sampling plan. If the testing determines that any materials contain hazardous substances at levels that are not suitable for unregulated disposal, these would be managed in accordance with the applicable laws and regulations of the relevant regulatory agencies.		

Resource	NO ACTION ALTERNATIVE No changes to existing condition along CMP	TENTATIVELY SELECTED PLAN (TSP) 100-foot-wide x 10-foot-deep channel	ALTERNATIVE 1 75-foot-wide x 10-foot-deep channel	ALTERNATIVE 3 125-foot-wide x 10-foot-deep channel
Habitat	Eastern CMP would continue to deteriorate resulting in significant adverse impacts to its wetlands (i.e. mangroves) and submerged habitats (i.e. mangrove prop root community, water column and benthos). The reduced salinities could support a greater number of freshwater species, such as the invasive water hyacinth, and its siltation would eventually cause it to shift or resemble an upland habitat. As a result, most species sustained or dependent on wetland and submerged habitats would be permanently displaced by those favoring upland habitats. Continued impairments to open waters and submerged habitats in the San José Lagoon would continue or worsen and the CMP becomes completed clogged. The SJBE would be fragmented into two distinct segments.	This alternative would result in the temporary construction loss of 33.46 acres of mangroves and 7.40 acres of open or water column habitat. However, with the proposed open channel configuration and mangrove restoration in its banks, the amount of available mangrove habitat within this segment of the CMP would increase to 34.38 acres. This would mean a net gain of 1.02 acres. Open or water column habitat, as well as restored benthic habitat, would increase in the Eastern CMP by 18.17 acres. Mangrove wetland and mangrove prop root habitat is expected to be greater in acreage under the TSP than for Alternative 3, but less in terms of open or water column habitat area.	Is expected to result in the greatest mangrove wetland and mangrove prop root area of all project channel alternatives, with a net increase of 6.16 acres. However, this would be at the expense of open or water column habitat, with a net increase of 13.02 acres. The TSP and Alternative 3 would entail a net increase of 18.17 and 23.57 acres, respectively, for this type of habitat. The proposed armored concrete bottom could preclude burrowing creatures and other organisms associated with soft bottom benthic habitats from living, as formerly, in this section of the CMP. Encrusting creatures (e.g. barnacles), however, are anticipated to be able to settle on the hard bottom (Atkins, 2012a).	This project channel alternative that would result in a permanent reduction in mangrove area, with a net loss of 4.38 acres. However, it would provide the most water column habitat area, with a net increase of 23.57 acres. The same acreage would be restored for benthos within the Eastern CMP. Alternative 3 would provide more area for benthos within the Eastern CMP than Alternative 1, but at the expense of less mangrove prop root habitat in this same section of the Project Area.

Resource	NO ACTION ALTERNATIVE No changes to existing condition along CMP	TENTATIVELY SELECTED PLAN (TSP) 100-foot-wide x 10-foot-deep channel	ALTERNATIVE 1 75-foot-wide x 10-foot-deep channel	ALTERNATIVE 3 125-foot-wide x 10-foot-deep channel
Flora and Fauna Resources	This Alternative would prolong deterioration trends for fish and wildlife habitat due to the hydrologic interruption that present conditions in the Eastern CMP have caused throughout the entire SJBE. Fish and shellfish that may be contaminated and caught by in the San José Lagoon would have the potential to affect the health of those who consumed these organisms. Low salinity concentrations in the remaining open water areas within the Eastern CMP could allow the proliferation of invasive flora dependent on freshwater conditions, further reducing its value for fish and wildlife.	Improved tidal exchange under any of the three project channel alternatives would increase average salinities, from 6.5 to 8.5 psu to approximately 20 to 26 psu, in the San José Lagoon, from the surface down to between 4 to 6 feet deep. This would reduce/eliminate invasive freshwater species such as the water hyacinth that are intolerant of such salinities, and preclude the potential establishment of others, such as the bluegill (*Lepomis macrochirus*) and members of the family Loricariidae (Plecostomus, or sucker fish). Aquatic species (e.g. fish, invertebrates) dependent on connectivity of the seascape (e.g. mangrove prop root habitat, seagrass beds and coral communities), and those that feed on these would be greatly benefited. An increase in diversity and population of those species that are least tolerant to water pollution or impairments is expected.		
Species of Special Concern	Existing impaired habitat conditions due to a severely limited hydrologic connection between San Juan Bay and San José Lagoon, and poor water quality in Eastern CMP and the San José Lagoon would persist and worsen. Such continuous impacts would result in permanently impaired conditions that would prevent any significant T&E species presence or recovery of these populations in these two areas, possibly affecting other segments of the SJBE.	The TSP would have more potential benefits on those T&E species that could inhabit mangrove forests (i.e. yellow shouldered blackbird, black cowled oriole, Puerto Rican vireo, and white crowned pigeon) once restored in the Eastern CMP, than those from Alternative 3. The latter would have a net gain of -4.38 acres of mangroves while the TSP would result in a net gain of 1.02 acres. This difference in mangrove acreage and potential use by T&E species, however, is expected not to be significant.	Alternative 1 would result in more mangrove acreage available for any T&E species that inhabit this type of forest, when compared to the TSP and Alternative 3. Alternative 1 would have a net gain of 6.16 acres of mangrove, which is a significant increase from the TSP's gain of 1.02 acres, and Alternative 3's gain of -4.38 acres. It is worth noticing, however, that Alternative 1 would be more expensive to implement than the TSP. The narrower channel that Alternative 1 would provide is expected to be less effective in allowing its potential use of manatees to reach the San José Lagoon, when compared to the TSP or Alternative 3.	Alternative 3 would result in less mangrove acreage than either the TSP or Alternative 1. Alternative 3, however, would provide the widest channel configuration (i.e. 125 feet) that would potentially allow manatees to reach the San José Lagoon through the CMP. It would be, however, more expensive to construct than the TSP.

Resource	NO ACTION ALTERNATIVE No changes to existing condition along CMP	TENTATIVELY SELECTED PLAN (TSP) 100-foot-wide x 10-foot-deep channel	ALTERNATIVE 1 75-foot-wide x 10-foot-deep channel	ALTERNATIVE 3 125-foot-wide x 10-foot-deep channel
Land use and infrastructure	No changes to land use and/or infrastructure would be anticipated as a result of the No Action Alternative. In terms of land use, the area along the Eastern CMP would continue to be of Public Domain. However, its continuous use for residential or waste disposal purposes would continue to be incompatible with the area's natural and physical characteristics, as well as with those public policies that promote an efficient use of lands, open space, surface waters and other natural resources.	The TSP would cause fewer impacts to transportation than those from Alternative 1 and 3, although more impacts to navigation than those from Alternative 1. The TSP would cause fewer impacts to navigation than Alternative 3. All of these unavoidable, temporary impacts related to construction.	Alternative 1 would result in more impacts to transportation than those that could be caused by the TSP. Alternative 1 would require less material to be dredged than the TSP, and thus, less debris to be hauled out of the Project Area for final disposal into the Humacao Regional Landfill. However, it would require additional trips to carry the articulated concrete mats that would be placed along the bottom and entire length of the Eastern CMP. Otherwise, any construction aggregates would have to be transported if the articulated concrete mats are to be made at the CDRC staging area. Alternative 1 would result in fewer impacts to navigation than those expected by the TSP and Alternative 3, since the latest two would involve additional material to be dredged from the Eastern CMP, requiring more scow and barge trips to dispose off the dredged sediments and dredged debris, respectively.	Alternative 3 would result in more impacts to transportation than those that could be caused by either the TSP or Alternative 1. Unlike Alternative 1, Alternative 3 would require more material to be dredged, and thus, more debris to be hauled out of the Project Area for final disposal into the Humacao Regional Landfill. Alternative 3 would also result in more impacts to navigation than those expected from the TSP and Alternative 1, since both would involve less material to be dredged from the Eastern CMP, requiring less scow and barge trips to dispose off the dredged sediments and dredged debris, respectively.

Resource	**NO ACTION ALTERNATIVE** **No changes to existing condition along CMP**	**TENTATIVELY SELECTED PLAN (TSP)** **100-foot-wide x 10-foot-deep channel**	**ALTERNATIVE 1** **75-foot-wide x 10-foot-deep channel**	**ALTERNATIVE 3** **125-foot-wide x 10-foot-deep channel**
Socioeconomics	No activities resulting in new economic opoortunities would occur. Lack of water conveyance through the CMP and associated flooding and poor water quality would continue, resulting in economic impacts to local commerce, tourism and land values, including eventually, the tarpon charter industry occurring in the San José Lagoon.	The TSP would create 4,275 jobs during construction and would also provide opportunities for future job creation in the surrounding communities associated with outdoor recreation related concessionaires. Road improvements, water, sewage, stormwater, and electrical infrastructure systems would eliminate much of the environmental burden currently impacting the residents of the communities adjacent to the CMP. Significant adverse impacts are anticipated due to the 390 relocations from the Public Domain lands to facilitate the restoration. All efforts would be made to relocate people within their same community and strategies to maintain community cohesion, which include a community land trust to prevent community displacement.	Similar benefits to the community would result as in the TSP. It is estimated that Alternative 1 would create 4,525 jobs during construction.	Similar benefits to the community would result as in the TSP. It is estimated that Alternative 3 would create 4,400 jobs during construction.

Resource	NO ACTION ALTERNATIVE No changes to existing condition along CMP	TENTATIVELY SELECTED PLAN (TSP) 100-foot-wide x 10-foot-deep channel	ALTERNATIVE 1 75-foot-wide x 10-foot-deep channel	ALTERNATIVE 3 125-foot-wide x 10-foot-deep channel
Socioeconomics, cont.		Temporary or short term unavoidable impacts would occur on charter boat operator's income lasting over the construction period, forcing these to resort to other areas of the San José Lagoon or the SJBE where tarpons may congregate and take advantage of sudden depths changes to feed. It is important to notice that charter boat operators would be benefited in the long term by any of the project channel alternatives. Significant improvements to submerged habitat conditions are expected, resulting in an increase in the number and diversity of potential nekton species upon which tarpon would prey, thus benefiting this sport fishery.		
Cultural Resources	Dredging of the Eastern CMP would not occur, thus no disturbance to the project area would take place and any as yet undiscovered resources would remain in place. No additional investigations for cultural resources would be undertaken.	No significant impacts to cultural resources are expected. Permanent sheet pile walls, weirs, and other structures during construction would protect the Martin Peña Bridge; photo-documentation would be recorded for this historic bridge. A field archeologist (full-time), aided by a supervising archeologist (part-time), would be employed to monitor construction activities near the bridge, as well as to monitor for cultural resources as each clamshell bucket of dredged material is laid onto the screen during the construction (dredging) process. In the event that material of interest is observed by the archeologist during dredging and sorting operations, lifting of sediment would halt until the archeologist could determine whether the material is historic. Evaluation of three to four areas from the deepest sediments in the Eastern CMP to identify debris that may be considered of historical value is also recommended (Vélez Vélez, 2001; Vega 2002). A Phase IA Cultural Resources Assessment for the proposed temporary disposal site at the CDRC staging area found a very low potential for cultural resources due to extensive impacts and modifications in the area. No additional archeological investigations were recommended for this site.		

Resource	NO ACTION ALTERNATIVE No changes to existing condition along CMP	TENTATIVELY SELECTED PLAN (TSP) 100-foot-wide x 10-foot-deep channel	ALTERNATIVE 1 75-foot-wide x 10-foot-deep channel	ALTERNATIVE 3 125-foot-wide x 10-foot-deep channel
Health and Safety	Communities would continue to be exposed to health and safety concerns associated to direct and indirect contact with unsanitary waters, related pathogens and air quality impairments (H_2S). Historic neighborhoods along the CMP would continue to experience disproportionate adverse economic and environmental burden compared with the surrounding areas of the San Juan and the rest of Puerto Rico.	Significant improvements to quality of life and health and safety conditions for vulnerable communities are anticipated. Disease vectors associated with trash and debris and contaminants would be significantly reduced under the TSP. A monitoring and analysis plan is recommended to better characterize H_2S conditions and prevent exposure to children. Development and implementation of a monitoring program is recommended. Disproportional impacts to children and the elderly would be alleviated and significant improvements to child health and safety are anticipated.	Alternative 1 has less impact on flood reduction due to the smaller water capacity channel, and therefore may not improve health and safety to the same extent described for the TSP.	Alternative 3 would have a greater impact on flood reduction due to a larger water capacity channel, and therefore may improve health and safety to a greater extent than described for the TSP and Alternative 1.
Recreation Resources	Residents would not have the opportunity to experience many of the potential outdoor benefits associated with a restored SJBE system. Limits to recreation opportunities for disadvantaged neighborhoods would persist, and access to the designated Public Domain would continue to be limited to those residents living within it.	Recreation woluld be significantly improved. Five acres of small parks, water plazas, and linear parks would provide access, connectivity, and recreational facilities to concentrate community activities and minimize future impacts to the restored natural areas. Outdoor-passive recreation areas would be available for all citizens.	Significant benefits, similar to the TSP, are expected.	
Aesthetic Resources	The quality of the views from within the CMP would be progressively compromised by the lack of definition of the channel and debris that has collected under the mangroves and upland areas.	The TSP's improvements to the CMP, including its recreational features, would positively alter the visual quality of the CMP. The proposed actions offer the community new open spaces suitable for the appreciation of an enhanced ecological scene.	Similar visual and aesthetic benefits to the community would result from Alternative 1.	Alternative 3 would also provide significant visual and aesthetic benefits to the community.

4.1 CLIMATE

Project alternatives were evaluated in relation to climate change based on their potential contributions to greenhouse gas (GHG) emissions and their impact to local ambient temperatures.[21]

Hydrogen sulfide and methane are intrinsically or naturally produced in the Project Area as part of the decomposition of organic matter. The TSP, Alternative 1 and Alternative 2 have the potential to exacerbate the release hydrogen sulfide and methane as the dredged material is removed, transported, and managed for final disposal in the CDRC staging area. This impact would be temporary, until construction work is completed. The No Action Alternative, however, would allow the abnormal levels of hydrogen sulfide and methane presently found in the Eastern CMP to continue or even worsen, since these gases are produce in large part due to the excessive accumulation and decomposition of organic material in its stagnant waters.

4.1.1 No Action

Because temperature is expected to increase in Puerto Rico (see Section 3.1.1) due to climate change, temperature in the CMP would likely increase as well, and would be exacerbated due to heat island effects in the adjacent urbanized areas.

4.1.2 Tentatively Selected Plan

The TSP could provide benefits toward reducing climate change and heat-island effects, such as an increase in average temperatures at the Eastern CMP.

The TSP would result in net gains of vegetated wetlands and uplands, increasing forest cover in the Project Area. This, in turn, could decrease heat island effects and provide additional means to cope with future increases in temperature, a benefit of particular value in a densely urbanized landscape such as that of the Study Area.

4.1.3 Alternative 1

The net gain in mangrove area (6.16 acres) along the Eastern CMP would result in equivalent increments in its potential to cool ambient temperatures, although not significantly different from that of the TSP.

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[21] Other impacts due to climate change have been included or discussed, if applicable, in the following subsections about the environmental consequences that the project alternatives could have on specific topics or resources.

4.1.4 Alternative 3

The net loss in mangrove area (-4.38 acres) along the Eastern CMP would result in equivalent reductions in its potential to cool ambient temperatures, although not significantly different from that of the TSP.

4.2 GEOLOGY

Impacts to the project area’s geology, as a result of any of the project alternatives, would be considered significantly adverse if the underlying geology (i.e., karst composition) is significantly altered or if the local geology is compromised (e.g., sinkhole formation). Subsurface investigations indicate that rock or limestone outcrops may exist at depths of −10.5 feet in the eastern end of the Eastern CMP.

4.2.1 No Action

The No Action Alternative would not result in any impacts to the Project Area’s geology.

4.2.2 Tentatively Selected Plan

The TSP would be dredged above −10.5 feet, avoiding the need to dredge rock from the channel section by allowing the rock to remain in place and slightly adjusting the channel’s configuration to maintain the design cross section.

Results of geotechnical analyses (Atkins, 2011f) indicated no concerns regarding the stability of the eastern CMP channel with respect to the proposed dredging, nor those involving sheet piling installation. No significant impacts to geology are anticipated as a result of the TSP.

4.2.3 Alternative 1

Significant impacts to geology are not anticipated with implementation of Alternative 1 and changes are the same as those described for the TSP, since both alternatives would consist of a channel 10 feet deep.

4.2.4 Alternative 3

Significant impacts to geology could result with implementation of Alternative 3. Its wider cross section (125 feet) when compared to the TSP (100 feet) and Alternative 1 (75 feet) could require the excavation of limestone rock. The remnants of a small karst hill or “mogote” are found in the Eastern CMP, north of its eastern end, and relatively close to what would be the proposed channel alignment under Alternative 3.

4.3 SOILS

Significant impacts to soils would be those that alter their physical conditions (e.g., compaction or excavation) making them unsuitable for habitat or for reuse in the system (e.g., debris or high organic content). Storm water and soil stabilization controls would be installed to limit siltation caused by silt laden runoff coming from upland during construction activities related to all three project alternatives that involve action. Potential contamination of soils is addressed in Section 4.5. Water and Sediment Quality.

4.3.1 No Action

Further impacts to soils could continue due to the disposal of household waste, rock and other debris used as fill material within the Eastern CMP. Soils would continue to include debris, which along the Eastern CMP may reach depths more than 10 feet below land surface. Even if improper waste disposal activities are completely halted, refuse that has been used as fill within the Eastern CMP would continue to be a source of concern due to its impact to soil structure, composition and the flora and fauna that could be directly or indirectly in contact with it.

4.3.2 Tentatively Selected Plan

Significant beneficial impacts to soils in the Eastern CMP are anticipated as a result of the removal of debris used as fill material, thereby benefiting local fish and wildlife, as well as humans. Under the TSP, approximately 762,000 cy of material, consisting of 76,200 cy of debris would be excavated from the Eastern CMP and transported to a landfill and about 648,000 cy (in situ sediment volume) of dredged sediments would be placed in the San José CAD. Substrate, at the eastern CMP channel behind the sheet pile, would be left without garbage and thus under a suitable condition that would promote its colonization by sediment boring organisms (e.g. crabs, etc.) and mangrove, respectively.

4.3.3 Alternative 1

This alternative would result in the dredging of approximately 680,000 cy of material, consisting of 68,000 cy of debris that would be transported to a landfill, and approximately 574,200 cy of sediments (in situ sediment volume) that would be placed in the San José CAD. Alternative 1 would require less space or capacity from the Humacao Regional Landfill to be compromised from the disposal of dredged debris than that from the TSP and Alternative 3. However, Alternative 1 would have less beneficial effects on the Project Area than those described for the TSP and Alternative 3. It would leave 8,200 cy or 19,200 cy of debris within the soils at both banks of the Eastern CMP, when compared to the TSP and Alternative 3, respectively.

4.3.4 Alternative 3

Dredging under this alternative would result in approximately 872,000 cy of material, consisting of 87,200 cy of debris that would be transported to a landfill, and approximately 747,000 cy of sediments (in situ sediment volume) that would be placed in the San José CAD. Because of the greater dredged material volume, Alternative 3 would provide more benefits to soils in the Study Area than both the TSP and Alternative 1. Alternative 3, however, would compromise or require a bigger area within the Humacao Regional Landfill to dispose an additional 11,000 cy of debris, when compare to that required by the TSP.

4.4 HYDROLOGY

Hydrological effects of the channel alternatives have been considered based on their impacts on hydrodynamics, bathymetry, and coastal processes. [22]

Impacts to hydrodynamics in the Study Area would be considered significant if the project alternative resulted in significant changes in hydraulic conveyance patterns and volumes, flood levels, current or tidal patterns, storm surge characteristics, and/or salinity gradients among these water bodies. Adverse impacts to the project's alternatives caused by environmental changes resulting from sea level rise were also considered.

Impacts to bathymetry in the Eastern CMP and the San José Lagoon as a result of the project alternatives would be considered significant if bathymetric contours were modified as a result of additional dredging or sediment disposal and subsequently alter the use by living resources, including humans.

Impacts to coastal processes would be considered significant if tidal exchange and sedimentation were altered such that circulation patterns, water quality, and/or sedimentation in the SJBE system were substantially altered.

An elongated weir, or "hump," under the Martín Peña, Tren Urbano, and Luis Muñoz Rivera bridges involving a 115-foot-wide by 6.5-foot-deep channel is considered for all of the three project channel configurations alternatives evaluated. This structure would limit water conveyance in the same way for all three project channel alternatives. Fouling of the sheet pile walls by encrusting organisms and its effect on water velocities was considered negligible to differentiate among the three project

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[22] Methods used to evaluate impacts of the proposed project on the hydrology and hydrodynamics of the SJBE included the CH3-WES hydrodynamic model and the advanced Interconnected Pond Routing (adICPR) model. The CH3-WES hydrodynamic model was used to identify circu¬lation patterns to determine ecological improvement potential for various tidal restoration alternatives. The adICPR model was used to develop hydrographs and evaluate subsequent effects of flood levels with and without storm surge and with the CMP open and closed. Potential scour was determined using equations from the FHWA HEC-15 (2005). Hydrologic and hydrodynamic models, and results, are detailed in Atkins (2011a).

channel alternatives, and thus, is not expected to change the roughness coefficient significantly enough to affect any of the channel's hydraulics.

Modeling indicates that under the evaluated project channel alternatives, that is, after any of these have been built, storm surge elevations would control water levels for all return interval rainfall events.

Water levels would be less than the existing condition under all project channel alternatives during rainfall events without storm surge; standing water levels at CMP would be lower at the beginning of the storm event due to its augmented water conveyance capacity.

Water levels along the CMP are directly influenced by the storm surge at San Juan Bay and San José Lagoon. Hydraulic analysis with storm surge compared the water levels in the channel prior to and during construction. For all three project channel alternatives during construction, the channel flow would be plugged towards the western half of the CMP, under the Ponce de León Avenue bridge, to minimize the dispersion of sediments. A sheet pile would be placed in the eastern face, under the Ponce de León Avenue Bridge to shut off flow temporarily at the CMP. This would keep the CMP in a temporary "plugged" condition. Storms lower than 25-years in return interval had virtually the same surface elevation for the existing and plugged condition. Storms 25 years or greater experienced maximum increases of 0.5 foot for the existing condition and 0.86 foot for the plugged condition. Storm events without storm surge are the ones most affected by the blocking of channel flow with the 100-year event increasing the water surface from 1.28 feet for the existing condition and 3.94 feet for the plugged condition, a change of 2.66 feet. To minimize the extent of floods during plugged conditions, the temporary sheet pile wall would be placed at an elevation that allows flood waters to overtop and flow west, but still high enough to limit or impede tidal flow into the Project Area.

The proposed channel along with its sheet pile walls and adjoining mangrove beds are intended to form the floodway to contain the frequent storm events under the three project channel alternatives.

In its existing topographic condition are low-lying areas with poor drainage due to their low elevations (near mean lower low water) or their lack of adequate receiving channels. Water, influenced by the tides and storms, would backflow into the any of the three project channel while in construction. Without proper controls, structures in these low-lying areas may be at risk of adverse impacts from high water events. Possible flooding impacts on adjoining communities are discussed in detail on Section 4.14 - Human Health and Safety.

Residence time for the San José Lagoon would be reduced from 16.9 days to approximately 3.9 days under all three project channel alternatives. Reducing the residence time would also significantly reduce the salinity stratification (and associated low DO) at –4- to –6-foot depths (MSL) in the San José Lagoon.

Tidal amplitude within the CMP and the San José Lagoon would increase as a result of construction of the channel, decreasing from west to east. That is, increases are expected to be higher at the weir than at the San Jose Lagoon. The tide range is expected to increase 1.28 feet, from 0.33 foot preconstruction to 1.61 feet after construction, which would equate to a 0.64-foot increase in average monthly water levels in the general area where the channel meets the lagoon. Furthermore, tidal amplitude decreases from west to east, so surface elevations across the lagoon are expected to be somewhat lower. The water surface rise may still affect extremely low-lying structures around the SJL. In addition, storm sewers from the airport, at the north of the Suarez Canal, outfall into the SJL. The airport has been present for decades (1950s) and presumably when there was significant flow through the CMP prior to its filling. The airport is higher than its outfalls and thus may be able to build up a hydraulic head in its conduit to offset these monthly events. Additional hydraulic and hydrologic (H&H) modeling and analyses are needed to confirm the potential for induced flooding as a result of the implementation of the CMP-ERP. This additional technical investigation would be completed before the conclusion of preconstruction engineering and design (PED).

The effect of sea level change (SLC) on the CMP project provides information guided by the U.S. Army Corps of Engineers recommending that sea level change be calculated and reported as a low, intermediate, and high rate for consideration of project impacts. The following analysis is made consistent with Engineer Regulation (ER) 1100-2-8162 “Incorporating Sea-Level Change Considerations in Civil Works Programs,” released in December 2013.

The “low” sea level change rate is defined as the historic rate of relative sea level change at the local tide station. NOAA has evaluated sea level change trends for each tide station (NOAA 2008) and provides the data for the mean sea level trend at the San Juan tide gauge, station 9755371. The mean sea level trend has been calculated by NOAA to be 0.00541 feet/year.

The “intermediate” sea level change rate is defined as the rate of local mean sea level change using the modified Natural Research Council (NRC) Curve I. The “high” sea level change rate is defined as the rate of local mean sea level change using the modified Natural Research Council (NRC) Curve III. Both the “intermediate” and “high” rates include a consideration for the future acceleration of sea level change that is not considered when evaluating the historical (“low”) rate of relative sea level change.

Assuming a project life of 50 years, with construction beginning approximately in 2018 and completing in 2020, sea level change was calculated. Table 4-2 provides a summary of all estimated sea level change rates based on the updates to the NRC Equations and extending the calculation 50-years from a construction completion date of 2020. As further reference, Ernesto Diaz (Diaz, 2010) provides monthly sea level data for San Juan between 1962 and 2010 and estimates a change in sea level in 2100 of 0.414 meter (1.36 feet) using the regression formula $y = 0.0017x - 3.1565$. Using this equation, the estimated sea level change in 2069 would be 0.36 meter (1.18 feet), which would be in the intermediate range of the sea level change estimate.

Table 4-2. Summary of Sea Level Change Estimates (U.S. Army Corps of Engineers 2013)

SLC Estimate		
(feet)	Method	Estimate
0.36	Tide Gauge Trend	Low
0.76	NRC Curve I	Intermediate
2.03	NRC Curve III	High

All project alternatives (i.e. TSP, Alternative 1 and 3), with the exception of the No Action alternative, would contribute to mitigate or reduce some of the potential impacts of sea level rise (SLR) on surrounding communities. Some of these benefits, however, could be offset in the long term by SLR. Negative effects of climate change on the Eastern CMP and the San José Lagoon may be reduced through the implementation of adaptive management strategies.

SLR would overtop the elevations necessary to maintain the existing and planned mangrove planting areas for all three project alternatives (Atkins, 2013a). Mangrove forests are able to cope with higher water levels depending on how fast this change takes place and the resulting water depth. Red mangrove (*Rhizophora mangle*), for example, can develop new aerial roots to compensate for those that become drowned from a gradual, slow pace increase in water level, in order to maintain gas exchange between the roots and the atmosphere. Newly formed aerial roots also help maintain structural stability of individual trees.

In the event none of these morphological adaptations prove enough to deal with the effects of SLR under the channel configurations considered in all of the three project channel alternatives, mangrove trees would be able to colonize newly flooded lands adjacent to the Paseo del Caño. These lands would be proposed to be conserved as an upland buffer between any of the three channel configurations evaluated and the adjoining communities.

The new mangrove forest adjoining the Eastern CMP considered by the three channel configuration alternatives would provide different degrees of protection against storm surge damage aggravated by SLR than none from the No-Action Alternative. Saudamini & Vincent (2009) found that mangrove width was the most significant factor to mitigate storm surges. Therefore, increased mangrove acreage fringing the Eastern CMP would likely reduce risk associated with farther reaching storm surges as a result of SLR.

Increases in water elevations due to sea level change (Section 3.4.1) would not affect future navigation of the Eastern CMP under any of the project channel alternatives since the depth of any of these would be constructed and maintained as measured from the water surface. The proposed sheet pile wall's top (cap) elevation would be 3.0 feet and present mean high water is elevation 1.31 feet. Based on the estimated sea level changes, mean high water elevations would remain below the top of wall for the low and intermediate sea level change estimates and rise to 0.5 foot above the top of wall for the high estimate. The main consequence associated with water levels overtopping the walls to this minor extent would be a hazard to navigation as the tops of the wall would not be visible under certain tidal conditions. Channel markers may be required to adequately mark the position of the wall to minimize the hazard.

4.4.1 No Action

The No Action Alternative would result in no changes to existing flows between water bodies or circulation patterns, tides, wave action, or salinity in the San José Lagoon. Existing conditions due to impeded channel conveyance would persist. No changes to the 100 year floodplain, hydraulic conveyance volumes or patterns, runoff volumes, current or tide patterns, storm surge, or salinity are anticipated under this alternative. Poor tidal exchange, flooding, and poor water quality conditions would continue to adversely impact both the ecological and human health and integrity of the study area. Frequent floods would continue to occur and would disrupt normal residential daily life, business operations, and provision of essential services like education in flood-prone schools.

Under existing conditions, the average residence time of water in San José Lagoon is estimated at 16.9 days. At present, average tidal range for the San José Lagoon, is 3.93 in, reflecting the influence of the filled CMP. The absence of adequate tidal exchange between SJB and San José Lagoon and associated sedimentation and poor water quality would persist or worsen in the CMP and San José Lagoon under the No Action Alternative.

Impacts to bathymetry would be significant since sedimentation of the Eastern CMP would continue, incrementing with time, leading to its complete filling. Sedimentation would continue in the Eastern CMP due to low or no tidal exchange, and thus, no water conveyance capacity able to export or transport suspended sediments. Connectivity between the western and eastern section of the Study Area through the SJBE would not be possible for navigation nor for aquatic organisms.

4.4.2 Tentatively Selected Plan

The channel configuration of 100-foot-wide resulted in a peak channel bottom velocity of 2.80 fps, one of the lowest peak channel bottom velocities in the western end of the CMP. The analysis of potential scour for the channel scenarios indicates that the 100-foot channel configuration is the smallest channel suitable for an earthen bottom (as opposed to a protected bottom) based on shear stress limitations (0.072 to 0.094 pound/ft^2).

4.4.3 Alternative 1

The modeled cross-sectional area of the 75-foot-wide channel is 675 ft^2, compared with 900 ft^2 for the 100-foot-wide channel. This reduced area results in an increase in velocities and scour under Alternative 1, thereby requiring protection of the channel bottom. To address this issue, Alternative

1 would have to include paving with articulated concrete mats comprising flexible, interlocking, machine-formed blocks connected by cables for additional scour protection against higher velocities in the narrower channel.

4.4.4 Alternative 3

The modeled cross-sectional area of the 125-foot-wide channel is 1,125 ft^2, compared with 675 ft^2 and 900 ft^2 for the 75-foot and 100-foot-wide channel, respectively. Bottom velocities and potential scour would be less under this alternative when compared to the 75-foot alternative and the TSP, and would not require channel bottom protection.

4.5 WATER AND SEDIMENT QUALITY

Water quality impacts are based on relationships of water quality parameters to tidal exchange and water depth in the SJBE system. Sediment quality is based on an evaluation of the potential for contaminants in the sediments of the Eastern CMP. Impacts to water and sediment quality are considered significant if pollutants are demonstrated to exceed regulatory standards and impacts are long term.

For those alternatives involving dredging of the Eastern CMP (TSP, Alternative 1 and Alternative 2), the San José Lagoon and San Juan Bay would be reconnected and tidal exchange through the CMP would be restored. Hydraulic conveyance and tidal influence would significantly improve water circulation and water quality in the CMP and the San José Lagoon; the latest by diminishing water residence time to 3.9 days or less. This, in turn, would help diminish salinity stratification and improve DO levels in the lagoon, especially in shallow waters (<6 feet). Partially filling some of the subaqueous artificial dredged pits would also reduce water residence time and eliminate those areas with the worst water and sediment quality (e.g. anoxia, high hydrogen sulfide concentrations) in the San José Lagoon. The sediments and the water layer immediately above these, within the subaqueous artificial dredged pits could be consider “dead zones” due, in part, to the harmful processes and effects associated to their unnatural depth.

Temporary adverse impacts to water quality are anticipated from construction activities involving the TSP, Alternative 1 and Alternative 2. Dredging of sediments would result in short term localized deterioration of water quality. Dilution processes involved with the formation of the slurry for hydraulic dredging should reduce pore water concentrations of chromium, lead, nickel and zinc to values below their relevant water quality criteria, even within the Eastern CMP (Atkins, 2013d). Levels of copper and mercury would likely exceed criteria during the dredging operation, within the area where active dredging would occur. Exceedances for copper and mercury within the actively dredged area would occur mostly due to the fact that the surface waters of Eastern CMP and/or San José Lagoon already exceed relevant criteria. Concentrations of total cyanide are expected to exceed the free cyanide surface water quality standards in the area actively being dredged. Water quality impacts have been assessed based on concentrations expected during sediment disposal within the San José Lagoon CAD, but outside of a 1,000-foot mixing zone around it. Based on earlier work by Bailey et al. (2004) selenium concentrations would be expected to be reduced by 74 percent outside of a 1,000 foot mixing zone, during sediment disposal activities. After applying the expected 74 percent reduction in selenium to the other metal concentrations, there would be no anticipated exceedances of existing criteria for any of the metals examined outside of a 1,000-foot mixing zone, except for the ongoing impairments for copper and mercury in the waters of the San José Lagoon (Atkins, 2013e).

While previous sediment analysis and available data indicate that some contaminants in the sediments of the Eastern CMP exceed relevant guidance criteria, further testing (e.g. Section 404) could be required to determine their suitability and potential contaminant-related impacts of disposing these into the San José Lagoon CAD. Proposed features associated with dredging the Eastern CMP and disposing sediments into the San José CAD would help limit or control water and sediment contamination.

During construction of the three project alternatives, best management practices (BMPs) would be used to minimize short-term and long-term sedimentation, erosion, turbidity, and total suspended solids (TSS). BMPs would include the temporary installation of a sheet pile wall across the western limit of the Project Area to to control water flow, and thus suspended sediments and other potential contaminants moving towards the western half of the CMP.

Debris found within the dredged material would be separated and disposed into an upland landfill. Several measures would be adopted to reduce or minimize environmental impacts associated to the disposal of dredged sediment. Dredged sediments would be enclosed into geotextile bags or tubes, and turbidity curtains would be placed around the San José Lagoon CAD to limit sediment dispersion into the water column. After been filled, the geotextile bags would be place within the CAD and subsequently buried and capped with a 2-foot layer of sand. After the completion of the sediment disposal activities into the San José Lagoon CAD, Bailey et al. (2004) anticipated that the sediment cap of clean sand would reduce the “migration” of selenium into the overlying water column by approximately 90 percent. After applying a 90 percent reduction in expected metal concentrations, based on results previously proposed for selenium, there would be no anticipated exceedances of existing criteria for any of the metals examined in the waters of San José Lagoon, even inside of the previously described 1,000-foot mixing zone used during sediment disposal operation. Exceptions would be for the ongoing impairments for copper and mercury in the waters of the San José Lagoon (Atkins, 2013e).

Water quality monitoring and management measures would be implemented during construction activities per the Dredged Material Management Plan. It would include sampling and analyses during relevant construction activities, twice daily, and would include background and compliance samples to document any visible plumes generated by construction activities. Data would be compiled daily and included in quarterly construction reports. If turbidity or other contaminant levels exceed thresholds, relevant project activities would immediately be stopped, and the appropriate authorities would be notified. Work would not resume until it can be conducted in compliance with these turbidity and contaminant limits or an accompanying variance, where applicable.

Sedimentation resulting from discharges of the Juan Méndez Creek would be addressed by scheduled maintenance dredging in the CMP's outlet to the San José Lagoon, if needed.

In summary, all three "action" alternatives would cause very similar long term, water and sediment quality improvements to the Project Area and the Study Area. Impacts to water and sediment quality among these three alternatives would be short term, mostly limited to their construction. These, however, are not expected to be significantly different from each other. Initial positive responses from all three project channel alternatives are likely to occur within a year at most, after completing construction, and substantial improvements in the ecological health of benthic communities are likely to occur over a period of 2 to 3 years or less (Atkins 2011a).

4.5.1 No Action

Adverse impacts to existing water and sediment quality are anticipated to persist under the No Action Alternative: accumulation of debris and sediments and associated poor water and sediment quality would likely continue to worsen over time.

Under this alternative, renewal of the San José Lagoon's waters would continue to take 16.90 days, insufficient to allow for the breakdown or reduction of salinity stratification. This, in turn, would continue to promote low levels of dissolved oxygen in its waters, as well as anoxic conditions in most of its benthic habitat. Lack of water circulation would also continue to facilitate an above normal concentration of nutrients or eutrophic conditions which already have led to frequent algae blooms and fish kills.

4.5.2 Tentatively Selected Plan

Close to 730,000 cy of poor quality sediments from the Eastern CMP would be removed under the TSP. This is a larger volume of dredge material than that under Alternative 1, and thus, would result in better, long term improvements on the sediment quality of this segment of the SJBE. Temporary impacts related to suspended solids, turbidity and overall water quality, however, would be greater with the TSP due to the additional amount of dredge material and longer construction time needed to remove and dispose these when compare to Alternative 1.

4.5.3 Alternative 1

This alternative would entail the removal of approximately 638,000 cy of poor quality, dredged material, helping to improve the bottom conditions through the Eastern CMP. However, the entire length bottom of the Eastern CMP would have to be covered with articulated concrete mats to prevent its scour, eliminating its potential as a substrate for the development of benthic communities resembling those that may have originally been found in the channel. In addition, a larger volume of debris and other unnatural materials would remain within the banks of the new channel.

The removal of a lesser volume of dredge material proposed under this alternative than that entailed by the TSP and Alternative 3, should shorten construction time and those water quality impacts associated to the resuspension of sediments during dredging works and their disposal at the San José Lagoon CAD.

4.5.4 Alternative 3

Approximately 872,000 cy of dredged material would be removed under Alternative 3. This amount would provide better assurances for the removal of unsuitable, poor quality material that had been placed to fill both the open waters and associated mangrove wetlands along the historical footprint of the Eastern CMP, than that considered under the TSP and Alternative 1.

The removal of a larger volume of dredge material proposed under this alternative than that entailed by the TSP and Alternative 1, would extend construction time and those water quality impacts associated to the resuspension of sediments during dredging works, as well as those related to their disposal at the San José Lagoon CAD.

Improvements in the quality of those sediments that would remain along the bottom of the Eastern CMP would be the same among Alternative 3 and the TSP, since these would be dredged down to 10 feet below the surface water level under both alternatives.

4.6 AIR QUALITY

The Project Area’s ambient air quality is defined by emissions from natural and anthropogenic sources. To estimate air quality impacts, air pollutant loadings determined by the magnitude of emissions expected for project alternatives were compared to ambient emissions. Significant impacts are those that would permanently change and degrade the air quality in the Project Area. No significant impacts are expected from the three “action” alternatives.

Under the TSP, Alternative 1 and Alternative 3, fugitive dust would be generated by the physical disturbance of soils caused by earth-moving activities and vehicle traffic taking place at land-based construction sites within the Project Area. These, however, are expected to be minimal since most of what would be handled is dredged material (e.g. sand, silt, and clay), and thus, should be moist. Demolition of the dwellings that are located within the public domain areas would also generate dust. Effects from these may be characterized as nuisance conditions, yet on sensitive populations, such as children and the elderly, asthma may result in significant, short term impacts to local residents. Management measures, such as the use of a water truck to reduce the air suspension of soil or dust would be employed as a precaution for mitigating purposes, if necessary.

Internal combustion engine emissions from dredging and construction equipment, pumps, barges and trucks used to transport materials, equipment, personnel and employee vehicles would occur as part of all three "action" alternatives. These would result in air emissions of CO_2, NO_x, PM, SO_2, and VOCs. The emissions from all of the three "action" alternatives, however, would result in an increase of less than 1 percent of those inventoried for existing sources in the San Juan area. Therefore, emissions from the proposed activities are not anticipated to cause or create an increase in the NAAQS.

Temporary short-term impacts from all "action" alternatives would also include an increase in Hydrogen Sulfide (H_2S) ambient concentrations as the dredged material is removed at different points along the eastern CMP. An air quality dispersion model (i.e. Areal Locations of Hazardous Atmospheres or ALOHA), was used to predict the areal extent and maximum concentrations of H_2S that may be emitted (Atkins, 2012g). Potential emissions of H_2S may produce mild transient adverse health effects or a clearly defined, objectionable odor out to distances of 2.2 miles from the dredging sites. The model also predicted that concentrations may exceed the Toxic Level of Concern in some locations. Although very unlikely, a 100 percent sudden release of H_2S during dredging activities would exceed the chronic inhalation exposure criteria for children. The basis and assumptions used to arrive at these predicted concentrations, however, were conservative and the actual impacts are expected to be much less. Also, the resulting levels of H_2S concentrations from the models have not been observed in open air operations. The severity of H_2S emissions would be related to the amount or volume of material to be dredged and the time it takes to complete each of the alternatives considered.

Development of an H_2S monitoring program to be implemented during dredging operations for all project channel alterantives would be undertaken, nevertheless, to quantify ambient conditions and to manage/mitigate H_2S release as a precaution. Efforts may include: (1) water sprays near the source to reduce concentrations; (2) *in situ* chemical treatment of the sediments to sequester the hydrogen sulfide or convert it into a less harmful substance; (3) collection of the air at the site of sediment disturbances followed by air scrubbing to sequester hydrogen sulfide; and (4) collection of the air at the site of sediment disturbances and transmission to a safe zone (e.g. high above the ground or to the middle of the San José Lagoon) where dilution/dispersal can occur safely. As a last resort, individuals or residents located in the areas anticipated to be impacted by unsafe levels of hydrogen sulfide would be temporarily relocated (evacuation). Education and training regarding H_2S poisoning would be provided for workers, including personal protective equipment such as respirators and/or self contained breathing apparatus; the latest, if necessary.

4.6.1 Tentatively Selected Plan

Minor, short-term and very localized air quality impacts related to the release of dust from the demolition of structures is expected. Objectionable odors related to short term releases of H_2S are also expected on those sites been actively dredged. Its concentrations, however, are not expected to caused any health issues on workers and nearby residents.

4.6.2 Alternative 1

Minor short-term air quality impacts, such as those determined for the TSP, are anticipated for Alternative 1. These impacts however, are expected to be somewhat less than those resulting from the TSP and Alternative 3, since Alternative 1 would entail the least amount of dredged material to be removed from the Eastern CMP.

4.6.3 Alternative 3

Air quality impacts under Alternative 3 are anticipated to be of the same kind as those described for the TSP. Short term impacts could be more severe than caused by the TSP and Alternative 1, since Alternative 3 would involve a greater amount of dredge material and thus, a longer construction time.

4.7 NOISE

Potential noise impacts from a project alternative would result primarily from temporary construction activities, including dredging, material transport, employee vehicles, and water vessels. Impacts deemed significant are those that result in permanent exceedances of ambient noise conditions.

For the TSP, Alternative 1 and Alternative 3, noise levels would be temporary. Average noise levels for typical dredging projects resembling these three alternatives are listed below.

- Sediment and water pumps operate at around 66 to 70 dB.
- Hydraulic dredges generate noise at around 60 to 80 dB at a distance of 50 feet.
- A backhoe or loader generates about 85 dB, while a generator operates at about 78 dB.
- Clam shovels and impact pile drivers would generate 87 dB and 101 dB, respectively, at 50 feet.

During construction, a localized deterioration of noise quality is anticipated from heavy-equipment, demolition, and pile driving in non-urbanized areas. Dredging activities could result in short-term displacement of seabirds and shorebirds, but they are expected to resume normal use of foraging and roosting areas when project is completed. Demolition of the dwellings that are located within the public domain areas would also generate noise.

Construction of the project presents unique challenges due to the type of construction and its close proximity to residential areas. The work would generate noise and construction vibrations from the operation of heavy machinery and pile driving equipment. Construction vibrations may not only annoy people but may also have detrimental effects on structures and sensitive equipment. The potential for these effects is dependent upon numerous variables, including distance from the source, types of soil, frequency of vibration, and other factors.

Presently, there are approximately 158 structures facing the project footprint and approximately 20 percent (32) of these structures may be impacted due to vibrations. A vibration and noise mitigation plan would be prepared to include pre-construction surveys of adjacent structures and, if appropriate, distant structures with sensitive equipment (e.g. hospitals or businesses with precision instruments). In the event that damage is reported, the pre-construction survey becomes the baseline for comparing the pre and post-construction conditions.

Noise mitigation may include installation of temporary sound barriers in critical areas, mandating the use of heavy equipment less likely to create noise and vibration issues, such as the use of press-in sheet pile driving technology that generates noise no greater than 66 dB (52.5 feet) and minimum vibration. Establishing vibration monitoring equipment is recommended every 500 feet.

Sheet pile driving is the activity with the greatest potential for noise and vibration impacts under the three “action” alternatives. Noise and vibration caused by sheet pile driving would vary depending on the distance between where the sheet piles would be installed and the location of the receivers (e.g. local residents, structures). Noise and vibration impact time length is another difference between these alternatives, but that is associated to the time it would take for each of these alternatives to be constructed. No other noise or vibration impact differences are expected among TSP, Alternative 1 and Alternative 3.

4.7.1 No Action

No adverse impacts to noise levels are anticipated as a result of the No Action Alternative. However, this alternative would not provide the noise reductions or dissipation benefits produced by the natural corridor that would be established along the Eastern CMP from the combination of the restored open waters and vegetated fringes under any of the three “action” alternatives, whose undeveloped acreage would be greater than that presently available in this area. This service is especially valuable in the Project Area, whose surroundings are characterized by a dense and noisy urban landscape.

4.7.2 Tentatively Selected Plan

The TSP has the potential of causing less noise and vibration impacts on potential recipients than those that would be expected from Alternative 3. The latest, as defined, would require the installation of sheet piles closer to the adjoining communities in order to allow for the dredging of a

125-foot open-water wide channel. In addition, the TSP would create a wider mangrove fringe along the Eastern CMP, thus creating a wider, vegetated, noise buffer strip than that which would exist under Alternative 3. Noise and vibration impacts during the construction of the TSP would also last less than those for Alternative 3, since the former would involve a less amount of material to be excavated from the Project Area.

4.7.3 Alternative 1

Temporary dredging noise and vibrations under Alternative 1 would last fewer days than those needed to complete the TSP and Alternative 3. The former would require less material to be dredged from the Eastern CMP, so construction time would be shorter.

Alternative 1 would entail the widest mangrove fringe among those consider under the three project channel alternatives. As a result, sheet piles would have to be placed farther away from those landward structures adjoining the Project Area. This would allow for a larger buffer area to dissipate noise and vibrations during construction when compared against the TSP and Alternative 1. In the long term, it would also provide a better barrier against noises caused in the Eastern CMP's urban surroundings when compared to the TSP and Alternative 1.

4.7.4 Alternative 3

Short term, construction noise and vibration impacts caused by Alternative 3 would be longer in time and in magnitude than those resulting from the TSP and Alternative 1. For this alternative, the noise and vibration source (machinery) from construction would be at a closer distance of the receiver (local residences).

4.8 SOLID WASTE

Potential impacts due to solid waste have been determined in relation to their effect on the area where these are been placed for final disposal. All project channel alternatives would have a beneficial effect on the ecological health of the Project Area and Study Area regarding solid waste currently affecting both sites, although at varying degree.

Impacts related to HTRW would be significant if the proposed channel widening resulted in any of the following:

- Creation of a significant hazard (a hazard that is an actual or potential source of serious harm, or harm that occurs over a period of time) to the public or the environment through the transport, use, or disposal of hazardous materials;
- Creation of a significant hazard to the public or the environment through reasonably foreseeable accident conditions involving the release of hazardous materials into the environment;

- Generate hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within ¼ mile of an existing or proposed school; or
- Be located on a site, which is included on a list of hazardous materials sites, and, as a result, create significant hazard to the public or the environment.

Analytical methods used to characterized sediment quality have suggested that hazardous concentrations of lead may be present in the Eastern CMP. However, no evidence on HTRWs has been found in the Project Area. Neverthless, prior to clearing, grubbing, and dredging activities, a sampling and remediation plan would be developed and approved by ENLACE, USACE, USEPA, and PREQB to ensure that any HTRW materials that could be identified or detected, would be managed and disposed of according to applicable Federal, state, and local rules and regulations. All Actionable Hazardous Substances would be segregated. “Actionable Hazardous Substances” is defined for purposes of this project as any material that:

(1) contains a hazardous waste, as defined in USEPA’s RCRA regulations;
(2) contains a hazardous substance as identified in 40 C.F.R. 302.3 and 302.4 in concentrations that pose a threat to human health or the environment as determined by USEPA; or,
(3) cannot, without additional treatment, be disposed of legally in a Subtitle D municipal solid waste landfill located within the Commonwealth of Puerto Rico, and is not environmentally appropriate, as determined by the Puerto Rico Environmental Quality Board, in consultation with USEPA, for disposal, without additional treatment, in open water or in the San Jose Lagoon Contained Aquatic Disposal areas.

Materials may constitute Actionable Hazardous Substances under the above definition regardless of whether such materials are subject to disposal pursuant to 33 U.S.C. 1344 or 33 U.S.C. 1413 or of such materials’ jurisdictional status. Disposal of classes or categories of materials determined not to be an “Actionable Hazardous Substance” as defined above shall be documented with an affirmative determination (by the appropriate regulator entity) supporting the proposed disposal methodology and location. Final determination of the excavated material’s regulatory status would be made by the appropriate Federal and Commonwealth of Puerto Rico regulatory authorities and would be a matter for discussion between the Commonwealth, as the responsible party, and those regulatory agencies.

4.8.1 No Action

Solid waste improperly discarded and still found in the Eastern CMP would continue to impact the water and sediment quality, living resources and the aesthetic value of the Eastern CMP. These impacts include, among others, an increase in the proliferation of rats, insects, flies and other animals that transmit disease. Concentration of trash in particular areas also becomes a source of dust and leaching from the trash becomes another potential source of pollution for adjacent waters.

4.8.2 Tentatively Selected Plan

It is estimated that a total of 762,000 cy of mixed materials would be dredged under this alternative from the Eastern CMP. About 10 percent, or nearly 76,000 cy is estimated to be solid waste debris, which would be separated and transported by barge to the CDRC staging area for subsequent fiinal disposal at the Humacao Regional Landfill.

4.8.3 Alternative 1

It is estimated that a total of 680,000 cy of mixed materials would be dredged under this alternative from the Eastern CMP. About 10 percent, or nearly 68,000 cy is estimated to be solid waste debris, which would be separated and transported by barge to the CDRC staging area for subsequent fiinal disposal at the Humacao Regional Landfill. This alternative, as a result, would be the one occupying the least volume within that available at this landfill, and thus, would entail the least impact to its capacity when compared to the amount of solid waste that would be deposited by the TSP and Alternative 3.

4.8.4 Alternative 3

It is estimated that a total of 872,000 cy of mixed materials would be dredged under this alternative from the Eastern CMP. About 10 percent, or nearly 87,200 cy is estimated to be solid waste debris, which would be separated and transported by barge to the CDRC staging area for subsequent fiinal disposal at the Humacao Regional Landfill. As such, this material would compromise or need a larger volume of the available capacity found at the Humacao Regional Landfill than that resulting from the disposal of solid waste due to the TSP or Alternative 1.

4.9 HABITAT

Alternatives were evaluated based on their expected potential to restore or improve upland, wetland, and submerged habitats resembling those originally found in the Project Area, which in turn could improve conditions needed to sustain associated living resources. Impacts were considered significant if those habitats identified in the Project Area are not expected to recover or improve as a result of the implementation of each individual alternative.

Direct impacts to surface and subsurface habitats may result from continuous filling, dredging and/or the management and disposal of dredged material. Indirect adverse impacts may occur due to changes in salinity, water quality (e.g. turbidity and reduced light availability), and/or water depth and inundation. Similarly, improved water quality and restored hydrology would improve fish and wildlife habitat.

The CH3D-WES hydrodynamic model was used to quantify the improvement (decrease) in residence time in the San José Lagoon and improved connectivity between this water body and the San

Juan Bay as a result of increasing the cross-sectional area and thus, the water flow capacity of the CMP within the Project Area (Atkins, 2011b). The output on residence time was combined with data from a recently developed Benthic Index (BI) for the SJBE (PBS&J, 2009). The relationship between residence time and benthic community health in the San José Lagoon was found to be significant. It was determined, as a result, that restoring tidal flow through the CMP would improve the lagoon's circulation, helping to decrease water stratification and thus, hypoxic to anoxic conditions affecting its waters and associated submerged habitats. The greatest benefits are expected to occur at depths of 4 to 6 feet below the water surface, and extending over an approximate area of 702 acres (Atkins, 2011b) within the lagoon.

It is anticipated that the project channel alternatives would provide the following improvements in the ecological health of benthic communities within the Eastern CMP and the San José Lagoon:

- Upon completion, there would be an increase in the tidal flushing of the lagoon, reducing the residence time from approximately 16.9 days, which is the present condition represented by the No Action Alternative, to 3.9 days or less (Atkins 2011a).
- BI scores are expected to improve from 1.55 (No Action Alternative) to 2.84 (TSP, Alternative 1 and Alternative 3) (Atkins, 2012a).
- Increased BI scores would be indicative of conditions where the benthic community is characterized by: 1) increased species diversity, 2) a lower proportion of pollutant-tolerant taxa, and 3) a higher proportion of pollutant-intolerant taxa (Atkins 2009a).

The project channel alternatives are expected to produce almost similar benthic habitat benefits in the San José Lagoon by improving its water circulation. Water conveyance through the Eastern CMP would not be determined by the cross channel dimensions contemplated under any of the three "action" alternatives, but by the weir that would be placed on its western end. However, the different open water channel configurations considered in each of these would result in different mangrove wetland, mangrove prop root, water column and benthic habitat acreage along the Eastern CMP. Improvements in the quality of the resulting mangrove wetland, mangrove prop root and water column habitat would be very similar among all three "action" alternatives.

Mangrove prop roots have been documented as productive nursery habitat for a variety of aquatic organisms such as juvenile fishes, including commercial species. As such, the reestablishment of historical tidal connections from all three project channel alternatives would help restore those functions associated to the mangroves of the San José Lagoon as spawning grounds for aquatic organisms, and thus increase larval supply to the rest of the Study Area. Likewise, increase fish species diversity in the San José Lagoon is expected by the improved tidal connection provided by any of the project channel alternatives with the San Juan Bay and related ocean waters in the Study Area (Atkins 2011b).

Filling the deepest sections, and thus, raising the bottom of the subaqueous artificial dredged pits as proposed under all three project channel alternatives would help improve one of the most degraded areas, if not the worst, for benthos and the immediate overlying open water habitat in the San José Lagoon. Existing data on benthic communities and benthic index scores of zero in these locations indicate an absence of any significant biological communities (PBS&J 2009). The deepest parts of the dredged pits are specially affected by oxygen depletion and significant concentrations of hydrogen sulfide. These sites are where tidal currents and wind action are the least effective in the whole lagoon to produce mixing of the water column. Sunlight does not reach these water depths, and as a result, no photosynthetic activity is able to take place.

However, the uppermost waters of the dredge pits, especially the area of the halocline, have been shown to provide an important feeding ground for tarpon. The halocline that separates the water layers tend to concentrate phytoplankton, zooplankton and other small motile and non-motile organisms and particles. In turn, this layer would attract larger organisms, such as blue crabs and fish, upon which tarpon prey from the concealment of the dredge holes. As such, the proposed conversion of some of the San José Lagoon's subaqueous artificial dredge pits into a CAD site for the deposition of dredged sediments, as proposed by all three project channel alternatives, would cause inevitable short term impacts to this habitat. The two deepest dredge pits found in the southeastern section of the San José Lagoon (SJ1/SJ2) would be dredged and reshaped into one CAD site to accommodate the dredged sediments from the Eastern CMP. The resulting dredged material from the San José Lagoon CAD would be deposited in the artificial elongated dredged pits parallel to the northeastern shore of the lagoon (known as SJ3/SJ4/SJ5). During this process, the dredge pits and CAD would be surrounded by turbidity screens, impeding access to tarpon and to their anglers. This impact would last throughout the reshaping and disposal period. During this same time, water quality would be impaired by turbidity, suspended solids and from contaminants that may be present in the dredged material. The use of turbidity screens and geotextile tubes, the latest only for containing the dredged sediments from the Eastern CMP, would limit the extent and severity of these impacts.

Upland habitat created by any of the project channel alternatives, although less in acreage than the No Action Alternative, would harbor a greater number and diversity of native plant species than the latest, which is characterized by a great number of exotic flora.

Sea level rise (SLR) is expected to eventually overtop existing elevations where mangroves are found today, as well as those planned for mangrove planting restoration under all three project alternatives (Atkins, 2013a). Mangrove forests are able to cope with higher water levels depending on how fast this change takes place and the resulting water depth. Red mangrove (*Rhizophora mangle*), for example, can develop new aerial roots to compensate for those that become drowned from a gradual, slow pace increase in water level, in order to maintain gas exchange between the roots and the atmosphere. Newly formed aerial roots also help maintain structural stability of individual trees.

In the event none of these morphological adaptations prove enough to deal with the effects of SLR under the channel configurations considered in all of the three project channel alternatives, mangrove trees would be able to colonize newly flooded lands adjacent to the Paseo del Caño. These lands have been set aside to act as a buffer strip between the restored mangrove area and adjoining communities under the three channel project configurations.

4.9.1 No Action

Limited tidal exchange in the San José Lagoon due to channel encroachment of the Eastern CMP, and consequently, poor water quality conditions, would eventually increase the area affected by high dissolved ammonia and low dissolved oxygen concentrations. This would also lead to more frequent or intense algae blooms, accompanied by resulting fish kills in the lagoon.

The No Action Alternative would allow the Eastern CMP to continue to deteriorate due to siltation, trash, and debris accumulation within its banks and remaining open waters, resulting in significant adverse impacts to its wetlands (i.e. mangroves) and submerged habitats (i.e. mangrove prop root community, water column and benthos). The reduced salinities could support a greater number of freshwater species, such as the invasive water hyacinth, and its siltation would eventually cause it to shift or resemble an upland habitat. As a result, most species sustained or dependent on wetland and submerged habitats that once occurred in the Eastern CMP would be permanently displaced by those favoring upland habitats. Notwithstanding, this area could eventually lose most of its vegetation by becoming urbanized, just as it has been gradually transformed during the last 70 years.

4.9.2 Tentatively Selected Plan

This alternative would result in the temporary construction loss of 33.46 acres of mangroves and 7.40 acres of open or water column habitat. However, with the proposed open channel configuration and mangrove restoration in its banks, the amount of available mangrove habitat within this segment of the CMP would increase to 34.38 acres. This would mean a net gain of 1.02 acres. Open or water column habitat, as well as restored benthic habitat, would increase in the Eastern CMP by 18.17 acres (see Table 4-3).

Mangrove wetland and mangrove prop root habitat is expected to be greater in acreage under the TSP than for Alternative 3, but less in terms of open or water column habitat area.

Table 4-3. Habitat loss/gain summary for the TSP

Description	Existing	Proposed	Net (increase or loss)
TSP	**Acres**	**Acres**	**Acres**
Open water	7.4	25.57	18.17
Wetlands/mangroves	33.46	34.48	1.02
Upland	27.61	3.42	-24.19
Upland (recreation)	0	5.0	5.0
Totals	**68.47**	**68.47**	**0**

4.9.3 Alternative 1

Alternative 1 is expected to result in the greatest mangrove wetland and mangrove prop root area of all project channel alternatives, with a net increase of 6.16 acres (see Table 4-4). However, this would be at the expense of open or water column habitat, with a net increase of 13.02 acres.

Table 4-4. Habitat loss/gain summary for Alternative 1

Description	Existing	Proposed	Net (increase or loss)
75-ft channel	**Acres**	**Acres**	**Acres**
Open water	7.4	20.42	13.02
Wetlands/mangroves	33.46	39.62	6.16
Upland	27.61	3.43	-24.18
Upland (recreation)	0	5.0	5.0
Totals	**68.47**	**68.47**	**0**

Placement of an armored concrete mat along the entire length of the Eastern CMP bottom, as proposed in Alternative 1, would be a significant difference with the other project channel alternatives. The proposed armored concrete bottom could preclude burrowing creatures and other organisms associated with soft bottom benthic habitats from living, as these formerly did, in this section of the CMP. Encrusting creatures (e.g. barnacles), however, are anticipated to be able to settle on the hard bottom (Atkins, 2012a).

4.9.4 Alternative 3

Alternative 3 is the only project channel alternative that would result in a permanent reduction in mangrove area, with a net loss of 4.38 acres. However, it would provide the most water column habitat area when compared to the other two project channel alternatives, with a net increase of 23.57 acres. The same applies to the restoration of benthos within the Eastern CMP (see Table 4-5).

Table 4-5. Habitat loss/gain summary for Alternative 3

Description	**Existing**	**Proposed**	**Net (increase or loss)**
125-ft channel	**Acres**	**Acres**	**Acres**
Open water	7.4	30.97	23.57
Wetlands/mangroves	33.46	29.08	-4.38
Upland	27.61	3.42	-24.19
Upland (recreation)	0	5.0	5.0
Totals	**68.47**	**68.47**	**0**

4.10 FLORA AND FAUNA RESOURCES

Methods used to evaluate resulting impacts from all alternatives on the flora and fauna of the Study Area include mangrove and open water acreage; functional value of wetlands; habitat suitability indicators (e.g., access or connectivity, dissolved oxygen) for wildlife habitat as well as threatened and endangered species (Atkins, 2011c), and essential fish habitat (Atkins, 2011i). The National Ecosystem Benefit Evaluation Report and the ecological uplift report (Atkins, 2014) also discuss the metrics and evaluate the impacts of alternatives on fish and wildlife. Finally, the CH3-WES hydrodynamic model results was used to predict circulation patterns (residence time), which in turn were used to predict ecological improvement for various parameters, such as dissolved oxygen and salinity.

Impacts of invasive species on native communities are also evaluated. Impacts would be considered adversely significant if these cannot be managed or ultimately affect expected improvements in the eastern CMP and the San José Lagoon due to the implementation of any of the alternatives evaluated. In the event that an invasive species is able to thrive in the Project Area due the construction of any of the project channel alternatives, these could be control primarily by mechanical removal (e.g. plants) and by promoting the reestablishment of other native vegetation that provide habitat for other native flora and fauna.

Improved tidal exchange under any of the three project channel alternatives (TSP and Alternatives 1 and 3) is anticipated to reduce residence time in the San José Lagoon by 13 days (from 16.90 to 3.9 days or less). As a result, the BI score is expected to nearly double. Literature cited in the CMP Benefits Evaluation prepared by Atkins (2012a, 2013) report a positive response of the benthic community within the first year of implementing a restoration project.

Restored circulation and tidal exchange is expected to substantially improve water quality and promote the establishment of more diverse and healthy fish and wildlife habitats throughout the SJBE. The eastern CMP, which now has almost no tidal flushing and little to no depths, would have a full depth of oxygenated water to support fish and invertebrate populations providing adequate habitat for fish and wildlife (Atkins, 2011a). Improved tidal flushing would also increase the recruitment of marine and estuarine plants and animals. This is particularly true of the extensive mangrove forests fringing the San José Lagoon, which presently support a limited diversity of aquatic species associated with the roots of the trees that are able to cope with the limiting conditions of this poorly flushed water body. Flushing rates could improve larval recruitment and survivability for many of the organisms that comprise the encrusting community of the mangrove prop roots and other shallow surfaces, therefore increasing the health of that habitat, which is considered essential for fisheries. Whereas presently a single species of mussel, *Mytilopsis domingensis*, dominates the areal coverage of the mangrove roots throughout the San José Lagoon, increased flushing is expected to result in a red mangrove prop root encrusting community that resembles the existing conditions in La Torrecilla Lagoon, where it includes multiple types of mollusks, as well as sponges, crabs, polycheate worms, and ascideans. This added diversity of fauna would likely result in an improved sustenance fisheries resource for the Study Area (Atkins, 2011b). In addition, improved tidal flushing would increase the probability of survival of sensitive organisms, such as sponges, via an expected moderation of salinity extremes (Atkins, 2011b).

Dredged sediment disposal within the San José Lagoon CAD is expected to not cause adverse impacts to living resources as the waters of the pits are anoxic below a depth of about 6 feet, and bio-accumulation is unlikely to occur in a location of such limited biological activity (Atkins, 2013e). The deposited dredged sediments would be also contained within geotextile bags or tubes and capped with a 2-foot layer of sand, further reducing their exposure to benthic and aquatic organisms. All project channel alternatives have the potential to temporarily benefit many wading bird species (e.g. plovers, sandpipers, herons) since mudflat habitat would be available for these up to the time mangrove trees reach an adult size and cover the adjoining banks of any of the alternative open water channel alternatives.

It should be noted that no additional mangrove acreage is proposed or expected in the shorelines of the San José Lagoon that would attract waterfowl or other wildlife that could result dangerous to the Luis Muñoz Marín International Airport operations as a result of any of the project channel alternatives, besides that currently existing in its periphery. The restored habitat, nevertheless, would not be attractive to large migratory waterfowl (ducks and geese). In fact, water salinity is expected to be saltier than current conditions, from 6.5 to 8.5 psu to approximately 20 to 26 psu, in the San José Lagoon, from the surface down to between –4 to –6 feet deep. As a result, water salinities would be less attractive to most of these species, which after all, are very rare at the present time in the Project Area. In addition, the flight path over the CMP, where mangrove forests would result as part of any of the project channel alternatives, is generally too high for bird strike hazards to increase. Most bird species found or associated to mangrove forests, properly, in the Project Area, are canopy dwellers (e.g. warblers) or spend most of their time in the forest floor (e.g. herons, sandpipers, plovers, rails) searching for food. Normally, these species do not fly or hover at an elevation as high as the flight path of airplanes approaching the airport over the CMP. As mentioned before, water quality conditions in this whole area are expected to be brackish from any of the project channel alternatives, resembling the salinity regime existing during the 1950s, when the airport began operations. Therefore, it is expected that said water quality salinities would not increase the presence or risk of large waterfowl impacting approaching airplanes or those leaving the airport. The increase in average salinities resulting from all of the project channel alternatives would reduce/eliminate invasive freshwater species such as the water hyacinth that are intolerant of such salinities, and preclude the potential establishment of others. In addition, native species would be benefited from the resulting environmental improvements, becoming more resilient and able to cope with some of the impacts caused by invasive species.

Dredging and construction activities related to the project channel alternatives could facilitate, however, the colonization of other invasive species that thrive in marine or brackish waters, specifically the red lionfish (*Pterois volitans*), due to the aquatic connection that would be reestablished through the eastern CMP. This species has been observed mostly inhabiting marine benthic habitats. Its broad salinity tolerance may allow this species to colonize estuaries throughout their invaded range. Therefore, it is plausible that the lionfish would expand into most parts of the SJBE, with or without the CMP-ERP. In the event that lionfish invades the Project Area, management and control measures for the lionfish would be adopted following the Regional Strategy for the Control of Invasive Lionfish in the Wider Caribbean (Gómez-Lozano, et al., 2013) and Invasive Lionfish: A Guide to Control and Management (Morris, J.A., Jr. (Ed.), 2012). It is important to notice that with or without the CMP-ERP, lionfish management measures in the Project Area, as in the rest of Puerto Rico, are coordinated by the DNER.

Other invasive fauna species, such as the small Indian mongoose (*Herpestes javanicus*), the green iguana (*Iguana iguana*) and spectacled caiman (*Caiman cocodrilus*) are already well established within green areas or waterbodies, accordingly, in the Study Area. Although no significant changes are expected on the populations of these species in the Project Area, the small Indian mongoose could be displaced or affected by an increase in open waters and mangrove acreage in the eastern CMP as a result of the three project channel alternatives. The spectacled caiman could also be impacted by the resulting increase in water salinity at the San José Lagoon as tidal influence is restored. Green iguanas are only expected to be temporarily impacted during construction activities, and until mangrove cover is reestablished on the fringes of any of the project channel alternatives.

4.10.1 No Action

The No Action Alternative would prolong deterioration trends for fish and wildlife habitat due to the hydrologic interruption that present conditions in the Eastern CMP have caused throughout the entire SJBE. The SJBE would be divided in half, for all practical purposes, thus limiting wildlife movement through the estuary, including its connectivity with adjacent marine habitats (e.g. seagrass beds, coral communities). The latest is especially troublesome for fisheries, particularly those species whose development depends on their migration from the estuary to the ocean to complete all of their life stages (ontogeny).

Invasive species often become established due to disturbance of native habitats and some have already become established in the eastern CMP. Invasive plant species, such as the water hyacinth, may continue to thrive within the eastern CMP, as well as in some areas of the San José Lagoon, due to high levels of nutrients, low to no water flows and low salinity levels. Other invasive species such as the small Indian mongoose, the green iguana and the spectacled caiman would continue to thrive in the Project Area since its current degraded environmental condition has allowed or facilitated their establishment.

Subsistence fishermen in the San José Lagoon would potentially continue to be at risk of ingesting contaminants found in fish and shellfish caught in this waterbody. Other people may as well be affected by the consumption of these organisms since subsistence fishermen sometimes sell their catch (Atkins, 2011b).

4.10.2 Tentatively Selected Plan

The TSP would restore a greater area of mangroves in the eastern CMP than Alternative 3. Those species that depend on mangrove forests or inhabit forest canopies (e.g. warblers) can be expected to benefit more from the TSP than from Alternative 3. This difference in mangrove, open water and benthic habitat acreage, and its potential use by fish and wildlife species, however, is expected to be insignificant.

4.10.3 Alternative 1

Alternative 1 would result in the greatest mangrove acreage restored in the eastern CMP among all project channel alternative, and thus could be the one that results in the most benefits to mangrove or forest canopy dwelling species. However, this benefit would be at the expense of open water and benthic habitat dwelling species (e.g. fish, aquatic invertebrates) since this alternative would entail the narrowest channel among all other project channel alternatives. This difference in mangrove, water column and benthic habitat acreage, and its potential use by fish and wildlife species, however, is expected to be insignificant.

4.10.4 Alternative 3

Alternative 3 would restore the greatest area of open water and benthic habitat in the eastern CMP when compare to any of the other project channel alternatives. Thus, more habitat area for fish and benthic invertebrate species would be available under Alternative 3 than under the TSP and Alternative 1, but at the expense of additional mangrove forest area that could be restored in the eastern CMP under the latest two alternatives. The difference in mangrove, water column and benthic habitat acreage, and its potential use by fish and wildlife species, however, is expected to not be significant.

4.11 SPECIES OF SPECIAL CONCERN

Impacts to threaten or endangered (T&E) listed species would be considered significant if these would lead to a reduction in numbers or further limit their distribution along the Study Area due to the implementation of each individual alternative. Possible adverse or beneficial effects cause to T&E listed species are expected to be very similar among any of the project channel alternatives. Any impacts, however, would be temporary and associated to construction activities. Appropriate management measures would be implemented under any of the project channel alternatives in order to reduce or avoid any impacts to T&E listed species found in the Project Area's premises.

There are several Commonwealth's listed species that have been recently observed flying over or foraging in the Eastern CMP and the San José Lagoon, and that could be disturbed while construction activities are taking place at the CMP and the San José Lagoon from any of the project channel alternatives. These include the threatened Caribbean coot, the endangered brown pelican, the critically endangered peregrine falcon, the white crowned pigeon, the Puerto Rican vireo, the least tern, and the black cowled oriole. All of these birds, however, are highly mobile species that could temporarily move to other areas in the SJBE where suitable habitat conditions exist to help assure their survival. Future conditions in the Project Area, nevertheless, would benefit the reestablishment of all of these T&E listed birds, once any of the project channel alternatives is completed.

During construction of any of the project channel alternatives, the Puerto Rican slyder would have the capacity to move to other areas, especially outside the Eastern CMP when dredging activities would take place. Nevertheless, some individuals might be impacted during dredging operations. Improvements in water and habitat quality as a result any of the project channel alternatives would benefit this species once construction activities are completed.

Fiddler crabs individuals of the genus *Uca*, mangrove crabs of the genus *Goniopsis*, *Aratus* and *Ucides*, and the land crab of the genera *Cardisoma* may still be found in the Eastern CMP, and as a result, would be impacted by dredging activities under any of the project channel alternatives. Once any of these are completed, however, improvements in water quality, and mangrove substrate and cover would greatly benefit any of these species.

Beneficial effects to those species listed as T&E or as critical elements found in the Study Area, but not found or impacted in the Project Area, could result from any of the project channel alternatives, if seedlings or individuals are planted as part of the reforestation efforts to restore impacted upland sites during construction. All project channel alternatives are expected to temporarily benefit federally threatened species such as the roseate tern (*Sterna d. dougallii*) and the red knot (*Calidris canutus*), and the Commonwealth's critically endangered snowy plover (*Charadrius alexandrines*). Mudflat habitat would be available for these bird species up to the time mangrove trees reach an adult size and cover the adjoining banks of any of the project channel alternatives.

4.11.1 No Action

The filling and destruction of surface and submerged habitats in the Eastern CMP, its impact on its water quality, and the pervasive effect it also has caused on the ecological health of the San José Lagoon mangrove prop root habitat, water column and benthos, has significantly impacted the Project Area's capacity as a refuge for T&E listed species. This could be, at least, part of the reason explaining the "disappearance" of several T&E listed species that once inhabited the CMP, since these have not been observed again since decades ago. These include the federally listed yellow shouldered black bird and the West Indies subspecies of the roseate tern, or the Commonwealth listed white-cheeked pintail. Other T&E listed species, such as the masked duck and the West Indian whistling duck, could have been taking advantage of seemingly suitable habitat structure that exist for these in the CMP and the San José Lagoon. None of these however, have been documented in this area, presumably due its poor environmental quality.

These habitat impairments are expected to persist or worsen as the result of the No Action Alternative. Said situation is expected to prevent any significant T&E species presence or populations from inhabiting the Eastern CMP and the San José Lagoon, and to a lesser degree, the SJBE overall.

4.11.2 Tentatively Selected Plan

The TSP would be more beneficial to those T&E species that thrive in mangrove forests (i.e. yellow shouldered blackbird, black cowled oriole, Puerto Rican vireo and white crowned pigeon) than what would be expected from Alternative 3. The latest would lead to a reduction of 4.38 acres of mangroves while the TSP would result in a net gain of 1.02 acres. This difference in mangrove acreage and potential use by T&E species, however, is expected to not be significant.

4.11.3 Alternative 1

Alternative 1 would result in more mangrove acreage available for any T&E species that inhabit this type of forest than any of the other project channel alternatives. Alternative 1 would have a net gain of 6.16 acres of mangrove, while the TSP would have a net gain of 1.02 acres. The difference in mangrove acreage between Alternative 1 and the TSP and its potential use by T&E species, however, is expected to be insignificant.

The narrower channel that Alternative 1 would provide is expected to be less effective in allowing its potential use by manatees in the event these try to reach the San José Lagoon, when compared to the TSP and Alternative 3.

4.11.4 Alternative 3

Alternative 3 would result in less mangrove acreage and its potential use by those T&E species that inhabit this kind of forest, when compared to the TSP and Alternative 1. Alternative 3, however, would provide the widest channel configuration (i.e., 125 feet) that would potentially allowed manatees to reach the San José Lagoon through the CMP.

4.12 LAND USE AND INFRASTRUCTURE

Land Use

Impacts that permanently alter uses in the area and have long-term impacts on the natural and human systems, as well as those that would require demolition, relocation or construction of infrastructure, would be considered significant.

All three project channel alternatives would change land use along the current banks of Eastern CMP, which is use mostly for residential and waste disposal purposes. Instead, this segment of the CMP would be restored to conserve its natural landscape, consisting of open waters, wetlands and upland vegetation. This is consistent with the uses allowed by local law within public domain lands. Changes in land use along the Eastern CMP would also include public accesses to support recreational activities associated to the enjoyment of the surrounding natural landscape in order to discourage informal accesses and other undesirable activities that could compromise the restoration of the Project Area, and that of the overall efforts to improve the SJBE.

Infrastructure

Existing infrastructure, such as roads, bridges, water and sewer lines, would be significantly impacted as a result of any of the project channel alternatives, since some would need to be relocated or removed. The CMP-ERP would require the relocation of three major utilities that are located within the Project area: a 115-kV Power Line, the Borinquen Water Transmission Line, and the Rexach Sewer Line.

Much of this infrastructure is outdated and deteriorated, requiring repairs or retrofitting even without any of the project channel alternatives. Improvements on infrastructure are, therefore, necessary, and would be beneficial to help guarantee adequate living conditions for adjacent communities.

During construction of any of the project alternatives, stationary vibration monitoring devices (4) along the border between the work and the adjoining structures, both north and south of the CMP, would be installed. In addition, a photographic survey of the exterior of existing structures facing and adjoining the work would be prepared to document preconstruction conditions. Measurements from the monitoring devices would be observed for excessive levels of vibration, and visual inspection of existing structure/infrastructure in areas adjoining construction sites would be conducted to detect possible related damages. If excessive levels of vibration occurred, the response would be to stop work, avoid using equipment near adjoining structures that produces heavy vibrations, and/or review procedures to determine more-effective means and methods. Alternative sheet pile installation methods such as “press-in” pile drivers or other drivers that produce less vibration may be used if available and feasible.

Bridges

Potential impacts to the existing bridges located at the eastern CMP were identified (USACE, 1999) as a result of restoring tidal flow through dredging and sheet pile wall construction. The effects of dredging on the existing bridges could not be assessed because as-built plans of the existing bridge foundations have not been found. However, it was known that the pile caps for the Luis Muñoz Rivera Bridge were at an elevation of –3 feet. Since the CMP-ERP calls for dredging to below –10 feet and the pile tip elevations of the existing bridge foundations were not known, it was not possible to determine the impact that the project dredging would have on the capacities of the pile foundations of these bridges. The report recommended that these bridges be replaced before dredging closer than 100 feet. For the Martín Peña Bridge, the pile cap elevations were at –8 feet. However, because of the width of the proposed channel at this bridge location it was determined that the necessary hydraulic performance could be achieved even if the channel excavation under the bridge was limited to –8 feet. Because of the lack of as-built information on the Ponce de León Avenue and Luis Muñoz Rivera Avenue bridges foundations, it is recommended that further geotechnical studies be conducted to determine the depths of the piles supporting the bridges. It is also recommended that a detailed structural conditions analysis be conducted for these two bridges as well as the Linear Park pedestrian bridge.

During dredged material transportation and disposal, the scows and barges would navigate through the San José Lagoon and would cross under the José Celso Barbosa Avenue Bridge and the Teodoro Moscoso Bridge. These bridges provide sufficient clearance for the scows and barges. To avoid adverse long term impacts on bridges, a weir would be placed between the existing western CMP channel and that section to be dredged under any of the project channel alternatives to reduce flow and prevent scouring of bridges west of the dredging site. Also, the CMP section under the Martín Peña Bridge, the Tren Urbano Guideway and the Luis Muñoz Rivera Bridge would be constructed to a width of 115 feet with a depth of –6.5 feet msl. Riprap would be placed on the side slopes, and the channel bottom would be paved with articulated concrete mats.

Water and Sewer infrastructure

The segment of the Rexach Trunk Sewer that crosses under the Eastern CMP is located above the bottom of the three project channel alternatives. Based on the available information, approximately 262.5 feet of the 48-inch-diameter pipe needs to be relocated prior to the dredging and channeling of the Eastern CMP (PRASA, 2008).

The Borinquen Water Transmission Pipeline crosses under the Eastern CMP at a depth of 3 feet. Since the project channel alternatives would consist of a depth of approximately 10 feet, this segment of the water pipeline needs to be relocated prior to the construction of any of the alternatives evaluated. It is estimated that 263 feet of this pipeline need to be relocated (PRASA, 2008). The design and relocation of both, the Rexach Trunk Sewer and the Borinquen Water Transmission Pipeline is ongoing and will be completed prior to the dredge of the CMP.

Water lines east of Pachín Marín Street and West of the D Street, on the south bank, in Hato Rey, and water lines for Calle 8, 9, 10, 11, 12, 13, 14, and Calle 15 in Barrio Obrero Ward would be impacted by any of the project channel alternatives.

The proposed perimeter road, the Paseo del Caño, between the Eastern CMP and the community, would incorporate new storm sewers to intercept overland flow. The existing storm piping would require demolition and interruption of the existing stormwater conveyance systems. Additionally community stormwater plans would be developed for necessary repairs to the impacted storm pipes and to provide a protected channel or piping to a new point of discharge. Local codes do not require the management of stormwater quantity or quality, thus all upland stormwater runoff may be discharged directly into any of the project channel alternatives.

Stormwater would be collected at the point of discharge and carried through underground piping to the Eastern CMP, in order to prevent uncontrolled overland flow that could result in erosion, loss of upland soils and siltation in the mangrove beds, resulting in impacts to restoration efforts. Silt could also flow into the Eastern CMP, causing shoaling and accelerating the timeline for maintenance dredging.

Construction of an oil/water/sediment separator structure is contemplated within the Public Domain, near its interface with the future Paseo, under all three project channel alternatives. Storm sewer piping interrupted by construction would be extended to this structure.

Similar to the storm sewer infrastructure, many of the streets within the demolition limits contain underground sanitary sewer collection piping that would be impacted by any of the project channel alternatives. These would provide for the removal of lengths of piping, requiring appropriate plugging at the new terminus and repairs to affected laterals adjoining this section of the Project Area.

The project channel alternatives would necessitate termination and relocation of some waterlines affected by the channel ROW. As with sanitary sewer, relocations would have to be coordinated with street construction outside the configuration proposed by all of the project channel alternatives.Is

Power Infrastructure

The 115-kilovolt (kV) overhead transmission line has been relocated as a component of the CMP-ERP. This line, that crosses the eastern end of the Eastern CMP, had to be raised for the construction of any of the project channel alternative. Its former height was not sufficient, posing a hazard to equipment needed for construction/dredging associated to the CMP-ERP.

In addition, approximately 438 residential services would require electrical service demolition. Seven streets on the south bank, east of Barbosa Avenue at the Israel-Bitumul neighborhood, Streets 10, 11, 12, 13, and Street 14 on the north bank at Barrio Obrero Ward, and Street Pachín Marín, and Streets 4, and 5 on the south bank at Hato Rey Ward, have residences also requiring demolition and service termination. Prior to initiating these activities, the affected service lines would be deenergized. Through service lines slated for termination would be relocated first; cable service to about 100 residential services would require demolition for any of the project channel alternatives.

Transportation and Navigation

Other temporary effects resulting from any of the project channel alternatives considered could include interference with navigation resulting from the barges carrying dredged debris and sediment laden scows transiting the San José Lagoon on their way to the San José Lagoon CAD and the CDRC staging area, respectively.

Transportation of debris for final disposal from the CDRC staging site to the Humacao Regional Landfill could also have temporary impacts on the Iturregui Avenue, which is a common access route for residences, the CDRC recreational complex and for the preferred staging/management area. An increase in traffic flow would be anticipated. Therefore, permits for traffic and safety may be required, along with implementing an approved access control plan to manage public access to the CDRC staging area and to the temporary docking area in the San José Lagoon.

4.12.1 No Action

No changes to land use and/or infrastructure would be anticipated as a result of the No Action Alternative. In terms of land use, the area along the Eastern CMP would continue to be of Public Domain. However, improper residential or waste disposal practices affecting the Eastern CMP might not be deterred without an improvement in the area’s environmental quality, thus facilitating or allowing the area to continue its degradation in terms of the efficient use of lands, open space, surface waters and other natural resources.

4.12.2 Tentatively Selected Plan

The TSP would cause fewer impacts to transportation than those from Alternative 1 and 3, although more impacts to navigation than those from Alternative 1. The TSP would cause fewer impacts to navigation than Alternative 3.

4.12.3 Alternative 1

Alternative 1 would result in more impacts to transportation than those that could be caused by the TSP, but not Alternative 3. Alternative 1 would require less material to be dredged, and thus, less debris to be hauled out of the Project Area for final disposal into the Humacao Regional Landfill. However, it would require additional trips to carry the articulated concrete mats that would be placed along the bottom and entire length of the Eastern CMP. Otherwise, any construction aggregates would have to be transported if the articulated concrete mats are to be made at the CDRC staging area.

Alternative 1 would produce fewer impacts to navigation than those expected by the TSP and Alternative 3, since the latest two would involve additional material to be dredged from the Eastern CMP, requiring more scow and barge trips to dispose off the dredged sediments and dredged debris, respectively.

4.12.4 Alternative 3

Alternative 3 would result in more impacts to transportation than those that could be caused by either TSP or Alternative 1. Alternative 3 would require more material to be dredged, and thus, more debris to be hauled out of the Project Area for final disposal into the Humacao Regional Landfill. Alternative 3 would also result in more impacts to navigation than those expected from the TSP and Alternative 1, since the latest two would involve less material to be dredged from the Eastern CMP, requiring less scow and barge trips to dispose off the dredged sediments and dredged debris, respectively.

4.13 SOCIOECONOMICS

NEPA provides no specific thresholds of significance for socioeconomic impact assessment. Significance varies, depending on the setting of the proposed action, but indirect effects may include those that are economic growth inducing and others related to induced changes in land use patterns, population density or growth rate (40 CFR 1508.27[a]) & 1508.8).

The socioeconomic data assess indicated that low income communities surround the project area, particularly eastern CMP and San Jose Lagoon. Potential impacts of alternatives on these communities and economic impacts are evaluated in the following sections.[23]

The project channel alternatives would provide opportunities for job creation in the surrounding communities associated with recreational fisheries, and other outdoor recreation related concessionaires. These alternatives would also have a positive economic impact on the municipality and the Commonwealth in terms of construction fees and corporate, individual and sales taxes. Indirect socioeconomic benefits from any of the project channel alternatives would include increases in property value in the nearby communities, flood reductions, as well as recreation benefits that local and non-local residents would experience.

However, significant adverse impacts due to implementation of any of the project channel alternatives would be expected as families would need to be relocated and infrastructure repaired or constructed. It is estimated that 434 structures would be acquired, resulting in a total of 390 relocations. Efforts would be made to relocate people to other areas within the same community. At the same time, strategies would be developed to maintain community cohesion and avoid fracturing communities, which have coexisted for decades in the area.

In fact, the non-Federal sponsor has promoted meaningful public participation since the beginning of the planning process to ensure that residents are not disproportionately impacted by any of the project channel alternatives (See Section 6.2.1 Public Involvement). It has been documented that environmental restoration projects inadvertently, have resulted in the displacement of the communities they were meant to serve (NEJAC, 2006). To safeguard the community from future displacement due to potential land value increase after the ERP, the non-Federal sponsor have worked closely with the community to create a land trust.

Temporary short term adverse, but not significant, impacts to water quality during dredging activities are anticipated from any of the project channel alternatives. Also significant, but temporary, adverse impacts are anticipated during the construction of any of these mainly due to interruption of services, such as energy and water service. The best measures to address potential services interruptions would be continuously worked with community residents to minimize impact.

Temporary or short term unavoidable impacts would occur on charter boat operator's income lasting over the construction period of any of the project channel alternatives. Charter boat operators would have to resort to other areas of the San José Lagoon or the SJBE where tarpons

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[23] The basis for the economic impact's jobs and income figures presented in the report were the industry multipliers published by the PRPB (PRPB, 2002). Government revenue was calculated by applying the corresponding effective average tax rates, including income taxes, sales taxes, and property and other municipal taxes to the construction expenditures. All figures are adjusted for inflation to prevent overestimation of benefits. RED impacts would only be for the period of construction.

may congregate and take advantage of sudden depths changes to feed (i.e. La Torrecilla Lagoon, Suárez Canal) as in the dredged pits that would be used to deposit the dredged sediments. It is important to notice that charter boat operators would be benefited in the long term by any of the project channel alternatives. The proposed partial filling of some of the artificial dredged pits in the lagoon to a depth of -16 feet would not cause permanent impacts to this activity since there would still be a substantial difference in depth between this area and that of its surroundings within the San José Lagoon. This depth would provide 10 feet of water under the halocline (-4 to -6 feet deep) for tarpon to traverse. As such, tarpon would still be able to use this depth difference in their advantage to ambush their prey, as it has been reported. In addition, significant improvements to submerged habitat conditions are expected, resulting in an increase in the number and diversity of potential nekton species upon which tarpon would prey, thus benefiting this sport fishery.

4.13.1 No Action

Adverse economic impacts to commercial and recreational fishing, tourism and land values in the communities within and immediately adjacent to the Project Area, and indirectly, in the Study Area would continue or worsen, particularly due to an increase in the severity to the exposure of health hazards and flooding, the degradation of the overall environmental health of the SJBE system, and the loss of new economic opportunities related to its sustainable development.

4.13.2 Tentatively Selected Plan

The TSP would have a positive impact on the nearby communities and significant economic benefits, both direct and indirect, are anticipated. Direct benefits would include 4,275 jobs to be created during construction. The TSP would provide the least socioeconomic benefits in terms of jobs creation and income among all of the project channel alternatives (see Table 4-6).

4.13.3 Alternative 1

Significant benefits to the community as a result of Alternative 1 would be similar to those described for the TSP. However, the 75-foot-wide channel would also result in slightly more jobs (4,525 jobs) and income from its construction than any of the other two project channel alternatives (see Table 4-7).

Table 4-6. Estimated economic benefits from construction of the TSP

Direct Jobs in Construction	1,881
Indirect & Induced Jobs in Construction	2,394
TOTAL CONSTRUCTION JOBS	**4,275**
Direct income	$ 45,665,037.00
Indirect and Induced Income	$ 52,058,142.18
Income from construction activity	**$ 97,723,179.18**
State construction permit	$ 855,521.19
Municipal construction taxes	$ 855,521.19
Municipal excise tax	$ 8,555,211.90
Personal income taxes from Construction	$ 6,674,493.14
Corporate taxes from Contractors	$ 2,566,563.57
Sales Taxes from Contractors	$ 4,446,404.65
Government Revenues from Construction	**$ 23,953,715.63**
Fiscal Revenue to Municipal Government	$ 13,857,137.74
Fiscal Revenue to State Government	$ 10,096,577.90

Source: Estimates by Estudios Técnicos, Inc. November 2014.

Table 4-7. Estimated economic benefits during contruction of Alternative 1

Direct Jobs in Construction	1,991
Indirect & Induced Jobs in Construction	2,534
TOTAL CONSTRUCTION JOBS	**4,525**
Direct income	$ 48,335,507.00
Indirect and Induced Income	$ 55,102,477.98
Income from construction activity	**$ 103,437,984.98**
State construction permit	$ 907,654.60
Municipal construction taxes	$ 907,654.60
Municipal excise tax	$ 9,076,546.03
Personal income taxes from Construction	$ 7,064,814.37
Corporate taxes from Contractors	$ 2,722,963.81
Sales Taxes from Contractors	$ 4,706,428.32
Government Revenues from Construction	**$ 25,386,061.74**
Fiscal Revenue to Municipal Government	$ 14,690,628.95
Fiscal Revenue to State Government	$ 10,695,432.79

Source: Estimates by Estudios Técnicos, Inc. 2014

4.13.4 Alternative 3

The construction of the 125-foot-wide channel would result in slightly more jobs (4,400 jobs) and income than the TSP, but less than those related to the construction of Alternative 1 (see Table 4-8).

Table 4-8. Estimated economic benefits from construction of Alternative 3

Direct Jobs in Construction	1,936
Indirect & Induced Jobs in Construction	2,464
TOTAL CONSTRUCTION JOBS	**4,400**
Direct income	$ 47,000,272.00
Indirect and Induced Income	$ 53,580,310.08
Income from construction activity	**$ 100,580,582.08**
State construction permit	$ 884,745.51
Municipal construction taxes	$ 884,745.51
Municipal excise tax	$ 8,847,455.07
Personal income taxes from Construction	$ 6,869,653.76
Corporate taxes from Contractors	$ 2,654,236.52
Sales Taxes from Contractors	$ 4,576,416.48
Government Revenues from Construction	**$ 24,717,252.84**
Fiscal Revenue to Municipal Government	$ 14,308,617.06
Fiscal Revenue to State Government	$ 10,408,635.78

Source: Estimates by Estudios Técnicos, Inc. 2014

4.14 HUMAN HEALTH AND SAFETY

Health and safety issues to the communities surrounding the CMP and San José Lagoon were considered. Health related water and air quality parameters were characterized for the Project Area and compared with available health criteria to quantify potential impacts under the project alternatives. Possible impacts resulting from potentially induced floodings are also discussed, as well as incidental flood reduction benefits.

Impacts are considered significant if they are shown to disproportionately impact the health and safety of low income or minority groups, if USEPA or other agency human-health and/or safety criteria are exceeded, including those specific to the health of children.

Section 4.4 of this DEIS discusses expected changes in hydrology and its effects on flood waters and tidal levels in the Project Area. Temporary impacts resulting from dredging works proposed by any of the project channel alternatives include a potential increase in flood risks to the communities contiguous to the Eastern CMP.

The temporary sheet pile wall that would be placed at the eastern face under the Martín Peña Bridge to control the dispersion of sediments from dredging works and to protect the pilings of the bridges could potentially increase flood levels during rain events. A 100-year storm event without storm surge would be the one that would most affect flood levels within the Eastern CMP as a result of the temporary sheet pile wall blocking the channel's flow. It would increase the water surface from 1.28 feet for the existing condition and 3.94 feet for the plugged condition, a change of 2.66 feet. To minimize the extent of floods during plugged conditions, the temporary sheet pile wall would be placed at an elevation that allows flood waters to overtop and flow west, but still high enough to limit or impede tidal flow into the Project Area.

During PED, a "sequence of events" based upon performance standards, must be established and incorporated into the construction contract documents. Flood risk from "plugged" conditions would also be addressed by keeping close coordination with the adjacent community to establish local emergency management strategies.

After construction of the channel, tidal amplitude within the CMP and the San José Lagoon would increase. The Lagoon's tide range is expected to increase 1.28 feet, from 0.33 feet preconstruction to 1.61 feet after construction. This represents a 0.64-foot increase to the high spring tide. Furthermore, tidal amplitude decreases from west to east. That is, increases are expected to be higher at the weir than at the San José Lagoon. The 0.64-foot increase is representative of conditions where the channel meets the lagoon. Surface elevations across the lagoon are expected to be somewhat lower.

Although no substantial flood risk reduction for the 100-yr flood with storm surge would be provided by any of the project channel alternatives, the 335 housing units that would be relocated by any of these would place the occupants of these structures out of danger. This would reduce the number of flood-prone structures for this type of flood from approximately 4,700 to 4,300. Such conditions entail that frequent or moderate floods, like the one experienced in 2011 under Hurricane Irene, as well as the 100-yr flood risk (without storm surge), would be substantially reduced. Damages and government expenditure on relief, along with frequent disruptions to schools, businesses, and residential daily life, would be reduced considerably.

Any of the project channel alternatives would enhance environmental conditions and the quality of life in all of the communities adjacent to the Project Area. Restoring conveyance flows through the CMP is one of the easiest and most secure ways of eliminating the pollution hazards associated to direct and indirect contact with its waters and its effects on the health of residents in nearby communities.

Under any of the project channel alternatives, prevalence rates of gastroenteritis, asthma in children, and atopic dermatitis in children are expected to drop to the Puerto Rico average, resulting in health care cost reductions of $775,927 per year (see Table 4-9).

Table 4-9. Health Care Costs Related to Three Common Health Conditions in the CMP Neighborhoods

Condition	CMP Prevalence	Puerto Rico Prevalence[1]	CMP Population	Costs per year[2] ($/case/ year)	Existing Population Affected	Existing Health Costs	Improved CMP Population affected[3]	Improved CMP Health Costs
Gastroenteritis	31%	21%	18,074	$325	5,603	$1,820,956	3,796	$1,233,551
Asthma (children under 5 years old)	44.5%	22%	1,046	$654	465	$304,417	225	$147,078
Dermatitis (children 5–9 years old)	35.3%	24.8%	958	$310	338	$104834	238	$73,651
					TOTALs	***$2,230,207***		***$1,454,280***

[1,2] Source: Puerto Rico Department of Health.
[3] Assumes prevalence rate drops to Puerto Rico prevalence rate.

No further impacts are expected from direct or indirect contact with the Project Area's waters as a result of any of the three project channel alternatives. On the contrary and as mentioned before, flow and the associated water quality improvements should reduce exposure to contaminants, pathogens and other water borne health impairments presently found in the Project Area due to its degraded condition. No permanent human health impacts are expected from the disposition of dredged sediments into the CADs. Dredged sediments would be capped to reduce possible contaminant migration into the water column. The CAD upper layer would also be found at -16 feet below the lagoon's surface, and thus, deep enough to prevent direct human contact with the dredged sediments.

Expected water quality improvements resulting from any of the project channel alternatives would improve fisheries habitat and would reduce the risk of contaminants in edible species consumed by fishermen. The effect upon shallow fisheries in the Project Area, which for the most part is for human consumption, would be very positive (Atkins 2011b). An increase in tidal flushing should effectively reduce concentrations of contaminants that presently should discourage fish consumption from the Project Area.

Section 4.6 of this DEIS detail expected impacts and the precautonary measures that would be adopted to protect nearby residents and workers due to the release of H_2S from proposed dredging works in the Eastern CMP.

4.14.1 No Action

Under the No Action Alternative, high-density land uses due to human encroachment on the formerly natural system would continue to expose the communities to health and safety concerns. Low income communities nearby the proposed dredging site would continue to experience highly disproportionate and adverse burden due to lack of water conveyance through the CMP and associated floodings. Poor water quality would continue, resulting in adverse impacts to resident's properties and health. Prevalence rates for gastroenteritis, asthma in children, and atopic dermatitis in children are expected to remain similar to today's rate. Chronic impacts due to the inhalation of high concentrations of H_2S in ambient air would continue to affect residents living close to the Eastern CMP.

4.14.2 Tentatively Selected Plan

Under the TSP, flood risk would be less than that resulting from Alternative 1 due to the larger channel conveyance, and therefore may improve health and safety to a greater extent, although not as much as that which would be provided by Alternative 3.

4.14.3 Alternative 1

Alternative 1 has less impact on flood reduction due to the smaller channel conveyance, and therefore may not improve health and safety to the same extent described for the TSP and Alternative 3.

4.14.4 Alternative 3

Under Alternative 3 flood risk would be reduced due to the larger channel conveyance, and therefore may improve health and safety to a greater extent than described for the TSP and Alternative 1.

4.15 RECREATION

The potential impacts of the project alternatives were evaluated based on how these would affect existing recreational areas or facilities within or adjoining the Project Area, and how new opportunities could result from project implementation within the Study Area. Impacts that provide or remove recreation opportunities are considered significant. In addition, recreation opportunities that would negatively impact the restoration goal of the ERP would be considered adverse.

Temporary adverse impacts include the partial displacement of the use of the San José Lagoon pits by tarpon (*Megalops atlanticus*) charter operators during construction. The artificial deep pits in the lagoon appear to be their main angling site for this species. The partial filling of some of the artificial dredged pits in the lagoon for the disposal of dredged sediments would not cause permanent impacts to this activity. These would be filled to a depth of –16 feet. As such, a significant depth gradient or difference in this area and that of its surroundings in the San José Lagoon would still remain, allowing tarpon to continue its use to ambush prey. Expected overall habitat improvements would lead to an increase in potential prey species, resulting in a long term beneficial impact to this activity.

4.15.1 No Action

Under the No Action Alternative, the restoration of the CMP would not be implemented. Residents would not have the opportunity to experience many of the potential outdoor benefits associated with a restored SJBE system. Limits to recreation opportunities for disadvantaged neighborhoods would persist, and access to the designated Public Domain Lands woulld continue to be limited to local neighborhoods.

4.15.2 Tentatively Selected Plan

The Federal recreation plan is considered an essential component of the ecosystem restoration plan as it provides for a significant increase in recreational opportunities along the CMP, as well as helping alleviate the historic primary cause of ecosystem degradation in the area. Most local resident anglers in the San José Lagoon target snook at locations along the periphery of the lagoon. Improvements to circulation that would benefit water quality of bottom waters are likely to benefit the fisheries targeted by local resident anglers by increasing the amount of bottom areas capable of supporting healthy biological communities (Atkins, 2011b).

The presence of recreation areas (e.g. water plazas) including the projected increased visitation to the CMP and the construction of the Paseo (a related project but not a part of the CMP-ERP), would help reduce the improper uses of the Eastern CMP such as the disposal of solid waste. Other related projects in the adjacent communities, such as the relocation of families and subsequent demolition of structures located in the public domain limit, and the improvements to storm water management infrastructure to reduce sedimentation, would address the other significant and historic causes of CMP's degradation. At the same time, these efforts help to ensure the restoration efforts in the CMP would be preserved after construction.

The linear nature of the project area provides recreational uses for all eight neighboring communities; careful placement of these measures throughout the project area is intended to protect the investment in ecosystem restoration by facilitating appropriate uses of the Project Area. This approach facilitates the creation of larger, uninterrupted restored ecosystems, allows for easy access for project maintenance, and discourages improper and unmanaged uses of the area. It also aids education programs in increasing the environmental stewardship of this urban wetland. For example, improved and formalized access to the CMP through the water plazas and the resulting community engagement would facilitate strict enforcement of trash-dumping regulations and incentivize local conservation, thus avoiding future degradation in the process.

Provision of recreational access infrastructure has been demonstrated to foster community connection to the restored ecosystem and build and maintain a positive connection to their local landscapes (Golet et al, 2006; Ulrika Åberg & Tapsell, 2013). Additionally, increases in recreational activities such as wildlife viewing and fishing often translate to increases in support for conservation actions (Ulrika Åberg & Tapsell, 2013). These activities provide the basis for new and existing community-based enterprises to flourish (e.g., Excursiones Eco, Bici-Caño).

Temporary unavoidable impacts would occur in the recreational tarpon fishery in San José Lagoon, which is focused on the areas of the subaqueous artificial dredged pits, as described in the Socioeconomics section of this Chapter.

4.15.3 Alternative 1

Recreation benefits under Alternative 1 are the same as those described for the TSP. The width of the channel is not anticipated to affect the recreation benefits.

4.15.4 Alternative 3

Recreation benefits under Alternative 3 are the same as those described for the TSP. The width of the channel is not anticipated to affect the recreation benefits.

4.16 CULTURAL RESOURCES

Impacts to cultural resources would be considered significant if cultural resources listed or that are eligible for listing under the National Register of Historic Places (NRHP) are found in the Project Area and would be affected by any of the alternatives evaluated.

The Project Area was evaluated with respect to the potential presence of cultural and/or historic resources and the potential impacts that may occur as a result of project alternatives. Impacts to these resources can result from dredging, placement of dredged material, and direct or indirect disturbance during construction. Presence of resources would require coordination with appropriate agencies to determine proper actions and may include relocation, repatriation, recovering, or otherwise ensure proper management.

Results of site evaluations indicate that there is low potential to find cultural or historic resources in the Project Area due to its modifications and impacts. Consequently, adverse impacts to cultural resources due to dredging or sediment disposal from any of the project channel alternatives are not anticipated.

To protect the base of the Martín Peña Bridge, the CMP section under the bridge would be constructed under all three project channel alternatives to a width of 115 feet and a depth of 6.5 feet msl. Riprap would be placed on the side slopes, and permanent sheet pile walls, as well as the construction of a weir would protect the bridge’s pilings. Photo-documentation would be recorded for this historic bridge.

Construction activity monitoring for additional resources would be implemented during construction of any of the three project channel alternatives to ensure that, if additional cultural resources are found, they are identified and managed consistent with state and federal regulations. A field archeologist (full-time), aided by a supervising archeologist (part-time), would be employed to monitor construction activities near the bridge, as well as to monitor for cultural resources as each clamshell bucket of dredged material is laid onto the screen during the construction (dredging) process.

If historic material is encountered, work in the immediate vicinity would halt until the SHPO, USACE, and the Institute for Puerto Rican Culture (IPRC) could be notified, and approval was given to proceed. Dredging could, however, shift to another area provided archeological monitoring occurs to avoid a stop-work situation. Evaluation of three to four areas from the deepest sediments in the Eastern CMP to identify debris that may be considered of historical value is also recommended (Vélez Vélez, 2001; Vega 2002).

4.16.1 No Action

No additional investigations for cultural resources in the Project Area would be undertaken, avoiding any possible discoveries and salvage of any artifacts that may merit protection. No disturbance to the Project Area's cultural resources would occur, although degradation of any possible cultural resources still unknown would continue to take place since these would remain in place.

4.16.2 Tentatively Selected Plan

Impacts to cultural resources are not anticipated under the TSP. The 100-foot-wide channel would require dredging a wider channel cross section than that for Alternative 1, leading to possible impacts of any undiscovered artifacts during construction, but also allowing their detection and salvage.

4.16.3 Alternative 1

Impacts to cultural resources are not anticipated under Alternative 1. The 75-foot-wide channel would require dredging a narrower channel cross section, reducing the possibility of impacts on any undiscovered artifacts during construction, when compared to the TSP and Alternative 3. However, dredging a narrower channel would also reduce the possibilities of finding any unknown cultural resources, and thus, their salvage.

In addition, Alternative 1 would require the project channel bottom to be paved with articulated concrete mats, significantly limiting the possibility to conduct future studies of the Eastern CMP in search of any buried cultural resources.

4.16.4 Alternative 3

Impacts to cultural resources are not anticipated under Alternative 3. The 125-foot-wide channel for this alternative, however, would require dredging a wider channel cross section, thus increasing the possibility of impacts on any undiscovered artifacts during construction, when compared to the TSP and Alternative 1. On the other hand, dredging a wider channel would also increase the possibilities of finding any unknown cultural resources, and thus, their salvage.

4.17 AESTHETIC RESOURCES

Impacts to aesthetic resources entail visual impairment of the local landscape as a result of the proposed project. All the project channel alternatives are expected to improve aesthetic resources in the CMP and San José Lagoon.

The improved landscape and water quality in the CMP and San José Lagoon would offer a scenic oasis within the urban landscape. The increased mangrove acreage fringing the lagoons, as well as the additional open water habitat, would offer a pleasant contrast against the urban backdrop of the densely populated SJMA.

The CMP-ERP would greatly enhance the visual quality of the CMP for the entire community. Major vistas from the four bridges would be restored and improved under this project. The proposed project would create access to the water, providing users with long views of the CMP and its surroundings. When completed the visual quality for the user, both waterside and landside would be greatly improved. Walking or driving along the Paseo, the user would enjoy the newly established mangroves that would serve as shelter habitat for birds, fish and other species.

4.17.1 No Action

Current visual impairment would continue in the CMP and the San José Lagoon. The limited access to the CMP would continue to favor its use for illegal dumping, which coupled with decades of filling with various vegetative and non-vegetative materials, would continue to negatively affect the view to the CMP. The views into the existing mangroves would further be adversely impacted by abandoned structures, garbage, and general debris. The quality of the views from within the CMP would be progressively compromised by the lack of definition of the channel and debris that has collected under the mangroves and upland areas.

4.17.2 Tentatively Selected Plan

The TSP's improvements to the CMP, including its recreational features, would positively alter the visual quality of the CMP. The proposed actions offer the community new open spaces suitable for the appreciation of an enhanced ecological scene. Projected improvements to the CMP and the adjacent community projects would restore the mangroves, remove debris from illegal dumping, and connects the CMP to the community trough the Paseo, street improvements, and activity nodes.

Careful placement of recreational features not only would contribute to the protection of the restored ecosystem, but also would provide access to panoramic views, transforming the actual scenery. The removal of the 336 structures within the CMP would eliminate visual obstructions directly adjacent to the Project Area. This would provide a public corridor parallel to the CMP, creating a buffer or separation from private property. The CMP is naturally located at the lowest point within the community; this creates long uninterrupted views of the facility from the local streets as they transverse the topography down towards the CMP.

4.17.3 Alternative 1

Visual and aesthetic benefits would be similar to those achieved by the TSP.

4.17.4 Alternative 3

Like Alternative 1, visual and aesthetic benefits would also be similar to those achieved by the TSP.

4.18 CUMULATIVE IMPACTS

The Council on Environmental Quality (CEQ) defines a cumulative impact as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time” (40 CFR §1508.7). Therefore, individual actions can produce interrelated, compounded effects that can lead to significant benefits or impacts on single or various resources if carried out within a relatively short time frame and/or when developed over a related and clearly defined environmental setting.

The proposed analysis seeks to determine the cumulative effects or impacts from the CMP-ERP, in combination with past, present, and other reasonably foreseeable future projects within the SJBE.

4.18.1 Cumulative Impact Assessment Methods

The cumulative impact assessment for the CMP-ERP was conducted for the Study Area (the waters within the SJBE, their associated wetlands, and immediately adjoining communities, unless otherwise noticed). This area is anticipated to experience most of the significant effects and impacts dealing with the proposed tidal, water flow, and habitat restoration actions.

There are eight (8) plans/projects that have been completed, are underway, or have been proposed by Commonwealth or Federal agencies that could have a significant effect over parts of the SJBE and its immediate uplands. These have been selected in order to evaluate their cumulative effects or impacts and are briefly discussed in the following section, including:

- Foreseeable actions, such as, the CMP Special District Plan (CMP District Plan) and the SJBEP-CCMP.
- Past and Present Actions, which include: San Juan Harbor Project, the Comprehensive Development Plan for the Cantera Península (Cantera Plan), Río Puerto Nuevo Flood Control Project, Agua-Guagua (AcuaExpreso) Project, and the Juan Méndez Creek Flood Control Project.

Many aspects of the reasonably foreseeable plans/projects are planned, but do not have definitive implementation schedules due to a variety of factors, including funding constraints. The cumulative impact assessment was conducted based on the general assumption that these plans/projects would move forward over the next 1 to 3 years. Best professional judgment was relied upon for cumulative impact assessment to a greater extent than the impact analyses for the CMP-ERP, because information on other projects was based entirely on the limited information available in the public domain, and the inherent uncertainty of estimating the possible combined, future effects of projects conceptually, temporally, and spatially dissimilar. No attempt was made to verify or update documents available on the reviewed projects and no field data were collected to verify the impacts described in the available documents.

Table 4.10 summarizes the potential cumulative effects and impacts that would be anticipated from the CMP-ERP and from the other eight plans/projects identified for the Study Area. These were first evaluated for their individual effect on each of the topics or resources used to compare the environmental effects (e.g. climate, water, and sediment quality, etc.) of the four project alternatives analyzed for the CMP-ERP. Based on the expected environmental consequence or response, a grade was allocated to each plan/project [beneficial or positive (+); adverse or negative (-) or negligible (N)]. A qualitative assessment was then provided on the cumulative effects or impacts that all of the plans/projects are estimated to cause on these topics or resources. It should be noted that all three evaluated plans (CMP District Plan, Cantera Plan, and the SJBE-CCMP) include the CMP-ERP as a proposed action, as well as similar infrastructure improvements commitments to control of untreated sewage discharges under the Consent Decree signed by PRASA and the USEPA. The CMP-ERP and those infrastructure improvements related to the Consent Decree were excluded as if these were not proposed under the CMP District Plan, the Cantera Plan, and the SJBE CCMP to avoid "double counting" their anticipated cumulative effects or impacts to the Study Area.

The following section includes a brief presentation on the eight plans/projects identified and selected for the cumulative impact assessment, in addition to a description on the most notable anticipated effects or impacts resulting from their implementation and how these compare or interrelate with those from the CMP-ERP.

4.18.2 Past, Present, and Reasonably Foreseeable Future Actions

4.18.2.1 CMP Special District Plan

In 2001, the Puerto Rico Department of Transportation and Public Works (DTPW) assumed the inter-agency leadership of the CMP dredging and established what became the Caño Martín Peña ENLACE Project (ENLACE Project) under the Puerto Rico Highway and Transportation Authority (PRHTA). On May 17, 2002, the Puerto Rico Planning Board (PRPB) designated the CMP Special District (District) and delegated the elaboration of the District's Land Use and Comprehensive Development Plan (District's Plan) to the PRHTA. The District includes the following seven communities: (1) Barrio Obrero (West and San Ciprián); (2) Barrio Obrero-Marina; (3) Buena Vista-Santurce; (4) Parada 27; (5) Las Monjas; (6) Buena Vista-Hato Rey; and (7) Israel-Bitumul (see Figure 3).

The CMP's dredging, channelization, and ecosystem restoration is one of the principal elements of the District Plan. It also integrates the design and implementation of strategies before, during, and after the channel's dredging and restoration phase in areas such as the environment, infrastructure, housing development, family relocation, urban revitalization, land tenure, and socioeconomic development.

The District's Plan focuses its vision, goals, and policies on four principal areas: (1) environment; (2) socioeconomic development; (3) institutional capacities; and (4) mobility, transportation, and tourism development. It included the following relevant critical components:

- The CMP-ERP with a recommended channel configuration alternative of a 150-foot width and a depth of 10 feet following the existing channel alignment, as a reference for the future establishment of the MTZ-CMP and for the relocation and infrastructure strategies.
- A mangrove conservation area within the MTZ-CMP along the proposed channel.
- Recreational access areas, proposed as formal interaction public spaces between the CMP and its users located within the conservation area. They are critical to avoid disturbance to the mangroves and as recreational components that would also provide the District with economic development opportunities.
- The Paseo del Caño, a proposed street along the MTZ-CMP as a public space that separates the eight communities from the CMP and its mangroves and prevents future encroachment. It also provides a bicycle lane and pedestrian amenities, as well as access to the recreational access areas.
- A relocation plan as required under the Uniform Relocation Act of Assistance and Real Property Acquisition Policies Act as amended, P.L.91-646; 42 U.S.C 4601 et seq. (URA).
- Construction of new housing units and rehabilitation of existing ones, primarily to provide relocation alternatives within the District.
- Construction of critical infrastructure and relocation of several infrastructure facilities, including 66-inch-diameter San José and Rexach sewer trunks, the 36-inch-diameter Borinquen water distribution line, and the 115-kV power transmission line.

- New streets to provide for public space that can be used to locate critical infrastructure, as needed to address the lack of sewer systems.

The following initiatives are or have been implemented by ENLACE itself or by other entities or Commonwealth agencies, most under the coordination of ENLACE:

- Acquisition of 98 structures to date within the MTZ-CMP, which includes the relocation of 55 eligible occupants, and demolition of structures. All acquisition and relocation efforts have been made in compliance with the URA, as required under PR Law PR 2004-489. Together with the efforts of the Cantera Company, the Israel-Bitumul CHDO, and the PRHTA, approximately 500 households have been relocated from the MTZ-CMP and adjacent areas and the remaining 336 structures located within the MTZ-CMP still need to be acquired. No more than 5 percent of the total remaining relocations are expected to be mandatory, with the remaining relocations to be voluntary. Real estate acquisitions in other areas of the District, and housing rehabilitation to serve as relocation opportunities within the District.
- One-on-one orientation to families living within the MTZ-CMP in the District.
- Design of improvements to the San José Trunk in the segment within the Israel-Bitumul communities. The project will be built by the Puerto Rico Aqueduct and Sewer Authority (PRASA).
- Development of the FR/EIS for the CMP-ERP.
- Design of the Israel-Bitumul segment of the Paseo del Caño, the street along the MTZ-CMP was designed, in part, to prevent future encroachment of the CMP.
- Environmental awareness activities targeting mainly school children.
- A microbusiness incubator that provides support to recycling and ecotourism community owned businesses.
- Relocation of the Barbosa Bridge over the CMP, elevating it to allow access for the barges, as part of the future CMP dredging (PRHTA).
- Two surface debris clean-up activities in areas adjacent to the CMP, which resulted in the removal of over 885 tons of debris and the recuperation of over 1,500 pounds of recyclable material.
- Construction of the Barrio Obrero Marina vacuum sewer system, north of the CMP. Evaluation of alternatives for the relocation of the San José and Rexach 66-inch-diameter sewer trunks and the Borinquen 36-inch-diameter potable water distribution line (PRASA).
- Conceptual design for a sewer system in northern Israel-Bitumul (PRASA).
- Delineation of the public domain lands associated to the MTZ-CMP within the District (DNER).

The activities and projects being implemented by ENLACE are vital to the success of the CMP-ERP. Is important to continue with the public outreach campaign to inform and educate the public of the importance of a healthy ecosystem in the area, discouraging future secondary effects that could occur. Utility and other infrastructure improvements that have been conducted are also vital, and debris removal, sewer construction and other activities guarantee the effectiveness of the CMP-ERP. Additionally, the *Fideicomiso de la Tierra del Caño Martín Peña*, a community land trust, was created under PR Law 489-2004 to prevent gentrification as a result of the CMP-ERP.

The strategies and actions proposed under the CMP Special District Plan, besides those already included under the CMP-ERP, would help improve the natural environmental quality in the Eastern CMP and that of its adjacent, built-up lands. Reconstruction and upgrades proposed for the area's infrastructure (i.e., storm and sewage system) would help further maintain those improvements expected from the CMP-ERP (e.g., water quality) into the future. Earthwork activities involving removal and placement of fill would probably be required for the foundations of the Paseo del Caño roadway. These works would be performed outside of the CMP-ERP footprint and, thus, would not be part of the Federal Project. An elevated road could perform as an inland levee, depending on how high or elevated it is finally designed. Thus, it would help control flood waters rising from the dredged channel and its fringing mangroves that would be restored as part of the restoration project, protecting adjacent communities from these floods. However, if the elevation of the Paseo del Caño is higher than that of nearby areas, it could impact adjacent structures and cause runoff waters to pond in low-lying areas. This would require additional infrastructure measures to address this potential problem.

4.18.3 San Juan Bay Estuary CCMP

As discussed in Section 1.5, the SJBE Program completed a Comprehensive Conservation and Management Plan (CCMP) for the SJBE system on August 2000. The CCMP is a long -term plan that contains 49 specific actions designed to address: (1) water and sediment quality; (2) habitat, fish, and wildlife; (3) aquatic debris; and (4) public education and involvement solutions to the estuary's priority problems. Nine actions dealing with water and sediment quality improvements were identified as high priority or "urgent", as they "deserve immediate attention and should be initiated as soon as possible or within 0-5 years after CCMP approval" (SJBEP, 2000). Three of these actions are directly related to the CMP-ERP and include:

- Action WS-2: Relocate families living adjacent to the CMP
- Action WS-5: Improve flow in the Martín Peña Channel
- Action WS-6: Fill artificial depressions at the Suárez Canal and at the San José and La Torrecilla lagoons

The SJBE Program is one of the main partners of the ENLACE Project Corporation and is part of the Technical Committee for the CMP-ERP. The CCMP, besides proposing the restoration of the CMP includes other actions that would help further and maintain those benefits expected from the CMP-ERP. Both initiatives would help support each other environmental restoration and enhancement efforts.

4.18.4 PRASA-USEPA Consent Decree

In June 2006, the USEPA issued a Consent Decree stating that PRASA must spend an estimated $1.7 bmillion dollars in capital improvement projects to improve wastewater infrastructure in Puerto Rico, in order to comply with the Clean Water Act (CWA). Some of these improvements involve wastewater management works to address By addressing combined sewer system (CSS), combined sewer system overflow (CSO), and direct household discharges in the CMP, and whose need has been identified and proposed PRASA would improve wastewater management in the CMP Planning District , under the CMP Special District Plan and the CCMP.and further ensure compliance with the USEPA's Consent Decree.

Some of these infrastructure improvements would take place concurrently with the CMP-ERP and would be completed prior to finalizing the Federal project. For example, by June 2019 and in accordance with special condition No. 3 of the Consent Decree, PRASA would have constructed and completed capital improvements to replace, repair and upgrade the collection and wastewater treatment system in the Ponce de Leon Ave. area of San Juan of not less than $10M, to remedy and prevent direct discharges to the CMP. The Ponce de Leon Ave. sewer separation project is a combined storm water and wastewater system that discharge combined wet weather flows into the Martin Peña Channel, immediately west of the Martín Peña Channel Bridge, and thus, within the Project Area. The existing combined flow channel is approximately 10,700 feet, located in the center of Ponce de León Ave., which runs through a mainly business and commercial area within a heavily congested arterial (PRASA, 2014).

These works, which are also related to similar infrastructure improvements proposed as part of the CMP Special District Plan and the CCMP, would take place prior or concurrently with the CMP-ERP and would be completed prior to finalizing the ERP. Once these and other discharges are addressed, water and sediment quality impairments would be reduced, helping to enhance water quality within the CMP. Further improvements, however, would still be dependent on the CMP-ERP.

4.18.5 San Juan Harbor Project

San Juan Harbor, which is part of the SJBE system, has the Commonwealth's main port, handling over 15 million tons (or 80%) of waterborne commerce, moving through the harbor annually.

The San Juan Harbor Project (SJHP), west of the CMP, is a completed Federal Deep Draft Navigation Project with congressional authorizations dating back to 1917, the most recent included in the Water Resources Development Act (WRDA) of 1996, to deepen the navigation channels. The current project consists of a Bar Channel with depths from 56 to 49 feet, a 40-foot-deep Anegado entrance channel, a 40-foot-deep Army Terminal Channel, a 39-foot-deep Puerto Nuevo Channel, a 34-foot-deep Sabana Approach, a 36-foot-deep Graving Dock Channel, a 30-foot-deep Graving Dock Turning Basin, a 36-foot-deep San Antonio Channel, a 30-foot-deep extension to the San Antonio Channel, two 30-foot-deep Cruise Ship Basins, a 36-foot-deep Anchorage Area E, and a 30-foot-deep

Anchorage Area F. Maintenance dredging works of the navigational channels is performed on a regular basis. The basic channel structure of the SJHP is complete; however, there may be requirements in the future for basin or wharf improvements or modifications.

Dock and storage facilities in the San Juan Bay (SJB) led to the elimination of almost all of the mangrove basin forests that existed in this waterbody, such as those associated to the outlets of the CMP, the Puerto Nuevo River, and the San Fernando Channel, and especially those that used to fringe the San Antonio Channel, including most of what is today the Isla Grande Península. Dredging works have caused the temporary resuspension of sediments and concomitant impacts to the Bay's water quality, including the mechanical destruction of benthic communities. The USACE has proposed to mitigate the latest impacts to submerged aquatic vegetation by filling two artificial dredged pits in the Condado Lagoon in order to promote its restoration with seagrasses (USACE, 2014; Tetra Tech, 2011)

Overall, beneficial effects resulting from the CMP-ERP are anticipated within San Juan Harbor. The CMP-ERP would help offset some of the SJHP short and long term impacts of the ports operations and maintenance by restoring over 34 acres of mangrove forests and 25 acres of open waters along the Eastern CMP, and improving overall water quality and benthic habitat conditions within the SJBE.

4.18.6 Comprehensive Development Plan for the Cantera Península (Cantera Plan)

The Cantera Península is a low-income community located on approximately 290 acres at the north and eastern boundary of the CMP, in the Municipality of San Juan. It is bordered on the north and east by the San José Lagoon and on the south by the CMP.

This community initiated a comprehensive redevelopment with participation of the private sector and the Consejo Vecinal de la Península de Cantera, a grassroots organization that today is part of the G-8, Inc. These efforts continue and strengthened with the approval of Law 20-1992, as amended, which created the Company for the Comprehensive Development of the Cantera Península (Cantera Company). In 1995, the PRPB adopted the Comprehensive Development Plan for the Cantera Península (Cantera Plan), which includes the following projects, many of which have been implemented:

- Relocation of most of the residents of the Cantera Península living along the public domain lands in the Eastern CMP;
- Development of several housing projects to allow for relocation alternatives within the community;
- Construction of a vacuum sanitary sewer, as well as other vital infrastructure, and the first segment of the Paseo del Caño.

The portion of the CMP south of the Cantera Península and north of the Israel-Bitumul neighborhood is the most affected by accumulation of trash and debris, and encroachment. The future without-project condition and CMP-ERP design assume that the relevant aspects of Cantera Peninsula project are fully implemented. If the remaining features are not constructed, there should be little to no impact on the physical features of the Project and no diminution of benefits.

East of the Cantera Península is a small haystack hill located north of the eastern end of the CMP, named Guachinanga Islet. It used to be surrounded by waters from the San José Lagoon, but debris and sedimentation closed the small channel that separated it from the Cantera Península. Guachinanga is a roosting site for coastal birds and is home to a very unique biodiversity in the midst of the SJMA, in part because of its isolation. The Cantera Company has organized several cleanup activities in the Guachinanga Islet and is currently working together with the SJBE Program in the restoration of the small channel that separated Guachinanga from the Cantera Península.

The strategies and actions proposed under the Cantera Plan, as with the CMP Special District Plan, would help improve the natural environment in the Eastern CMP and that of its adjacent, built-up lands.

4.18.7 Puerto Nuevo (Río Piedras) River Flood Control Project

The Puerto Nuevo River Flood Control Project, currently under construction, is located on the north coast of Puerto Rico within the SJMA. The Puerto Nuevo River (Río Piedras) used to flow into the SJB, and now flows into the western end of the CMP. The Survey Report for the flood control project was completed in October 1984 and revised in June 1985. The Chief of Engineers Report is dated April 25, 1986. Project construction was authorized under Section 202 of WRDA 1986 (PL 99-662). Improvements to the CMP were not included as part of this authorization.

The Puerto Nuevo River basin drains 25 square miles, 75 percent of which is highly developed with a population of approximately 250,000 inhabitants. Rapid upstream runoff, inadequate channel capacity, constriction at bridges, and elimination of the flood plain by urbanization cause severe flooding to approximately 7,500 residents and 700 commercial and public structures valued at over $3 billion. These include important transportation facilities, as well as major public works complexes and strategic water, sewer, electrical power, and telephone services.

The flood control project, as currently proposed, seeks protection against the 100-year flood (the flood with a 1 percent likelihood of occurring in any year) through the construction of 1.7 miles of earth lined channel, 9.5 miles of concrete lined channels (5.1 of which are high velocity), and two debris basins in the Puerto Nuevo River and its tributaries. The plan also requires the construction of five new bridges, the replacement of 17 bridges, and the modification of eight existing bridges. The project eliminated 20.5 acres of mature mangrove wetlands and the affected area included the Constitution Bridge mudflat and mangroves, a Commonwealth designated Critical Coastal Wildlife Habitat. The project proposed a 30 acres wetland mitigation project (U.S. Department of the

Interior, 1994). The 1984 Survey Report associated with this project effort states that elevated levels of contaminants were found in the waters of the project site. Solid waste and sediments were also found at the site; however, these were not deemed hazardous and were disposed at the ocean in the USEPA-approved ocean disposal site in San Juan, pursuant to Section 103 of the CWA.

Concerns have been expressed over whether the construction of the Puerto Nuevo River Flood Control Project, as currently conceptualized (e.g. construction of enlarged, paved, high velocity channels) might have detrimental effects on the CMP-ERP. It is understood that the Corps modeled 10 scenarios resulting in hydrologic and water quality changes as part of the Hydrodynamic and Water Quality Model Study conducted for the SJBE Program in 2000. At least one of the scenarios, with a comparable configuration as the TSP for CMP-ERP, did not point to problems or issues such as backflow into the San José Lagoon, or significant increases in flood levels to those communities fringing the Eastern CMP. The model showed that levels in the San José Lagoon increased due to tidal influence.

It is recommended that this and other modeling conducted as part of the Puerto Nuevo Flood Control Project be further reviewed to determine if the simulations accounted for the Eastern CMP's proposed configuration, if there are any problems or issues such as backflow into the San José Lagoon, or a significant increase in flood levels resulting from the Puerto Nuevo Flood Control Project that would affect those communities fringing the Eastern CMP or others nearby once it is dredged. Dependent upon the results of the review, further modeling may be warranted.

The 9.5 miles of concrete lined channels (5.1 of which are high velocity) to be built along the Río Piedras River and some of its tributaries, as currently proposed under the Puerto Nuevo Flood Control Project, would eliminate most of the ecological services associated to the habitats on its earthen riverbed and banks. This would greatly diminish the river's capacity to sustain fish and wildlife, substantially affecting its water quality and hydrologic regime, impoverishing those opportunities for the development of outdoor recreational amenities related to these resources, while degrading its aesthetic values (Lugo, Ramos-González, and Rodríguez- Pedraza, 2011). The project could also cause significant impacts to cultural resources. [24]

The CMP-ERP could help offset some of the impacts associated to a reduction in forest cover (i.e. riparian corridors) and the degradation of water quality; the latest at their common outlet towards the SJB. These benefits, however, would be minimal since the ecosystems affected by the CMP-ERP

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[24] Concerns regarding the project's impacts on structures of cultural or historic structures include those associated to the nineteenth century Río Piedras Old Aqueduct's low-water dam and valve house, its gravity-operated sedimentation/filtration tanks or ponds, and the site's historical integrity consisting of maintenance, storage and administrative buildings. The Río Piedras Old Aqueduct is believed to be the only known Spanish-period aqueduct in existence in all of the United States and its territories. The Department of the Interior's National Park Service has included this site in the National Register of Historic Places since 2007. It was designated by the National Trust for Historic Preservation as a National Treasure in 2014. Retrieved online from http://www.paralanaturaleza.org/antiguo-acueducto-eng/

and the Puerto Nuevo Flood Control Project differ substantially, especially when considering those present and that would be impacted by the latest in upper reaches of the Río Piedras River.

4.18.8 AguaGuagua Project (AcuaExpreso)

In 1982, the DTPW requested the USACE to conduct engineering and design studies for a waterway along the western half of the CMP, from the SJB to the Hato Rey Financial District, as part of the mass transportation Agua-Guagua Project. A Final Report was completed in August 1983. The Urban Mass Transit Administration provided funding for this project.

Construction began in 1984 and was completed in 1988 at a cost of $20 million. Work consisted of dredging the western CMP to a dimension of 200 feet wide and 10 feet deep, ocean disposal of over 1.3 mcy of material dredged from the channel, and construction of 13,000 feet of concrete retaining bulkhead. Docking facilities were designed and built by the Commonwealth of Puerto Rico. The completed mass transportation waterway project was inaugurated in March 1991. The Agua Guagua (now AcuaExpreso) Project created substantial environmental and recreational benefits along the western half of CMP in addition to its use by the public as a transportation system. The Enrique Martí Coll Lineal Park was built above the bulkheads along the northern shore of the CMP, connecting the Hato Rey Financial District to the Parque Central. A pedestrian bridge to cross over the CMP, next to the AcuaExpreso docking facilities in Hato Rey, was also built. The infrastructure associated with this project was considered in the CMP-ERP FR/EIS as increased tidal flows through the entirety of the CMP may affect it.

In section III.A.5 of the 1983 EIS, it is stated that the western CMP had been plagued by water quality problems, mostly due to the construction of structures over the water, untreated wastewater discharges, and garbage and debris disposal. Elevated levels of contaminants were also found from water samples taken in this area. Even though contaminants were found in the western CMP, the report states that dredged material would be preferably disposed at the ocean (given that requirements of Section 103 of the CWA were met), while non-dredging waste would be disposed in the municipal dump. Upon completion of appropriate testing, dredged sediments were in fact disposed of in the ocean, while solid waste was disposed of in a landfill.

The CMP-ERP would further those benefits that resulted from the Agua-Guagua (AcuaExpreso) Project in terms of tidal flow and water quality improvements, and mangrove habitat restoration, finally reconnecting the SJB and the San José Lagoon. Navigation by small vessels would be possible across the CMP, and as a result, through most of the SJBE, once the CMP-ERP is completed.

4.18.9 Juan Méndez Creek Flood Control Project

Juan Méndez Creek, whose outlet originally discharged into the eastern end of the CMP, is a small drainage system lying within one of the most densely developed residential sectors of San Juan. Prior to constructing the flood control project, encroachment on the creek by informal settlements and fill deposition, as well as a lack of maintenance of the upstream channel led to the formation of a shoal at the mouth. This shoal impeded drainage and became colonized by mangroves. It became a major cause of upstream flooding and associated health hazards to the occupants of 290 residential and commercial structures near the creek's outlet. It extended about 1,640 feet upstream from the outlet at San José Lagoon, with an average depth of about 3 feet in this area.

The project for the clearing of the Juan Méndez Creek outlet was conducted under the authority of Section 208 of the Flood Control Act of 1954, as amended. The Municipality of San Juan was the non-Federal sponsor for the project. During the 3 years prior to construction of the project, the Municipality of San Juan invested $2.5 million to relocate 35 families that were living in areas required for construction and maintenance. The project consisted of removing the existing shoal to restore the natural channel cross section. Excavation work was performed by a long arm backhoe working from the southeast channel bank. Channel cleaning activities generated about 15,700 cubic yards of dredged material that was hauled by truck to a sanitary landfill. Also, the creek's outlet was rerouted through the excavation of a trapezoidal channel with an average top width of 89 feet and a depth of 3.3 feet. Now, the creek runs south and parallel to the CMP for about 1,214 feet into the San José Lagoon (USACE, 2004).

Sediment inputs from this creek have the potential to affect the eastern outlet of the CMP into the San Jose Lagoon. Flood waters discharged by the Juan Méndez Creek, however, would be able to exit the San José Lagoon more easily through the SJB by means of the restored CMP.

Table 4-10. Cumulative Impacts Summary (N: negligible)

TOPIC / RESOURCE	PLANS/PROJECTS IN THE STUDY AREA									Qualitative Summary of Cumulative Effects or Impacts
	CMP ERP	CMP Special District Plan	SJBE CCMP	San Juan Harbor Project	Cantera Península Plan	Puerto Nuevo Flood Control Project	Aqua-Expreso Project	Juan Méndez Creek Flood Control Project	PRASA USEPA Consent Decree	
Climate	+	N	+	N	N	-	+	N	N	Temporary fossil fuel emissions generated by construction equipment (e.g. machinery). Otherwise, most of these projects would improve or maintain adequate ambient temperatures due to an expected net increase in forest cover and/or green spaces, or from the designation of natural protected areas. Resulting vegetated areas would help remove and sequestered greenhouse gases such as carbon dioxide (CO_2). Infrastructure improvements built to collect and treat sewage discharges would also help ameliorate localized hydrogen sulfide (H_2S) and methane (CH_4) emissions.
Geology	N	N	N	N	N	N	N	N	N	Mining and extraction of aggregates (e.g. rock, sand) and other minerals from the Earth's crust for the production of materials to be used in the development of these projects. Digging or blasting of rock is required in some of the projects involving dredging works. However, the underlying geology in the Study Area is not expected to be significantly altered by the collective impacts of these plans/projects.
Soils	+	N	+	N	N	-	+	+	+	A cumulative beneficial effect is expected. A positive effect would be derived from those plans/projects that require the removal of soils formed through the deposition of unsuitable fill, construction debris, and/or domestic trash. Soils would also be maintained, enhanced or protected by those plans/projects that entail the designation of natural protected areas or the creation of green spaces, as well as those that would include infrastructure upgrades to control the discharge of pollutants. Impacts are expected from those plans/projects involving concrete, flood control channels. The latest would require the excavation of potentially fertile soils in areas within and adjacent to stream and river channels, paving and isolating those that would remain underneath by the construction of a concrete channel.

TOPIC / RESOURCE	PLANS/PROJECTS IN THE STUDY AREA									Qualitative Summary of Cumulative Effects or Impacts
	CMP ERP	CMP Special District Plan	SJBE CCMP	San Juan Harbor Project	Cantera Península Plan	Puerto Nuevo Flood Control Project	Aqua-Expreso Project	Juan Méndez Creek Flood Control Project	PRASA USEPA Consent Decree	
Hydrology	+	N	+	-	+	-	+	+	N	An overall beneficial effect is estimated. Most of the plans/projects include actions towards restoring water conveyance capacity within or from discharges into the Study Area through the removal of severe artificial flow constrictions. Storm water sewer infrastructure upgrades can alleviate localized ponding or drainage problems, but by exacting further demands on the hydraulic capacity of receiving waterbodies. Vegetated areas created or protected by some of the plans/projects, especially those adjacent to surface waterbodies intercept and store storm water runoff. Excess waters are then gradually release down gradient, thus helping to maintain natural water flows within surface waterbodies. This function is eliminated when soils and surface waterbodies, such as streams and rivers, are paved or confined with concrete channels, respectively, thus impacting hydrologic regimes.
Water & Sediment Quality	+	+	+	-	+	-	+	+	+	Temporary impacts are expected from all plans/projects during construction activities associated to dredging and infrastructure improvements due to the resuspension of sediments and soil erosion. However, a permanent beneficial effect has been determined for the Study Area's water and sediment quality condition. Those plans/projects that include dredging works would involve the removal of trash and debris that have been deposited and mixed with sediments, thus reducing possible leaching of contaminants into waters and sediments. The creation of vegetated buffers or greenways, and the designation of natural protected areas are predicted to facilitate the concomitant function as filters, transformers, and sinks for nutrients, sediments, organic materials, pesticides, and other detrimental substances normally carried by runoff into surface waters.

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Air Quality	**+**	**+**	**+**	**N**	**+**	**-**	**+**	**N**	**+**	The use of machinery and the demolition of structures are expected to produce fossil fuels emissions and fugitive dust during construction activities. Those plans/projects involving dredging works would also temporarily promote or facilitate the emission of H_2S as sediments are disturbed or removed. However, permanent, net cumulative benefits are anticipated. Restoration of hydraulic capacity would significantly reduce the production of undesirable odors from the decomposition of organic material in stagnant waters. The same would result from those plans/projects that entail infrastructure upgrades to eliminate raw sewage discharges into the Study Area.
Noise	**+**	**N**	**+**	**N**	**+**	**N**	**+**	**N**	**N**	Impacts are expected to be short term and temporary, mostly associated to those actions requiring the use of heavy equipment for construction activities. Long term cumulative possitive effects are otherwise forecasted. Vegetated areas to be restored, planted, or protected in or close to the estuarine portions of the Study Area would help buffer noise pollution caused by nearby urban activities.
Solid Waste	**+**	**+**	**+**	**N**	**+**	**N**	**+**	**N**	**+**	Overall, improvements in solid waste management or disposal practices is expected due to an increase in public awareness, the implementation of community-based programs involving recycling and periodic aquatic clean-up events. In addition, infrastructure works that have been planned or constructed in those communities fringing the CMP (e.g. realignment or expansion of streets) would facilitate access of municipal trucks, and thus, the collection of household refuse. No determination has ever been made regarding the detection of hazardous, toxic, radioactive wastes (HTRWs) involving those plans/projects that have been partially performed or completed in the Study Area. HTRWs are not forecasted for those plans/projects that still have not been implemented. In the event that these need to be handled in order to perform any of the latest, compliance with the corresponding regulatory measures would have to be guaranteed. Those plans/projects that have as an objective the enhancement or restoration of natural features and functions, or the reduction of

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										pollutant loadings, would help prevent the accumulation of contaminants at specific sites and in such concentrations that could result harmful to fish and wildlife and human health.
Habitats	+	N	+	-	+	-	+	N	N	Temporary, short term impacts related to the degradation or elimination of forested or vegetated areas, among other biological communities, are anticipated from the implementation of those actions that require construction. However, permanent, significant beneficial cumulative effects are expected to predominate since many of the actions entailed in these plans/projects have been propose with the main purpose of restoring or protecting many of the Study Area's habitats, leading to an increase in the acreage occupied by these natural communities. Habitat fragmentation is to be reduced. Improved conditions would strengthen habitat resiliency against the anticipated impacts of climate change.
Flora & Fauna Resources	+	N	+	-	+	-	+	N	+	Short term disturbance and displacement of fish and wildlife species and the unavoidable elimination of some animals (e.g. crabs, reptiles, amphibians) and plants are expected from those actions that would entail construction. Animal species, such as birds, would be able to cope better with these temporary impacts by moving into other natural sites within the Study Area. Permanent, significant beneficial cumulative effects are otherwise predicted for flora and fauna resources. Expected increases in acreage and habitat quality improvements would provide new feeding, roosting and nesting grounds for many species of fauna, with concomitant increases in their populations. The same applies to fisheries. This would strengthen flora and fauna resiliency capabilities against climate change and other impacts related to invasive species.

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Species of Special Concern	+	N	+	N	+	N	+	N	N	No significant impacts are anticipated for Federal and/or Commonwealth listed species reported in the Study Area. Listed species are predicted to benefit in the same way as determined for other flora and fauna resources due to an increase in habitat area and quality, the protection of those listed species found within proposed or designated natural protected areas, and the introduction of listed plant individuals into newly restored sites. These benefits are significant, since the status of most of the listed species is due to the degradation or destruction of habitat.
Land use & Infrastructure	+	+	+	+	+	+	+	+	+	Short term impacts due to the temporary interruption of utility services (e.g. electricity, water supply, roads, etc.) are expected as part of the construction works related to infrastructure upgrades. Overall environmental and infrastructure improvements can "reenergized" and lead to the renewal of underutilized areas, promoting a more efficient use of limited land space, and strengthening communities to become more resilient to some of the impacts resulting from climate change (e.g. flooding). However, if not properly handled or regulated, land use pressures could jeopardize gained environmental benefits.
Socioeconomics	+	+	+	+	+	+	+	+	+	The majority of the plans/projects considered involve, to some degree, the relocation of households and other structures, and the temporary displacement of businesses during construction. This impact can be lessened through proper compensation and diligent response coordination. No significant disproportionate impacts have been determined for disadvantage or environmental justice communities. These plans/projects are driven with the purpose of improving citizens living standards irrespective of any social characteristics. The overall economic impact of all the plans/projects evaluated is very significant in terms of the investment of public funds and the new development opportunities that can be created. A reduction in flood damage related costs is expected due to storm and sewage infrastructure upgrades and the enhancement or conservation of green areas that can help manage flood waters and mitigate their impact.

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Human Health & Safety	+	+	+	+	+	+	+	+	+	The use of heavy machinery and other construction related activities are inherently dangerous even when performed during a short period of time, thus posing a risk to human health and safety. However, this potential impact is not expected to be significant since it would be very limited to site specific areas, and proper safety measures would be adopted to guarantee the health of workers and nearby residents (e.g. fencing, controlling pests or vectors, etc.). Cumulative beneficial effects are anticipated from all plans/projects. These would be a direct consequence of improvements in environmental or ambient conditions related to the restoration and protection of natural areas and infrastructure upgrades. Most notably, restoring the water conveyance capacity of the SJBE, in addition to the construction of storm sewers and other flood control works would reduce frequent damages to life and property. The construction of sanitary sewers and the removal of trash and other wastes improperly disposed of would significantly reduce the risk of contracting water borne diseases, the reproduction of pests and vectors, and other health ailments. This would enhance communities resiliency against these health related issues due to the compounding impacts of climate change. Those works that would entail upgrading access routes would also bring safety improvements to land and water transportation.
Cultural Resources	N	N	+	+	N	-	N	N	N	No cumulative significant impacts within the Study Area limits in the SJBE are expected to occur. Reconnaissance studies commissioned for these plans/projects can provide a better historical picture of land use change and the cultural value of archeological remains, buildings and other structures. Documentation, salvage, and/or preservation of unknown historic or cultural remains would be performed in the event these are encountered during construction activities.

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Recreation	+	+	+	+	+	-	+	N	N	No significant cumulative impacts over recreational facilities or structures are anticipated within the SJBE Study Area. Temporary, short term impacts could result, mostly by limiting or closing access to some recreational areas while construction activities are been completed; nevertheless, other areas would still be accessible or able to serve those needs. Long term, cumulative beneficial effects are anticipated due to the construction or upgrades of facilities, especially those associated to outdoor recreation. Improvements to the overall environmental quality of the SJBE, including reestablishing its connection through the CMP, would provide extraordinary new opportunities for the development and enjoyment of aquatic (e.g. kayaking, sport fishing, paddle boarding) and nature-based (e.g. bid washing) recreational amenities within a densely populated, urban landscape. Some of the plans/projects entail infrastructure improvements that include access upgrades to the estuary's waterways.
Aesthetic Resources	+	+	+	N	+	-	+	N	N	No significant cumulative impacts over aesthetic resources within the SJBE Study Area limits are expected, other than those which would be temporary, such as demolition and deforestation, increase turbidity of surface waters, and others related to construction activities. Significant, long term or permanent cumulative, beneficial effects are anticipated due to the removal of improperly disposed trash and debris, the renewal of depauperate communities, and enhancement of overall natural features (e.g. mangrove forests and other green areas, surface waterbodies, water quality); the latest within a densely urbanized setting.

4.19 UNAVOIDABLE ADVERSE ENVIRONMENTAL EFFECTS

Unavoidable adverse environmental effects include temporary project construction losses of wetlands and upland vegetation, whose functions and values are presently impaired, and do not provide significant habitat for many species. Temporary project construction losses under TSP include the 34.46 acres of wetlands and the replacement of 24.19 acre of upland vegetation within the Project Area, a condition that would be significantly improved with the CMP-ERP. These would be replaced with 34.48 acre of mangroves and 25.57 of open water. In the CDRC staging area, 1 acre of vegetated wetland would be temporarily impacted for construction of the staging pier. In addition, approximately 5 acres of secondary upland forest would be temporarily impacted in the CDRC staging area, but restored with native vegetation.

Related unavoidable adverse impacts due to the temporary elimination of wetlands and upland vegetation also include disturbance to fish and wildlife species still present in the Project Area during contruction. Many of these species, especially those that are highly mobile such as birds and fish, would be able to move into other areas of the SJBE while project construction is completed. Unavoidable temporary impacts to water quality are expected, since dredging projects cause turbidity, affect water quality, and cause sedimentation. These impacts are expected to occur in those areas proposed for dredging, as well as those where the dredeged sediments would be placed. Contaminants found in the sediments may also become dissolved in the surrounding waters and get dispersed. As previously discussed, the CMP sediments are contaminated with various substances, including pesticides, other organic compounds, and metals. These are presently trapped in the CMP, but may get diluted to some extent and travel as do sediments and turbidity. The proposed measures to control these contaminants are the same methods to control turbidity.

During construction, best management practices (BMPs) would be used to minimize short-term and long-term sedimentation, erosion, turbidity, and total suspended solids (TSS). These would include seeding for temporary plant cover, retention blankets, silt fencing, and/or earthen diversions. Long-term turbidity and TSS management would be accomplished with storm water dispersion systems, blankets, matting, vegetative filter strips, and berms. These BMP would include turbidity controls such as the placement of turbidity curtains, the use of a clamshell bucket, encapsulation of dredged sediments into geotextile tubes or bags, and burying geotextile tubes with a sand layer into the SJ1/SJ2 pits.

In addition, to prevent sediment dispersion during construction, the channel flow would be plugged increasing the potential of flooding in structures adjacent to the eastern CMP. Proper coordination with residents will be carried out by ENLACE.

Once the CMP-ERP is constructed and its unconsolidated bottom is exposed to the intended tidal exchange, there would be a period of time that the flowing water would stir bottom sediments, and carry them to San Juan Bay. This transition period is anticipated to last less than one month.

Other unavoidable temporary impacts that would result from the implementation of the CMP-ERP, include noise from construction activities, however, the heavier activities would take place during daytime and would be at levels that would not cause hearing impairment. Monitoring and mitigation measures would be enforced to guarantee that noise levels would not cause hearing impairment. Other impacts include emission of air pollutants associated with heavy equipment, hydrogen sulfide from the sediment and particulates from demolition. The use of non-renewable energy resources (fuel for the heavy equipment) is also unavoidable.

4.20 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

An irreversible commitment of resources is one in which the ability to use and/or enjoy the resource is lost forever. An irretrievable commitment of resources is one in which, due to decisions to manage the resource for another purpose, opportunities to use or enjoy the resources, as they presently exist are lost for a period of time. An analysis of irreversible and irretrievable commitment of resources is listed in Table 4-11.

Table 4-11. Irreversible and Irretrievable Commitment of Resources by the ERP

Resource	Irreversible Commitment	Irretrievable Commitment	Description
Soils	Yes	Yes	Landfill space or capacity needed to discard, approximately, 76,200 cy of trash to be dredged and removed from the Eastern CMP.
Water Quality	No	Yes	Temporary impacts to water quality due to sediment resuspension cause by dredging and dredged material disposal during a period extending almost 27 months, and at a limited area, as part of project construction.
Vegetation	Yes	Yes	An irretrievable commitment would have to be made due to the elimination of wetland and upland vegetation at the Eastern CMP during the project's construction and afterwards, until it is restored and reaches maturity. However, the 34.46 acres of wetlands that would be impacted in the Project Area would be improved and increase with 35.48 acres of mangroves. In addition, approximately 5 acres of secondary forest would be temporarily impacted in the CDRC staging area, but later restored with native vegetation. An irreversible commitment would occur with the elimination of 24.19 acres of upland vegetation that would be converted or restored into wetlands and open water areas within the Eastern CMP. Notwithstanding, additional areas would be available for reforestation with upland vegetation along the mangrove fringe that would be restored within the Eastern CMP.
Fish & Wildlife	No	Yes	An irretrievable commitment would have to be made with any benthic fauna that may exist in the Eastern CMP due to the project's construction. The same applies to those wildlife species that would be temporarily displaced during construction activities. However, once flow is restored through the CMP, fish and wildlife species populations would be able to expand into this area and others in the Study Area.

Resource	Irreversible Commitment	Irretrievable Commitment	Description
Cultural	No	No	No irretrievable or irreversible commitments are anticipated for cultural resources.
Air Quality	No	Si	During construction, a localized temporary deterioration of air quality may occur due to hydrogen sulfide emissions from the dredged material, from heavy-equipment emissions, and particulates from demolition activities.
Land use and Recreation	No	No	An irreversible commitment would result due to the relocation of existing settelments within Public Domain Lands to allow restoration; residents would be moved into safer areas. Recreational opportunities would increased.
Social and Economic Values	No	Yes	An irretrievable commitment would have to be made with those tarpon fishing charters that would have used the San José Lagoon dreged pits during the project's construction. However, once the ecosystem is restored, revenue opportunities from tourism and sport fishing activities would increase. During construction, an irretrievable commitment would be made associated to the daily livelihoods of low income communities next to the construction site. However, ENLACE would maintain close coordination with these communities during construction to guarantee that no disproportionate adverse effects area caused by the proposed project.
Transportation	No	No	No irretrievable or irreversible impacts are anticipated to transportation resources.
Noise	No	Yes	An irretrievable commitment may occur during construction from the use of heavy-equipment, and from demolition and pile-driving activities.
Visual	No	Yes	An irretrievable commitment would have to be made associated to the scenery of the San José Lagoon during construction and while the dredged sediments are deposited in its artificial dredged pits. This, from the presence of barges and dredging equipment. Removal of vegetation, including trees, would occur during the initial period of construction within the Project Area.
Solid Waste	No	No	No irretrievable or irreversible impacts are anticipated.
Public Health	No	Yes	During construction, the air quality and noise impacts may temporarily impact the health of sensitive populations, such as asthmatics, young children and the elderly. However, there would be close on-site monitoring and community coordination during construction, in order to address these effects.

4.21 ENERGY REQUIREMENTS AND CONSERVATION POTENTIAL

Energy requirements associated with the ERP alternatives would be similar to, and involve, consumption of various fuels for construction equipment used for the dredging operations, as well as for the transportation and sorting of the dredged material, and the installation of bulkheads. The contractors would try to make efficient use of vehicles and equipment and minimize energy consumption whenever possible and would keep vehicles and equipment in good working condition.

4.22 COMPLIANCE WITH FEDERAL STATUTES

Table 4-12. Compliance with Federal Statutes

Statute	Description
Clean Water Act (CWA)	This activity would involve dredging of wetlands and surface water a the CMP, the construction of a temporary dock for the barges at the CDRC staging and dredged material management site, and the disposal of dredged sediments in the SJ Lagoon pits. Therefore a Section 401 Water Quality Certificate from the EQB would be obtained and a Section 404 (b) evaluation has been conducted. A public notice would be issued and a public hearing would be held, if required, to comply with the requirements of Section 404 of the CWA. A water quality monitoring and management plan would be implemented during construction activities to ensure that, if water quality indicators are non-compliant with corresponding standards, appropriate actions are taken.
Clean Air Act (CAA)	The project is in compliance with the CAA and no air quality permits are required, as there would be no permanent sources of air emissions. This Draft EIS would be submitted to the USEPA for review and comments, in order to comply with Section 309 of the Clean Air Act, which requires USEPA to review and publicly comment on the environmental impacts of major Federal actions including actions which are the subject of Draft and Final EIS. The Project Area is not located in any designated “non-attainment” or “maintenance” area under the CAA, nor would any works pertaining to the CMP-ERP. Therefore, the CMP-ERP satisfies the requirements set in the CAA Section 176 (c) (known as “the conformity rule”).
Coastal Barrier Resources Act (CBRA) and Coastal Barrier Improvement Act (CBIA)	The CMP is located within the SJBE, which is an "otherwise protected area" (OPA) a new category of coastal barriers, as defined by the CBIA. OPAs are undeveloped coastal barriers that are within the boundaries of an area established under federal, state, or local law, or held by a qualified organization, primarily for wildlife refuge, sanctuary, recreational, or natural resource conservation purposes. The CMP-ERP proposes the restoration of the historic tidal flow to portions of this OPA. The predicted outcome is a healthier and more resilient coastal barrier. Therefore, the ERP would be in compliance with both, CBRA and CBIA.
Coastal Zone Management Act (CZMA)	A draft Application for a Certification of Consistency with the Puerto Rico Coastal Zone Management Program (PRCZMP) for the CMP-ERP has been prepared in accordance with the provisions of 15 CFR 930. The CMP-ERP would be undertaken in a manner consistent to the Maximum Extent Practicable with the enforceable policies of the PRCZMP. Its effects on coastal uses and resources are all consistent with the enforceable policies of the CZMP. Therefore, the ERP would be in compliance with this Act.

Statute	Description
Endangered Species Act (ESA)	The USFWS and the NMFS were officially informed of this effort on September 30, 2010, when the non-Federal sponsor called for participation in the CMP-ERP's Technical Committee (TC) meeting. There are no threatened or endangered species in the Project Area. Eighteen threatened or endangered species under ESA have been found or has the potential to ocurr in the Study Area (4 species of flora and 14 species of fauna). The CMP-ERP, also, would improve tidal circulation to the San José Lagoon and, through this improvement, it could eventually become habitat for the Antillean manatee (*Trichechus manatus manatus)*. The ERP has been and would continue to be coordinated under ESA. A biological assessment under Section 7 of the ESA has been drafted, but consultation with USFWS and NMFS has not been initiated. The package to be submitted to the USFWS and NMFS would include this Draft EIS. Therefore, the proposed ERP is in the process to be in compliance with the ESA.
Estuary Protection Act	The CMP-ERP is in compliance with the Estuary Protection Act. The CMP-ERP is essential for the restoration of the SJBE resources and is part of the goals and objectives of the CCMP for the SJBE. The Draft-EIS has given full consideration of the SJBE and its natural resources. In fact, the SJBEP is represented in the ERP's TC.
Federal Water Project Recreation Act (FWPRA)	Outdoor recreation opportunities were considered in this Draft-EIS. A Recreation Plan was prepared consistent with USACE regulations. Also, the effects of the proposed action on outdoor recreation have been discussed in this document. Therefore, the Draft EIS is in compliance with the FWPRA.
Fish and Wildlife Coordination Act	A Public Notice inviting scoping comments on the proposed ERP was sent by the USACE to all fish and wildlife resources agencies on August 5, 2013, for the reconnaissance phase of this study. Preliminary coordination with the USFWS, the U.S. Department of Agriculture and Commonwealth agencies (the DNER and the PRPB) indicated that these agencies support an ERP for the study area. The USACE's reconnaissance study found that there was a Federal interest in continuing the study into the feasibility phase, based on the likelihood that a Federal ERP is environmentally and economically justified and implementable. Issues identified during that process have been addressed in this Draft EIS. The FWS, the DNER, and the NMFS, are a part of the ERP's TC, which has met several times since September 2010. Their comments have been incorporated in the preparation of this Draft EIS. A NEPA Scoping Letter was prepared and circulated on February 2013 and comments received during scoping process were also addressed and included in Appendix H-7.
Farmland Protection Policy Act	This Act is intended to reduce the unnecessary and irreversible conversion of farmland to nonagricultural uses through Federal projects. No prime or unique farmland would be impacted by the implementation of the CMP-ERP. Therefore, this Act is not applicable.

Statute	**Description**
Magnuson-Stevens Fishery Conservation & Management Act	Two types of EFH have been identified in the Project Area: mangrove wetland EFH and estuarine water column EFH. There are also 84 managed species under the Reef Fish Fishery Management Plan (FMP) that could potentially be present within the Project Area during their larval/post-larval and juvenile life stages. Additionally, the postlarvae/juvenile and subadult life stages of 15 species under the Reef Fish FMP may occur within the project area. The postlarvae/juvenile life stage of the spiny lobster (*Panulirus argus*) would potentially occur within the mangrove habitat within the project area. While there are no geographically defined Habitat Areas of Particular Concern (HAPC) within the project area, the CFMC has generically identified estuary habitat as a HAPC due to the importance of this habitat type as a nursery ground for commercially important fish species. Several Caribbean reef fish use the SJBE, particularly the mangrove root habitat, as nursery. Therefore, an Essential Fish Habitat (EFH) Assessment was conducted in compliance with this Act. Its initial determination was that the proposed action would not have a significant adverse impact on EFH or federally managed fishery species in the CMP and surrounding waters. Impacts would only be unavoidable and short term while construction takes place. Once completed, the proposed project would result in greater connectivity and accessibility of species to EFH throughout the SJBE system and near offshore reef habitat. The NMFS is also actively represented in the ERP's TC. Compliance with this Act wouldl occur upon this agency's revision of this Draft EIS.
Marine Mammal Protection Act	This ERP would have no impact of marine mammal for there is no suitable habitat for these species and no individual has been identified along the Project Area. The NMFS as well as the USFWS would provide comments as part of the Fish and Wildlife Coordination Act. The NMFS is part of the ERP's TC. Full compliance with this Act would occur upon USFWS review of this Draft EIS.
Marine Protection, Research and Sanctuaries Act (MPRSA)	Ocean disposal is not the preferred disposal option for dredged material under this ERP. Therefore, this Act is not applicable.
Anadromous Fish Conservation Act	Benefits associated with the CMP-ERP include a healthier habitat for fish and wildlife. Therefore, the ERP should bring widespread benefits to anadromous fish that may be present in the SJBE. This project is in compliance with this Act.
Migratory Bird Treaty Act and Migratory Bird Conservation Act	The proposed ERP consists of restoring the ecosystem of the SJBE from its existing impaired condition. Benefits associated with the ERP include a healthier habitat for fish and wildlife. Therefore, the ERP is in compliance with this Act and should bring widespread benefits to migratory birds that use the SJBE.
National Environmental Policy Act	On November 16, 2012, a NOI to prepare an EIS was published in the Federal Register. On February 22, 2013, a scoping letter was sent out to all stakeholders for comments on the ERP. Comments of the scoping process are included on Appendix H-7. Environmental information on this project has been compiled, and a Draft EIS has been prepared. This Draft-EIS would be distributed to Federal and State agencies and to the public for a formal consultation period. Upon public and agency review and comment on this document and the subsequent Final EIS, and the signing of the ROD, this project would be in full compliance with this Act. The non-Federal sponsor, also, has promoted meaningful public participation as part of the ERP consultation process with the neighboring communities and the general public, since 2002.
National Historic Preservation Act of 1966	The Martín Peña Bridge is in the NRHP. A Section 106 Review Process would be conducted at the SHPO in relation to the potential effect of the proposed action. To protect the base of this bridge, project design measures would be taken as well as construction activity monitoring.

Statute	Description
Resources Conservation and Recovery Act (as amended by the Hazardous and Solid Waste Amendments of 1984, the Comprehensive Environmental Response, the Compensation and Liability Act, the Superfund Amendments and Reauthorization Act of 1996, the Toxic Substances Control Act of 1976)	There are no hazardous, toxic, or radioactive waste substances in the Project Area. The ERP is in compliance with these Acts.
Rivers and Harbors Act of 1899 (RHA)	The proposed ERP would not cause permanent obstructions in navigable waters of the United States. On the contrary, the ERP consists of opening the CMP where it presently is unusable for navigation or even tidal connection. Proper coordination with the U.S. Coast Guard and other Federal, State, and local agencies would be ensure to comply with Section 10 of the RHA.
Submerged Lands Act	The ERP's purpose is to return formerly submerged lands to their original condition. Therefore, the proposed ERP aims to bring to compliance the Submerged Lands Act where these formerly submerged lands are presently filled.
Wild and Scenic River Act	No designated Wild and Scenic River would be affected by ERP related activities. Therefore, this Act is not applicable.

EXECUTIVE ORDERS AND MEMORANDUMS OF UNDERSTANDING OR AGREEMENT	
EO	**DESCRIPTION**
Executive Order 11514, Protection of the Environment	Executive Order (EO) 11514 requires Federal agencies to "initiate measures needed to direct their policies, plans and programs to meet national environmental goals." This Draft EIS supports this initiative, and therefore is in compliance with the goals of this EO.
Executive Order 11593, Protection and enhancement of the cultural environment	There is the potential to encounter cultural items during the dredging/construction that would be have to be addressed. A cultural resources monitor (a professional archeologist) would be present during construction to inspect sediments and the site for remains of any archeological material. If archeological material, or any other cultural resource, is found on site, construction works would be temporarily halted until these materials are properly removed, protected, and transported.
Executive Order 11988, Flood Plain Management	An additional benefit of dredging the channel to increase conveyance is improved (reduced) flood conditions. Also, the CM-ERP includes the relocation of residences that are subject to floodings given the deteriorated conditions of the CMP. Therefore, this project is in compliance with the goals of this EO.
Executive Order 11990, Protection of Wetlands	A Wetlands Assessment has been prepared for this ERP. The creation of a wetland conservation fringe along the canal is part of the ecosystem habitat uplift and restoration goals. Wetlands in the CMP and the SJBE would be increased in area and functional value would be improved. Therefore, this project is in compliance with the goals of this EO.
Executive Order 12962, Recreational Fisheries	The ERP would temporarily impact recreational fisheries. However, it would enhance the CMP and associated resources productivity and, improve conditions for recreational fisheries. Therefore, the ERP complies with the goals of this EO.
Executive Order 12898, Environmental Justice	The ERP would improve the environment, health, housing, and infrastructure conditions within the CMP adjacent communities. While some temporary adverse effects would be felt by low income and minority communities during the construction phase, final actions would have a significant positive outcome, improving their living conditions and their quality of life. Also, there has been fair treatment and meaningful public participation of the communities through the non-Federal sponsor coordination process. Therefore, the CMP-ERP would not cause disproportionately high and adverse effects on any minority or low-income populations in accordance with the provisions of E.O. 12898.
Executive Order 13045, Protection of Children	The environmental risks and safety risks that may disproportionately affect children were identified and assessed in this Draft EIS. This project addresses disproportionate risks to children that result from environmental health risks or living with safety risks in the CMP. The ERP would reduce exposure to health risks such as floodings with contaminated waters. Therefore this project is in compliance with this EO.
Executive Order 13089, Coral Reef Protection	The ERP would enhance the conditions of coral reefs in the Study Area. Therefore, the proposed ERP is in compliance with EO 13089.
Executive Order 13112, Invasive Species	This ERP would not exacerbate the status of invasive species in the study area. On the contrary, it would provide for restoration of native species and habitat conditions in ecosystems that have been disturbed. Proposed alternatives don't have the potential to disturb previously undisturbed areas. Therefore, this project is in compliance with this EO.

EO	DESCRIPTION
Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds	No effects to migratory birds are anticipated, in contrast, the ERP would improve habitats, and benefits to migratory birds are expected. This project is in compliance with this EO.
Memorandum of Agreement (MOA) between the Federal Aviation Administration, the U.S. Air Force, the U.S. Army, the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, and the U.S. Department of Agriculture to Address Aircraft-Wildlife Strikes	This MOA acknowledges each signatory agency's respective missions. Through this MOA, the agencies establish procedures necessary to coordinate their missions to more effectively address existing and future environmental conditions contributing to aircraft-wildlife strikes throughout the United States. These efforts are intended to minimize wildlife risks to aviation and human safety, while protecting the Nation's valuable environmental resources. This environmental document would be distributed to the FAA and the Luis Muñoz Marín International Airport administration (Aerostar Airport Holdings LLC) as part of the public comment review period, and any comments received by these will be addressed by the non-Federal Sponsor; the latest would consult and seek a sign-off letter from the FAA regarding the proposed project.

4.22.1 Compliance with Local Statutes

The Commonwealth of Puerto Rico’s regulations have concurrent jurisdiction with Federal regulation, unless local’s regulations become more restrictive or contemplate a specific matter that Federal regulations do not. The CMP-ERP is in compliance with the applicable regulations summarized in Table 4-13.

Table 4-13. Compliance with Local Statues

Statute	Description
Environmental Public Policy Act (Law 416-2004)	The environmental information on the ERP has been compiled in accordance with Federal and Commonwealth’s environmental policies. This Draft EIS compiles the information that will be disseminated for public participation required by the Federal and Commonwealth’s NEPA versions.
Water Quality Standards Regulation of Puerto Rico (2014)	The ERP would comply with the EQB- Water Quality Standards Regulation. A Water Quality Certificate will be obtained from the EQB, according to Section 401(d) of the CWA.
Puerto Rico Permit Process Reform Act, Law No. 161-2009 as amended and the Joint Permit Regulation for the Evaluation and Issuance of Permits Related to Development and Land Use, Reg. No. 31	To establish the legal and administrative framework that shall govern the application for and the evaluation, granting, and denial of permits by the Government of Puerto Rico; to create the Permit Management Office, define its functions, authorities, and obligations, and to provide for its organization; to create the legal construct of the Authorized Professional, define the composition, functions, authorities, and obligations thereof, and provide for his/her authorizations; to create the constructs of the Permit Manager and the Service Representative, and the construct of the Permit Officer, and provide for their authorities; to create the Office of the Chief Permit Inspector, define its functions, authorities, and obligations, and provide for its organization; to provide for the administrative and judicial review of decisions made pursuant to this Act; to establish penalties; and for other purposes.
Atmospheric Pollution Control Regulation (1995)	Emissions during construction would be temporary and limited to the typical emissions of construction and dredging projects: mobile combustion sources, such as trucks and heavy equipment during the construction process; odors from the dredged sediments; and particulates from the structures demolition. There is concern about the emission of hydrogen sulfide as a result of the dredging. As precautionary methods, development and implementation of an H2S monitoring program during dredging operations would be undertaken to quantify ambient conditions and to manage/mitigate H2S release.
Noise Control Regulation (1987)	The proposed ERP is not expected to exceed the noise level allowed for residential areas.
Control of Erosion and Prevention of Sedimentation Regulation (1998)	Erosion and sedimentation prevention would be addressed with the best available control technology, which presently consists of turbidity screens, double turbidity screens and fast water turbidity barriers, as applicable. Land-based turbidity controls would be addressed with the Erosion Sedimentation Permit, required by the Commonwealth during the pre-construction phase.
Hazardous Solid Waste Control Regulation (1998)	Following the Federal regulations, the EQB requires a cradle-to-grave tracking format (manifest), and requires testing of the material suspected of being a HW. The Humacao Regional Landfill, for instance, proposed for the disposal of the trash and debris separated from the dredged sediments, would require a manifest demonstrating that the material they would accept is not hazardous. The necessary permits, which include the Solid Waste Generator Permit, would impose the necessary testing conditions for the ERP’s solid waste. Preliminary testing along the CMP indicates that the “contaminated” sediments would not be classified as hazardous waste.

Statute	Description
Non-Hazardous Solid Waste Control Regulation (1997)	The proper storage, transportation and disposal of non-hazardous solid wastes are also regulated by the EQB. Solid wastes to be generated by the ERP's dredge works are considered to be of domestic waste origin, should the above-indicated testing demonstrate so. This waste can be deposited in approved landfills. Transporters of the ERP's solid wastes would have to be properly licensed.
Caño Martin Peña Special District Act (Law 489-2004) PR Law 104 of 2013, amended Law 489-2004	Gives ENLACE the authority to make the necessary efforts to assure the comprehensive development of the CMP Special District. Through this authority, ENLACE has integrated governmental and community sectors, and elaborated a District Plan in order to guide the processes related to the CMP ecosystem restoration efforts and associated matters. The District Plan was used as a baseline for the ongoing studies, to assure consistency and compatibility with Federal, Commonwealth and local's objectives. ENLACE is the non-Federal sponsor for the ERP, in order to meet the objective of this law. Law 104 of 2013 ammended the Caño Martín Peña Planning Distric Act of 2004. Section 10 of Law 104 states that the EQB will certify compliance of the CMP District Plan. Once the District Plan's compliance has been certified, said compliance determination shall be extended to any action included in the District's Plan as of its date of approval by the Governor. Thus, the CMP-ERP is in compliance with the Commonwealth environmental review process.
Puerto Rico Wildlife Act (Law 241-1999)	Protects fisheries and wildlife species in the Commonwealth. Its Regulation 6766 includes a number of species not contemplated in the Federal ESA. All of these were considered in this EIS. None of these species would be impacted during the ERP construction or operation, although some individuals of these species may be displaced during the construction period.
To Declare the Public Policy on Wetlands in Puerto Rico (Law 314-1998)	Established the protection of wetlands as a public policy. The proposed ERP would conduct restoration measures upon the SJBE, and restore wetlands from an artificial upland condition. Therefore, the ERP is in accordance with the tenets of this law, which has concurrent jurisdiction with EO 11990, Protection of Wetlands.
Special Flood Hazard Areas Regulation (2010)	The purpose of this PRPB's Regulation is to control buildings and land development in zones declared as susceptible to floods. The proposed ERP would remove buildings that have informally settled within areas susceptible to floods, and would return those lands to their original function as wetlands. Therefore, the ERP is in accordance with this regulation.
DNER Administrative Order 2004-04	This order exempts all actions or projects proposed or performed by the DNER, or those entities authorized to work on its behalf, from requesting those applicable permits under the agency's jurisdiction. These include permits for cutting or removing trees and extracting or dreging materials from the earth's crust. ENLACE is coordinating with the DNER to become a local co-sponsor for the CMP-ERP, or as an alternative, to sign a memorandum of understanding between both to facilitate corresponding processes and permits and consecuently facilitate the Project's construction. This would advance the latest mission or duties with respect to the conservation and restoration of Puerto Rico's natural resources.

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5.0 LIST OF PREPARERS

The following tables list the people involved in the preparation (Table 5-1) and review (Table 5-2) of this Draft EIS.

Table 5-1. List of Preparers

ENLACE

NAME	POSITION
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Katia R. Avilés Vázquez, MS; PhD	Environmental Affairs Manager

ESTUDIOS TÉCNICOS, INC.

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Raúl Santiago Bartolomei, PE, MP	Engineer and Planner (former employee)
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Roberto E. Moyano Flores	GIS
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ATKINS

NAME	POSITION
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David Tomasko, Ph.D. (former employee)	Hydrodynamic Studies Water Quality Sediment Quality HTRW, Air Quality, Technical Assessment
Adelís Cabán	Deputy Project Manager and Co-author
Anthony Risko, PE (former employee)	Dredged Material Disposal Plan, Alternatives Analysis
Beth Zimmer	Essential Fishery Habitat
David Conrad	P.E. Structures
Donald Ator	Plan Formulation, Economic Studies
Emily Keenan, M.S., (former employee)	CEP Water Quality Fisheries, Technical Support
Donald Deis	CEP Environmental Studies Environmental Benefit Alternatives Analysis

NAME	POSITION
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Juan Carlos Moya, Ph.D. (former employee)	Dredged Material Disposal Plan, Alternatives Analysis
Juan Meléndez	PLS Surveyor/imaging
Karla Córdova, RPA	Cultural Resource Study
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Marcia Rivera	Technical coordinator
Nancy Smith (former employee)	Water Quality, Air Quality Studies
Raúl Di Cristina	Environmental specialist
Roberto Mantecón	PSM Surveyor
Julie Morelli	HTRW
Nathan Collier	HTRW
Joseph Banta	CADD and GIS
Desi Maldonado	CADD
David Carter	Cost schedule risk analysis
Monica Rosario	Cost schedule risk analysis
Don Ator (former employee)	Recreation
Bill Stevenson (former employee)	Cost Engineering
Jonathan Porthouse (former employee)	Plan Formulation

Table 5-2. List of Reviewers

ENLACE’s Review Team	
Katia R. Avilés Vázquez, MS	Environmental Affairs Manager
Ana Elisa Pérez	Environmental Affairs Coordinator (Former Employee)
Mariano Solorzano Thillet	GIS Analyst
USACE’s Review Team	
Jim Suggs	Project Manager
Iván Acosta	Chief Special Projects Section
Javier Cortes	Environmental Engineer
Ken Dugger	Jacksonville District Planning Division-Environmental
Brooks Moore	Office of Legal Counsel
Alfred Walker	Planning Technical Lead

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6.0 PUBLIC INVOLVEMENT

A National Environmental Policy Act (NEPA) scoping letter was sent out on February 22, 2013 to the Federal and Commonwealth's agencies, organizations, and private individuals. A copy of the scoping letter is included within Appendix H7.c.

Previously, a Notice of Intent (NOI) to prepare this Draft EIS was published on November 16, 2012 in the Federal Register. Two federal agencies submitted comments to the NOI during December 2012: the National Parks Service and the Fish and Wildlife Service. A copy of the NOI and the comments received are included within Appendix H-7.

6.1 AGENCY COORDINATION

The various agencies, affected stakeholders, and interested members of the community were allowed opportunities to provide input during NEPA scoping (Appendix H7.d). Opportunities to provide input during the NEPA process will be provided for Federal and Commonwealth's agencies, communities and all interested parties.

6.2 NON-FEDERAL SPONSOR PREVIOUS COORDINATION

ENLACE's non-federal coordination process for the CMP-ERP began in 2001, with USACE's 2001 Design Report as a baseline reference. For the past 10 years, ENLACE has carried out multiple stakeholder meetings to address the CMP-ERP. Between 2002 and 2004, ENLACE hosted over 700 community meetings, including round table discussions, public assemblies, workshops, presentations, and educational activities at local schools, in order to select the community alternative for the CMP-ERP, which was incorporated as part of the Comprehensive Development Plan. Topics discussed through these meetings included: the degraded conditions of the CMP and its adjacent waterbodies; alternatives for the relocation of families living within the Project Area; the construction of appropriate infrastructure; its impacts to public health, urban and socioeconomic conditions, including the potential for gentrification; wildlife, and ecosystems, as well potential solutions to these conditions and impacts.

For the discussion of the CMP dredging alternatives, ENLACE developed informational material that was distributed throughout the CMP District and the Península de Cantera neighborhood, and held several community assemblies. Kick-off community assemblies for the preparation of this Draft EIS were held during October 2010 at each community, to inform residents on the status of the ERP and for gathering and documenting their concerns and suggestions. Each of the eight communities selected two representatives to be part of ENLACE's Community Committee (ECC) to review and comment the draft technical documents produced. Other affected stakeholders, such as the sports fisheries and local fishermen, were invited to be part of the ECC. The ECC met monthly or bi-monthly, depending on the amount of technical documents produced and the need for community feedback.

A second round of Community Assemblies was carried out during October and November 2011 to receive community feedback and input regarding the optimization of the CMP proposed dredging. During the Community Assemblies, residents voted for their preferred alternative. Through their votes, residents clearly expressed their preference for the 100-foot channel width scenario, with either a rectangular or a hybrid section. Residents considered the 100-foot channel width alternative the most natural, the most reminiscent of what the CMP used to be, and the one that better accommodated their expectation for future uses of the CMP. Residents chose the rectangular section over the proposed hybrid section by a slight majority of votes.

A third round of Community Assemblies took place on May 2012 to discuss the Draft EIS and any other relevant issues regarding the implementation of the ERP, such as the expected impacts to the communities during construction of the CMP-ERP and the alternatives for the disposal of the dredged material. ENLACE held informational meetings regarding the Draft EIS with other interested parties, such as the sports fishing business owners, local subsistence fishermen, environmental advocacy organizations, the Autonomous Municipality of Carolina, and the SJBEP Technical Committee (STAC). Also, a web page was created (www.dragadomartinpena.org) to continuously inform the public, provide contact information, and feedback on the CMP-ERP. Additional public input shall also be integrated as part of the public review and comment process regarding this Draft EIS. ENLACE, as the non-Federal sponsor, will continue to incorporate public participation during NEPA process.

ENLACE, as the non-Federal sponsor, summoned a Technical Committee (TC) in 2009 to help draft the original FR and support the preparation of this Draft EIS with their expertise. This Committee is integrated by Federal and Commonwealth's agencies, as well as other stakeholder organizations such as the SJBEP and the Península of Cantera Corporation, among others. The TC's kick-off meeting was held on September 30, 2010, initiating the Draft EIS preparation process. Several meetings have been conducted as part of the coordination process regarding the CMP-ERP.

More recently, on April 1, 2014, the STAC held a meeting for a presentation on the CMP Restoration Project Ecological Uplift Assessment (hereinafter, EUA). All STAC members attending the meeting agreed with the approach followed by the EUA. A technical report, with a detail explanation on the EUA, was later sent to all STAC members for review and endorsement. After reviewing the technical report, the STAC endorsed the approach followed in the EUA, after determining that it was based on acceptable techniques and peer-reviewed processes.

6.3 COMMENTS RECEIVED DURING SCOPING PROCESS AND RESPONSES

During circulations of scoping letter, the following agencies provided comments:

- Commonwealth Government:
    - Puerto Rico Electric Power Authority (PREPA)
    - State Historic Preservation Office (SHPO)
    - Autonomous Municipality of Carolina
- Federal Government:
    - NOAA's National Marine Fisheries Services
- Community organizations:
    - Asociación Pro-Bienestar Parada 27, Inc.
    - Residentes Unidos de Barrio Obrero Marina, Inc.
    - Junta de Acción Comunitaria Israel & Bitumul, Inc.

Comments received during USACE's scoping, consultation and circulation processes address the following concerns:

- Commonwealth agencies:
    - The need to ensure proper coordination with infrastructure-related agencies if relocations and excavations would take place, and
    - The location of the dredged material disposal site and how it could exacerbate existing vulnerabilities to adjacent communities (if Suarez Canal was selected).
    - The potential to find archeologic material in the Project Area.
- Public:
    - The need to relocate flood-prone households before dredging and to ensure community participation, particularly related to the selection of the dredged material disposal site;
    - Address temporary impacts during construction, such as excessive noise and health impacts, especially respiratory illnesses or conditions; the need to provide controls to reduce pest invasion to adjacent households and the implementation of precautionary measures to avoid exposing children to machinery or dangerous areas.
- Federal agencies:
    - The need of a detailed analysis of alternatives related to the dredging method, including access to the channel and any disposal sites for dredging material in the Draft EIS; and the need of a thorough analysis of the environmental benefits of alternatives.

- There are concerns regarding some of the dredging material disposal alternatives, in terms of the potential transport of contaminated sediments and potential fish kills from dispersal of anoxic waters if dredged materials are to be disposed in the dredge pits located in the San José Lagoon.
- Include EFH information on the Draft EIS as well as in project design.

A matrix detailing comments received during USACE's scoping, consultation and circulation processes and USACE's responses is included in Appendix H7.c.

6.4 CIRCULATION OF THE DRAFT EIS

Copies of the document or notices of availability of the Draft EIS were mailed to those parties identified in Table 6-1.

Table 6-1. Entities to which the Draft EIS will be circulated

Federal Agencies	• FAA- Federal Aviation Administration • NOAA NMFS • USCG, Sector San Juan • USACE, Antilles Regulatory Section • USDA Forest Service International Institute of Tropical Forestry • USEPA, Caribbean Environmental Division • USEPA, Region 2 Planning & Projects • USFWS, Caribbean Ecological Services Field Office
Local Agencies and Municipalities	• Autonomous Municipality of Carolina • Autonomous Municipality of San Juan • Compañía para el Desarrollo Integral de la Península de Cantera • Corporación del Proyecto ENLACE del Caño Martín Peña • Government Development Bank of Puerto Rico • Institute of Puerto Rican Culture • Puerto Rico Aqueduct and Sewer Authority • Puerto Rico Department of Natural and Environmental Resources • Puerto Rico Department of Transportation and Public Works • Puerto Rico Electric Power Authority • Puerto Rico Environmental Quality Board • Puerto Rico Industrial Development Company (Puerto Rico Solid Waste Authority) • Puerto Rico Permits Management Office • Puerto Rico Planning Board • Puerto Rico Ports Authority • Puerto Rico Solid Waste Authority • Puerto Rico Tourism Company • State Historic Preservation Office of Puerto Rico
Community Groups, NGO and other Private Entities	• Arrecifes Pro-Ciudad • Asociación de Damas Salesianas, Inc. • Asociación de Pescadores de Cantera • Asociacion Residente Promejora De La Comunidad Villa Prades, Inc • Asociación de Residentes Las Monjas Renace, Inc. • Asociación Nacional de Derecho Ambiental • Asociación Pro-Bienestar Parada 27, Inc. • Buena Vista Florece, Inc. • Cangrejos Yatch Club – Sports fishing businesses • Consejo Vecinal para la Península de Cantera • Corporación Desarrolladora de Viviendas de las Barriadas Israel-Bitumul, Inc.

	• Fideicomiso de la Tierra del Caño Martín Peña • Grupo de las Ocho Comunidades Aledañas al Caño Martín Peña, G-8, Inc. • Junta de Acción Comunitaria de Bitumul e Israel, Inc. • Junta de Residentes de Buena Vista Santurce, Inc. • Líderes Jóvenes en Acción • Residentes Unidos por Barrio Obrero Marina, Inc. • San Juan Bay Estuary Program • San Juan ULTRA • Scuba Dogs Society • Sierra Club, Puerto Rico Chapter • Sociedad Puertorriqueña de Planificación • Vecinos Unidos por Barrio Obrero San Ciprián, Inc. • Aerostar Airport Holdings LLC (Luis Muñoz Marín International Airport administration)
Universities	• Inter-American University of Puerto Rico Library • Polytechnic University of Puerto Rico Library • Ponce School of Medicine and Health Science Library • Sacred Heart University Library • University of Puerto Rico Library System

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Appendix H1

Essential Fish Habitat Assessment

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DRAFT
ESSENTIAL FISH HABITAT ASSESSMENT PLAN
CAÑO MARTÍN PEÑA
ECOSYSTEM RESTORATION PROJECT
SAN JUAN, PUERTO RICO

Prepared for:

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September 2015

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Executive Summary

An Essential Fish Habitat (EFH) Assessment for the Caño Martín Peña (CMP) Ecosystem Restoration Project (ERP) has been prepared. The package to be submitted to the National Marine Fisheries Service would include the Draft Environmental Impact Statement. The purpose of the consultation package is to determine to what extent the proposed action may impact EFH and managed species. The final package, however, is to be submitted by the "Action Agency," which in this case is the U.S. Army Corps of Engineers (USACE).

Two types of EFH have been identified within the Project Area: mangrove wetland EFH and estuarine water column EFH. The existing mangrove habitat within the Project Area is degraded as a consequence of extensive human encroachment; the massive amount of fill material, scrap and trash deposited within the mangroves; the severely degraded water quality from wastewater discharges; and the severely limited tidal flushing within the CMP. Likewise, the estuarine water column within the CMP is severely impaired by the existing high sedimentation rates, presence of toxins within the sediments, low dissolved oxygen levels, and salinity fluctuations.

There are 84 managed species under the Reef Fish Fishery Management Plan (FMP) that could potentially be present within the Project Area during their larval/post-larval and juvenile life stages. Additionally, the post-larvae/juvenile and subadult life stages of 15 species under the Reef Fish FMP may occur within the Project Area. The post-larvae/juvenile life stage of the spiny lobster (*Panulirus argus*) could potentially occur within the mangrove habitat within the Project Area.

There are no geographically defined Habitat Areas of Particular Concern (HAPC) within the Project Area. The Caribbean Fishery Management Council has generically identified estuary habitats as a HAPC due to their importance as a nursery ground for commercially important fish species.

The preferred project alternative is the 10-foot-deep by 100-foot-wide plan. Direct impacts to these EFH would result from the proposed dredging activities, installation of the vertical steel sheet pile and the concrete bulkhead walls, and the disposal of dredged material within the San José Lagoon dredged pits. The total short term direct impacts would include 33.46 acres of mangrove wetland EFH and 7.4 acres of estuarine water column EFH.

The primary goal of the proposed project is to achieve environmental restoration within the CMP and the San Juan Bay Estuary (SJBE) system. The performance metrics for the benefits analysis were developed from project planning documents, and relationships and hypotheses developed in a Conceptual Ecological Model. All of the performance metrics use relationships with the CH3D-WES hydrodynamic model, a curvilinear hydrodynamics model in 3-dimensions developed by the USACE Waterways Experiment Station. The available relationships (Fish and Fishery Habitat, Mangrove Habitat, and Benthic Index) are that the planned CMP-ERP would result in improved tidal flow and circulation and increased flushing within the SJBE system, improving water quality and expanding connectivity to aquatic habitat throughout the SJBE system and the near shore reef system.

The ultimate goal of the proposed project is to achieve environmental restoration within the CMP and the San José Lagoon; thus, the project is self-mitigating and mitigation for impacts to estuarine water column EFH is not proposed. Temporary adverse effects to EFH, specifically mangrove losses, from the proposed project would be compensated by planting mangroves. **Our initial determination is that the proposed action would not have substantial adverse effects on EFH or federally managed fishery species in the surrounding waters, but results in a long term positive effect.**

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Acronyms and Abbreviations

BMP	Best Management Practice
CCMP	Comprehensive Conservation & Management Plan for the San Juan Bay Estuary
CDRC	Ciudad Deportiva Roberto Clemente
CFMC	Caribbean Fisheries Management Council
CFR	Code of Federal Regulations
CMP	Caño Martín Peña
CMP-ERP	Caño Martín Peña Ecosystem Restoration Project
CSO	Combined Sewer Overflow
CSS	Combined Sewer System
cy	cubic yards
DO	Dissolved oxygen
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
ENLACE	Corporación del Proyecto ENLACE del Caño Martín Peña
ERP	Ecosystem Restoration Project
FEIS	Final Environmental Impact Statement
FMC	Fishery Management Council
FMP	Fishery Management Plan
FR	Feasibility Report
ft	feet
ha	hectare
HAPC	Habitat Areas of Particular Concern
mg/L	milligrams per liter
mi^2	square miles
mL	milliliters
MLLW	Mean Lower Low Water
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MTZ	Maritime Terrestrial Zone
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
ppt	parts per thousand
PRASA	Puerto Rico Aqueduct and Sewer Authority
PRHTA	Puerto Rico Highway and Transportation Authority
psu	practical salinity unit
SAV	submerged aquatic vegetation
SJB	San Juan Bay
SJBE	San Juan Bay Estuary

SJBEP	San Juan Bay Estuary Program
SJHP	San Juan Harbor Project
SJMA	San Juan Metropolitan Area
TSS	total suspended solids
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
WRDA	Water Resources Development Act

1.0 INTRODUCTION

This Essential Fish Habitat (EFH) Assessment contains an evaluation of the possible impacts on EFH associated with the proposed Caño Martín Peña Ecosystem Restoration Project (CMP-ERP), hereafter referred to as the "Project," located in San Juan, Puerto Rico. The project includes the dredging of the CMP between Luis Muñoz Rivera Avenue and the San José Lagoon. This EFH Assessment was prepared in accordance with the Magnuson-Stevens Fishery Conservation and Management Act, which is described below.

1.1 MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

The Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) of 1976 was amended in 1996 and reauthorized in 2006. Under the requirements of the MSFCMA, EFH Assessment consultation is required for the proposed project. This report section represents the initiation of the EFH consultation by the United States Corps of Engineers (USACE) and the non-Federal sponsor, Corporación del Proyecto ENLACE del Caño Martín Peña (ENLACE) with the National Marine Fisheries Service (NMFS).

Because the proposed CMP restoration project would involve impacts to mangroves and the estuarine water column, an EFH Assessment was conducted under the provisions of the MSFCMA of 1976, as amended through January 12, 2007. EFH is defined as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (16 U.S.C. 1802(10)). The MSFCMA established standards for fishery conservation and management, and created eight Regional Fishery Management Councils (FMC) to apply those national standards in Fishery Management Plans (FMP). The MSFCMA, as amended, requires a FMP to be based upon the best available scientific and economic data for each commercial species (or related group of species, such as "reef fishes") that is in need of conservation and management within each respective region. The Caribbean FMC (CFMC) has jurisdiction over the fisheries within the Project Area.

Another provision of the MSFCMA requires that each FMC identify and protect EFH for every species managed by the FMP (50 CFR 600). The MSFCMA also requires federal agencies to provide consultation on activities that may adversely affect EFH designated in the FMP. The NMFS, a service of the U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA), is responsible for implementing this mandate.

Project-related activities may have direct (e.g., physical disruption) or indirect (e.g., loss of prey species) effects on EFH and may be site-specific or habitat-wide. The potential effects must be evaluated individually and cumulatively. The NMFS provides comments and recommendations to the responsible federal permitting agency. That information is considered by the permitting agency, and may be included in the recommendation as part of the permit conditions. According to the 50 CFR 600.920 (e)(3), an EFH assessment must include:

- A description of the proposed action;
- An analysis of the effects, including cumulative effects, of the action on EFH, the managed species and associated species by life history stage;
- Reviews regarding the effects of the action on EFH; and
- Proposed mitigation, if applicable.

1.2 PROJECT PURPOSE

The CMP-ERP is an urban ecosystem restoration project for the Caño Martín Peña (CMP) and surrounding areas of the San Juan Bay Estuary (SJBE). Restoration of the CMP would re-establish the tidal connection between the San José Lagoon and the San Juan Bay, which would improve dissolved oxygen levels and salinity stratification, increase biodiversity by restoring fish habitat and benthic conditions, and improve the functional value of mangrove habitat within the estuary.

The eastern half of the CMP (Project Channel), historically between 200 and 400 feet wide and navigable, has a current depth of between 3.94 feet and 0 foot towards the San José Lagoon. Due to years of encroachment and filling of the mangrove swamps along the CMP, the channel no longer serves as a functional connection between the SJB and the San José Lagoon. Sedimentation rates within the Project Channel are nearly twice as high as in other parts of the SJBE due to infilling and extremely limited water flow. Open waters in areas closer to the San José Lagoon have been lost, as the area has started transitioning into emergent wetlands and uplands. Sediments include a combination of debris, household refuse, and other waste account for 10% of its composition. In some sites, thickness of this material is close to 10 feet below the bottom.

The Project Channel conditions have led to the degradation within the entire estuary. Connectivity of the ecosystem has been severed and the biodiversity within the San José Lagoon has been compromised, as a reduced number of species are found when compared with other lagoons throughout the SJBE. Habitat degradation has in turn decreased the ability of those species still found to respond to natural changes, disease, and other stressors, reducing the ecosystem functions and values, including losses of economic and recreational opportunities.

For example, water residence time in the San José Lagoon is approximately 17 days. This has caused strong salinity stratification, which in turn limits dissolved oxygen levels in the 702 acres of the lagoon's bottom with depths below 4 to 6 feet, severely affecting benthic habitats. Reduced flushing capacity has also led to an increase in sedimentation rates. This, in turn, can limit oxygen exchange between mangrove roots and the surrounding environment, eventually resulting in suffocation. Habitat for many species of fauna is then lost as reduced mangrove coverage and health decreases forage opportunities and reproductive success.

Ecological degradation within the estuary has also begun to affect human health and safety of surrounding communities. Inability to implement flood risk management measures due to the lack of conveyance capacity in the Project Channel leads to localized flooding. Subsequent human contact with CMP's waters has been associated with higher rates of asthma, dermatitis, and gastrointestinal diseases.

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2.0 PROJECT DESCRIPTION

2.1 LOCATION OF ACTION

The CMP is a tidal channel 3.75 miles long in San Juan, Puerto Rico. It is part of the SJBE, found in the northern coast of Puerto Rico and the largest system of its kind in the Island. The SJBE is the only tropical estuary in the National Estuary Program and the only one found outside the continental United States and is located within the San Juan Metropolitan Area (SJMA), the most urbanized and densely populated region in Puerto Rico.

The SJBE and its associated marine ecosystems are considered the “Study Area” (Figure 2-1). The SJBE’s watershed covers an area of approximately 97 square miles (mi^2). It is characterized by a network of lagoons, channels, man-made canals, a bay, and wetlands permanently and seasonally flooded with woody and herbaceous plants.

Associated marine ecosystems include those hard and soft substrates found north of the SJBE. These are influenced by the exchange of ocean waters and the discharges of waters exiting the estuarine system. Fresh water flows into the system from the creeks and rivers flowing mostly north from its watershed, which include the Puerto Nuevo River, Juan Méndez Creek, San Antón Creek, and the Blasina Creek.

Figure 2-1. The San Juan Bay Estuary Study Area

The "Project Area" is where relocation, dredging, construction, and overall restoration activities would take place (Figure 2-2). It has been defined as the Project Channel, where dredging would take place; the adjacent delimitation of the public domain lands within the maritime terrestrial zone, where relocations are scheduled to occur; the San José Lagoon southeastern most artificial dredged pits, where dredged sediments would be disposed and turned into a CAD site; and the 6-acre Ciudad Deportiva Roberto Clemente (CDRC) dredged material staging area, where trash and debris would be transported to by barges in order to be handled and transferred by trucks for their final disposal at the Humacao Regional Landfill and were the temporary pier/dock would be built as a pontoon system for loading/unloading the dredged material.

Also included are the boating routes from the Project Channel to the CDRC, through the San José Lagoon. The Project Area is divided between the Municipality of San Juan, to the West, and the Municipality of Carolina, to the East.

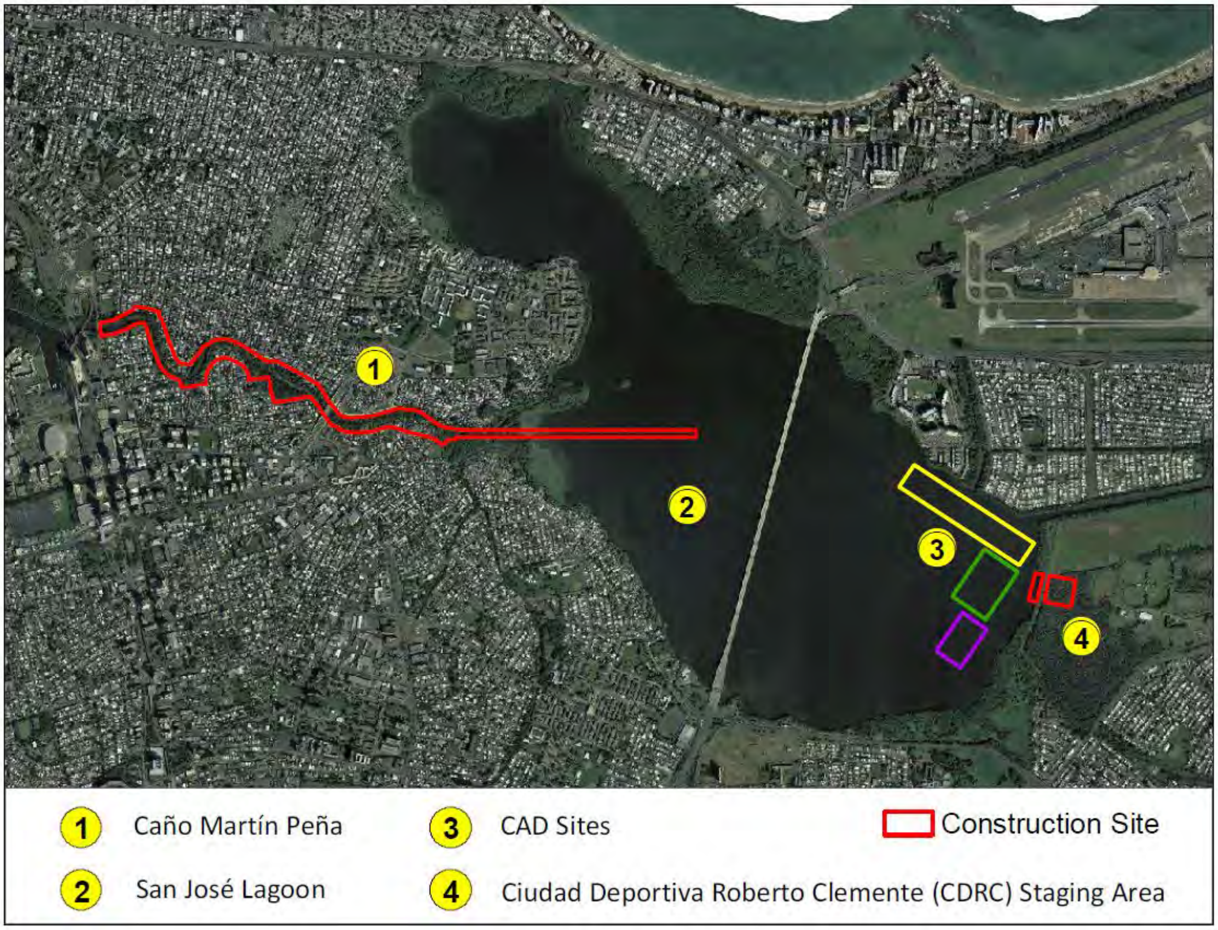

Figure 2-2. Project Area

2.2 PROJECT COMPONENTS

The proposed CMP-ERP consists of the following components:

Channel: Consists of dredging approximately 2.2 miles of the Project Channel to a width of 100 feet and a depth of 10 feet. At the terminus of the Project Channel with the San José Lagoon, an extended channel would be dredged east into the San José Lagoon (over a distance of approximately 4,300 feet) as a hydraulic transition from the CMP. This extended channel would transition from the 10-foot-deep Project Channel to the 6-foot-deep areas of San José Lagoon. The extended channel would maintain the Project Channel's 100-foot width but replace its steel sheet pile walls with a trapezoidal configuration with 5-foot to 1-foot earthen side slopes.

A barge-mounted mechanical clamshell dredge would be used to widen and deepen the CMP, and would place dredged material into dump scows. Of the 762,000 cubic yards (cy) of mixed materials, screens would separate solid waste debris (estimated at 76,200 cy) from sediments. Under this alternative, it is also estimated that the dredged solid waste debris would make up 10% of the total material to be dredged from the CMP, and the dredged sediments would bulk up to 126% of their *in* *situ* volume. Solid waste debris would also be transported by barge to a staging area for subsequent landfill disposal. Sediments would be transported by barge for disposal at the SJ1 and SJ2 CAD pits.

The walls of the channel would be constructed with vertical concrete-capped steel sheet piles with hydrologic connections to the surrounding lands. The sill depth of the window would be set at mean low water so tidal exchanges are facilitated to the mangrove beds.

Alternative Plan: 100 Foot Channel Width, 10 feet deep

Sources: Atkins, ENLACE & Puerto Rico Planning Board

Figure 2-3. Proposed Channel

Mangrove Restoration: Dredging would affect existing mangrove wetlands, albeit of extremely low functional quality. Approximately 34.46 acres of wetlands would be disturbed for construction activities, including 33.46 acres within the CMP and 1 acre at the CDRC staging area. Mangrove wetlands would be re-established in areas along a dredged canal. The north and south slopes of the channel above the sheet pile would be graded to receive tidal influence and then planted with appropriate mangrove species: *Rhizophora mangle* (red mangrove), *Avicennia germinans* (black mangrove), *Laguncularia racemosa* (white mangrove), and the associated species *Conocarpus erectus* (buttonwood). Microtopography would be added to diversify habitat.

The flow of water from the channel to the mangrove planting beds would be facilitated by building hydraulic connections, or windows, in the bulkhead at regular intervals. The sill depth of the window would be set at mean low water so that tidal exchanges are facilitated to the mangrove beds. The width of the planting beds would vary depending upon the land availability, but in general would extend from the channel wall to the line of public domain, excluding only areas set aside for recreation elements. The minimum width for mangrove fringes would be approximately 32 feet on either side of the CMP, as recommended by Fischer and Fischenich (2000).

After dredging and construction of mangrove planting beds, the CMP would consist of 25.57 acres of open water and 34.48 acres of mangroves.

Erosion Control: This alternative would also feature a weir at the Western end of the Project Area for mitigating water flows into the adjacent waterways and to protect the structural integrity of the existing four bridges. The dimensions of the weir (6.5 x 115 feet) would replicate the cross sectional area of Alternative 1 (75 x 10 feet), and would prevent scour around bridges, bulkheads, and other marine structures west of the Project Area by providing a transition area to reduce unacceptable bottom velocities between the Project Area and the adjacent channels. The weir would be constructed with an articulated concrete bottom, while the remainder of the Project Channel would be earthen bottom.

Disposal: Materials within the Cano Martin Pena include various types of solid waste, debris, and other materials. Such materials will require further testing prior to and/or during project construction, as appropriate, in accordance with an agreed sampling plan. If the testing determines that any materials contain hazardous substances at levels that are not suitable for unregulated disposal, then they will be managed in accordance with the applicable laws and regulations of the relevant regulatory agencies.

Collected debris would be loaded onto trucks, where accessible to uplands, and then transported to the Humacao Regional Landfill. Dewatering is not expected to be necessary since solid waste would air dry during transportation to the landfill. The Humacao Regional Landfill, which is located approximately 32 miles from the CMP-ERP site, is the preferred solid waste disposal site for the dredged debris because of the higher certainty it affords to receive all the trash and debris that would be originated from this project.

A barge-mounted mechanical clamshell dredge would be used to widen and deepen the CMP, and would place dredged material into dump scows. Trash would be separated from the dredged sediments by a metal sieve that overlays the dump scow opening where the dredged material would be placed after being dredged. The sieve allows the sediments to fall into the hull of the scow while the trash and debris remains on top, and can then be collected and removed to an awaiting debris barge. The debris barge would then navigate to the CDRC staging/management area for overland transport of the material to the landfill.

After screening and removal of solid waste debris, the remaining sediments would be transported in barges and disposed in the San José Lagoon CAD site. This is the preferred option for the disposal of dredged sediments because is the one that most contributes to ecosystem restoration goal, would allow a beneficial use of the sediments, and is the most complete sediment management option. Prior to disposal of dredged sediment additional water quality and sediment testing, such as bioassays, would be conducted in accordance with Section 404 of the Clean Water Act to confirm that the sediments are suitable to be disposed within the San José Lagoon CAD site.

As presented in the Bailey et al. (2002) report, the artificial depressions (pits) within the San José Lagoon were analyzed to potentially serve as CAD sites for the CMP dredged sediments.

Figure 2-4. Artificial Pits at the San José Lagoon

Bailey et al. (2002) concluded that 2 feet of clean sand are necessary to maintain a physical barrier between contaminated dredged sediments to be disposed at the CAD pits and the benthic community above (USACE, 2002). This 2-foot sand cap would contribute in preventing the release of contaminants at concentrations above water quality standards. In addition, an analysis of the currents and water circulation occurring in the lagoon was performed and it was established that the energy within the lagoon and around the CAD sites is low, which means there is a very low risk of erosion of the cap within the CAD sites.

These 4 man-made depressions found within, or adjacent, to the Project Area have been identified as sources of water quality problems in the CCMP for the SJBE (SJBEP, 2000 p. 96). Filling these man-made depressions has been recommended as one of the most cost-effective alternatives for improving the water and sediment quality in the Study Area (USACE, 2000; SJBEP, 2000). In fact, the SJBEP's CCMP identified the filling of all these pits as a priority and urgent action needed for the improvement of the water quality and habitat conditions of the entire estuarine system (Action

WS-6) (SJBEP, 2000). Therefore, the use of the CAD alternative is attractive because it would give the dredged material a beneficial reuse.

Surface areas and total and existing storage volume capacities for the evaluated pits are summarized in Table 2-1. For the San José Lagoon artificial pits, a −16 foot top-of-fill was selected to ensure uncontrolled dredged and cap sediments spill over into adjacent pits does not occur.

Table 2-1. Surface Areas and Existing Capacity of Each Artificial Pit

Artificial Dredged Pit	Existing (Max) Floor Depth (ft)	Fill Depth (ft)	Surface Area (square ft)	Existing Pit Capacity (cy)*
SJ1	–27	–16	897,190	260,516
SJ2	–27	–16	956,000	245,450
SJ3/4/5	–24	–16	1,591,070	275,373
LCC	–18	–6	1,624,865	166,210
Total Capacity of Combined San José and Los Corozos Lagoon Pits				947,549

* Existing pit capacity in cubic yards (CY) based on bathymetric study references (USACE, 1996).

The required storage volume for placing all of the bulked dredged sediments is 814,000 cy. The total existing capacity for the six artificial pits is sufficient to receive the bulked dredged sediments volume. However, additional capacity of approximately 86,000 cy would be needed to allow for the geoencapsulated sediments to be capped with 2 feet of clean sediments. This additional capacity can be achieved by modifying the depth and/or width of the artificial pits by excavating sediments from within the pits.

In conformity with the *Design of Contained Aquatic Disposal Pits for Martín Peña Canal, San Juan, Puerto Rico* study developed in 2002 by the U.S. Army Engineer Research and Development Center (ERDC) for the CMP-ERP, sand is the recommended sediment to be used as the capping material. However, since the availability of sand for capping material is limited, the best combination of pits to modify was determined based upon an objective to minimize the amount of capping material needed. The combination of SJ1 and SJ2 (prior to expansion) resulted as the alternative that would need the least amount of capping material.

Modification of the SJ1 and SJ2 pits would entail excavating the pits to their original borrow depths of –32 and –30 feet, respectively. Existing side slopes would be maintained for stability purposes as the SJ1 and SJ2 pits are deepened. The geoencapsulated-dredged sediments would be placed within the modified pits to a fill elevation of –18 feet. The placed geoencapsulated dredged sediments would be capped with 2 feet of clean sand to an unconsolidated fill depth of –16 feet. SJ1 and SJ2 would provide the capacity necessary for disposal and capping of the dredged sediments, without adversely affecting the tarpon-feeding zone at the –6-foot halocline interface.

The existing capacities for SJ1 and SJ2 to the −16-foot fill depth are 260,516 cy and 245,450 cy, respectively, for a total capacity of 505,966 cy. The revised capacities of the modified SJ1 and SJ2 pits to the −16-foot fill depth are estimated in 880,000 cy for the dredged sediments and 198,347 cy for the capping material, for a total of 1,078,347 cy. This provides sufficient capacity to place the 814,000 cy of dredged sediments and the 198,347 cy sand cap with an excess capacity of 66,000 cy. Therefore a total of 506,381 cy of sediments would need to be excavated from the SJ1 and SJ2 pits to acquire the total capacity needed to place the geoencapsulated dredged sediments and capping material within the two pits.

It is assumed that the excavated pit material is clean and therefore is suitable for unconfined open water disposal. If suitable sand is found in the excess material proposed to be removed from the SJ1/2 pits to increase their capacity, it would be utilized because is the most readily accessible and logistically viable cap material source for the SJ1 and SJ2 CAD sites.

If it is definitively determined through future investigations that the excavated pit material is not suitable for use for the sand cap, it would be placed in SJ 3/4/5/LC. Then an upland quarry site would be a reasonable secondary alternative for cap material sand sources.

Recreational features: The recreation plan would consist of three types of recreation access areas on approximately 5 acres, which would allow for major recreational use in some areas and median use in others. The recreational features would include (a) one linear park extending from the existing Enrique Martí Coll located in the western segment of the CMP, which would be constructed over the sheet pile bulk head in the Project Channel and would be located on the southern side of the CMP; (b) nine recreational access parks that would provide visual openings through the mangrove forests to the CMP, and (c) twelve recreational parks that would be smaller in scale than the proposed recreational access park, and scaled to accommodate less than 100 persons for passive recreation. The natural mangrove forest would serve as a backdrop; the twelve recreational parks would be strategically located along the Paseo del Caño, a proposed street along the MTZ-CMP as a public space that separates the eight communities from the CMP and its mangroves and prevents future encroachment. In six of the recreation parks, a trail would be built to allow access to CMP.

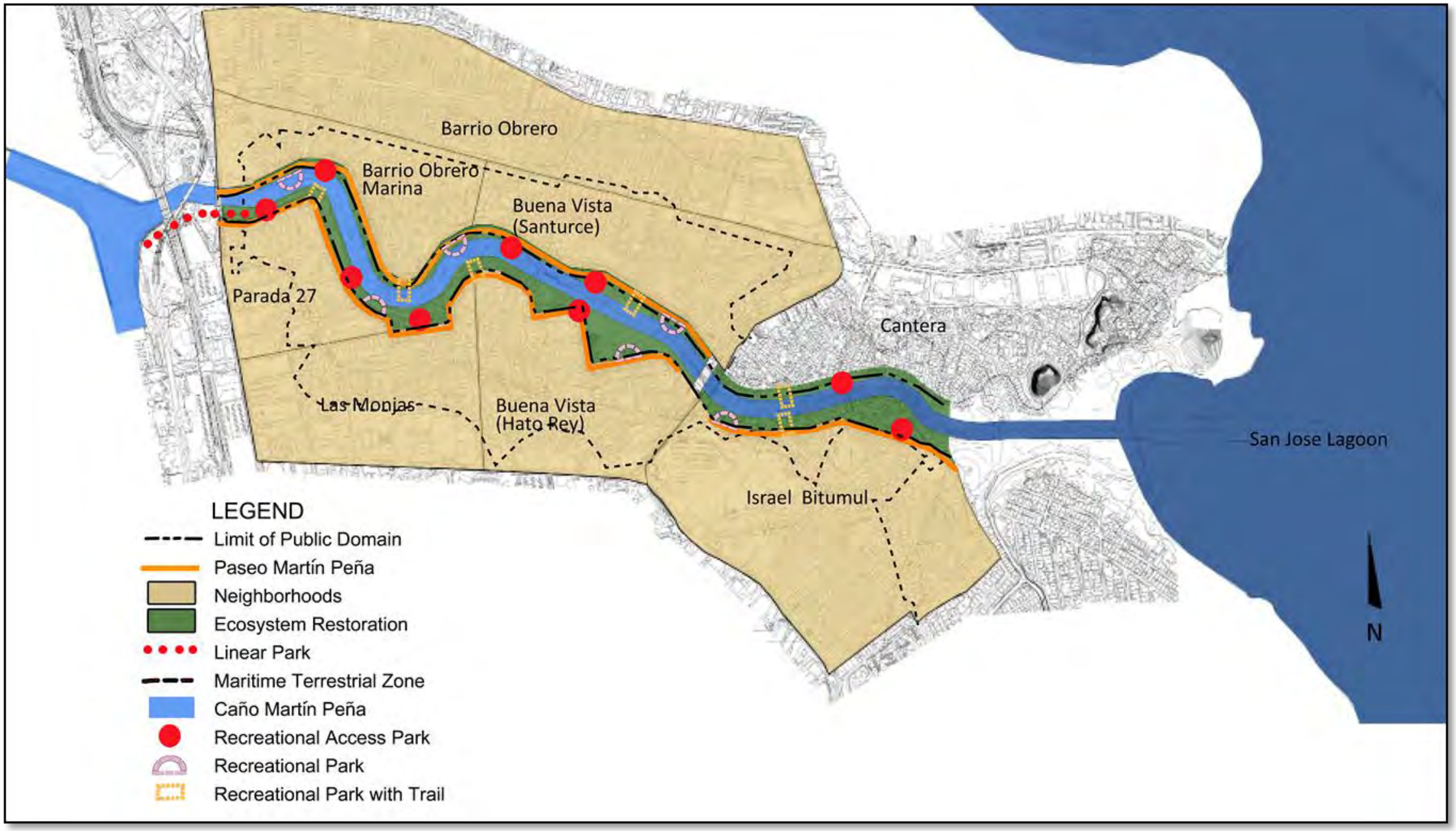

Figure 2-5. Recreational Features

Non-Structural Measures: There are no non-structural measures for the dredging of the CMP. Other measures included the acquisition of approximately 434 residential structures and 390 relocations within the confines of the Federal project. Other measures independent of the Federal project would be implemented by the non-Federal sponsor and adjacent communities, such as enforcement of illegal dumping and community education.

Proposed Schedule: Total construction time would be approximately 27 months, from October 2018 to December 2020. The duration of the benefits for the restoration of the action is anticipated to be approximately 50 years.

3.0 FIELD ASSESSMENTS

Field assessments were conducted within the Project Area and vicinity for inclusion in the *Draft Technical Memorandum – Task 3.7(a) Existing Wildlife Habitat and Task 3.7(b) Identify Threatened or Endangered Species* (Atkins, 2011d). The results of these field assessments are summarized below.

3.1 BENTHIC HABITAT ASSESSMENT

In February 2011, a field effort was conducted to characterize the surface sediment and benthic habitat of the Project Area. Benthic habitats were characterized using a petit ponar grab sampler to collect surface sediments. Epifauna were then identified from these samples. A total of six petit ponar sediment samples were collected within the CMP (Figure 3, sites F-1 through F-6). The sediment-water interface conditions were also documented using water quality profiles.

The sediment samples collected within the CMP revealed a benthic substrate consisting of highly organic, dark, unconsolidated sediment with a strong hydrogen sulfide (H_2S) odor, indicating hypoxic/anoxic conditions within the sediment. There was no evidence of epifauna, submerged aquatic vegetation (SAV), or other benthic habitat types. Cyanobacteria were observed on the sediment surface in one of the six sediment grab samples.

3.1.1 Red Mangrove Assessment

The submerged root systems of red mangroves (*Rhizophora mangle*) provide important habitat for invertebrates and fish; thus, red mangroves are considered EFH for a variety of species. Submerged red mangrove roots provide a base for the attachment of biological communities, which in turn provide prey and protection for many important commercial and recreational fish species, such as snook (Centropomidae), tarpon (Elopiidae), jacks (Carangidae), porgies (Sparidae), snappers (Lutjanidae), and groupers (Serranidae).

In February 2011, a field effort was conducted to characterize the biological (fouling) communities established on the prop roots of red mangroves within the CMP. Community assessments were conducted at 6 sampling locations within the CMP (Figure 3, sites F-1 through F-6). No tunicates (class Ascidiacea) and no individuals of the Crustacea (barnacles), Annelida (polychaete worms), or Porifera (sponges) phyla were observed at any of the sampling sites within the CMP. Cyanobacteria were observed growing on the mangrove roots in all six sampling locations.

3.1.2 Wetland Habitat Assessment

In 2011, a field effort was conducted to characterize the wetland communities within the Project Area. In order to characterize forest composition and density, a modified Gentry 0.01-hectare (ha.) sampling methodology was implemented. The basic sampling unit was a census of trees with a height greater than 2 meters and woody plants within linear transects (50 meters long by 2 meters wide) located throughout the Project Area. Based upon the information collected, the following 4 wetland types were identified within the Project Area. Figure 4-1 depicts the location of each wetland type within the estimated Project Area (i.e., these reflect estimates of the Project Area at the time of this study). Section 5 reflects recent estimates of wetlands and open water habitat within the Project Area.

- **Estuarine Forested Wetlands (15.53 acres)**: Estuarine forested wetlands within the Project Area are tidally influenced. These wetlands consist of a mangrove forest fringe along most areas of the CMP bank and a large area on the Project Channel, near the connection with the San José Lagoon. The dominant species within the estuarine, forested wetlands are black mangroves (*Avicennia germinans*), white mangroves (*Laguncularia racemosa*), and red mangroves (*Rhizophora mangle*). Other abundant species include tropical almond (*Terminalia catappa*), coconut palm (*Cocos nucifera*), and seaside mahoe (*Thespesia populnea*). The Cowardin classification (1979) for these areas is Estuarine, intertidal, forested, broad-leaved evergreen, irregularly exposed (E2FO3M).

Figure 3-1. Sediment sampling sites and red mangrove root sampling locations
Sites F-1 through F-6 were collected within the proposed study area in February 2011

- **Palustrine Forested/Emergent Wetlands (17.93 acres)**: Palustrine forested/emergent wetlands are tidally influenced and share the same vegetation composition as the estuarine forested wetlands, with some differences in their structure. While estuarine forested wetlands were dominated by black mangroves (*A. germinans*), the palustrine forested/emergent wetlands had a relatively low abundance of this species. In addition, the abundance of emergent vegetation, mostly golden leather fern (*Acrostichum aureum*), is substantial. The Cowardin classification (1979) for these areas is Palustrine, forested, broad-leaved evergreen/emergent, persistent, seasonally flooded (PFO3/EM1C). The seasonal wetlands can be described as follows: surface water is present for extended periods, especially early in the growing season, but is absent by the end of the growing season in most years. The water table after flooding ceases is variable, extending from surface saturated to a water table well below the ground surface.

- **Palustrine Emergent Wetlands (0.6 acre)**: These wetland areas are mostly dominated by malanga (*Colocasia esculenta*), para grass (*Brachiaria purpurascens*), climbing dayflower (*Commelina diffusa*), Mexican crowngrass (*Paspalum fasciculatum*), and *Ipomoea* spp. These areas are located mostly between the mangroves and the houses on the North bank of the CMP, specifically in its easternmost portion. The Cowardin classification (1979) for these areas is Palustrine, emergent, persistent, seasonally flooded (PEM1C).

- **Estuarine Open Water (7.40 acres)**: These open water areas consist of the CMP channel and its connection to the San José Lagoon. Floating vegetation was present within some of the open water areas, specifically in the areas where the CMP channel is clogged. The dominant species within these areas are water hyacinth (*Eichhornia crassipes*), duckweed (*Lemna aequinoctialis*), and water lettuce (*Pistia stratiotes*). The Cowardin classification (1979) for these areas is Estuarine, subtidal, unconsolidated bottom, subtidal (E1UBL).

3.1.3 Dredged Material Disposal Site

In 2011, a field assessment was conducted at the Contained Aquatic disposal (CAD) site within the San José Lagoon. Water quality profiles indicated that within the artificial, subaqueous pits, a halocline exists at approximately –4- and –6-foot water depth, with mesohaline water [6.5 to 8.5 practical salinity units (PSU)] above the halocline and polyhaline water below (20 to 26 PSU). Below the halocline, the water was hypoxic or anoxic, with only 0 to 2 milligrams per liter (mg/L) of oxygen. The halocline is acting as a barrier to water mixing, preventing the oxygenation of water below –6-foot water depth (Atkins, 2011b).

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4.0 ESSENTIAL FISH HABITAT AND MANAGED SPECIES

This section will describe the EFH habitat types occurring within the Project Area along with those managed species that may potentially occur within these EFH habitat types.

4.1 ESSENTIAL FISH HABITAT WITHIN THE PROJECT AREA

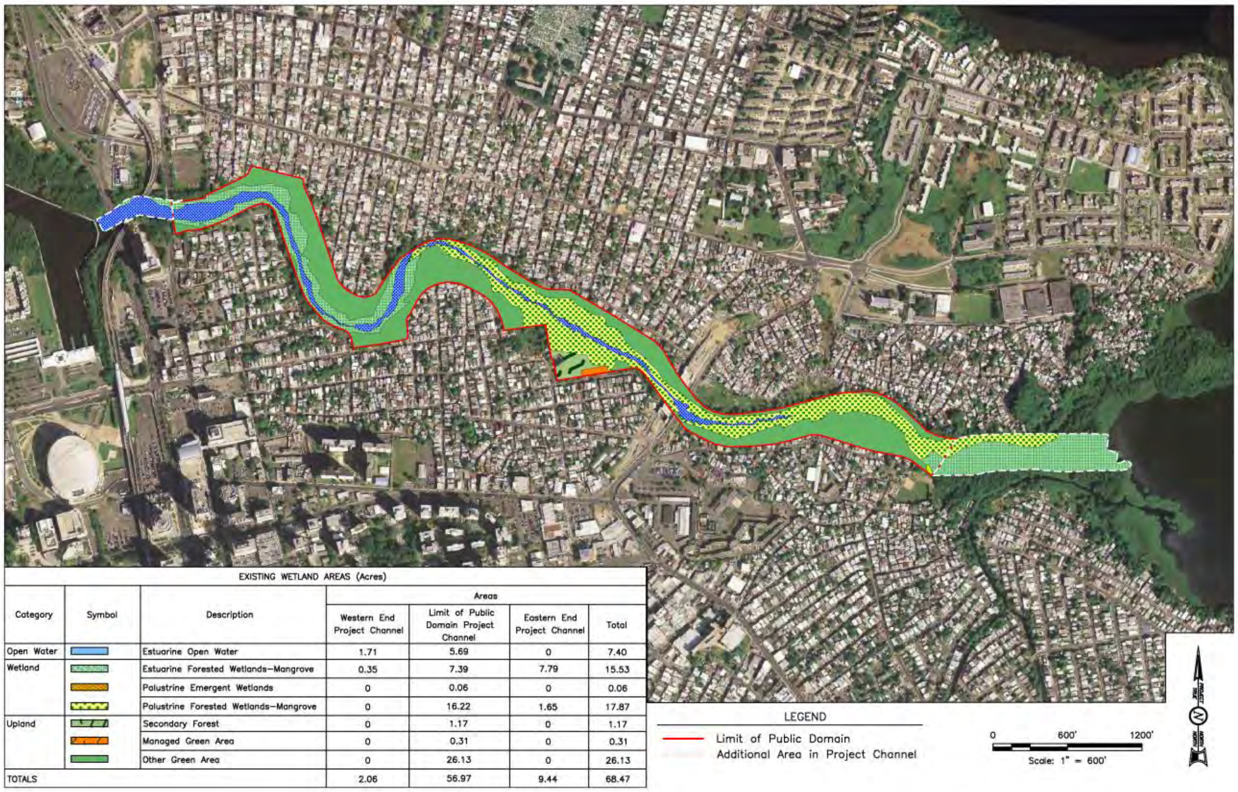
Within the Project Area, two habitats qualify as EFH based on NOAA's *Essential Fish Habitat: A Marine Fish Habitat Conservation Mandate for Federal Agencies – U.S. Caribbean* (NOAA, 1999, revised 2010). The EFH identified within the Project Area includes mangrove wetlands and estuarine water column.

4.1.1 Mangrove Wetlands

As previously described, a mangrove forest fringe occupies the majority of the banks along the CMP within the Project Area. This mangrove forest fringe is comprised of black (*Avicennia germinans*), white (*Laguncularia racemosa*), and red (*Rhizophora mangle*) mangroves. In addition, a large area of mangroves occurs in the eastern portion of the Project Area, near the connection with the San José Lagoon. Figure 4-1 shows the mangrove wetlands located within the Project Area (i.e., Estuarine Forested Wetlands/Mangroves and Palustrine Forested/Emergent Wetlands). The mangroves are located on a stabilized bank. This mangrove forest is tidally influenced by marine waters within the SJB.

Based on historic aerial photograph interpretation, the CMP was historically an extensive mangrove forest that was progressively cut and filled to accommodate dwellings for the communities currently present along the CMP. This encroachment of housing and development has resulted in a diminished mangrove forest and a drastic reduction of flow within the CMP. Some transitional wetland areas are located adjacent and contiguous to the mangrove wetlands; however, most of the wetland limits or borders are the housing structures themselves.

The ecological attributes and biological integrity of the mangrove habitat within the Project Area are degraded as a consequence of extensive human encroachment; the massive amount of fill material, scrap, and trash deposited within the mangroves; the severely degraded water quality from wastewater discharges; and the severely limited tidal flushing within the CMP. These factors severely impair the ability of the mangrove habitat within the CMP to serve as a protected nursery area for fish, crustaceans, and shellfish. In addition, the limited tidal flushing and severely degraded water quality make the mangrove wetlands within the Project Area inhospitable to larval and juvenile life stages of fish, crustaceans, and shellfish.



EXISTING WETLAND AREAS (Acres)

Category	Symbol	Description	Areas			
			Western End Project Channel	Limit of Public Domain Project Channel	Eastern End Project Channel	Total
Open Water	🟦	Estuarine Open Water	1.71	5.69	0	7.40
Wetland	🟩	Estuarine Forested Wetlands–Mangrove	0.35	7.39	7.79	15.53
	🟧	Palustrine Emergent Wetlands	0	0.06	0	0.06
	🟨	Palustrine Forested Wetlands–Mangrove	0	16.22	1.65	17.87
Upland	🟩	Secondary Forest	0	1.17	0	1.17
	🟧	Managed Green Area	0	0.31	0	0.31
	🟩	Other Green Area	0	26.13	0	26.13
TOTALS			2.06	56.97	9.44	68.47

Figure 4-1. Locations of each wetland type within the Project Area

4.1.2 Estuarine Water Column

Historically, tidal waters flowed from SJB through the CMP, and into the San José Lagoon. The Project Area is tidally influenced via marine water entering the SJB; however, the flow of water through the CMP has been altered as a result of siltation, accumulation of household and construction debris, and the encroachment of housing and other structures. The Project Channel is extremely shallow, with an approximate depth of 3 feet (1 meter) or less (Cerco et al., 2003) and the width has been narrowed to 8 feet (2.4 meters) in some areas. A review of the SJBE Program's Water Quality Monitoring Data for the CMP between September 2008 to August 2010 indicates that salinities within the CMP vary widely, from as low as 1.6 PSU to more than 35 PSU. During the February 2011 field effort, salinity within the CMP ranged from 2 to 26 PSU.

A study by Webb and Gómez-Gómez (1998) documented the severely degraded water quality within the CMP. High nutrient levels were documented within the CMP, with ammonia concentrations at 2.3 mg/L (as nitrogen) and orthophosphate concentrations of 0.22 mg/L (as phosphorus). Dissolved oxygen (DO) levels were measured to be negligible to zero within the CMP water column. Fecal-coliform bacterial counts ranging from 270,000 to 610,000 colonies per 100 mL were also documented. Sedimentation rates within the CMP are nearly two orders of magnitude higher than in other parts of the SJBE (SJBEP, 2000a). Substantial quantities of PCBs, PAHs, pesticides, B2EHP, lead, and mercury were measured within the sediments of the CMP (Webb and Gómez-Gómez; Bailey et al., 2004). The existing high sedimentation rates, presence of toxins within the sediments, low DO levels, and salinity fluctuations within the CMP do not provide a healthy ecosystem for benthic organisms (e.g., infauna, meiofauna, epifauna) or organisms relying upon the estuarine water column (e.g., fish and invertebrates).

Subaqueous pits are currently located within Los Corozos and San José Lagoons. Two subaqueous pits within the San José Lagoon have been identified as potential disposal sites for CMP dredge material (Atkins, 2011b). Water quality profiles conducted within these subaqueous pits indicate that a halocline exists at approximately –4- and –6-foot water depths. In water depths less than 4 feet, a well-mixed, oxygenated body of mesohaline water is present, capable of supporting viable flora and fauna (Atkins, 2011b). In contrast, a stagnant, hypoxic, polyhaline water body was found at depths exceeding 6 feet (Atkins, 2011b). The water qualities observed in the deeper water mass are not capable of supporting permanent biological communities.

4.2 MANAGED SPECIES WITHIN THE PROJECT’S EFH

The Mangrove Wetland EFH and Estuarine Water Column EFH provide foraging areas and shelter for a variety of species. The proposed project is located within an area designated as EFH for four FMPs: Reef Fish FMP, Queen Conch FMP, Spiny Lobster FMP, and Coral FMP. In addition, the Federally Implemented FMP includes 49 managed species within the U.S. Caribbean. Information regarding the managed species under these FMPs was reviewed to determine whether the Project Area provides suitable habitat for these species. The following resources were reviewed to determine the managed species with EFH in the Project Area:

- *Essential Fish Habitat: New Marine Fish Habitat Conservation Mandate for Federal Agencies – U.S. Caribbean* (NMFS 1999, revised 2010)
- *Final Environmental Impact Statement (FEIS) for the Generic Essential Fish Habitat Amendment to: Spiny Lobster FMP, Queen Conch FMP, Reef Fish FMP, Coral Fishery FMP for the U.S. Caribbean – Volume 1: Text* (CFMC, 2004)
- *Final Amendment 1 to the Consolidated Atlantic Highly Migratory Species FMP, Essential Fish Habitat, Chapter 5 – Life History and EFH Descriptions and Maps* (NOAA, 2009)
- NOAA’s EFH Mapper Tool (http://sharpfin.nmfs.noaa.gov/website/EFH_Mapper/map.aspx)

Reef Fish Fishery Management Plan: There are 84 managed species of reef fish in the Caribbean Region (NMFS, 1999, revised 2010), which are presented in Table 4-1. There is a general lack of information and data regarding the egg, larval, and postlarval life stages of Caribbean reef fishes (NMFS, 1999, revised 2010). Juveniles and subadults of many species of reef fish inhabit inshore seagrass and mangrove habitats as nursery grounds. They then migrate to reef habitats for their adult life stage (CFMC, 2004). Based upon the lack of information/data regarding estuarine habitat requirements for the managed reef fish species, for the purpose of this document, it is assumed that all 84 managed species could potentially be present within the Project Area during their larval/post-larval and juvenile life stages.

The FEIS for the Generic Essential Fish Habitat Amendment to: Spiny Lobster FMP, Queen Conch FMP, Reef Fish FMP and Coral Fishery FMP for the U.S. Caribbean (CFMC, 2004) lists the juvenile and adult habitats for some of the managed reef fish species (page 3-68). Based on this information, the postlarvae/juvenile and subadult life stages of the following species may occur within the mangrove habitat within the Project Area: ocean surgeonfish (*Acanthurus bahianus*), doctorfish (*A. hirurgus*), Nassau grouper (*Epinephelus striatus*), French grunt (*Haemulon flavolineatum*), white grunt (*H. plumeieri*), bluestriped grunt (*H. sciurus*), mutton snapper (*Lutjanus analis*), schoolmaster (*Lutjanus apodus*), gray snapper (*L. griseus*), dog snapper (*L. jocu*), mahogany snapper (*L. mahogani*), lane snapper (*L. synargris*), yellowtail snapper (*Ocyurus chrysurus*), rainbow parrotfish (*Scarus guacamaia*), princess parrotfish (*S. taeniopterus*), redfin parrotfish (*Sparisoma rubripinne*), redtail parrotfish (*S. chrysopterum*), and stoplight parrotfish (*S. viride*).

Table 4-1. Life Stages of Managed Species with Potential EFH in the Project Area

Species		**Life Stage Potentially Occurring in the Project Area**				
Common Name	**Scientific Name**	**Egg**	**Larvae**	**Postlarvae/ Juvenile**	**Subadult**	**Adult**
Reef Fish Fishery Management Plan						
almaco jack	*Seriola rivoliana*		✓	✓		
Atlantic spadefish	*Chaetodipterus faber*		✓	✓		
bar jack	*Caranx ruber*		✓	✓		
bigeye	*Priacanthus arenatus*		✓	✓		
black durgon	*Melichthys niger*		✓	✓		
black jack	*Caranx lugubris*		✓	✓		
black snapper	*Apsilus dentatus*		✓	✓	✓	
blackfin snapper	*Lutjanus buccanella*		✓	✓	✓	
Blackline tilefish	*Caulolatilus cyanops*		✓	✓		
blue parrotfish	*Scarus coeruleus*		✓	✓	✓	
blue runner	*Caranx crysos*		✓	✓		
bluestriped grunt	*Haemulon sciurus*		✓	✓	✓	
cardinal soldierfish	*Plectrypops retrospinis*		✓	✓		
chalk bass	*Serranus tortugarum*		✓	✓		
coney	*Epinephelus fulvus*		✓	✓		
Creolefish	*Paranthias furcifer*		✓	✓		
doctorfish	*Acanthurus chirurgus*		✓	✓	✓	
dog snapper	*Lutjanus jocu*		✓	✓	✓	
French grunt	*Haemulon flavolineatum*		✓	✓	✓	
glasseye snapper	*Priacanthus cruentatus*		✓	✓	✓	
goliath grouper	*Epinephelus itajara*		✓	✓	✓	
gray angelfish	*Pomacanthus arcuatus*		✓	✓		

Species		Life Stage Potentially Occurring in the Project Area				
Common Name	**Scientific Name**	**Egg**	**Larvae**	**Postlarvae/ Juvenile**	**Subadult**	**Adult**
gray snapper	*Lutjanus griseus*		✓	✓	✓	
graysby	*Epinephelus cruentatus*		✓	✓		
greater amberjack	*Seriola dumerili*		✓	✓		
greater soapfish	*Rypticus saponaceus*		✓	✓		
hogfish	*Lachnolaimus maximus*		✓	✓		
honeycomb cowfish	*Lactophrys polygonia*		✓	✓		
horse-eye jack	*Caranx latus*		✓	✓		
jolthead porgy	*Calamus bajonado*		✓	✓		
lane snapper	*Lutjanus synagris*		✓	✓	✓	
lantern bass	*Serranus baldwini*		✓	✓		
longspine squirrelfish	*Holocentrus rufus*		✓	✓		
mahogany snapper	*Lutjanus mahogani*		✓	✓	✓	
margate	*Haemulon album*		✓	✓		
midnight parrotfish	*Scarus coelestinus*		✓	✓	✓	
misty grouper	*Epinephelus mystacinus*		✓	✓		
mutton snapper	*Lutjanus analis*		✓	✓	✓	
Nassau grouper	*Epinephelus striatus*		✓	✓	✓	
ocean surgeonfish	*Acanthurus bahianus*		✓	✓	✓	
ocean triggerfish	*Canthidermis sufflamen*		✓	✓		
orangeback bass	*Serranus annularis*		✓	✓		
pluma	*Calamus pennatula*		✓	✓		
porkfish	*Anisotremus virginicus*		✓	✓		
princess parrotfish	*Scarus taeniopterus*		✓	✓	✓	
queen angelfish	*Holacanthus ciliaris*		✓	✓		
queen parrotfish	*Scarus vetula*		✓	✓		
queen snapper	*Etelis oculatus*		✓	✓	✓	
queen triggerfish	*Balistes vetula*		✓	✓		
rainbow parrotfish	*Scarus guacamaia*		✓	✓	✓	
red grouper	*Epinephelus morio*		✓	✓		
red hind	*Epinephelus guttatus*		✓	✓		
redband parrotfish	*Sparisoma aurofrenatum*		✓	✓	✓	
redfin parrotfish	*Sparisoma rubripinne*		✓	✓	✓	
redtail parrotfish	*Sparisoma chrysopterum*		✓	✓	✓	
rock hind	*Epinephelus adscensionis*		✓	✓		
sand diver	*Synodus intermedius*		✓	✓		
sand tilefish	*Malacanthus plumieri*		✓	✓		
schoolmaster	*Lutjanus apodus*		✓	✓	✓	
scrawled cowfish	*Lactophrys quadricornis*		✓	✓		
scrawled filefish	*Aluterus scriptus*		✓	✓		

Species		Life Stage Potentially Occurring in the Project Area				
Common Name	Scientific Name	Egg	Larvae	Postlarvae/ Juvenile	Subadult	Adult
sea bream	*Archosargus rhomboidalis*		✓	✓		
sergeant major	*Abudefduf saxatilis*		✓	✓		
sheepshead porgy	*Calamus penna*		✓	✓		
silk snapper	*Lutjanus vivanus*		✓	✓	✓	
smooth trunkfish	*Lactophrys triqueter*		✓	✓		
spotted goatfish	*Pseudupeneus maculatus*		✓	✓		
spotted trunkfish	*Lactophrys bicaudalis*		✓	✓		
squirrelfish	*Holocentrus adscensionis*		✓	✓		
stoplight parrotfish	*Sparisoma viride*		✓	✓	✓	
striped parrotfish	*Scarus croicensis*		✓	✓	✓	
tiger grouper	*Mycteroperca tigris*		✓	✓		
tobaccofish	*Serranus tabacarius*		✓	✓		
tomtate	*Haemulon aurolineatum*		✓	✓		
trunkfish	*Lactophrys trigonus*		✓	✓		
vermilion snapper	*Rhomboplites aurorubens*		✓	✓	✓	
wenchman	*Pristipomoides aquilonaris*		✓	✓		
white grunt	*Haemulon plumieri*		✓	✓	✓	
whitespotted filefish	*Cantherhines macrocerus*		✓	✓		
yellow goatfish	*Mulloidichthys martinicus*		✓	✓		
yellow jack	*Caranx bartholomaei*		✓	✓		
yellowedge grouper	*Epinephelus flavolimbatus*		✓	✓		
yellowfin grouper	*Mycteroperca venenosa*		✓	✓		
yellowtail snapper	*Ocyurus chrysurus*		✓	✓	✓	
Spiny Lobster Fishery Management Plan						
spiny lobster	*Panulirus argus*			✓		

A review of pertinent literature indicates that 124 species of fish have been identified within the entire SJBE system (Yoshiura and Lilyestrom, 1999). Of these, 15 are managed species under the Reef Fish FMP: sergeant major (*Abudefduf saxatilis)*, schoolmaster (*L. apodus*), gray snapper (*L. griseus*), dog snapper (*L. jocu*), lane snapper (*L. synargris*), Atlantic spadefish (*Chaetodipterus faber*), French grunt (*H. flavolineatum*), bluestriped grunt (*H. sciurus*), white grunt (*H. plumeieri*), margate (*H. album*), porkfish (*Anisotreums virginicus*), greater soapfish (*Rypticus saponaceus*), blue runner (*Caranx crysos*), mutton snapper (*L. analis*), and horse-eye jack (*C. latus*). The postlarvae/juvenile and subadult life stages of these 15 species could potentially occur within the Project Area.

Queen Conch Fishery Management Plan: All life stages of the queen conch (*Strobus gigas*) occur in sandy reefs or seagrass habitats. Little is known regarding the life history stages of the additional eight species listed in the Queen Conch FMP. The existing habitat within the Project Area does not provide suitable habitat for species under the Queen Conch FMP.

Spiny Lobster Fishery Management Plan: The spiny lobster (*Panulirus argus*) has 6 distinct life history stages. Mating typically occurs along the outer reefs during the spring and early summer. Fertilized eggs of this species are attached to the females that are located in the reef habitat. Once the eggs have hatched, the larval life stage occurs in the offshore pelagic environment. Postlarvae then migrate to nearshore environments where they settle on the benthos. Juvenile *P. argus* inhabit algal beds or mangrove roots and move into crevices as they grow larger. Thus, the postlarvae/juvenile life stage of *P. argus* could potentially occur within the Project Area. In the subadult stage, lobsters move out to the reef habitat, where they spend their adult life stage (CFMC, 2004).

Coral Fishery Management Plan: The Coral FMP includes several hundred managed species. The NOAA's EFH Mapper Tool indicates that the post-egg and larval life stages of species under the Coral FMP may occur within the Project Area; however, based upon the salinities, restricted tidal flow, and water pollution present within the CMP, it is highly unlikely that coral larvae would survive within the existing Project Area. The existing habitat within the Project Area does not provide suitable habitat for species under the Coral FMP.

Federally Implemented (NMFS) Fishery Management Plan: The Federally Implemented FMP includes 49 managed species of tuna, swordfish, billfish, coastal sharks, and pelagic sharks in the U.S. Caribbean (NMFS, 1999, revised 2010). A review of the EFH maps and species life history descriptions within the *Final Amendment 1 to the Consolidated Atlantic Highly Migratory Species FMP, Essential Fish Habitat* (NOAA, 2009) indicates that the existing estuarine habitat within the Project Area does not provide suitable habitat for the species under the Federally Implemented FMP.

4.3 ESSENTIAL FISH HABITAT USAGE

4.3.1 Mangrove Wetlands

In healthy mangrove systems, the roots of the mangrove trees provide a complex habitat for a diverse community. Important inhabitants of mangrove habitats include invertebrates (e.g., sponges, crabs, lobsters, tunicates, bivalves) and fish (e.g., grunts, snappers, parrotfish, barracuda, eels, surgeonfish, doctorfish, tangs). The mangrove roots provide both shelter and foraging opportunities, making them an important nursery habitat for many recreational and commercial fishery species.

Six sampling zones were identified in the San José Lagoon system for comparison of the biological communities associated with prop roots of red mangroves (Atkins, 2011d). Results indicated a presence of sponges, annelids, oysters, mussels, and tunicates within zones closest to tidal flushing (e.g., Torrecilla Lagoon) and a complete lack of fauna on mangrove roots within the CMP. Once construction is complete and tidal flushing is restored, the spiny lobster and the 84 species of reef fish managed under the Reef Fish FMP (listed in Table 4-1) could utilize this mangrove wetland habitat.

4.3.2 Estuarine Water Column

The estuarine water column habitat is typically divided into four salinity categories: low salinities found in the upstream estuary (<8 parts per thousand [ppt], oligohaline), moderate salinities found in the middle estuary (8–18 ppt, mesohaline), higher salinities found in the lower estuary (18–30 ppt, polyhaline), and seawater found near the mouth of the estuary (>30 ppt, euhaline). The estuarine water column is the avenue by which nutrients and migrating organisms are transported between river systems and the ocean. This environment is productive yet stressful to many organisms, due to variable temperature and salinity. Many species that spawn in marine waters enter the estuarine water column during their larval life stages, where they utilize the abundant food, suitable substrate, and shelter from predators. Salinities within the CMP range greatly (from less than 2 PSU to more than 35 PSU) due to freshwater pulses during storm events.

Many species that spawn in marine waters enter the estuarine water column during their larval life stages, where they utilize the abundant food, suitable substrate, and shelter from predators. As described in Section 4.1.2, the estuarine water column habitat occurring within the Project Area is severely degraded by nutrients, sewage discharges, low dissolved oxygen concentrations, and contaminants. The estuarine water column EFH may be utilized by all 85 managed species (84 reef fishes and the spiny lobster) listed in Table 4-1; however, it is likely that mobile fishes (juveniles and adults) would avoid the CMP based upon the degraded water quality present in this system.

Economically important sport fishes, including snook (*Centropomus undecimalis*) and tarpon (*Megalops atlanticus*), utilize the estuarine water column within the San José Lagoon (Atkins, 2011e). Interviews with recreational fisherman revealed that local charter boat operators focus their fishing activities at the subaqueous pits within San José and Los Corozos Lagoons. These subaqueous pits appear to be important habitats for tarpon, possibly due to the aggregation of food sources along the salinity stratification layers (haloclines) that occur within the subaqueous pits. Charter operators confirmed the conclusions of Yoshiura and Lilyestrom (1999), which indicate that recreational fishing activities targeting tarpon, a catch-and-release fishery, are an important income generator in San José Lagoon.

4.4 HABITAT AREAS OF PARTICULAR CONCERN

The CFMC is responsible for the designation of Habitat Areas of Particular Concern (HAPC) for managed species within Puerto Rico. HAPC are specific areas within EFH that either play especially important ecological roles in the life cycles of managed species or are especially vulnerable to degradation from fishing or other human activities. According to Appendix 6 of NOAA's *Essential*

Fish Habitat: New Marine Fish Habitat Conservation Mandate for Federal Agencies (NOAA, 1999, revised 2010), there are no geographically defined HAPCs within the Project Area.

However, in the *EFH Generic Amendment to the FMPs of the U.S. Caribbean* (1998), the CFMC acknowledged the scarcity of information available for the life history characteristics of their managed species. The CFMC generically designated specific habitat types as habitat areas of particular concern, including estuaries, nearshore reefs, and other hard bottom structures, based on ecological function and their importance as nursery grounds.

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5.0 ASSESSMENT OF IMPACTS TO ESSENTIAL FISH HABITAT AND MANAGED SPECIES

Sections 4.1–4.4 have identified the EFH, managed species, and HAPC within the Project Area. EFH within the Project Area has been identified for the 85 species listed in Table 4-1. Project-related activities may have direct or indirect effects on EFH and may be site-specific or habitat-wide. The potential effects must be evaluated individually and cumulatively. This Section will discuss the permanent (direct and indirect) and temporary (direct and indirect) impacts to EFH and managed species from the proposed project. The quantitative impacts were calculated based on the most recent design drawings. Mitigation to address these impacts is discussed in Section 6.0. ***Our initial determination is that the proposed action will not have a significant adverse impact on EFH or federally managed fishery species in the CMP and surrounding waters.*** The action will result in greater connectively and accessibility of species to EFH throughout the SJBE system and near offshore reef habitat.

5.1 AVOIDANCE AND MINIMIZATION OF IMPACTS TO ESSENTIAL FISH HABITAT

Several strategies have been employed in the proposed project design to avoid and minimize impacts to EFH, including selection of a channel configuration that meets the technical needs of the project and minimizes impacts to EFH, the use of scour protection measures, and the implementation of Best Management Practices (BMP) during construction.

Channel Configuration: One technique employed to minimize impacts to EFH was the careful evaluation of channel configurations for the proposed project. A hydrodynamic modeling study (Atkins, 2011a) was conducted to estimate the results of the various alternatives on flow rate and residence time for the waters within the San José Lagoon.

Scour Protection*:* All channel configurations considered would result in peak bottom velocities that would be capable of bottom scouring of the unconsolidated CMP sediments. In order to avoid scouring and any associated sediment resuspension, redistribution, and effects on water quality and clarity, scour protection measures would be used within the CMP.

Best Management Practices: BMP would be implemented at appropriate stages during construction to minimize short-term and long-term sedimentation, erosion, turbidity, and total suspended solids (TSS) in the water column. Stormwater dispersion systems, paved discharges, blankets, matting, vegetative filter strips, and berms would be employed to minimize the long-term turbidity and TSS in the water column. Sedimentation and erosion control devices would be deployed at the interface of the CMP dredging and the uplands. Stormwater from the project uplands would be filtered through these devices prior to discharge to the channel corridor. Stormwater from existing community storm sewers would be directed into the channel corridor through temporary channels and flumes. Further treatment within the channel corridor would be handled as turbidity control.

Turbidity controls and control of potential resuspension of contaminated sediment would focus on minimizing the dispersal of silt-laden water from the project limits. To minimize the dispersal of turbid water from the CMP, a temporary sheet pile coffer dam(s) would be constructed. Locations of installation include just east of the Ponce de León Avenue Bridge.

Silt curtains would be deployed within the channel corridor and around active dredging and excavations. Silt curtains are vertical, flexible structures that extend downward from the water surface to a specified water depth. Typically fabricated of flexible, polyester-reinforced thermoplastic (vinyl) fabric, the curtain is maintained in a vertical position by flotation material at the top and a ballast chain along the bottom. The curtains would be constructed to the full depth of the water where they are placed. In critical areas, the curtains may be double ringed around the active area for additional precaution.

In addition, during dredge material disposal, the subaqueous artificial dredged pits would be surrounded by a temporary sheet pile and turbidity curtains to control sediment dispersion into other areas of the San José Lagoon.

5.2 DIRECT IMPACTS TO ESSENTIAL FISH HABITAT AND MANAGED SPECIES

Direct impacts are defined as those effects caused by the action and occurring at the same time and place. The proposed CMP dredging and restoration project would result in temporary direct impacts to the estuarine water column and mangrove wetland EFH habitats. Those impacts would result from the proposed dredging activities, installation of the vertical steel sheet pile and concrete bulkhead walls, and disposal of dredged materials into the San José Lagoon pits. Long-term impacts of the restoration project would be the creation of 34.48 acres of mangrove wetlands of higher functions and value.

5.2.1 Permanent Direct Impacts to Essential Fish Habitat

The following reflects the most current estimates of direct impacts to EFH for the proposed selected project alternative (100- by 10-foot plan). Field reviews were conducted in March 2011 to verify the EFH communities within the Project Area and more recent estimates of the available Project Area have refined the impact and restoration area estimates. The short term direct impact to low functional value wetlands would generate mangrove wetlands with greater functional value and, ultimately, a net increase in wetlands with respect to open water habitat for fish and wildlife in the SJBE: a total of 34.48 acres of wetlands, for a net gain in functional habitat acres of 1.02 for mangrove wetlands and 18.17 for open water.

5.2.1.1 Mangrove Wetlands

The selected project alternative would have direct impacts to 33.46 acres of mangrove wetland EFH. This estimate includes impacts from the proposed dredging activities and the installation of the bulkhead walls. The project would result in the construction and planting of 34.48 acres of mangrove wetland EFH.

The ecological attributes and biological integrity of the mangrove habitat within the Project Area are degraded as a consequence of extensive human encroachment; the substantial quantity of fill material, scrap and trash that has been placed within the exiting mangrove community; the severely degraded water quality from wastewater discharges; and the severely limited tidal flushing within the CMP. These factors have impaired the ability of the mangrove habitat within the CMP to serve as a protected nursery area for fish, crustaceans, and shellfish, and have made the Project Area inhospitable to larval and juvenile life stages of these species. The primary goal of the proposed project is to increase tidal flushing of the San José Lagoon (via water movement through the CMP) in order to achieve environmental restoration within both water bodies; however, short term impacts to mangroves from the proposed project are unavoidable. Compensation for short-term impacts to mangrove EFH is further discussed in Section 6.1.

5.2.1.2 Estuarine Water Column

The selected project alternative would have direct impacts to 7.40 acres of estuarine water column EFH within the CMP. This estimate includes impacts from the proposed dredging activities and the installation of the bulkhead walls. The selected project alternative would result in the construction of 25.27 acres of estuarine water column EFH. The project includes disposal of dredged material within the San José Lagoon CAD pits; however, this dredged material disposal would not result in any permanent impact to estuarine water column EFH.

The proposed dredging activities would result in a permanent change in the configuration of the CMP. Currently, the Project Channel is extremely shallow, with a depth of 3 feet (1 meter) or less and the width has been narrowed to 8 feet (2.4 meters) in some areas. Dredging would remove the trash, debris, and illegal fill material that has clogged the CMP.

The volume and velocity of water flowing through the CMP from tidal flushing would increase dramatically with the proposed dredging. Currently, salinities within the CMP vary widely (SJBEP, 2011; Atkins, 2011a). With the restoration of tidal flushing within the CMP, the salinity of the water column would become less variable (Cerco et al., 2003). Freshwater pulses from storm events would be minimized due to tidal mixing and increased flow volumes and rates. A more stable salinity regime would provide a less stressful environment for fishery species.

The use of scour protection measures is proposed to avoid scouring and resuspension of the CMP sediments. The anticipated water velocities within the proposed channel configurations would prevent the establishment of submerged aquatic vegetation within the CMP; however, the scour protection measures can be permeable to water and oxygen and support infauna, benthic invertebrates, and demersal fishes.

The primary goal of the proposed project is to increase tidal flushing of the San José Lagoon (via water movement through the CMP) in order to achieve environmental restoration within both water bodies; thus, the project is self-mitigating for impacts to water column EFH. Compensatory mitigation for impacts to water column EFH is not required.

5.2.2 Temporary Direct Impacts to Essential Fish Habitat and Managed Species

Temporary direct impacts to managed species would occur in the form of habitat loss associated with the proposed project. Thus, impacts to managed species will be discussed on the basis of habitat type.

Mangrove Wetlands: Temporary direct impacts to mangrove EFH within the Project Area cannot be avoided during the proposed project (Section 5.2.1.1). In a healthy mangrove system, mangrove trees provide nursery habitat, abundant food, and shelter for a multitude of fishery organisms. The mangrove habitat within the Project Area is severely degraded as a consequence of extensive human encroachment; the massive amount of fill material, trash and debris deposited within the mangroves; the severely degraded water quality from wastewater discharges; and the severely limited tidal flushing within the CMP. As a result of this degradation, field assessments indicate a complete lack of fauna on mangrove roots within the CMP (Section 4.3.1). Once construction is complete and tidal flushing is restored within the CMP and the San José Lagoon, invertebrates (e.g., sponges, crabs, lobsters, tunicates, bivalves) and fish (e.g., grunts, snappers, parrotfish, barracuda, eels, surgeonfish, doctorfish, tangs) could utilize this mangrove wetland habitat. It is important to state that additional mangrove wetlands with higher functions and value would be created and promoted in the designated conservation zones along the CMP alignment, which results in larger mangrove areas than the existing. The ultimate goal of the proposed project is to achieve environmental restoration within the CMP and the San José Lagoon.

Estuarine Water Column: Temporary direct impacts to estuarine water column EFH within the Project Area cannot be avoided during the proposed project (Section 5.2.1.2); however, the project would result in the construction of additional estuarine water column EFH. In a healthy estuarine environment, the water column provides food, suitable substrate, and shelter for a variety of species during their larval and adult life stages. The estuarine water column within the Project Area is severely degraded by elevated nutrient levels, sewage discharges, low dissolved oxygen concentrations, and contaminants. Once construction is complete and tidal flushing is restored within the CMP and the San José Lagoon, the spiny lobster and the 84 species of reef fish managed under the Reef Fish FMP (listed in Table 4-1) could utilize this habitat. There would be no permanent direct impacts to estuarine water column EFH as a result of ocean disposal of sediments.

The ultimate goal of the proposed project is to achieve environmental restoration within the CMP and the San José Lagoon; thus, the project is self-mitigating and mitigation for impacts to estuarine water column EFH is not proposed.

No permanent direct impacts to EFH or managed species are anticipated from the proposed project. Direct impacts are considered to be short term for the purposes of this document.

5.3 INDIRECT IMPACTS TO ESSENTIAL FISH HABITAT AND MANAGED SPECIES

Indirect impacts are defined as those effects caused by the action that are later in time or farther removed in distance, but are still reasonably foreseeable. Thus, the indirect beneficial impacts from the proposed project would occur outside of the project footprint and/or subsequent to project completion.

The primary goal of the proposed project is to increase tidal flushing in the CMP and the San José Lagoon. The proposed project is anticipated to result in short term and temporary adverse indirect impacts (e.g., increases in turbidity, resuspension of contaminated sediments) and permanent beneficial indirect impacts (e.g., increase is dissolved oxygen levels, decrease in residence time). Various ecological benefits are anticipated within the Project Area (CMP) and the study area (SJBE) after construction is complete. The following sections discuss the anticipated indirect impacts.

5.3.1 Permanent Indirect Impacts to Essential Fish Habitat

5.3.1.1 Mangrove Wetlands

Permanent, indirect beneficial impacts to mangrove wetland EFH are expected from the proposed project. Restored tidal flushing within the CMP and the San José Lagoon would improve water quality within the mangrove wetlands, creating a hospitable environment for larval and juvenile life stages of fish, crustaceans, and shellfish. This would improve the red mangrove root habitat as indicated in the performance metric (Atkins, 2013). In addition, the increase in the volume and velocity of water moving through the CMP would also benefit mangrove seedling recruitment, by trapping seeds within the existing, intertidal mangrove system and/or by allowing mangrove seedlings to travel further distances and creating new mangrove wetland habitat.

5.3.1.2 Estuarine Water Column

As described in Section 1.2, the CMP currently exists in a severely degraded state, including a lack of flushing, poor water quality, contaminated sediments, and inhospitable benthic habitat. Implementation of the proposed project is expected to provide a substantial improvement to the ecological health of the CMP and portions of the SJBE, and likewise an increase in the Benthic Index Score. The improvements in water quality and flushing would benefit all habitats within the study area including seagrasses located near the inlets and the nearshore reef system through the connectivity of the SJBE system. The “epicenter” of improved conditions would be the Project Area, the CMP and San José Lagoon, but the ecosystem improvements would benefit other areas as well: 1) SJB and the Condado Lagoon would both benefit from being newly connected to a restored San José Lagoon, 2) the Suarez Canal, Torrecillas Lagoon, and Piñones Lagoon would benefit from being connected to a newly restored San José Lagoon, and 3) the offshore reefs would benefit from being adjacent to a newly inter-connected SJBE system complex. This is the premise of the fish and fisheries performance metric (Atkins, 2013).

Water Quality: Currently, water quality within the CMP and the adjacent San José Lagoon is severely degraded due to the lack of tidal flushing and illegal sewage discharges within the CMP. Implementation of the proposed project would include the restoration of tidal flushing within both water bodies. This improvement, along with the stormwater and sewage improvements that are being implemented by the Commonwealth, would beneficially impact the water quality within the CMP and the San José Lagoon. The restoration of tidal flushing (and thus, a decrease in residence time) would result in increased levels of DO throughout the water column (and eliminate the hypoxic conditions at the sediment/water interface), which is vital for creating a hospitable environment for fish and invertebrates. Additionally, the increased tidal flow would dilute the concentration of nutrients and dissolved contaminants, and decrease turbidity levels.

Salinity Fluctuation and Stratification: Current salinities within the CMP vary widely. Salinity stratification within the San José Lagoon has been documented at depths between −4 and −6 feet with mesohaline salinities in surface waters and polyhaline salinities below the stratification layer (Atkins, 2011b). Above this salinity stratification layer, DO levels are high enough to support diverse and healthy biological communities. Therefore, areas less than −4 feet presently have diverse and healthy benthic communities and high Benthic Index Scores. Below this salinity stratification layer, DO levels are hypoxic to anoxic. The hypoxic to anoxic condition was determined to be a long-term condition due to lack of water exchange within the San José Lagoon (Atkins, 2011b).

With the restoration of tidal flushing within the CMP, the salinity of the water column would become less variable, freshwater pulses from storm events would be minimized due to tidal mixing, and a more stable salinity regime would result, providing a less stressful environment for fish and invertebrates. The new tidal exchange would also result in a decrease in residence time within the San José Lagoon from 16.9 days to 3.9 days, which would decrease the salinity stratification and increase DO below the stratification layer. With increased DO in these waters, it is anticipated that the benthic communities within the San José Lagoon would become as diverse and healthy as benthic communities found at other relatively shallow depths within the SJBE system.

The proposed restoration project is anticipated to result in a substantial increase in the Benthic Index Score from 1.55 to 2.84 (Atkins, 2014) and of Habitat Unit Score from 362.95 to 663.81.

5.3.2 Temporary Indirect Impacts to Essential Fish Habitat

Temporary indirect impacts to mangrove wetland EFH and estuarine water column EFH would occur from increased turbidity, resuspension of contaminated sediments, and increased noise/vibration during construction.

Turbidity: The proposed project's temporary indirect impacts to EFH would include increased turbidity within the estuarine water column resulting from dredging activities. Increased turbidity affects light transmission through the water column, which could affect the ability of submerged aquatic vegetation to photosynthesize; however, the benthic habitat assessment conducted in February 2011 found no evidence of submerged aquatic vegetation or other benthic communities. Cyanobacteria were observed occupying the sediment surface in one of the six sampling locations. However, a temporary sheet pile and turbidity curtains to control sediment dispersion into other areas of the San José Lagoon would be used while construction activity is taking place.

Resuspension of Contaminated Sediments: Stormwater runoff carries pollutants which settle and accumulate in sediments. Many pollutants bind to sediment and are deposited on the benthos along with sediment particles. Thus, sediments often serve as a sink (storage) for toxic chemical pollutants. A multitude of studies found that sediments within SJB and the CMP contained several contaminants (Webb and Gómez-Gómez 1998; Ruiz and Schroeder 2004; Bailey et al., 2004). Natural and human disturbances, such as dredging, can release contaminants within sediments into the overlying water column which can negatively impact species utilizing these habitats (see section 5.3.3 for indirect impacts to managed species). Section 5.1 discusses the BMPs that would be implemented to minimize impacts from resuspension of contaminated sediments.

Noise/Vibration: The proposed project would include dredging construction activities within the CMP. These construction activities may temporarily increase the amount of noise and vibration within the project vicinity. Construction noise is not anticipated to reach levels that would injure or kill fish (e.g., swim bladder rupture, internal hemorrhaging, stunning). The juvenile, subadult, and adult life stages of the managed species discussed in Section 4.2 are considered to be motile and these species would likely temporarily leave the immediate Project Area during construction.

5.3.3 Indirect Impacts to Managed Species

Mangrove Habitat Loss: The current condition of the mangrove habitat within the Project Area is degraded as a consequence of extensive human encroachment; the massive amount of fill material, debris and trash deposited within the mangroves; the severely degraded water quality from wastewater discharges; and the severely limited tidal flushing within the CMP. Field assessments revealed a complete lack of fauna on mangrove roots within the CMP. Short term, negative indirect impacts to managed species resulting from the proposed construction would include mangrove habitat loss; however, this habitat loss would be greatly offset by the ecological lift anticipated by project construction (see section below). Compensatory mitigation for impacts to mangrove is not required.

Ecological Lift: Permanent, beneficial indirect impacts to managed species resulting from the proposed project include an improvement in the ecological habitats of the CMP and SJBE. As described in Sections 5.3.1.1 and 5.3.1.2, the project would restore tidal flushing and improve the health of mangrove and estuarine habitats within the CMP and the San José Lagoon. This tidal flushing would be associated with a decrease in residence time, an increase in DO levels, and a decrease in salinity fluctuations within the CMP, resulting in dramatically improved water quality. The proposed tidal flushing restoration would also allow for the recruitment and success of fishery species and invertebrates within a currently inhospitable water column and the establishment of the submerged mangrove root ecosystem by various marine organisms, such as crabs, bivalves, and mollusks, which would provide structure and food sources for a variety of fish species.

Temporary Indirect Impacts: Temporary indirect impacts to managed species would include increased turbidity within the estuarine water column resulting from construction activities. Such increased turbidity could result in the burial of benthic species, physical impairment to estuarine species (e.g., clogging of gills from suspended particulates resulting in suffocation or abrasion of sensitive epithelial tissue), and contaminant exposure to estuarine species as a result of sediment resuspension. The effect of contaminant exposure could range from immediate death (acute toxicity) to long-term illness (chronic toxicity), depending on the type and the concentration of the pollutants and the degree of exposure. In addition, resuspension of contaminated sediments has the potential to introduce contaminants into the food chain; however, the juvenile, subadult, and adult life stages of the managed species discussed in Section 4.2 are considered to be motile and highly capable of eluding adverse conditions. Turbidity control would be addressed through established permit conditions and BMPs to control erosion and sedimentation.

5.3.4 Evaluation of Cumulative Impacts to Essential Fish Habitat

Cumulative impacts are defined as “impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. “Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time” (43 CFR 56003, Nov. 29, 1978).

The proposed project would provide an ecological lift to the ecosystem by increasing tidal flushing of the San José Lagoon via the CMP, achieving environmental restoration within both water bodies and the SJBE. Several projects, which are summarized below, have been completed or are planned to occur within the SJBE.

- **CMP's District Land Use and Comprehensive Development Plan**: ENLACE, the non-Federal sponsor, is responsible for implementing this Plan. The CMP-ERP is one of the main components of the CMP Special Planning District's Comprehensive Development and Land Uses Plan strategies, which also integrates the design and implementation of additional environmental, infrastructure, housing development, family relocation, urban revitalization, land tenure, and socioeconomic development strategies before, during, and after the CMP-ERP construction.

  Currently, ENLACE is implementing the following CMP-ERP related initiatives: acquisition of 336 structures; real estate acquisition in other areas of the District, and housing rehabilitation to serve as relocation opportunities within the District; design of improvements to the San José Trunk in the segment within the Israel-Bitumul communities; the development of a FR and Draft EIS for the CMP-ERP in coordination with the USACE; the design of the Israel-Bitumul segment of the Paseo del Caño, the street along the public domain lands associated with the CMP-MTZ, storm drain and sewer system; the development of public participation activities to ensure meaningful public participation in the Project; and a micro-business incubator that provides support to recycling and ecotourism community-owned businesses.

  The following relevant initiatives are or have been implemented by other Commonwealth agencies, most under the coordination of ENLACE: relocation of the Barbosa Bridge over the CMP, elevating it to allow access for the barges, as part of the future CMP dredging (PRHTA); two surface debris clean-up activities in areas adjacent to the CMP, which resulted in the removal of over 885 tons of debris and the recuperation of over 1,500 pounds of recyclable material; construction of the Barrio Obrero Marina vacuum sewer system, north of the CMP; evaluation of alternatives for the relocation of the San José and Rexach 66 inch sewer trunks and the Borinquen 36 inch potable water distribution line [Puerto Rico Aqueduct and Sewer Authority (PRASA)]; and conceptual design for a sewer system in northern Israel-Bitumul (PRASA).

  The CMP District's Plan does not have a cumulative impact on EFH for the managed fish species and their major food sources.

- **Comprehensive Development Plan for the Cantera Península**: The Cantera Península is located at the eastern boundary of the CMP. In 1995, the Puerto Rico Planning Board adopted the Plan which includes the following projects, many of which have been implemented: relocation of most of the residents of the Cantera Península living along the public domain lands; development of several housing projects to allow for relocation alternatives within the community; and construction of a vacuum sanitary sewer, as well as other vital infrastructure, and the first segment of the Paseo del Caño. The portion of the CMP south of the Cantera Península and north of the Israel-Bitumul neighborhood is the most affected by the accumulation of trash and debris, and encroachment. All CMP-ERP alternative plans assume implementation of the projects proposed in the Cantera Plan. The Cantera Península Comprehensive Development Plan does not have a cumulative impact on EFH for the managed fish species and their major food sources.

- **Comprehensive Conservation and Management Plan for the SJBE (CCMP):** The CCMP is a long-term plan containing 49 specific targeted actions designed to address: (1) water and sediment quality; (2) habitat, fish, and wildlife; (3) aquatic debris; and (4) public education and involvement solutions to the estuary's priority environmental problems. Six actions related to water and sediment quality improvements were identified as high priority or "urgent", as they "deserve immediate attention and should be initiated as soon as possible or within 0 to 5 years after CCMP's approval" (SJBEP, 2000). Three of these are directly related to the CMP-ERP: Action WS-2- Relocate families living adjacent to the CMP, Action WS-5- Improve flow in the CMP, and Action WS-6- Fill artificial depressions at the Suárez Canal and at the San José and La Torrecilla Lagoons.

  The CCMP's Priority Action Items address habitat, fish, and wildlife. Its implementation, along with the CMP-ERP would have a positive cumulative beneficial impact on the EFH for the managed fish species and their major food sources.

- **PRASA-USEPA Consent Decree:** In June 2006, the United States Environmental Protection Agency (USEPA) issued a Consent Decree stating that PRASA must spend an estimated $1.7 million dollars in capital improvement projects to improve wastewater infrastructure in Puerto Rico, in order to comply with the Clean Water Act. By addressing Combined Sewer System (CSS), Combined Sewer Overflow (CSO), and direct household discharges in the CMP, PRASA would improve wastewater management in the CMP Planning District and further ensure compliance with the USEPA's Consent Decree. These works would take place concurrently with the CMP-ERP and will be completed prior to finalizing the ERP. Once these discharges are addressed, water and sediment quality would improve. The Consent Decree's implementation, along with the CMP-ERP would have a positive cumulative beneficial impact on the EFH for the managed fish species and their major food sources.

- **San Juan Harbor Project (SJHP)**: San Juan Harbor, which is part of the SJBE system, has the Commonwealth's main port, handling over 15 million tons (or 80%) of waterborne commerce moving through the harbor annually.

  The San Juan Harbor Project (SJHP), west of the CMP, is a completed Federal Deep-Draft Navigation Project with congressional authorizations dating back to 1917, the most recent included in the Water Resources Development Act (WRDA) of 1996, to deepen the navigation channels. The current project consists of a Bar Channel with depths from 56 to 49 feet, a 40-foot-deep Anegado entrance channel, a 40-foot-deep Army Terminal Channel, a

39-foot-deep Puerto Nuevo Channel, a 34-foot-deep Sabana Approach, a 36-foot-deep Graving Dock Channel, a 30-foot-deep Graving Dock Turning Basin, a 36-foot-deep San Antonio Channel, a 30-foot-deep extension to the San Antonio Channel, two 30-foot-deep Cruise Ship Basins, a 36-foot-deep Anchorage Area E, and a 30-foot-deep Anchorage Area F. Maintenance dredging works of the navigational channels is performed on a regular basis. The basic channel structure of the SJHP is complete; however, there may be requirements in the future for basin or wharf improvements or modifications.

Dock and storage facilities in the San Juan Bay (SJB) led to the elimination of almost all of the mangrove basin forests that existed in this waterbody, such as those associated to the outlets of the CMP, the Puerto Nuevo River, and the San Fernando Channel, and especially those that used to fringe the San Antonio Channel, including most of what is today the Isla Grande Península. Dredging works have caused the temporary resuspension of sediments and concomitant impacts to the bay's water quality, including the mechanical destruction of benthic communities. The USACE has proposed to mitigate the latest impacts to submerged aquatic vegetation by filling two artificial dredged pits in the Condado Lagoon in order to promote its restoration with seagrasses (USACE, 2014; Tetra Tech, 2011).

Overall, beneficial effects resulting from the CMP-ERP are anticipated within San Juan Harbor. The CMP-ERP would help offset some of the SJHP short- and long-term impacts of the ports operations and maintenance by restoring over 34 acres of mangrove forests and 25 acres of open waters along the Eastern CMP, and improving overall water quality and benthic habitat conditions within the SJBE.

- **Agua-Guagua Project (AcuaExpreso):** A mass transportation waterway project. Work consisted of dredging the western CMP to a dimension of 200-foot-wide and 10-foot-deep, ocean disposal of over 1.3 million cy of material dredged from the channel, and construction of 13,000 feet of concrete retaining bulkhead. Docking facilities were designed and built by the Commonwealth of Puerto Rico. Construction began in 1984 and was completed in 1988. The Project created substantial environmental and recreational benefits along the western half of CMP in addition to its use by the public as a transportation system. The Enrique Martí Coll Lineal Park was built above the bulkheads along the northern shore of the CMP. A pedestrian bridge to cross over to the southern shore, next to the AcuaExpreso docking facilities in Hato Rey, was also built. The increased tidal flows expected from the CMP-ERP would be experienced through the entirety of the CMP. This project would have a positive cumulative beneficial impact on the EFH for the managed fish species and their major food sources.
- **Juan Méndez Creek Flood Control Project:** Juan Méndez Creek, whose outlet originally discharged into the Project Channel, is a small drainage system lying within one of the most densely developed residential sectors of San Juan. The project for the clearing of the Juan

Méndez Creek outlet was conducted under the authority of Section 208 of the Flood Control Act of 1954, as amended. The Municipality of San Juan was the non-Federal sponsor for the project. The project consisted of removing the existing shoal to restore the natural channel cross section. Excavation work was performed by a long arm backhoe working from the southeast channel bank. Channel cleaning activities generated about 15,700 cy of dredged material that was hauled by truck to a sanitary landfill. Also, the creek's outlet was rerouted through the excavation of a trapezoidal channel with an average top width of 89 feet and a depth of 3.3 feet. It runs now south and parallel to the CMP for about 1,214 feet into the San José Lagoon (USACE, 2004). Sediment inputs from this creek have the potential to affect the eastern outlet of the CMP into the San José Lagoon.

- **Puerto Nuevo (Río Piedras) River Flood Control Project:** Currently under construction, is located on the north coast of Puerto Rico within the SJMA. The Puerto Nuevo River (Río Piedras) used to flow into the SJB, and now flows into the western end of the CMP. The Puerto Nuevo River basin drains 25 square miles, 75% of which is highly developed with a population of approximately 250,000 inhabitants. The improvement plan protects against the 100-year flood (the flood with a 1% likelihood of occurring in any year) through the construction of 1.7 miles of earth lined channel, 9.5 miles of concrete lined channels (5.1 of which are high velocity), and 2 debris basins in the Puerto Nuevo River and its tributaries. The plan also requires the construction of 5 new bridges, the replacement of 17 bridges, and the modification of 8 existing bridges. Two phases of this project have been completed. The project eliminated 20.5 acres of mature mangrove wetlands and the affected area included the Constitution Bridge mudflat and mangroves, a Commonwealth designated Critical Coastal Wildlife Habitat. The project proposed a 30-acre wetland mitigation project (U.S. Department of the Interior, 1994).

On May 2014, the USACE published a Draft Environmental Assessment for the La Esperanza Península maintenance dredging and the beneficial use of dredged material to restore the depressions in the Condado Lagoon. This proposed project resulted from the mitigation required for the widening of the Puerto Nuevo Channel in the San Juan Harbor, which impacted an estimated 1.2 acres of seagrass (*Halophila decipiens*) and marine macro-algae.

- **Maintenance Dredging of La Esperanza Península:** From 1962 to 1965, the San Juan Navigation Project was developed in SJB and included the construction of the Puerto Nuevo Port facilities. Aspects of this project included the deepening and widening of the SBJ's entrance channel as well as the dredging of a new navigation channel, the Puerto Nuevo Channel (SJBEP, 2000). A substantial amount of the dredged material from the development of these 2 channels was disposed at the northwestern section of the bay, to protect Cataño's Bay View coastline from wave action and erosion. The two man-made islands created by the placement of dredged material eventually formed La

Esperanza Península. Due to the littoral drift and wave action, La Esperanza Península is now in need of maintenance dredging (previously dredged by the USACE in 2005). Thus, Action WS-7 of the CCMP recommends improving the flow of water between La Esperanza Península and the SJB through its maintenance dredging. This maintenance dredging would improve water flow and decrease contaminant levels.

This mitigation project would have a positive cumulative beneficial impact on the EFH for the managed fish species and their major food sources.

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6.0 IMPACTS TO ESSENTIAL FISH HABITAT

The primary goal of the proposed project is to achieve environmental restoration within the CMP and the SJBE. This would be accomplished by increasing tidal flushing of the San José Lagoon via water movement through the CMP. Various ecological lifts are anticipated within the Project Area (CMP), east of the Project Area (San José Lagoon), and throughout the SJBE system after construction is complete. The following sections describe the restoration project goals for mangrove wetlands, as well as the improvements expected within the CMP and the San José Lagoon after completion of the project.

Adverse impacts to EFH, specifically mangrove losses, from the proposed project will be compensated by planting mangroves. ***Our initial determination is that the proposed action would not have a significant adverse impact on EFH or federally managed fishery species in the CMP and surrounding waters.***

6.1 COMPENSATION FOR SHORT TERM MANGROVE IMPACTS

As described in Section 5.2.1.1, the proposed project would result in unavoidable temporary impacts to mangrove wetlands along the CMP. The project would result in long-term benefits with increased functional value of the mangrove wetlands. Mangrove area would increase onsite to 1.4 acres for every one acre of temporary loss. Details regarding the mangrove restoration plan would be provided with further definition of the preferred project alternative. Within the mangrove planting area, red, black, and white mangroves and buttonwoods will be planted. The flow of water from the channel to the mangrove planting bed will be facilitated by building lowered wall sections or windows in the bulkhead at regular intervals. The top of the window will be set at mean low water so that tidal exchanges reach the mangrove planting beds. The width of the planting bed will vary depending upon land availability.

The mangrove restoration plan listed above would create additional, new mangrove habitat, providing shelter and foraging opportunities for recreational and commercial fishery species, bird populations, invertebrate communities, and the managed species listed in Table 4-1.

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7.0 REFERENCES

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Appendix H1.a

San Juan Bay Estuary Program
Water Quality Monitoring Data 2008–2010

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Caño Martín Peña

Red values are those that do not meet the water quality criteria Objective for the specified parameter. The Objective is a Water Quality Index that helps to identify the environmental health condition of a waterbody. Objective values are either minimum or maximum goals to be aimed as a water quality assessment criterion for the SJBEP. Some of these objectives were obtained after evaluating a year of water quality data.

	Date													
Hydrolab Quanta	May-08	Sep-08	Nov-08	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Objective	Average
Temperature C°	*	28.4	29.07	*	27.05	27.17	28.1	28.9	28.7	30.2	28.6	28.30		
Dissolved Oxygen (mg/L)†		1.31	2.56		3.9	2.5	0.69	10.42	1.25	2.87	0.08	0.05	≥ 5	
Dissolved Oxygen (%)		14.3	39.4		53.2	48.7	7.5	117.9	15.3	44.9	1	0.90		
Specific Conductance (mS/cm)		6.91	47.5		47.9	47.0	35.1	33.2	42.1	45.8	28.7	19.30		
Salinity (PSS)		3.77	31.15			33.2	22	22.3	27.4	29.3	17.6	10.34		
Turbidity (NTU)†		26	14.7		5.5	3.2	19.3	30.1	6.8	2.2	13.2	13.60	< 10	
pH†		8.62	7.6		7.7	7.8	7.6	8.1	7.8	7.4	6.9	7.10	6.0-9.0	
Secchi Depth (Meters)•		0.36	0.72		1.01	0.71	0.54	0.85	0.45	1.16	0.89	0.51	≥ 1	
Time		10:38	11:42	10:50	10:48	10:16	10:20	10:22	10:28	10:25	8:48	8:24		
Laboratory results														
Oil & Grease (mg/L) •	2.2	4.3		14.1			1.5			BDL			< 1	
Total Kjeldahl Nitrogen (mg/L) †		4.79		5.18			1.98			0.91			< 1	
Nitrate & Nitrite,total (mg/L) •	BDL	BDL		1.87			0.02			BDL			< 1	
Total Phosphorus (mg/L) †	0.493	1.010		0.963			0.428			0.060			< 0.5	
TOC (mg/L) •	6.830	6.400		3.51			2.70			BDL			< 5	
Chlorophyll a (mg/m^3) •	3.050	1.080		4.17			7.95			7.550			< 5	
Turbidity (NTU)	18.5	22.7		14.1			8.27			4.77				
Ammonia (mg/L)	3.18	4.21		1.68			0.68			1.6				
BOD (mg/L)	8	6		19			5			7			< 5	
Coliform-Fecal (CFU/100ml	78000	200000		190000			53000			2900			< 200	
Fecal Enterococcus (CFU/100mL)†	69000	61000		120000			22000			4100			< 35	
Sample Number	1211332	1267448		1267449			1377131			1412951				

*Hydrolab Quanta was not available

† PR Water Quality Standard Regulation, Evironmental Quality Board, Act 4282 as amended on May 14, 2003.

• This parameter objective is not regulated by PRWQB.

Caño Martín Peña

Red values are those that do not meet the water quality criteria Objective for the specified parameter. The Objective is a Water Quality Index that helps to identify the environmental health condition of a water body. Objective values are either minimum or maximum goals to be aimed as a water quality criterion for the SJBEP. Some of these objectives were obtained after evaluating a year of Water Quality data.

	Date										
Hydrolab Quanta	**Nov-09**	**Dec-09**	**Jan-10**	**Feb-10**	**Mar-10**	**Apr-10**	**May-10**	**Jun-10**	**Jul-10**	**Aug-10**	**Objective**	**Average**
Temperature C°	26.5	28.35	27.3	28.1	29.02	28.9	28.22	27.9	27.3	31.5		
Dissolved Oxygen (mg/L)†	1.4	1.85	0.06	2.08	2.85	1	0.22	0.22	2.66	1.18	≥ 5	
Dissolved Oxygen (%)	1.31	18.4	0.9	19.8	45.9	20.5	3.9	2.7	10	19.7		
Specific Conductance (mS/cm)	8.6	53.8	36.8	51.2	51.1	49.7	42.2	34.2	3.1	47.6		
Salinity (PSS)	5.07	35.87	23.05	34.13	33.8	32.5	26.9	20.77	1.6	31.1		
Turbidity (NTU)†	22.1	3.3	8.1	4.4	3.4	4.8	7.1	9.1	4.5	10.4	< 10	
pH†	6.9	7.8	7.41	7.5	7.5	7.85	7.2	7.1	6.83	7.7	6.0-9.0	
Secchi Depth (Meters)*	0.81	1.21	1.07	1.445	0.84	0.89	0.94	0.67	0.89	0.865	≥ 1	
Time	9:28	8:56	9:20	9:12	8:46	8:56	10:05	9:35	10:24	9:40		
Laboratory results												
Oil & Grease (mg/L) •	2			1.4			1.4			BDL	< 1	
Total Kjeldahl Nitrogen (mg/L) †	2.24			0.42			1.69			1.71	< 1	
Nitrate & Nitrite,total (mg/L) •	0.21			0.06			0.04			0.06	< 1	
Total Phosphorus (mg/L) †	0.273			BDL			BDL			BDL	< 0.5	
TOC (mg/L) •	5.710			1.00			1.49			1.170	< 5	
Chlorophyll a (mg/m^3) •	1.990			0.38			0.92			6.250	< 5	
Turbidity (NTU) ˆ TSS (mg/L)	8.57			3.68			10.3 ˆ			6.7		
Ammonia (mg/L)	1.41			0.5			1.66			0.57		
BOD (mg/L)	2			3			5			BDL	< 5	
Coliform-Fecal (CFU/100mL)†	80000			2900			15000			2100	< 200	
Fecal Enterococcus (CFU/100mL)†	14000			1200			3900			1100	< 35	
Sample Number	1469276			1507611			1543295			1582562		

*Hydrolab Quanta was not available

† PR Water Quality Standard Regulation, Evironmental Quality Board, Act 7832, March 31,2010.

• This parameter objective is not regulated by PRWQB.

ˆ(TSS: Total Suspended Solids, May and August)

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Appendix H2

Biological Assessment under Section 7 of the Endangered Species Act

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DRAFT
BIOLOGICAL ASSESSMENT UNDER SECTION 7 OF THE ENDANGERED SPECIES ACT
CAÑO MARTÍN PEÑA ECOSYSTEM RESTORATION PROJECT
SAN JUAN, PUERTO RICO

Prepared for:

Corporación del Proyecto ENLACE del Caño Martín Peña
Apartado Postal 41308
San Juan, Puerto Rico 00940-1308

September 2015

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Executive Summary

A draft Biological Assessment under Section 7 of the Endangered Species Act (ESA) for the Caño Martín Peña Ecosystem Restoration Project (CMP-ERP) has been included as part of the package that will be submitted to the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS). The package is to be submitted by the U.S. Army Corp of Engineers. The non-Federal sponsor, the *Corporación del Proyecto ENLACE del Caño Martín Peña* (ENLACE), has completed a Draft Feasibility Study and Environmental Impact Statement for the CMP-ERP. The package will also include the draft Environmental Impact Statement (DEIS).

The purpose of the consultation package is to determine to what extent the proposed action may affect any of the threatened, endangered, proposed species, and designated or proposed critical habitats.

There are no federally listed species under the ESA or critical habitat present in the eastern end of the Caño Martín Peña (the Project Area). However, in the SJBE and its associated marine ecosystems (Study Area), there are four (4) federally listed species of flora and fifteen federally listed species of fauna that may be present, and one critical habitat:

- Flora: *Schoepfia arenaria*, *Stahlia monosperma*, *Banara vanderbiltii*, and *Goetzea elegans* (beautiful goetzea)
- Fauna: *Sterna dougallii dougallii* (Roseate Tern); *Agelaius xanthomus* (Yellow-shouldered Blackbird); *Calidris canutus* (Red Knot); *Epicrates inornatus* (Puerto Rican Boa); *Trichechus m. manatus* (Antillean Manatee); three sea turtles species: *Chelonia mydas* (Green Sea Turtle), *Eretmochelys imbricata* (Hawksbill Sea Turtle), and *Dermochelys coriacea* (Leatherback Sea Turtle); as well as seven species of coral: *Acropora palmata* (Elkhorn Coral), *Acropora cervicornis* (Staghorn Coral), *Orbicella anularis* (Lobed Star Coral), *Orbicella faveolata* (Mountainous Star Coral), *Orbicella franksi* (Boulder Star Coral), *Mycetophyllia ferox* (Rough Cactus Coral), and *Dendrogyra cylindrus* (Pillar Coral*).*
- Critical habitat for *A. palmata* and *A. cervicornis.*

The CMP-ERP would restore or improve upland, wetland, and submerged habitats resembling those originally found in the Project Area, which in turn could improve conditions needed to sustain associated living resources for these species found in the Study Area. Therefore the CMP-ERP may affect, but not likely to adversely affect any of these threatened or endangered species or the critical habitat that have been documented in the Study Area.

Resumen Ejecutivo

Un borrador la Evaluación Biológica bajo la Sección 7 de la Ley Federal de Especies en Peligro (ESA, por sus siglas en inglés) para el Proyecto de Restauración Ambiental del Caño Martín Peña (CMP-ERP, por sus siglas en inglés) ha sido incluido como parte de la consulta al Servicio de Pesca y Vida Silvestre y el Servicio Nacional de Recursos Marinos. La consulta será sometida por el Cuerpo de Ingenieros del Ejército de los Estados Unidos (USACE por sus siglas en inglés). La *Corporación del Proyecto ENLACE del Caño Martín Peña* (ENLACE), el patrocinador no Federal del proyecto, ha completado un borrador de Estudio de Viabilidad y Declaración de Impacto Ambiental (DIA). La consulta también incluirá el borrador de la DIA.

El propósito de la consulta es determinar cuánto podría la acción propuesta afectar las especies en peligro de extinción, amenazadas o propuestas para designación (listadas), así como el hábitat crítico designado o propuesto.

No se han identificado especies listadas bajo ESA en la porción Este del Caño Martín Peña (el Área del Proyecto). Sin embargo, en el Estuario de la Bahía de San Juan y sus ecosistemas marinos (Área de Estudio) se identificaron cuatro (4) especies de flora y quince (15) especies de fauna listadas que pudieran estar presentes, además de un hábitat crítico:

- Flora: *Schoepfia arenaria*, *Stahlia monosperma*, *Banara vanderbiltii* y *Goetzea elegans* (matabuey)
- Fauna: *Sterna dougallii dougallii* (palometa); *Agelaius xanthomus* (mariquita); *Calidris canutus* (playero gordo), *Epicrates inornatus* (boa de Puerto Rico); *Trichechus m. manatus* (manatí antillano); tres especies de tortugas marinas: *Chelonia mydas* (tortuga verde o peje blanco), *Eretmochelys imbricata* (carey) y *Dermochelys coriacea* (tinglar); además de siete especies de coral: *Acropora palmata* (coral cuerno de alce), *Acropora cervicornis* (coral cuerno de ciervo), *Orbicella anularis* (coral estrella), *Orbicella faveolata* (coral estrella laminar), *Orbicella franksi* (coral estrella masivo), *Mycetophyllia ferox* (coral cactus áspero) y *Dendrogyra cylindrus* (coral pilar).
- Hábitat crítico para *A. palmata* y *A. cervicornis.*

El CMP-ERP restaurará y mejorará hábitats sumergidos, de tierra firme y humedales, procurando que estos se asemejen a los que se encontraban originalmente en el Área del Proyecto. Esto, a su vez, podría mejorar las condiciones necesarias para sostener los recursos asociados para la subsistencia de estas especies encontradas en el Área de Estudio. Por consiguiente, el CMP-ERP podría afectar, pero no es probable que afecte de manera adversa, estas especies amenazadas o en peligro o el hábitat crítico encontrado en el Área de Estudio.

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Acronyms and Abbreviations

BA	Biological Assessment
CAD	Contained Aquatic Disposal
CCMP	Comprehensive Conservation and Management Plan
CDRC	Ciudad Deportiva Roberto Clemente
CFR	*Code of Federal Regulations*
CMP	Caño Martín Peña
CMP-ERP	Caño Martín Peña Ecosystem Restoration Project
cy	cubic yard
DNER	Puerto Rico Department of Natural and Environmental Resources
DTPW	Puerto Rico Department of Transportation and Public Works
EA	Environmental Assessment
EIS	Environmental Impact Statement
ENLACE	Corporación del Proyecto ENLACE del Caño Martín Peña
ENLACE Project	Caño Martín Peña ENLACE Project
ER	Engineering Regulation
ERP	Ecosystem Restoration Project
ESA	Endangered Species Act
FR	Feasibility Report
FR	*Federal Register*
mi^2	square miles
MLW	Mean low water
MPRSA	Marine Protection, Research, and Sanctuaries Act
MTZ	Maritime Terrestrial Zone
MTZ-CMP	Public Domain lands within the Caño Martín Peña Maritime Terrestrial Zone
NEP	USEPA's National Estuary Program
NER	National Ecosystem Restoration
NOAA	National Oceanic and Atmospheric Administration
PL	Public Law
PR	Commonwealth of Puerto Rico
PRGAP	Puerto Rico Gap Analysis Project
Project Channel	2.2 miles of the Eastern CMP associated with the CMP-ERP
RCRA	Resource Conservation and Recovery Act
SJBE	San Juan Bay Estuary
SJBEP	San Juan Bay Estuary Program

SJHP	San Juan Bay Harbor
SJMA	San Juan Metropolitan Area
T&E	Threatened and Endangered Species
TSP	Tentatively Selected Plan
U.S.C.	United States Code
USACE	United States Army Corp of Engineers
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
WRDA 2007	Water Resources Development Act of 2007

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1.0 INTRODUCTION

The U.S. Army Corps of Engineers (USACE) and the non-Federal sponsor, Corporación ENLACE del Caño Martín Peña (ENLACE), are submitting this Biological Assessment (BA) to the National Marine Fisheries Service and the US Fish and Wildlife Service (USFWS) associated with the proposed Caño Martín Peña Ecosystem Restoration Project (CMP-ERP), located in San Juan, Puerto Rico.

The purpose of this initiation package is to review the proposed project in sufficient detail to determine to what extent it may affect any of the federally listed threatened, endangered, or proposed species, and the designated or proposed critical habitats. This initiation package is prepared in accordance with legal requirements set forth under regulations implementing Section 7 of the Endangered Species Act (50 CFR 402; 16 U.S.C. 1536 (c)).

1.1 AUTHORITY AND PURPOSE OF THE PROPOSED ACTION

Initial efforts for the CMP improvements date back to the 1970s. The USACE has been working with the non-Federal sponsor on several issues since 2000. Two of the USACE's previous reports are particularly relevant: (1) the March 2001 Caño Martín Peña Project Design Report conducted under the Support for Others Program and (2) the July 2004 Section 905(b) Analysis for Caño Martín Peña, Puerto Rico, Ecosystem Restoration prepared under the authority of a 25 September 2002 House of Representatives study resolution.

The 110th Congress enacted Public Law (PL) 110–114, known as the "Water Resources Development Act of 2007," or WRDA 2007, on November 8, 2007. Section 5127 directed that:

> *The Secretary shall review a report prepared by the non-Federal interest concerning flood protection and environmental restoration for Caño Martín Peña, San Juan, Puerto Rico, and, if the Secretary determines that the report meets the evaluation and design standards of the Corps of Engineers and that the project is feasible, the Secretary may carry out the project at a total cost of $150,000,000.*

On October 27, 2008, the Director of Civil Works issued an implementation guidance memorandum for Section 5127 of the WRDA 2007, which established that the feasibility study "will follow the requirements set forth in Appendix H of Engineering Regulation (ER) 1105-2-100 for projects authorized without a report and be submitted for approval by the Assistant Secretary of the Army (Civil Works)." Accordingly, the draft Feasibility Report (FR) and Draft Environmental Impact Statement (DEIS) have been prepared in coordination with the non- Federal Sponsor (ENLACE). This Biological Assessment is presented as part of the draft FR/EIS.

1.2 GENERAL DESCRIPTION

The CMP-ERP is an urban ecosystem restoration project to restore the Caño Martín Peña (CMP) and surrounding areas of the San Juan Bay Estuary (SJBE). Restoration of the CMP would reestablish the tidal connection between the San José Lagoon (SJL) and the San Juan Bay (SJB), which would improve dissolved oxygen levels and salinity stratification, increase biodiversity by restoring fish habitat and benthic conditions, and improve the functional value of mangrove habitat within the estuary.

The eastern half of the CMP, historically between 200 and 400 feet wide and navigable, has a current depth of between 3.94 and 0 foot towards the SJL. Due to years of encroachment and filling of the mangrove swamps along the CMP, the channel no longer serves as a functional connection between the SJB and the SJL. Sedimentation rates within the eastern CMP are nearly twice as high as in other parts of the SJBE due to infilling and extremely limited water flow. Open waters in areas closer to the SJL have been lost, as the area has started transitioning into emergent wetlands and uplands. Sediments include a combination of debris, household refuse, and other waste accounting for 10% of its composition. In some sites, thickness of this material is close to 10 feet below the bottom.

The conditions within the eastern CMP have led to degradation within the entire SJBE. Connectivity of the ecosystem has been severed and the biodiversity within the SJL has been compromised, as a reduced number of species are found when compared with other lagoons throughout the SJBE. Habitat degradation has in turn decreased the ability of those species still found to respond to natural changes, disease and other stressors, reducing ecosystem functions and values, including losses of economic and recreational opportunities.

For example, water residence time in the SJL is approximately 17 days. This has caused strong salinity stratification, which in turn limits dissolved oxygen levels in the 702 acres of the lagoon's bottom with depths below 4 to 6 feet, severely affecting benthic habitats. Reduced flushing capacity has also led to an increase in sedimentation rates. This, in turn, can limit oxygen exchange between mangrove roots and the surrounding environment, eventually resulting in suffocation. Habitat for many species of fauna is then lost as reduced mangrove coverage and health decreases forage opportunities and reproductive success.

Ecological degradation within the estuary has also begun to affect human health and safety of surrounding communities. Inability to implement flood risk management measures due to the lack of conveyance capacity in the eastern CMP leads to localized flooding. Subsequent human contact with CMP's waters has been associated with higher rates of asthma, dermatitis, and gastrointestinal diseases.

2.0 PROJECT DESCRIPTION

2.1 LOCATION OF ACTION

The CMP is a tidal channel 3.75 miles long in San Juan, Puerto Rico. It is part of the SJBE, found in the northern coast of Puerto Rico and the largest system of its kind in the Island. The SJBE is the only tropical estuary in the National Estuary Program and the only one found outside the continental United States and is located within the San Juan Metropolitan Area (SJMA), the most urbanized and densely populated region in Puerto Rico.

The SJBE and its associated marine ecosystems are considered the Study Area (Figure 2-1). The SJBE's watershed covers an area of approximately 97 square miles (mi^2). The SJBE is characterized by a network of lagoons, channels, man-made canals, a bay, and wetlands permanently and seasonally flooded with woody and herbaceous plants.

Associated marine ecosystems include those hard and soft substrates found north of the SJBE. These are influenced by the exchange of ocean waters and the discharges of waters exiting the estuarine system. Fresh water flows into the system from the creeks and rivers flowing mostly north from its watershed, which include the Puerto Nuevo River, Juan Méndez Creek, San Antón Creek, and Blasina Creek.

Figure 2-1. The San Juan Bay Estuary Study Area

The Project Area is where relocation, dredging, construction and overall restoration activities would take place (Figure 2-2). It has been defined as: (1) the eastern CMP, where dredging would take place; the adjacent delimitation of the public domain lands within the maritime terrestrial zone, where relocations are scheduled to occur; (3) the SJL southeastern most artificial dredged pits, where dredged sediments would be disposed and turned into a Contained Aquatic Disposal (CAD) site, and (4) the 6-acres Ciudad Deportiva Roberto Clemente (CDRC) dredged material staging area, where trash and debris would be transported to by barges in order to be handled and transferred by trucks for their final disposal at the Humacao Regional Landfill, and in CDRC, where the temporary pier/dock would be built as a pontoon system for loading/unloading the dredged material.

Also included are the boating routes from the eastern CMP to the CDRC, through the SJL. The Project Area is divided between the Municipality of San Juan, to the West, and the Municipality of Carolina, to the East.

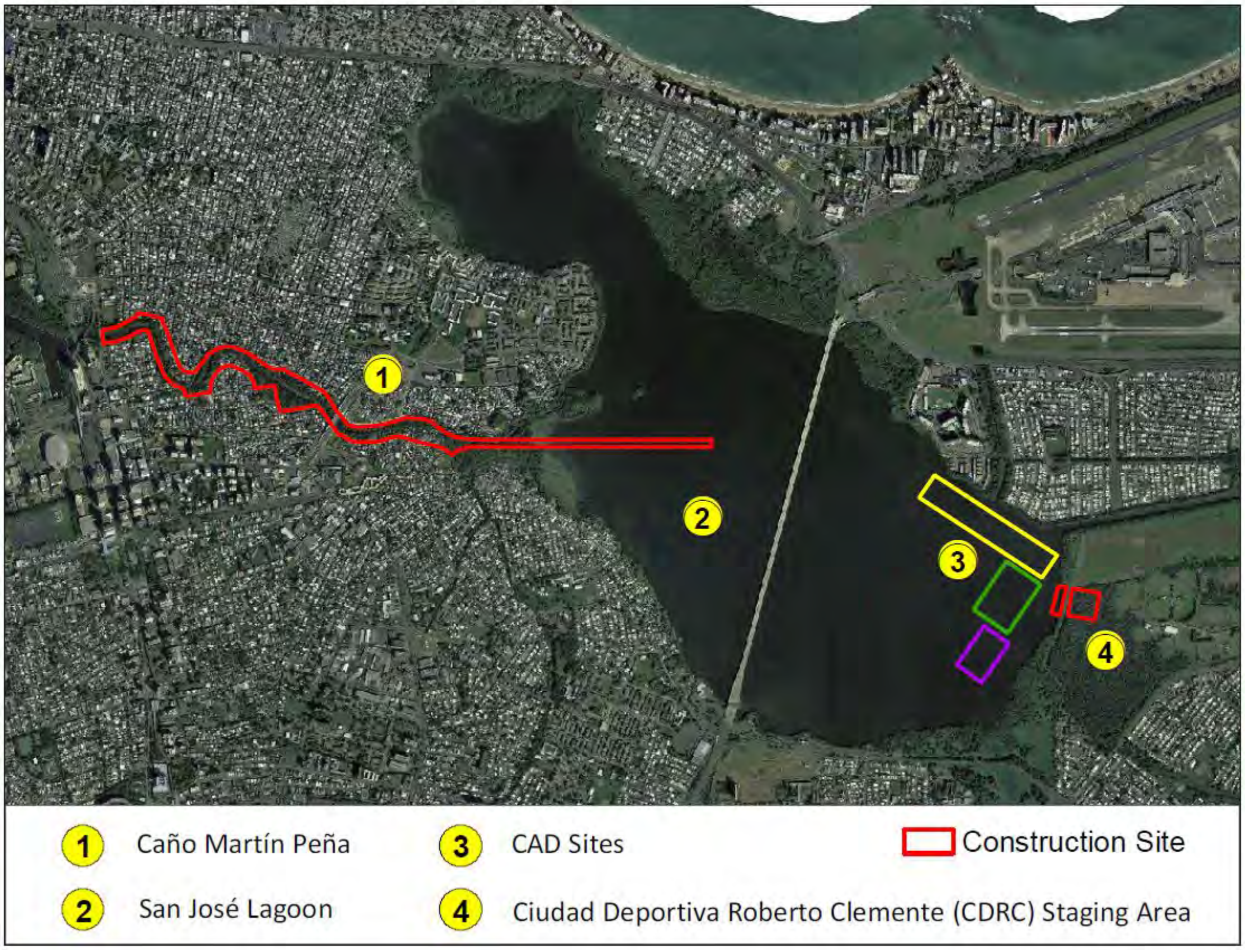
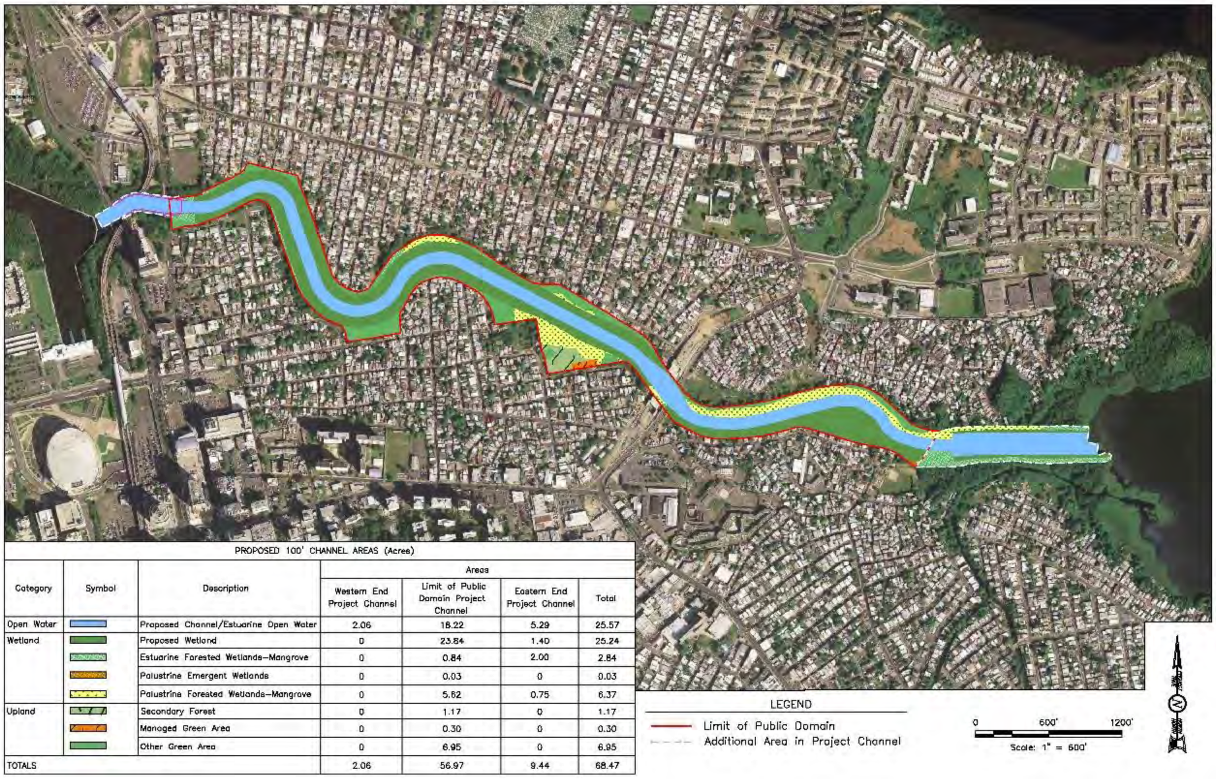


Figure 2-2. Project area

2.2 PROJECT COMPONENTS

The proposed Tentatively Selected Plan for the CMP-ERP consists of the following components:

Channel: Consists of dredging approximately 2.2 miles of the eastern CMP to a width of 100 feet and a depth of 10 feet. At the terminus of the Project Channel with the San José Lagoon, an extended channel would be dredged east into the San José Lagoon (over a distance of approximately 4,300 feet) as a hydraulic transition from the CMP. This extended channel would transition from the 10-foot-deep Project Channel to the 6-foot-deep areas of San José Lagoon (Figure 2-3). The extended channel would maintain the Project Channel's 100-foot width, but replace its steel sheet pile walls with a trapezoidal configuration with 5-foot to 1-foot earthen side slopes.



PROPOSED 100' CHANNEL AREAS (Acres)

Category	Symbol	Description	Areas			
			Western End Project Channel	Limit of Public Domain Project Channel	Eastern End Project Channel	Total
Open Water	🟦	Proposed Channel/Estuarine Open Water	2.06	18.22	5.29	25.57
Wetland	🟩	Proposed Wetland	0	23.84	1.40	25.24
	▨	Estuarine Forested Wetlands–Mangrove	0	0.84	2.00	2.84
	🟧	Palustrine Emergent Wetlands	0	0.03	0	0.03
	🟨	Palustrine Forested Wetlands–Mangrove	0	5.62	0.75	6.37
Upland	▨	Secondary Forest	0	1.17	0	1.17
	🟧	Managed Green Area	0	0.30	0	0.30
	🟩	Other Green Area	0	6.95	0	6.95
TOTALS			2.06	56.97	9.44	68.47

Figure 2-3. Proposed Channel

A barge-mounted mechanical clamshell dredge would be used to widen and deepen the CMP, and would place the dredged material into dump scows. Of the 762,000 cubic yards (cy) of mixed materials, screens would separate solid waste debris (estimated at 76,200 cy) from sediments. It is estimated that the dredged solid waste debris would make up 10% of the total material to be dredged from the CMP, and the dredged sediments would bulk up to 126% of their in situ volume. Solid waste debris would also be transported by barge to a staging area for subsequent landfill disposal. Sediments would be transported by barge for disposal at the SJ1 and SJ2 CAD pits (Figure 2-4).

The walls of the channel would be constructed with vertical concrete-capped steel sheet piles with hydrologic connections to the surrounding lands. The sill depth of the window would be set at mean low water so that tidal exchanges are facilitated to the mangrove beds.

Mangrove Restoration: Dredging would affect existing mangrove wetlands, albeit of extremely low functional quality. Approximately 34.46 acres of wetlands would be disturbed for construction activities, including 33.46 acres within the CMP and 1 acre at the CDRC staging area. Mangrove wetlands would be reestablished in areas along the dredged canal, in the Maritime Terrestrial Zone (MTZ). The north and south slopes of the channel above the sheet pile would be graded to receive tidal influence and then planted with appropriate mangrove species: *Rhizophora mangle* (red mangrove), *Avicennia germinans* (black mangrove), *Laguncularia racemosa* (white mangrove), and the associated species *Conocarpus erectus* (buttonwood). Microtopography would be added to diversify habitat.

Figure 2-4. Artificial Pits at the San José Lagoon

The flow of water from the channel to the mangrove planting beds would be facilitated by building hydraulic connections, or windows, in the bulkhead at regular intervals. The sill depth of the window would be set at mean low water so that tidal exchanges are facilitated to the mangrove beds. The width of the planting beds would vary depending upon the land availability, but in general would extend from the channel wall to the line of public domain, excluding only areas set aside for recreational elements. The minimum width for mangrove fringes would be approximately 32 feet on either side of the CMP, as recommended by Fischer and Fischenich (2000).

After dredging, construction, and seeding of mangrove planting beds, the CMP would consist of 25.57 acres of open water and 34.48 acres of mangroves.

Erosion Control: The CMP-ERP would also feature a weir at the western end of the project area for mitigating water flows into the adjacent waterways and to protect the structural integrity of the existing four bridges. The dimensions of the weir (115 x 6.5 feet) would replicate the cross sectional area of the 75-x-10-foot channel, and would prevent scour around bridges, bulkheads, and other marine structures west of the project area by providing a transition area to reduce unacceptable bottom velocities between the project area and the adjacent channels. The weir would be constructed with an articulated concrete bottom, while the remainder of the eastern CMP would be earthen bottom.

Disposal: It is estimated that trash and debris would make up 10% of the total material to be dredged from the CMP and 90% would be sediments. Larger, easily accessible pieces of debris that may be found at the surface, such as remains of discarded automobiles and refrigerators, would be collected using hydraulic excavators. Collected debris would be loaded onto trucks, where accessible to uplands, and then transported to the Humacao landfill. Dewatering is not expected to be necessary since solid waste would air dry during transportation to the landfill.

The Humacao landfill, which is located approximately 32 miles from the CMP-ERP site, is the preferred solid waste disposal site for the dredged debris because of the higher certainty it affords to receive all the trash and debris that would be originated from this project.

A barge-mounted mechanical clamshell dredge would be used to widen and deepen the CMP, and would place dredged material into dump scows. Trash would be separated from the dredged sediments by a metal sieve that overlays the dump scow opening where the dredged material would be placed after being dredged. The sieve allows the sediments to fall into the hull of the scow while the trash and debris remains on top, and can then be collected and removed to an awaiting debris barge. The debris barge would then navigate to the CRDC staging/management area for overland transport of the separated material to the landfill.

After screening and removal of solid waste debris, the remaining sediments would be transported in barges and disposed in the San José Lagoon CAD site. This is the preferred option for the disposal of dredged sediments because is the one that most contribute to ecosystem restoration goal, would allow a beneficial use of the sediments, and is the most complete sediment management option. Prior to disposal of dredged sediment additional water quality and sediment testing, such as bioassays, would be conducted in accordance with Section 404 of the Clean Water Act to confirm that the sediments are suitable to be disposed within the San José Lagoon CAD site.

As presented in the Bailey et al. (2002) report, the artificial depressions (pits) within the San José Lagoon were analyzed to potentially serve as CAD sites for the CMP dredged sediments not encapsulated with geotextile containers.

Bailey et al. (2002) concluded that 2 feet of clean sand are necessary to maintain a physical barrier between contaminated dredged sediments to be disposed at the CAD pits and the benthic community above (USACE, 2002). This 2-foot sand cap would contribute in preventing the release of contaminants at concentrations above water quality standards. In addition, an analysis of the currents and water circulation occurring in the SJL was performed and it established that the energy within the lagoon and around the CAD sites is low, which means there is a very low risk of erosion of the cap within the CAD sites.

These four man-made depressions found within, or adjacent, to the Project Area have been identified as sources of water quality problems in the Comprehensive Conservation and Management Plan (CCMP) for the SJBE (SJBEP, 2000 p. 96). Filling these man-made depressions has been recommended as one of the most cost-effective alternatives for improving the water and sediment quality in the Project Area (USACE, 2000; SJBEP, 2000). In fact, the SJBEP's CCMP identified the filling of all these pits as a priority and urgent action needed for the improvement of the water quality and habitat conditions of the entire SJBE system (Action WS-6) (SJBEP, 2000). Therefore, the use of the CAD alternative is attractive because it would give the dredged material a beneficial reuse.

Surface areas and total and existing storage volume capacities for the evaluated pits are summarized in Table 2-1. For the San José Lagoon artificial pits, a –16-foot top-of-fill was selected to ensure uncontrolled dredged and cap sediments spill over into adjacent pits does not occur.

Table 2-1. Surface Areas and Existing Capacity of Each Artificial Pit

Artificial Dredged Pit	Existing (Max) Floor Depth (ft)	Fill Depth (ft)	Surface Area (square ft)	Existing Pit Capacity (cy)*
SJ1	–27	–16	897,190	260,516
SJ2	–27	–16	956,000	245,450
SJ3/4/5	–24	–16	1,591,070	275,373
LCC	–18	–6	1,624,865	166,210
Total Capacity of Combined San José and Los Corozos Lagoon Pits				947,549

* Existing pit capacity in cubic yards (CY) based on bathymetric study references: (USACE, 1996).

The required storage volume for placing all of the bulked dredged sediments is 814,000 cy. The total existing capacity for the six artificial pits is sufficient to receive the bulked dredged sediments volume. However, additional capacity of approximately 86,000 cy would be needed to allow for the geoencapsulated sediments to be capped with 2 feet of clean sediments. This additional capacity can be achieved by modifying the depth and/or width of the artificial pits by excavating sediments from within the pits.

Based upon a CAD analysis performed by the USACE ERDC in 2002 for the CMP-ERP (Bailey, et.al (2002)), sand is the recommended sediment to be used as the capping material. However, since the availability of sand for capping material is limited, the best combination of pits to modify was determined based upon an objective to minimize the amount of capping material needed. The combination of SJ1 and SJ2 (prior to expansion) resulted as the alternative that would need the least amount of capping material.

Modification of the SJ1 and SJ2 pits would entail excavating the pits to their original borrow depths of –32 and –30 feet, respectively. Existing side slopes would be maintained for stability purposes as the SJ1 and SJ2 pits are deepened. The geoencapsulated-dredged sediments would be placed within the modified pits to a fill depth of –18 feet. The placed geoencapsulated dredged sediments would be capped with 2 feet of clean sand to an unconsolidated fill depth of –16 feet. SJ1 and SJ2 would provide the capacity necessary for disposal and capping of the dredged sediments, without adversely affecting the tarpon-feeding zone at the –6-foot halocline interface.

The existing capacities for SJ1 and SJ2 to the –16-foot fill depth are 260,516 cy and 245,450 cy, respectively, for a total capacity of 505,966 cy. The revised capacities of the modified SJ1 and SJ2 pits to the –16-foot. fill depth are estimated in 880,000 cy for the dredged sediments and 198,347 cy for the capping material, for a total of 1,078,347 cy. This provides sufficient capacity to place the 814,000 cy of dredged sediments and the 198,347 cy sand cap with an excess capacity of 66,000 cy. Therefore a total of 506,381 cy of sediments would need to be excavated from the SJ1 and SJ2 pits to acquire the total capacity needed to place the geoencapsulated dredged sediments and capping material within the two pits.

It is assumed that the excavated pit material is clean and therefore is suitable for unconfined open water disposal. If suitable sand is found in the excess material proposed to be removed from the SJ1 and SJ2 pits to increase their capacity, it would be utilized because is the most readily accessible and logistically viable cap material source for the SJ1 and SJ2 CAD sites. In that case, 198,347 cy less sediments need be placed in SJ 3/4/5/LC.

If it is definitively determined through future investigations that the excavated pit material is not suitable for use for the sand cap, it would be placed in SJ 3/4/5. Then an upland quarry site would be a reasonable secondary alternative for cap material sand sources.

Recreational Features: The recreation plan would consist of three types of recreation access areas, which would allow for major recreational use in some areas and median use in others. Recreational features would include: (1) a linear park, extending from the existing Enrique Marti Coll linear park located to the western CMP. It would be constructed over the sheet pile bulk head in the eastern CMP (with the mangrove fringe between the linear park trail and the Paseo), and would be located on the southern side of the CMP; (2) 9 recreation access parks that would provide visual openings through mangrove forest to the CMP, and (3) 12 recreation parks that would be smaller in scale than the proposed recreational access park, and would be scaled to accommodate less people for passive recreation. The natural mangrove forest would serve as a backdrop, the 12 recreation parks would be strategically located along the Paseo del Caño walkway corridor to serve immediately adjacent blocks. In six of the recreation parks, a trail would be built through the forest to allow access to CMP.

Non-Structural Measures: There are no non-structural measures for the dredging of the CMP. Other measures included: the acquisition of approximately 434 residential structures and 390 relocations within the confines of the Federal project. Other measures independent of the Federal project would be implemented by the non-Federal sponsor and adjacent communities, such as enforcement of illegal dumping and community education.

Proposed Schedule: Total construction time would be approximately 27 months, from October 2018 to December 2020. The duration of the benefits for the restoration of the action is anticipated to be approximately 50 years.

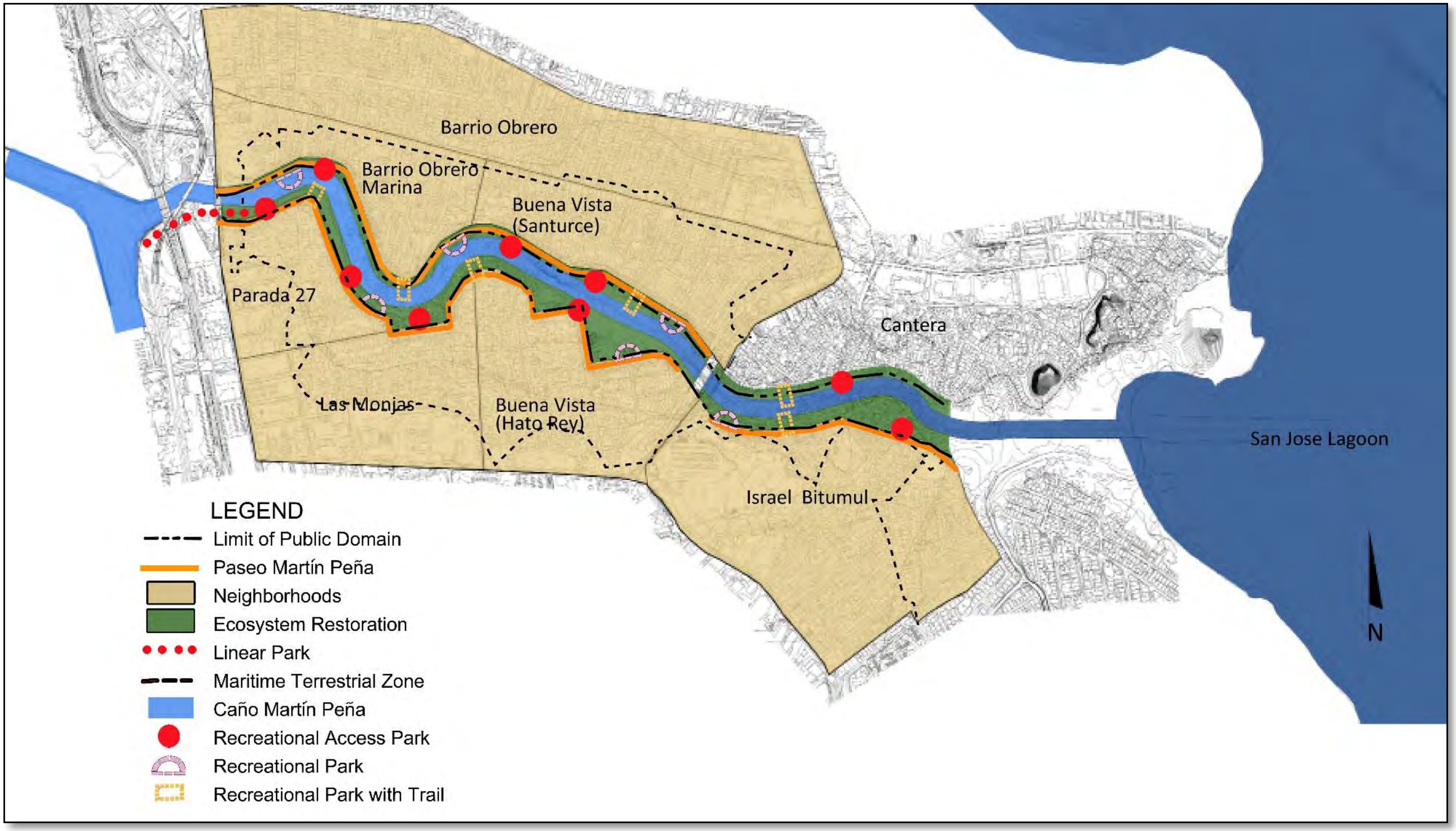


Figure 2-5. Proposed Federal Recreation Plan

3.0 THREATENED OR ENDANGERED SPECIES

Based on field visits and revisions of pertinent literature, including previous environmental documents prepared for the site, neither federally listed species nor critical habitats were found in the Project Area.

There are 19 federally listed species and a critical habitat identified in the Study Area. Terrestrial species were identified using the USFWS Caribbean Endangered Species Map (2012), which provides the latest official reference for the identification of general locations (municipalities) where federally listed species, according to the Endangered Species Act (ESA), may be found. This publication presents the best available information, although it does not represent the absolute distribution of a particular species since additional sightings may occur. In addition, the Flora and Fauna inventory prepared for the SJBEP, as well as various benthic studies conducted for the installation of submarine fiber optics cables in the study area, were also reviewed.

The species identified in the study area are described below.

3.1 FLORA

A. Banara vanderbiltii (Palo de Ramón) - E

***Banara vanderbiltii* (Palo de Ramón)**

This species is classified as endangered under the ESA. It is also classified by the Commonwealth as Critically Endangered under Regulation 6766, for the Threatened and Endangered Species (created under the Puerto Rico Wildlife Act, Law No. 241 of August 15, 1999).

B. vanderbiltii was discovered by Amos Arthur Heller in 1899, and named in honor of Cornelius Vanderbilt, who financed his collection in Puerto Rico. The first specimens were collected at Cataño and Martín Peña, near the project area, but it has not been found at this location since that time. *B. vanderbiltii* was not collected again until the 1950s, when two trees were found in the haystack hills west of the municipality of Bayamón. These trees were subsequently destroyed when the area was cleared to plant yams, and the species was thought to be extinct. However, further investigation of the same general area yielded five young plants (Vivaldi & Woodbury, 1961). More recently, a sixth plant was found at the site.

Description of the affected environment: This species has been documented in the vicinity of the Caño Martín Peña (USFWS, 2012), in the haystack hills (“mogotes”), outside the project area. Originally, reported in the early 20th century in the "mogotes" adjacent to the CMP. This species, however, has not been documented ever since in this vicinity, probably eliminated due to limestone and fill mining, and the consequent destruction of these "mogotes" during the mid-decades of that century. It is believed to no longer persist in this area (USFWS, 2014).

Description of species biology: *B. vanderbiltii* is an evergreen shrub or small tree reaching 30 feet in height and 5 inches in diameter. The leaves are arranged alternately in a single plane, have a dentate margin, and are densely pubescent on both sides. The flowers of the *B. vanderbiltii* plant are bisexual, its fruits were only discovered circa 1987, and there is no information available as to the frequency or viability of the fruit and seed. The species is restricted to a single locality in the semi-evergreen forests of the limestone karst region of northern Puerto Rico, between Vega Baja and Bayamón. Nothing is known of the species' regenerative capacity, thus it is not clear whether the existing population is capable of maintaining or increasing its size (USFWS, 1991).

Description of current conditions:

1. **Range-wide:** Palo de ramón, family Salicaceae, was first collected in 1899 by Amos A. Heller near the municipality of Cataño, west of San Juan (USFWS, 1991). The species was later found in Rio Lajas in the municipality of Dorado and at Las Piedras del Collado in the municipality of Salinas (USFWS, 1991). Only 11 plants were known from two localities: one at the Rio Lajas ward in the municipality of Dorado, and another at Las Piedras del Collado area (also known as Las Tetas de Cayey) in the municipality of Salinas. These natural populations have been poorly monitored, and currently the status of these populations is unknown. No additional location information is available. Since the early 1990s, PRDNER has propagated approximately 190 individuals of Palo de ramón, introducing them in eight localities throughout Puerto Rico (Eduardo Cintrón, PRDNER, pers. comm. 2013) on privately owned lands and Commonwealth lands managed for conservation. However, due to the lack of updated information on its status, the current status of these introduced populations is uncertain. Because the natural and introduced populations of Palo de ramón have been poorly monitored and no status surveys on the species have been conducted recently, the status of Palo de ramón is unknown.

2. **In project area:** This species was not observed during site reconnaissance surveys conducted during January and February 2011 (Atkins, 2011).

3. **Cumulative effects of State and private actions in project area:** Expansion of human habitation in the San Juan area has been responsible for the destruction of other known populations, and the sole remaining population is threatened by continued development of adjacent areas. A Karst protection regulation is anticipated to help prevent additional habitat loss for this species.

Critical habitat: No critical habitat has been designated for this species (USFWS, 1991).

Effects of proposed action on each species and/or critical habitat: The Project will not impact haystack hills nor create them; therefore it is not likely to have any direct or indirect effects upon this species. The interrelated and interdependent actions associated with the project will not impact this habitat either, and thus are not anticipated to have an effect on this species or its habitat. Since the species has not been observed in the project impact area, and its habitat will not be impacted by the project, it is not anticipated that incidental take will result from project activities (Atkins, 2011).

Conservation measures: None applicable to the proposed project.

Conclusions: The proposed action may affect, but not likely to adversely affect *B. vanderbiltii.*

B. *Schoepfia arenaria* - T

This species is classified as Threatened under the ESA. It is also classified by the Commonwealth as Endangered under Regulation 6766, for the Threatened and Endangered Species (created under the Puerto Rico Wildlife Act, Law No. 241 of August 15, 1999).

Description of the affected environment: This species was not observed during site reconnaissance surveys conducted during January and February of 2011 (Atkins, 2011).

This species was originally reported in the early 20th century. Was first documented in the sandy coastal thickets north of the San José Lagoon, but it has not been recorded ever since in that area.

Description of species biology: *S. arenaria* is an evergreen shrub or small tree that occurs in low elevation evergreen and semi-evergreen forests of the limestone hills of northern Puerto Rico at elevations varying from 490 to 1,150 feet. It grows to 20 feet tall, and may have several trunks from the base, each reaching 10 centimeters in diameter. Flowering has been observed in spring and fall, and fruits in the summer and winter months. Two to three light-yellow tubular flowers are borne on the end of the stalk at the leaf bases. The fruit is elliptic, one-seeded, shiny, red, and only 12 millimeters in diameter. Its wood is light brown and hard.

Schoepfia arenaria

The historical range of the species included the coastal forests of northern Puerto Rico; however, it is presently (1992) known from only Isabela (150 individuals), Piñones (thirty individuals), Fajardo (50 individuals), and the Río Abajo Commonwealth Forest (one individual).

Description of current conditions for the species:

1. **Range-wide:** The species has been reported from Isabela, Piñones, Fajardo, the Río Abajo Commonwealth Forest, and the Tortuguero Lagoon Natural Reserve. Deforestation and limestone hill destruction for industrial, urban, and tourism expansion have restricted this species to its present locations.

   S. arenaria was documented in 1899 and 1939 from coastal thickets at San José Lagoon. Karst was quarried in the area for many years, thence the name of one of the communities surrounding the CMP: Cantera. There is a limestone hill (karst) adjacent to the proposed project area, but not within its footprint.

2. **In project area:** This species has not been documented in the Project area. It was not observed during site reconnaissance surveys conducted during January and February of 2011.

3. **Cumulative effects of State and private actions in project area:** Federal and Commonwealth efforts are to protect privately owned population sites where it is found, and to establish self-sustaining populations in Commonwealth forests. The karst habitat for *S. arenaria* has also been somewhat protected by Commonwealth regulation. Therefore, the subject action and other proposed actions will face these regulatory protections against further impacts upon *S. arenaria.*

Critical habitat: No critical habitat has been designated for this species.

Effects of proposed action on each species and/or critical habitat: Since *S. arenaria* is not found within the proposed project's footprint, nor is its habitat, there are no anticipated effects upon it from the proposed project's construction or operation.

Conservation Measures: No conservation measures are applicable to the proposed project.

Conclusions: The proposed action may affect, but not likely to adversely affect *S. arenaria.*

C. Stahlia monosperma (Cóbana negra) –T

This species is classified as Threatened under the ESA and under the Commonwealth Regulation 6766, for the Threatened and Endangered Species (created under the Puerto Rico Wildlife Act, Law No. 241 of August 15, 1999).

Stahlia monosperma (Cóbana negra)

Description of the affected environment: Trees were planted immediately west of the San José Lagoon as part of a restoration project conducted by the SJBEP during the early 2000s, in an upland buffer strip between the mangrove fringing the lagoon and a local road adjoining Las Margaritas Public Housing Project, in the Cantera community.

Description of species biology: Cóbana negra is a medium size tree that reaches 25–50 feet in height and a trunk diameter of 1 to 1.5 feet. It belongs to a monotypic genus of the Leguminosae (Fabaceae) family and Caesalpinaceae subfamily endemic to Puerto Rico and the Dominican Republic (Little & Wadsworth, 1964, as cited by USFWS, 2014). The pinnately compound, alternate leaves have from 6 to 12 opposite leaflets with scattered black dots or glands on the lower surface. Racemes (3 to 8 inches or 7 to 15 centimeters) of yellow flowers are produced between March and May, with the exact period being dependent upon rainfall. The fruits are about 1 inch (2 to 3 centimeters) in diameter and have a thin, red fleshy covering surrounding the single, large seed. These fruits have the noticeable odor of ripe apple. Seeds are apparently animal dispersed and germinate after burial and when surface water has receded.

Description of current conditions for the species:

1. **Range-wide:** Natural populations of Cóbana negra are found in nine areas: Punta Ventana, Punta Guaniquilla, Laguna Joyuda, Punta Melones, Road PR-307 (Boquerón Country Club), near Villa Taína, Sierra Bermeja, Punta Picúa, and Vieques Island. Additionally, the specie has been planted in at least 18 municipalities throughout Puerto Rico, besides those individuals planted as part of reforestation efforts and public education, and those that have been planted Island-wide around public parks, and along Commonwealth and rural roads and private parcels (USFWS, 2014).

2. **In project area:** This species has not been documented in the Project area. It was not observed during site reconnaissance surveys conducted during January and February of 2011.

3. **Cumulative effects of State and private actions in project area:** As their presence in the project area has not been confirmed, there are no cumulative impacts to *S. monosperma.*

Critical habitat: No critical habitat has been designated for this species.

Effects of proposed action on each species and/or critical habitat: Since *S. monosperma* is not found within the proposed project's footprint, nor is its habitat, there are no anticipated effects upon it from the proposed project's construction or operation.

Conservation measures: No conservation measures are applicable to the proposed project.

Conclusions: The proposed action may affect, but not likely to adversely affect *S. monosperma.*

*D. Goetzea elegans (*Beautiful Goetzea/ matabuey) - E

This species is classified as Endangered under the ESA. It is also classified by the Commonwealth as Endangered under Regulation 6766, for the Threatened and Endangered Species (created under the Puerto Rico Wildlife Act, Law No. 241 of August 15, 1999).

Description of the affected environment: Trees were planted immediately west of the San José Lagoon as part of a restoration project conducted by the SJBEP during the early 2000s, in an upland buffer strip between the mangrove fringing the lagoon and a local road adjoining Las Margaritas Public Housing Project, in the Cantera community.

***Goetzea elegans* (Beautiful goetzea)**

Description of species biology: A small understory tree of limestone forests. Occur in the Subtropical Moist Forest Life Zone as described by Ewel and Whitmore (1973). The plant has been documented growing in a semi-evergreen seasonal forest with an almost continuous upper canopy, having few emergent trees, and vines and lianas. This species has been documented growing on the Aymamón limestone formation.

Description of current conditions for the species:

1. **Range-wide:** By 1981, the species was extirpated from three historic sites (i.e., Río Grande, Canóvanas, and Arecibo). Since *G. elegans* was listed in 1985 and its Recovery Plan completed in 1987, the species was only found in the municipalities of Isabela and Quebradillas. Currently, the spatial distribution of the *G. elegans* has increased to 10 populations in Isabela and Quebradillas, one population in Fajardo, and five populations in Vieques Island. A number of individuals have been planted and survived in at least nine other municipalities. These planted individuals support the recovery of the species by creating experimental populations and having a seed bank for future material.

2. **In project area:** This species has not been documented in the Project area.

3. **Cumulative effects of State and private actions in project area:** Since its presence in the project area has not been confirmed, there are no cumulative impacts to *G. elegans*.

Critical habitat: No critical habitat has been designated for this species.

Effects of proposed action on each species and/or critical habitat: Since *G. elegans* is not found within the proposed project's footprint, nor is its habitat; there are no anticipated effects upon it from the proposed project's construction or operation.

Conservation measures: No conservation measures are applicable to the proposed project.

Conclusions: The proposed action may affect, but not likely to adversely affect *G. elegans.*

3.2 FAUNA

C. *Sterna dougallii dougallii* (Roseate Tern) - T

This species is classified as Threatened under the ESA. It is also classified by the Commonwealth as Vulnerable under Regulation 6766, for the Threatened and Endangered Species (created under the Puerto Rico Wildlife Act, Law No. 241 of August 15, 1999).

Sterna dougallii dougallii **(Roseate Tern)**

Description of the affected environment: The San José and Los Corozos Lagoons are potential feeding habitat for *S. dougallii dougallii*, and both Lagoons are anticipated to have significant ecological lifts from the proposed project: as flushing increases, biological diversity, including fish fauna, is anticipated to also increase (Atkins, 2011).

The West Indies subspecies of the roseate tern has been documented in the Piñones-Vacía Talega-Torrecillas complex, at the eastern end of the Study Area. In the early 1980s, it was sighted with other terns, gulls, and shorebirds on the mudflats that once existed in the western end of the CMP, at its outlet to the SJB (Rivera Herrera, 1996). This tern subspecies has not been reported in the eastern CMP nor the San José Lagoon. Poor water quality (i.e., low dissolved oxygen) and its detrimental effect over fish populations, low water transparency which difficult visibility, and thus, fish capture opportunities, present marginal to poor feeding habitat conditions for this species in these two water bodies.

Description of species biology: *S. dougallii dougallii* is a white tern with a long, forked tail and orange legs. It has a black bill with variable amounts of red at the base. In breeding plumage it has a black cap and a pink tinge to the undersides, although the forehead turns white when not breeding. The species grows to 16.1 inches in length and to 0.22 pounds. *S. dougallii dougallii* inhabits coastal and open waters following schools of predatory fish to capture the smaller fish that are forced to the surface. They fly into the wind or hover over the school of fish and plunge vertically to catch them in its bill. The species breeds in New England and in the Caribbean laying 1 to 3 eggs, which are incubated by both male and female for approximately 22 to 24 days. For nesting, *S. dougallii dougallii* selects sparsely vegetated, rocky offshore islands (USFWS, 2010). *S. dougallii dougallii* migrates from New England through the Caribbean to northern Brazil.

Current conditions:

1. **Range-wide:** This highly migratory species has a pantropical distribution, although it breeds in selected areas north of their typical distribution (USFWS, 2010).The world breeding population was estimated at 40,000 pairs, with about 4,000 to 6,000 in the Caribbean (year 2000). For Puerto Rico, nearly 600 to 800 breeding pairs were estimated by Waterbird Conservation for the Americas in 2008. The following locations were deemed important breeding or resting sites: Coastal cays of Barceloneta and Arecibo, Conejo Cay, Punta Verraco, cays of La Parguera, Media Luna Cay, Molinos Cay, the Ponce cliffs, Punta Soldado, Ratón Cay, San Cristóbal Cay, Turrumote Cay, and Yerba Cay (USFWS, 2010).

2. **In project area:** The CMP does not presently provide suitable nesting habitat substrates for *S. dougallii dougallii*. Surveys for the identification of flora and fauna for this project did not detect the presence of *S. dougallii dougallii* within the CMP. This species was not observed during site reconnaissance surveys conducted during January and February of 2011 (Atkins, 2011).

3. **Cumulative effects of State and private actions in project area:** Since its presence in the project area has not been confirmed, there are no cumulative impacts to *S. dougallii dougallii*.

Critical habitat: No critical habitat has been designated for this species.

Effects of proposed action: During construction, *S. dougallii dougallii* individuals present within the study area may be impacted by the noise, odor, and exhaust that the dredging and material handling equipment will generate. However, *S. dougallii dougallii* has the potential to seek more quiet, less perturbed areas for its activities while construction is underway. The study area includes open sea, beaches, and coastal lagoons, which are potential roosting and feeding habitats.

The project is also anticipated to improve the water quality of San José Lagoon and the diversity of its fish population; both of these factors should improve conditions for *S. dougallii dougallii*. The fish and shellfish of San José Lagoon are presently impacted by various contaminants, with levels of mercury and lead posing a potential risk to human health. The additional flushing afforded by the proposed project is anticipated to improve water quality, with the ensuing reduction in fish and shellfish tissue contamination.

The Project will increase the acreage of open water habitat that could be used as feeding habitat for *S. dougallii dougallii*, as it dives from the air to catch underwater prey. The project is also anticipated to improve the water quality of San José Lagoon, and improve the diversity of its fish population; both of these factors should improve conditions for *S. dougallii dougallii*.

Conservation measures: No conservation measures are applicable to the proposed project.

Conclusions: The proposed action may affect, but not likely to adversely affect S*. dougallii dougallii*.

D. *Agelaius xanthomus* (Yellow-shouldered Blackbird) - E

This species is classified as Endangered under the ESA. It is also classified by the Commonwealth as Endangered under Regulation 6766, for the Threatened and Endangered Species (created under the Puerto Rico Wildlife Act, Law No. 241 of August 15, 1999).

It has a small, fragmented, and declining range, which has been affected by the parasite nesting habits of *Molothrus bonariensis* (Shiny Cowbird). A subspecies, *Agelaius xanthomus monensis* is found in Mona Island, 41 miles off the western coast of Puerto Rico (USFWS, 2010).

Agelaius xanthomus
(Yellow-shouldered Blackbird)

Description of the affected environment: This species has not been documented in the Project area. In the Study Area, it has been reported in Las Cucharillas Marsh and in the Piñones-Vacía Talega-Torrecillas complex; the latter has suitable, ample habitat for this species. Was documented at the western half of the CMP in the early 1980s (Rivera Herrera, 1996). Habitat loss from severe urban encroachment, the improper disposal of household waste, and predation by rats, could have deterred its presence in the eastern CMP and the San José Lagoon, where no sightings have been reported.

However, the mangrove forests are potential nesting and foraging habitat for *A. xanthomus*, and the project proposes to impact mangrove trees under the footprint of the dredged canal. Nevertheless, the proposed project will convert many acres of uplands into wetlands to restore the presently impacted mangrove communities (Atkins, 2011).

Description of species biology: *A. xanthomus* is an endemic species belonging to the family *Icteridae*, which includes grackles, cowbirds, and orioles. It is a black bird with a small yellow patch around its "shoulders". Immature individuals have a duller coloration and a brown abdomen. Adult individuals measure from 7.8 to 9.0 inches. It nests chiefly on mangrove trees and coconut palms to avoid predators, such as *Herpestes auropunctatus* (Small Asian Mongoose), *Rattus rattus* (Black Rats), *Rattus norvegicus*

(Norway Rat), and various species of snakes. It feeds mostly on arthropods (insects and crabs), mollusks, seeds, and nectar (USFWS, 2010).

Description of Current conditions:

1. **Range-wide:** Formerly common in Puerto Rico, the only known *A. xanthomus* populations are located in Mona and Monito islands and along southwestern Puerto Rico. The former Naval Station Roosevelt Roads appears to not have had a breeding population for a number of years (USFWS, 2010).

2. **In project area:** Although suitable nesting and foraging habitat is available, as well as within the adjacent Piñones Forest, populations of *A. xanthomus* have not been documented in the area for a number of years. This species was not observed during site reconnaissance surveys conducted during January and February 2011 (Atkins, 2011).

3. **Cumulative effects of State and private actions in project area:** Populations of *A. xanthomus* are believed to have decreased due to several causes: (i) Heavy development has impacted the natural integrity of the coastal mangrove systems altering or eliminating in many locations of its main habitat (ii) Fowl Pox, (iii) the introduction of nest predators such as the *Rattus rattus* (Black Rat), *Rattus norvegicus* (Norway Rat), and *Herpestes auropunctatus* (Small Asian Mongoose), (iv) nest predation by *Margarops fuscatus* (Pearly–eyed Thrasher), and (v) by far the most significant factor presently causing a strong decline in population of *A. xanthomus* is the brood parasitism of *Molothrus bonariensis* (Shiny Cowbird), which lays its eggs in the nests of other birds out-competing the offspring of the hosts for food (USFWS, 2010) .

Critical habitat: Mona and Monito islands, along southwestern Puerto Rico and in the former Naval Station Roosevelt Roads (see Figure3-1) (USFWS, 2010).

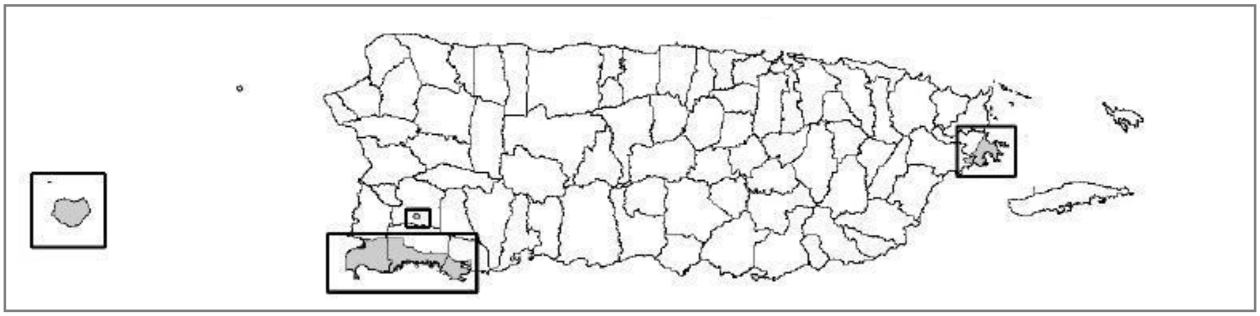


Figure 3-1. Critical habitat designated for Agelaius xanthomus (shaded gray)

Conservation measures: None applicable to the proposed project.

Conclusions: Since *A. xanthomus* does not utilize the proposed project area, and has not been documented in the area for a number of years, the proposed action may affect, but not likely to adversely affect this species.

E. *Calidris canutus* (Red Knot) – T

This species is classified as Threatened under the ESA.

Description of the affected environment: In the early 1980s, it was sighted with other shorebirds on the mudflats that once existed in the western end of the CMP, at its outlet to the SJB (Rivera Herrera, 1996). It has not been sighted since then in the Study Area. Its occurrence in the Project Area is unlikely due to the absence of proper habitat conditions to support its presence.

Description of species biology: The Red Knot forages on insects, spiders, small crustaceans, snails, and worms. It is associated with the black-bellied plover. This species is a full long-distance migrant that breeds from June to August in the high Arctic on dry upland tundra. The Red Knot is considered one of the longest distance migrants in the animal kingdom. Thus, as crab populations decline due to harvest by the fishing and biomedical industries, so do the Red Knot's. This bird is also threatened by habitat destruction and climate change. It is generally rare through the West Indies in September and October during its southbound migration. It apparently flies long distances between stops, many birds likely overflying the area. It is generally found in sandy tidal flats (Raffaele et al., 1998). During nonbreeding season, it is usually in compact flocks (PRGAP, 2011).

Calidris canutus **(Red Knot)**

© USFWS

Description of current conditions for the species:

1. **Range-wide:** The Red Knot has a wide distribution in America. At the U.S. Virgin Islands it has been known to occur in Manning Bay and Great Pond on St. Croix and has also been reported in St. John. This species is strictly found in coastal environments, frequenting tidal mudflats or sandflats, sandy beaches of sheltered coasts, rocky shelves, bays, lagoons, and harbors, occasionally also oceanic beaches and saltmarshes (Gould et al., n.d.).

2. **In project area:** The CMP does not presently provide suitable habitat for *C. canutus*. Surveys for the identification of fauna for this project did not detect the presence of *C. canutus* within the CMP.

3. **Cumulative effects of State and private actions in project area:** Since its presence in the project area has not been confirmed, there are no cumulative impacts to *C. canutus*.

Critical habitat: No critical habitat has been designated for this species.

Effects of proposed action on each species and/or critical habitat: Since *C. canutus* is not found within the proposed project's footprint, nor is its habitat; there are no anticipated effects upon it from the proposed project's construction or operation.

Conservation measures: No conservation measures are applicable to the proposed project.

Conclusions: The proposed project may affect, but not likely to adversely affect *C. canutus*.

F. *Epicrates inornatus* (Puerto Rican Boa) - E

Epicrates inornatus (Puerto Rican Boa)

This species is classified as Endangered under the ESA. It is also classified by the Commonwealth as Vulnerable under Regulation 6766, for the Threatened and Endangered Species (created under the Puerto Rico Wildlife Act, Law No. 241 of August 15, 1999).

Description of the affected environment: The distribution for this species near the proposed project is unknown. Even though *E. inornatus* was not observed during the field study, it has the potential to be present. A karst mound is adjacent but not under the proposed project's footprint. The Project construction may temporarily displace individuals of this species if they are present; however, the proposed project will remove human disturbance from areas currently encroached by asphalt, buildings, and human activity, and restore them with wetland vegetation (Atkins, 2011).

Description of species biology: *E. inornatus* is a member of the family *Boidae*, and the largest snake that inhabits Puerto Rico, reaching approximately 6.5 feet in length. Its color is variable, but ranges from pale to dark brown, sometimes grayish, with 70 to 80 darker colored blotches (dark-bordered with the centers of a lighter hue) along the back.

E. inornatus habitat ranges from wet montane forest to subtropical dry forest and from sea level (mangrove forests) to about 1,300 feet in elevation. It also tolerates various degrees of human presence, even choosing buildings and machinery as hiding places. However, it is most often encountered in the northern karst belt that extends from Carolina to Aguadilla (USFWS, 1986).

E. inornatus is believed to be mostly nocturnal, remaining concealed or basking in the sun during the day. Its diet consists of birds, small mammals (including bats), and lizards. It feeds by seizing the prey in its jaws, wrapping several coils around the victim, and then constricting until the prey has suffocated, which then it swallows head first. The feeding habits of the very young *E. inornatus* are unknown (USFWS, 1986).

E. inornatus is ovoviviparous, believed to mate between February and April, and delivers between September and October (USFWS, 1986).

Description of Current conditions:

1. **Range-wide:** Currently, herpetologists agree that the species appears to be more abundant than previously thought, although there is no reliable data to assess the total population of *E. inornatus*. Widespread deforestation during the 1800s is blamed for the reduced population numbers and distribution. A reversal in the forest coverage trend may be responsible for this apparent resurgence. Hunting, in order to extract their supposedly medicinal oils, and due to prejudice against snakes, have also been blamed for their population decline (USFWS, 1986).

2. **In project area:** No *E. inornatus* have been reported in the Project Area. Although suitable but limited habitat for this boa exists in the remaining haystack hills or "mogotes" found close to the eastern CMP, these have been isolated for many years due to urban encroachment. The latest may have become a physical barrier that could have limited this species dispersal into other forested areas nearby, resulting in no reports of its presence in the mangroves fringing the channel. However, based on interviews with local residents, whose houses are located in the easternmost section and northern bank of CMP, it is probable that *E. inornatus* is present within the vicinity of the eastern CMP. A variety of suitable habitats are present within or adjacent to the CMP, including mangroves, channel banks, and karst hills. Also, the availability of suitable prey like rats, mice, bats, doves, anoles, and invertebrates within or in the vicinity of the proposed project suggests the occurrence of this species in the area. However, the species was not documented during site reconnaissance surveys conducted January through March of 2011 (Atkins, 2011).

3. **Cumulative effects of State and private actions in project area:** The subject area consists of a combination of densely urban environment with coastal wetlands and lagoons. The former is unsuitable habitat for *E. inornatus*. Due to the protection afforded by Commonwealth and Federal regulations, the latter environment remaining in the area is and will mostly remain wildlife habitat, including habitat for *E. inornatus* (Atkins, 2011).

Critical habitat: No critical habitat rules have been published for *E. inornatus*. Karst formations are considered its essential habitat.

Effects of proposed action on the species: The project consists of dredging what once was open water, which is now occupied by mangroves and other vegetation, by fill, structures and densely occupied urban areas in general. The only karst formation near the area is outside the project area. Therefore, the presence of *E. inornatus* within the impact area is unlikely, although possible.

The mobility of this snake, the availability of adjacent, similar habitat, combined with the implementation of a protocol for the identification and removal of individuals within the construction area, will make unlikely that the proposed project's construction will have an adverse impact upon individuals of this species. The removal of human disturbances from the mangrove areas adjacent to the CMP will make this a more attractive habitat for *E. inornatus* (Atkins, 2011).

Conservation measures: The implementation of a protocol for the identification and removal of individuals within the construction area is proposed.

Conclusions: The proposed project may affect but is not likely to adversely affect *E. inornatus*.

G. *Trichechus manatus manatus* (Antillean Manatee) - E

Trichechus m. manatus was listed as Endangered on October 13, 1970 (35 FR 16047) wherever found, under the Federal Endangered Species Act of 1973; however, no critical habitat has been designated for the Antillean subspecies (USFWS, 2009).

Description of the affected environment: Presently, *Trichechus m. manatus* has not been observed within the Project Area. Current conditions provide inadequate habitat for individuals, although they may be found within waters of the western CMP (Atkins, 2011).

Trichechus manatus manatus **(Antillean Manatee)**

Description of species biology: *Trichechus m. manatus* is a large, air breathing, seal-shaped mammal with paired front flippers and a round, paddle-shaped tail. They inhabit marine, estuarine, and freshwater environments. Adult manatees, on average, are about 9 feet long and weigh about 1,000 pounds. They possess a thick gray or brown colored skin with a sparsely distributed pelage. The muzzle is heavily whiskered and coarse, single hairs are sparsely distributed throughout the body. At birth, calves are 3–4 feet long and weigh between 40–60 pounds (USFWS, 2009).

Description of Current conditions:

1. **Range-wide:** *Trichechus m. manatus* ranges freely between marine and freshwater habitats, although in Puerto Rico it is largely a marine species. Its specific habitat requirements include: feeding areas, freshwater drinking areas, and areas protected from surf and wind where they rest. Manatees are herbivores that feed opportunistically on a wide variety of marine, estuarine, and freshwater plants, including submerged, floating, and emergent vegetation, such as: *Spartina* sp. (cord grass), *Thalassia* sp. (turtle grass), shoal grass, *Syringodium* sp. (manatee grass), *Zostera sp.*

(eel grass), *Eichhornia* sp. (water hyacinth), *Pistia* sp. (water lettuce), and other plant types, some of which are found within the Lagoons (USFWS, 2009).

2. **In project area:** There are no *Trichechus m. manatus* in the CMP at the present, and the current condition of the CMP does not provide adequate habitat for individuals. Therefore, the project is not likely to affect the species. However, the San José and Los Corozos Lagoons could provide feeding, drinking (freshwater source), and protected habitat for *Trichechus m. manatus.* Presently, the access is severely limited through the Suárez Canal and non-existent into and through the CMP (Atkins, 2011).

   Trichechus m. manatus has been documented in ocean waters within the Study Area. It has been observed in the SJB and the estuary portion of the Puerto Nuevo River and ranges freely between marine and freshwater habitats. There is no access for manatees into or through the eastern CMP. As a result, it is extremely unlikely for manatees to be found in those sections of the Project Area where the proposed construction activities would take place within the eastern CMP and the San José Lagoon.

3. **Cumulative effects of State and private actions in project area:** Since its presence in the project area has not been confirmed, there are no cumulative impacts to *Trichechus m. manatus*.

Critical habitat: No critical habitat rules have been officially published for *Trichechus m. manatus*.

Effects of proposed action on the species: The project consists of dredging what once was open water, which is now occupied by mangroves and other upland vegetation, by fill, structures, and densely occupied urban areas in general. As stated above, the CMP is a highly degraded habitat that is currently not suitable for the species. Therefore, the probability of *Trichechus m. manatus* being present within the impact area is very low. The ability of the species to move away from impact areas and the availability of similar habitats nearby (western CMP, Puerto Nuevo River, San Juan Bay), combined with the implementation of a protocol for the identification of individuals near the construction area will make it highly unlikely that the development of the proposed project will have an adverse impact upon individuals. The restoration to the CMP and its mangrove areas will make this a more attractive habitat for *Trichechus m. manatus* (Atkins, 2011).

Conservation measures: The implementation of a protocol for the identification and removal of individuals within the construction area is proposed.

Conclusions: The proposed project may affect, but not likely to adversely affect *Trichechus m. manatus.*

H. Sea Turtles - T & E

Three species of sea turtle occur in waters of Puerto Rico: *Chelonia mydas* (Green Sea Turtle), *Eretmochelys imbricata* (Hawksbill Sea Turtle), and *Dermochelys coriacea* (Leatherback Sea Turtle).

Under the ESA, the Puerto Rico population of *C. mydas* is classified as Threatened and the other two as Endangered. All three are listed as Endangered under the Puerto Rico Regulation 6766. Sea turtles are under the joint jurisdiction of the NMFS and the USFWS.

Description of the affected environment:

- *Chelonia mydas* (Green Sea Turtle): *C. mydas* has not been observed within the Project area. Current conditions provide inadequate habitat for individuals, although they may be found within waters of the western CMP (Atkins, DNER 2009, USFWS). *C. mydas* have been reported in the nearshore waters at the Study Area. It is highly improbable for sea turtles to use or be present in the eastern CMP and the San José Lagoon given that it does not provide habitat conditions for nesting or their sustenance.

- *Eretmochelys imbricata* (Hawksbill Sea Turtle): *E. imbricata* has not been observed within the project area. Current conditions provide inadequate habitat for individuals. *E. imbricata* is found in coral reefs and other hard bottom communities. Has been sighted foraging in the rocky shores of Boca del Morro, at the outlet of SJB, as well as in the nearshore coral reefs within the Study Area. Highly improbable in the CMP and the San José Lagoon.

- *Dermochelys coriacea* (Leatherback Sea Turtle): *D. coriacea* is the most pelagic of all turtle species preferring sandy beaches near rough seas and open waters; it has not been reported near or within waters of the Project area (Atkins, DNER 2009, USFWS). There are records of *D. coriacea* nesting in the sandy beaches that are also part of the Study Area (CSA Architects & Engineers, LLP, 2014; ERM, 2013; Glauco A. Rivera & Associates, 2011; CFMC, 2004). Leatherback marine turtles approach the north shore of Puerto Rico during their nesting season (March-June) and may be present in offshore waters during this time, but basically spend the rest of their adult lives as a pelagic species in deep waters of the Atlantic Ocean. Has been reported in the nearshore waters at the Study Area. It is highly improbable for sea turtles to use or be present in the CMP and the San José Lagoon given that it does not provide habitat conditions for nesting or their sustenance.

Description of species biology:

- *Chelonia mydas* (Green Sea Turtle): The green sea turtle grows to a maximum size of about 4 feet and a weight of 440 pounds. It has a heart-shaped shell, small head, and single-clawed flippers. Color is variable. Hatchlings generally have a black carapace (upper shell), white plastron (under shell), and white margins on the shell and limbs. The adult carapace is smooth, keelless, and light to dark brown with dark mottling; the plastron is whitish to light yellow. Adult heads are light brown with yellow markings. Identifying characteristics include four pairs of


Photo Credit: NOAA, Office of Protected Resources, Andy Bruckner.

Chelonia mydas **(green sea turtle)**

costal scutes (plates), none of which borders the nuchal scute, and only one pair of prefrontal scales between the eyes. *C. mydas* feeds mostly on seagrasses and algae. Females return to the same beaches where they were born ("natal" beaches) every 2-4 years to lay eggs, generally in the summer months (DNER, 2004).

- *Eretmochelys imbricata* (Hawksbill Sea Turtle): The endangered Hawksbill Sea Turtle is one of seven species of sea turtles found throughout the world. One of the smaller sea turtles, it has overlapping scutes that are thicker than those of other sea turtles. This protects them from being battered against sharp coral and rocks during storm events. Adults range in size from 30 to 36 inches (0.8-1.0 meters) carapace length, and weigh 100 to 200 pounds (45-90 kilograms). Its carapace (upper shell) is an attractive dark brown with faint yellow streaks and blotches and a yellow plastron (under shell). The name "hawksbill" refers to the turtle's prominent hooked beak. *E. imbricata* feeds on sponges and other invertebrates, algae. Females return to the beaches where they were born (natal beaches) to nest, which occurs every 2–3 years at night and approximately every 14–16 days during the nesting season (DNER, 2004).


Photo Credit: NOAA, Office of Protected Resources, Caroline Rogers (USGS).

***Eretmochelys imbricata* (Hawksbill Sea Turtle)**

- *Dermochelys coriacea* (Leatherback Sea Turtle): The leatherback is the largest, deepest diving, and most migratory and wide ranging of all sea turtles. The adult leatherback can reach 4 to 8 feet in length and 500 to 2,000 pounds in weight. Its shell is composed of a mosaic of small bones covered by firm, rubbery skin with seven longitudinal ridges or keels. The skin is predominantly black with varying degrees of pale spotting; including a notable pink spot on the dorsal surface of the head in adults. A toothlike cusp is located on each side of the gray upper jaw; while the lower jaw is hooked anteriorly. The paddle-like clawless limbs are black with white margins and pale spotting. *D. coriacea* feeds on soft-bodied animals, such as jellyfish and salps. Females lay clutches of approximately 100 eggs several times during a nesting season, typically at 8–12 day intervals (DNER, 2004).


Photo Credit: NOAA, Office of Protected Resources, Scott R. Benson (SWFSC).

***Dermochelys coriacea* (Leatherback Sea Turtle)**

Description of Current conditions:

Range-wide: All three species of sea turtles are entirely marine. Only females return to land, usually to the same sandy beach where they were born, to lay their eggs.

- *Chelonia mydas* (Green Sea Turtle): The species is often associated with algae and seagrass beds. Nesting, which typically occurs on high energy beaches with relatively deep, loose sand, free of debris, and successful sites are located above high tide levels, is rare on mainland Puerto Rico. However, two large nesting colonies have been identified in Vieques and one in Mona Island. Although nesting is not frequently documented on the island of Culebra, the largest subadult and adult populations are found in its surrounding waters (DNER 2009, USFWS).

- *Eretmochelys imbricata* (Hawksbill Sea Turtle): This species is the most abundant in Puerto Rico. It uses different habitats at different stages of their life cycle, but is most commonly associated with healthy coral reefs. Nesting peaks in Puerto Rico are from September to December.

- *Dermochelys coriacea* (Leatherback Sea Turtle): This highly pelagic species nests during the summer in areas that are typically wide, sandy, dynamic (high energy) beaches with cyclical patterns of erosion and accretion. Successful nests are laid above the high tide level, in areas of moderate to steep slope, and free of debris, and have been reported throughout the main island from Isabela to Fajardo in the north coast, Mayagüez to Aguada on the west, and Humacao to Maunabo on the east.

In project area: It is highly improbable for *D. coriacea, E. imbricata,* and/or *C. mydas* to use or be present in the CMP and the San José Lagoon, given that they do not provide habitat conditions for nesting or their sustenance.

Cumulative effects of State and private actions in project area: Since their presence in the project area has not been confirmed, there are no cumulative impacts to *C. mydas, E. imbricata*, and/or *D. coriacea.*

Critical habitat:

- *Chelonia mydas* (Green Sea Turtle): Critical habitat was designated in 1998 for green sea turtles in coastal waters surrounding the island of Culebra, Puerto Rico (DNER, 2004, USFWS).

- *Eretmochelys imbricata* (Hawksbill Sea Turtle): Critical habitat was designated in 1998 for the species in coastal waters surrounding the islands of Mona and Monito, Puerto Rico (DNER, 2004, USFWS).

- *Dermochelys coriacea* (Leatherback Sea Turtle): No critical habitat has been officially designated in Puerto Rico for this species (DNER, 2004, USFWS).

Effects of proposed action on the species: The project consists of dredging what once was open water, which is now occupied by mangroves and other vegetation, by fill, structures and densely occupied urban areas in general. The project would have a beneficial impact on the benthic habitat on the study area, consequently benefiting these species.

Conservation measures: Presently, *D. coriacea, E. imbricata,* and/or *C. mydas* do not inhabit the project area. Therefore, the project is not likely to affect sea turtles species.

Conclusions: The proposed project may affect, but not likely to adversely affect any individuals *D. coriacea, E. imbricata,* and/or *C. mydas*.

I. Corals - T

Seven species of coral are listed as Threatened under the ESA: *Acropora palmata* (Elkhorn Coral), *Acropora cervicornis* (Staghorn Coral), *Orbicella annularis* (Lobed Star Coral), *Orbicella faveolata* (Mountainous Star Coral), *Orbicella franksi* (Boulder Star Coral), *Mycetophyllia ferox* (Rough Cactus Coral), and *Dendrogyra cylindrus* (Pillar Coral).

Acropora palmata (Elkhorn Coral) and *Acropora cervicornis* (Staghorn Coral) - T

Description of the affected environment:

- *Acropora palmata* (Elkhorn Coral)- Found in the Study Area, north of the SJBE. Was formerly the dominant species in shallow water reefs 3 to 16 feet deep throughout the Caribbean, forming extensive, densely aggregated thickets (stands) in areas of heavy surf. Coral colonies prefer exposed reef crest and fore reef environments in depths of less than 20 feet, although isolated corals may occur to depths of 65 feet. Over the last 10,000 years, this species has been one of the three most important Caribbean corals contributing to reef growth and development, providing essential fish habitat.[1]

- *Acropora cervicornis* (Staghorn Coral)- Found in the Study Area, north of the SJBE. The staghorn coral is also another of the three most important Caribbean corals in terms of its contribution to reef growth and fish habitat found in reefs within the Study Area. This species occurs in back reef and fore reef environments from 1 to 100 feet deep. The upper limit is defined by wave forces and the lower limit is controlled by suspended sediments and light availability.[2]

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[1] http://www.nmfs.noaa.gov/pr/species/invertebrates/elkhorncoral.htm

[2] http://www.nmfs.noaa.gov/pr/species/invertebrates/staghorncoral.htm

Description of species biology:


Acropora palmata (Elkhorn Coral)

- *Acropora palmata* (Elkhorn Coral): A large, branching coral with thick and sturdy antler-like branches that may grow over 6.5 feet, the species highly contributes to reef growth, providing essential fish habitat. Colonies are fast growing, with branches increasing in length 2–4 inches per year, with maximum size being reached at around 12 years in age. Formerly the dominant species in coastal waters 3 to 16 feet deep throughout the Caribbean in areas of heavy surf, since 1980s, populations have collapsed greatly (90–95% reduction in abundance), due in part to the effects of diseases, climate change and human related factors. The once characteristic "*Acropora palmata* zones" have been mostly transformed into reef rubble fields with few living colonies left (NOAA).


Acropora cervicornis (Staghorn Coral)

- *Acropora cervicornis* (Staghorn Coral): This species has similar habitat requirements as *A. palmata*, with the exception that it occurs mostly in the back reef in depths from 0 to 100 feet. *A. cervicornis* exhibits the fastest growth of all known Western Atlantic corals, with branches increasing in length by 4 to 8 inches per year, and has one of the most important contributions to reef growth and fish habitat. There has been a population reduction exceeding 80–98% in the Caribbean region over the past 30 years due to the effects of diseases, climate change and human related factors. *A. cervicornis* is very susceptible to coral bleaching (loss of intracellular endosymbionts (Symbiodinium, also known as zooxanthellae) through either expulsion or loss of algal pigmentation). Threats to *A. cervicornis* include disease, such as white band disease hurricanes, predation, bleaching, algae overgrowth, sedimentation, temperature and salinity variation, and low genetic diversity (NOAA).

Description of Current conditions: Both species are strictly from marine environments.

Range-wide:

- *Acropora palmata* (Elkhorn Coral): Formerly the dominant species in shallow waters between 3 and 16 feet deep throughout the Caribbean and on the Florida Reef Tract, forming extensive, densely aggregated stands in areas of heavy surf. Coral colonies prefer exposed reef crest and fore reef environments in depths of less than 20 feet, although isolated corals may occur to depths of 65 feet (DNER, 2000).

- *Acropora cervicornis* (Staghorn Coral): The species occur in back reef and fore reef environments from 0 to 100 feet deep. The upper limit of establishment is defined by wave forces, and the lower limit is controlled by suspended sediments and the availability of light entering the water (DNER, 2000).

In project area:

- *Acropora palmata* (Elkhorn Coral): Due to the highly degraded conditions of the Project area and the lack of adequate habitat, it is very unlikely that *A. palmata* will be found within the project area.

- *Acropora cervicornis* (Staghorn Coral) Due to the highly degraded conditions of the CMP and the lack of adequate habitat, it is very unlikely that *A. cervicornis* will be found within the project area.

Cumulative effects of State and private actions in project area:

- *Acropora palmata* (Elkhorn Coral): As their presence in the project area has not been confirmed, and it is not expected due to the lack of suitable habitat, there are no cumulative impacts to *A. palmata* colonies.

- *Acropora cervicornis* (Staghorn Coral): As their presence in the project area has not been confirmed, and it is not expected due to the lack of suitable habitat, there are no cumulative impacts to *A. cervicornis* colonies.

Critical habitat: Critical habitat for *A. palmata* and *A. cervicornis* has been designated and included nearshore reefs within the Study Area, north of the SJBE, as well as other coastal areas around the Island with suitable requirements for these to thrive (e.g. heavy surf, clear-low nutrient ocean-water salinity conditions).

Approximately 1,383 square miles of marine habitat in waters surrounding the island of Puerto Rico have been designated as Critical Habitat for *A. palmata* and *A. cervicornis*. The boundaries of each specific Critical Habitat area are all areas surrounding the islands of the Commonwealth of Puerto Rico, 98 feet in depth and shallower (see 33 CFR 80.738). Except as specified, the seaward boundary is the 98 feet (30 meter) depth contour and the shoreward boundary is the line of mean low water (MLW; 33 CFR 2.20). Within these boundaries, discrete areas of water deeper than 98 feet (30 meters) are not included.

Effects of proposed action on each species and/or critical habitat: The project consists of dredging what once was open water, which is now occupied by mangroves and other vegetation, by fill, structures and densely occupied urban areas in general. These actions will not have any negative impact on the species due to their absence in the Project area; however, a beneficial impact would result on coral reefs from the proposed project.

Conservation measures: Presently, *Acropora palmata* and/or *Acropora cervicornis* do not inhabit the project area. The project is not likely to affect habitat for the species, therefore, no conservation measures are applicable to the proposed project.

Conclusions: Due the absence of these species in this type of habitat, it is very unlikely that the proposed project will affect any colonies. The proposed project may affect, but not likely to adversely affect *A. palmata* and/or *A. cervicornis.*

Dendrogyra cylindrus (Pillar Coral) –T

This species is classified as Threatened under the ESA.

Description of affected environment: Has been reported in most reef environments, although in some regions it appears to be absent in nearshore hard bottoms, nearshore patch reefs, and backreef environments, and more common on forereef spurand-groove habitats. It has been reported in water depths ranging from 6.6 to 82.0 feet.

Description of species biology*: D. cylindrus* forms cylindrical columns on top of encrusting bases. Colonies are generally grey-brown in color and may reach 3 meters in height. Tentacles remain extended during the day, giving columns a furry appearance (NOAA, 2014).

It is a gonochoric (separate sexes) broadcast spawning specie with relatively low annual egg production for its size. The combination of gonochoric spawning with persistently low population densities is expected to yield low rates of successful fertilization and low larval supply. Sexual recruitment of this species is low, and reported juvenile colonies in the Caribbean are lacking. *Dendrogyra cylindrus* can propagate by fragmentation following storms or other physical disturbance. Average growth rates of 1.8 to 2.0 cm per year in linear extension have been reported in the Florida Keys compared to 0.8 cm per year in Colombia and Curaçao (NOAA, 2014).

Dendrogyra cylindrus **(Pillar Coral)**
© NOAA

Description of current conditions for the species:

1. **Range-wide:** present in the western Atlantic and throughout the greater Caribbean. *Dendrogyra cylindrus* inhabits most reef environments in water depths ranging from 1 to 82 feet (NOAA, 2014).

2. **In project area:** This species has not been documented in the Project area.

3. **Cumulative effects of State and private actions in project area:** As their presence in the project area has not been confirmed, and it is not expected due to the lack of suitable habitat, there are no cumulative impacts to *D. cylindrus*.

Critical habitat: No critical habitat has been designated for this species.

Effects of proposed action on each species and/or critical habitat: Since *D. cylindrus* is not found within the proposed project's footprint, nor is its habitat; there are no anticipated effects upon it from the proposed project's construction or operation.

Conservation measures: No conservation measures are applicable to the proposed project.

Conclusions: The proposed project may affect, but not likely to adversely affect *D. cylindrus.*

Mycetophyllia ferox (Rough Cactus Coral) –T

This species is classified as Threatened under the ESA.

Description of affected environment: Has been reported to occur in shallow reef environments, in water depths ranging from 16.4 to 98.4 feet.

Description of species biology: *M. ferox* forms a thin, encrusting plate that is weakly attached. *M. ferox* is taxonomically distinct and its maximum colony size is 50 cm. *M. ferox* is a hermaphroditic brooding species. Colony size at first reproduction is greater than 0.11 ft^2. Recruitment of *M. ferox* appears to be very low, even in studies from the 1970s (NOAA, 2014).

Description of current conditions for the species:

1. **Range-wide:** Occurs in the western Atlantic and throughout the wider Caribbean. It is usually uncommon or rare, constituting less than 0.1% of all coral species at generally less than 1% of the benthic cover (NOAA, 2014).
2. **In project area:** This species has not been documented in the Project area.
3. **Cumulative effects of State and private actions in project area:** As their presence in the project area has not been confirmed, and it is not expected due to the lack of suitable habitat, there are no cumulative impacts to *M. ferox*.

Critical habitat: No critical habitat has been designated for this species.

Effects of proposed action on each species and/or critical habitat: Since *M. ferox* is not found within the proposed project's footprint, nor is its habitat; there are no anticipated effects upon it from the proposed project's construction or operation.

Conservation measures: No conservation measures are applicable to the proposed project.

Conclusions: The proposed project may affect, but not likely to adversely affect *M. ferox. .*

Orbicella annularis (Lobed Star Coral) –T

This species is classified as Threatened under the ESA.

Description of affected environment: *Orbicella spp*. are a common, often dominant component of Caribbean mesophotic reefs suggesting the potential for deep refuge (Smith et al., 2010 as cited in Brainard et al., 2011). The Lobed Star Coral (*O. annularis*) has historically been one of the primary reef framework builders of the western Atlantic and Caribbean, ranging in depths 3.3 to 98.4 feet, and has been considered a highly plastic species with multiple growth forms ranging from columnar, to massive, to platty.

Description of species biology: Colonies grow in columns that exhibit rapid and regular upward growth. In contrast to the other two *Orbicella*s species, margins on the sides of columns are typically dead. Live colony surfaces usually lack ridges or bumps (NOAA, 2014).

Description of current conditions for the species:

1. **Range-wide:** The Orbicella species complex is a common, often dominant component of Caribbean mesophotic reefs, suggesting the potential for deep refuge across a broader depth range, but *O. annularis* is generally described with a shallower distribution (NOAA, 2014).
2. **In project area:** This species has not been documented in the Project area.
3. **Cumulative effects of State and private actions in project area:** As its presence in the project area has not been confirmed, and it is not expected due to the lack of suitable habitat, there are no cumulative impacts to *O. annularis*.

Critical habitat: No critical habitat has been designated for this species.

Effects of proposed action on each species and/or critical habitat: Since *O. annularis* is not found within the proposed project's footprint, nor is its habitat; there are no anticipated effects upon it from the proposed project's construction or operation.

Conservation Measures: No conservation measures are applicable to the proposed project.

Conclusions: The proposed project may affect, but not likely to adversely affect *O. annularis.*

Orbicella faveolata (Mountainous Star Coral) –T

Orbicella faveolata **(Mountainous Star Coral)**
© NOAA Fisheries

This species is classified as Threatened under the ESA.

Description of affected environment: Has been reported in most reef habitats, often the most abundant coral between 32.8 to 65.6 feet in fore reef environments, but also found between 1.6 to 131.2 feet.

Description of species biology: Grows in heads or sheets, the surface of which may be smooth or have keels or bumps. The skeleton is much less dense than in the other two Orbicella species. Colony diameter can reach up to 33 feet with a height of 13 to 16 feet (NOAA, 2014).

Description of current conditions for the species:

1. **Range-wide:** *O. faveolata* occurs in the western Atlantic and throughout the Caribbean (NOAA, 2014).
2. **In project area:** This species has not been documented in the Project area.
3. **Cumulative effects of State and private actions in project area:** As its presence in the project area has not been confirmed, and it is not expected due to the lack of suitable habitat, there are no cumulative impacts to *O. faveolata*.

Critical habitat: No critical habitat has been designated for this species.

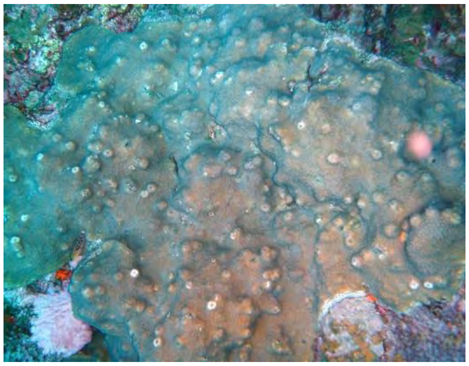
Effects of proposed action on each species and/or critical habitat: Since *O. faveolata* is not found within the proposed project's footprint, nor is its habitat; there are no anticipated effects upon it from the proposed project's construction or operation.

Conservation Measures: No conservation measures are applicable to the proposed project.

Conclusions: The proposed project may affect, but not likely to adversely affect *O. faveolata.*

Orbicella franksi (Boulder Star Coral) –T

This species is classified as Threatened under the ESA.



Orbicella franksi (Boulder Star Coral)
© NOAA Fisheries

Description of affected environment: Occupies most reef environments and has been reported from water depths ranging from 16.4 to 164.0 feet. It tends to have a deeper distribution than the other two species in the *Orbicella* complex.

Description of species biology: It is distinguished by large, unevenly arrayed polyps giving the colony its characteristic irregular surface. Colony form is variable, and the skeleton is dense with poorly developed annual bands. Colony diameter can reach up to 16 feet with a height of up to 7 feet (NOAA, 2014).

Description of current conditions for the species:

1. **Range-wide:** *Orbicella* species are a common, often dominant, component of Caribbean mesophotic reefs, suggesting the potential for deep refuge for *O. franksi* (NOAA, 2014).

2. **In project area:** This species has not been documented in the Project area.

3. **Cumulative effects of State and private actions in project area:** As its presence in the project area has not been confirmed, and it is not expected due to the lack of suitable habitat, there are no cumulative impacts to *O. franksi*.

Critical habitat: No critical habitat has been designated for this species.

Effects of proposed action on each species and/or critical habitat: Since *O. franksi* is not found within the proposed project's footprint, nor is its habitat; there are no anticipated effects upon it from the proposed project's construction or operation.

Conservation Measures: No conservation measures are applicable to the proposed project.

Conclusions: The proposed project may affect, but not likely to adversely affect *O. franksi.*

4.0 LIST OF PREPARERS

ATKINS

Jaime Pabón, Project Manager. Twelve years of scientific and technical experience, encompassing a wide range of environmental permitting, scientific studies, and has designed and implemented mitigation efforts throughout Puerto Rico, the U.S. Virgin Islands, and other parts of the Caribbean and Central/South America. He has been the lead scientist in numerous scientific surveys for the state and federal government, as well as for the non-profit sector, which has gained him awards such as the "Ten Outstanding Young People Award" in Environmental Leadership. He is a member of the Natural Resources Conservation Service State Technical Committee, and collaborates with several environmental groups as board member.

Francisco Pérez Aguiló, Task Leader. Twenty-eight years of experience in the environmental field including study design, field supervision, marine invertebrate taxonomy, permitting, compliance assurance and enforcement, water and biological sampling, and coliform analyses. Mr. Pérez has held positions as project manager, field supervisor, lead scientist, biological scientist and environmental specialist for private and public projects. Mr. Pérez has lead and participated in at least twelve flora and fauna inventories, ten jurisdictional wetland delineations, and nine endangered species surveys or reports. Mr. Pérez holds an M.S. in Environmental Management from Metropolitan University (2010) and a B.S. in Marine Biology from the University of West Florida (1983). He is a Registered Environmental Manager (National Registry of Environmental Professionals) since April, 2004. His off-duty activities include participation in Audubon's Bird Census.

Raúl Di Cristina Centeno, Environmental Specialist. Ten years of experience as an Agronomist, 8 of which were at the Puerto Rico Department of Natural and Environmental Resources where he worked in the Forest Service Bureau, Tree Management Permit Division and in the Puerto Rican Parrot (*Amazona vittata*) Recovery Project, Terrestrial Resources Division. Mr. Di Cristina has lead and participated in tree surveys, flora and fauna inventories, jurisdictional wetland delineations and natural resources management plans. Mr. Di Cristina is an M.S Candidate in Conservation and Management of Natural Resources from Metropolitan University and holds a B.S. in Horticulture from the University of Puerto Rico, Mayagüez (2002). He is a Licensed Agronomist.

Gabriel Hernández Castro, Field Scientist. Mr. Hernández has 9 years of experience as an Environmental Biologist, having worked with the U.S. Fish & Wildlife Service and the U.S. Department of Agriculture assisting scientists during forest management duties, which includes fauna assessments and surveys. A professional photographer, Mr. Hernández has also worked photo documenting field work and photographing wildlife at the Cabo Rojo National Wildlife Refuge, Culebra National Wildlife Refuge and the Laguna Cartagena National Wildlife Refuge, among others. Mr. Hernández has lead or participated in tree surveys, flora and fauna inventories, jurisdictional wetland delineations and natural resources management plans. More recently, he prepared a photodossier on *Agelaius xanthomus* and related icterids to assist field scientists in the field differentiation from birds with similar appearance.

Adelís Cabán Acevedo, Field Assistant. A recent college graduate, Mrs. Cabán's personal qualities, professional skills, and ability to quickly understand and effectively respond to project needs has ushered her into an outstanding position within our science team. Mrs. Cabán holds a B.S. in Environmental Engineering from Polytechnic University of Puerto Rico (2008). Her extracurricular activities include bird watching and water quality monitoring as a leader volunteer within the San Juan Bay watershed for different organizations.

This document was updated and revised in May 21, 2015 by Estudios Técnicos, Inc.

Wanda I. Crespo, PPL- Environmental Scientist and Planner, Planning Division Director

Luis Jorge Rivera Herrera, PPL - Environmental Scientist and Planner (Consultant for Estudios Técnicos, Inc.)

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Appendix H2.a

Agency Coordination

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From: Marelisa_Rivera@fws.gov
Sent: Tuesday, May 24, 2011 7:08 PM
To: Perez, Francisco
Cc: Pabon, Jaime
Subject: Re: Caño Martín Peña Restoration Project

Please submit the project for our review. In our letter we will provide the requested assistance. Send it by mail. Thanks

Message sent from Blackberry

From: "Perez, Francisco" [Francisco.Perez@atkinsglobal.com]
Sent: 05/24/2011 11:44 AM AST
To: Marelisa Rivera
Cc: "Pabon, Jaime" <Jaime.Pabon@atkinsglobal.com>
Subject: Caño Martín Peña Restoration Project

Dear Marelissa,

We are preparing a draft biological assessment of endangered species concerning the subject project. See the one-page, attached project description, and the attached two images of the project area. This is part of the preparation of an environmental impact statement and a feasibility report for the subject project, and so the Action Agency, the U.S. Army Corp of Engineers, is not yet formally involved. I wanted to reach out and verify that the following assumptions are correct:

1. There is no critical habitat present in the eastern end of the Caño Martín Peña (the project area).
2. The following listed species are the only listed or proposed T&E species that may be present in the action area:
    a. *Banara vanderbiltii* (Palo de Ramón)
    b. *Schoepfia arenaria* (no common name)
    c. *Pelicanus occidentalis* (Brown Pelican) (de-listed)
    d. *Sternula antillarum* (Least Tern)
    e. *Sterna dougallii dougallii* (Roseate tern)
    f. *Vireo latimeri* (Puerto Rican Vireo)
    g. *Dendrocygna arborea* (West Indian Whistling-Duck)
    h. *Falco peregrinus* (Peregrine Falcon)
    i. *Agelaius xanthomus* (Yellow-Shouldered Blackbird)
    j. *Epicrates inornatus* (Puerto Rican Boa)
    k. *Trichechus manatus* (West Indian Manatee)

Please advise if you have the time to confirm, or if we need to wait for the Action Agency to submit a formal package.

Sincerely,

Pachi
Francisco Pérez Aguiló, M.S., REM
Senior Scientist/Environmental Project Manager

ATKINS

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Appendix H3

Section 404(b)(1) Evaluation

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DRAFT
SECTION 404(b) (1) EVALUATION
CAÑO MARTÍN PEÑA ECOSYSTEM RESTORATION PROJECT
SAN JUAN, PUERTO RICO

Prepared for:

Corporación del Proyecto ENLACE del Caño Martín Peña
Apartado Postal 41308
San Juan, Puerto Rico 00940-1308

September 2015

Contents

Figures

Tables

Acronyms and Abbreviations

B2EHP	Bis (2-ethylhexyl) phthalate
C&D	construction and demolition
CAD	Contained Aquatic Disposal
CDRC	Ciudad Deportiva Roberto Clemente
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CMP	Caño Martín Peña
CMP-MTZ	Caño Martín Peña Maritime Terrestrial Zone
cy	Cubic yards
DMMP	Dredged Material Management Plan
EIS	Environmental Impact Statement
ENLACE	Corporación del Proyecto ENLACE del Caño Martín Peña
ER	Engineering Report
HHW	Household hazardous waste
HW	Household waste
LI	Liquidity index
LL	Liquid Limit
NEP	National Estuary Program
NTP	Notice to Proceed
PAH	Polycyclic aromatic hydrocarbons
PCBs	Polychlorinated biphenyls
PI	Plasticity index
PL	Plastic limit
P.R.	Puerto Rico
PREQB	P.R. Environmental Quality Board
PUD	Permanent Upland Disposal
SJBE	San Juan Bay Estuary
SJBEP	San Juan Bay Estuary Program
TCLP	Toxicity characteristic leaching procedure
TM	Thermal stability analysis
TSP	Tentatively Selected Plan
U.S.	United States
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
WRDA	Water Resources Development Act of 2007

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1.0 PROJECT DESCRIPTION

1.1 LOCATION

The Caño Martín Peña (CMP) is one of five interconnected waterbodies in the San Juan Metropolitan Area (Figure 1). The canal is approximately 4 miles long and extends in an East-West direction through the urban center of the highly populated municipality of San Juan in Puerto Rico. It connects the San Juan Bay with San José Lagoon and Los Corozos Lagoon; these lagoons are further connected by the Suárez Canal to La Torrecilla Lagoon and to the Atlantic Ocean. The entire estuarine system of interior coastal lagoons and tidal canals is connected to the Atlantic Ocean at both ends. The drainage area of the CMP comprises about 4 square miles (2,500 acres). The “Project Area,” which mostly lays out the construction footprint, has been defined as the Project Channel, where dredging would take place, and the adjacent delimitation of the public domain lands within the Caño Martín Peña Maritime Terrestrial Zone (CMP-MTZ) where relocations are scheduled to occur. Also included in the Project Area is the 6-acre dredged material staging area within the 35-acre Ciudad Deportiva Roberto Clemente (CDRC) site, the boating routes from the eastern limit of the CMP to the CDRC and the nearby San José Lagoon pits, and the five pits in the San José Lagoon.

1.2 GENERAL DESCRIPTION

The Caño Martín Peña Ecosystem Restoration Project (CMP-ERP) is an urban ecosystem restoration project to restore the CMP and surrounding areas of the San Juan Bay Estuary (SJBE). Restoration of the CMP will re-establish the tidal connection between the San José Lagoon and the San Juan Bay, which will improve dissolved oxygen levels, reduce salinity stratification, increase biodiversity by restoring fish habitat and benthic conditions, and improve the functional value of mangrove habitat within the estuary.

The CMP is a tidal channel of 3.75 miles long in metropolitan San Juan, Puerto Rico. It is an integral part of the SJBE, the only tropical estuary included in the U.S. Environmental Protection Agency (USEPA) National Estuary Program (NEP). The SJBE’s watershed covers 97 square miles and it is heavily urbanized, with a population density of over 5,000 people per square-mile. The SJBE includes over 33 percent of the mangrove forests on the island with over 124 species of fish and 160 species of birds. The eastern half of the CMP, historically between 200 and 400 feet wide and navigable, currently ranges in depth from 3.94 feet to 0 foot towards San José Lagoon. Due to years of encroachment and fill of the mangrove swamps along the CMP, the channel no longer serves as a functional connection between San Juan Bay and San José Lagoon. Sedimentation rates within the CMP are nearly two orders of magnitude higher than in other parts of the SJBE. Open waters in areas closer to the San José Lagoon have been lost, as the area has started transitioning into a wetland. A combination of sediment and solid waste is found in the CMP, of which the solid waste accounts for approximately 10 percent of its composition. In some sites, the solid waste extends to depths 10 feet below the sediment surface.

The conditions in the eastern segment of the CMP have led to degradation within the entire estuary. Connectivity of the ecosystem has been severed and the biodiversity within the lagoons has been compromised, as less individuals of a reduced number of species are found when compared with other lagoons throughout the SJBE. The reduction in biodiversity in turn decreases the ability of fish and invertebrates to respond to natural changes, disease and other factors, resulting in a depletion of fish stock and losses of economic and recreational resources.

Water residence time in the San José and Los Corozos lagoons is of 16.9 days, much higher than a normal residence time, estimated to be about 3 days. The lack of tidal flushing causes strong salinity stratification and in turn leads to low oxygen or no oxygen levels in the 702 acres of lagoons with depth below 4 to 6 feet, severely affecting benthic habitats. Mangrove habitat, extremely important for native aquatic invertebrates, has been severely impacted, reducing habitat where important commercial fish species spend their juvenile life stages.

Ecological degradation within the estuary has also begun to affect socio-economic conditions of local human population surrounding the CMP. Inability to improve local drainage infrastructure due to the lack of conveyance capacity in the CMP leads to substantial flooding with the surrounding neighborhoods. Fecal coliform levels within these floodwaters are alarmingly high, and subsequent human contact with the waters of the CMP has been associated with higher rates of asthma and gastrointestinal disease. Recreational navigation within the estuary has also been severed, restricting public and commercial waterborne traffic within the capital city.

ENLACE, the non-Federal sponsor, through the enactment of Puerto Rico Law 489 of September 24, 2004, has been tasked with the responsibility to give priority attention to the environmental restoration of the CMP and to rehabilitate and revitalize the communities along its north and south banks, and to thereby promote a healthy relationship between the natural environment and its surrounding city and communities, with a vision of comprehensive development based on community empowerment. This vision was included in the Comprehensive Development and Land Use Plan for the Caño Martín Peña Special Planning District (District's Plan), which serves as the main guiding tool for the Proposed Project.

Figure 1. Caño Martín Peña Ecosystem Restoration Project Area Map

The Commonwealth of Puerto Rico has been investing a considerable amount of public funds in solving the many infrastructure, housing, and social problems affecting the eastern half of the CMP and its surrounding communities. Notwithstanding, without the collaboration of Federal assistance, it is expected that the CMP will continue to deteriorate for many years by siltation and solid waste accumulation within its banks, and continuing direct sewage discharges. This will ultimately lead to a complete blockage of the canal and the continued segregation of this important system. As a direct result, increased degradation to the water quality and fish and wildlife habitats will continue to occur throughout this segment and the rest of the SJBE. Area inhabitants will continue to suffer social stresses associated with substandard housing, deteriorated air and water quality, frequent flooding, and numerous health hazards.

The CMP represents a unique ecosystem restoration opportunity with potential for significantly enhancing the fish and wildlife habitat of the entire SJBE system. The dredging of the CMP could remove most of the solid waste deposited along the eastern half of the canal and induce circulation of clean ocean water across the entire estuary. This circulation is expected to substantially improve the water quality of the system and promote the establishment of more diverse and healthy fish and wildlife habitats throughout the SJBE, particularly CMP and San José Lagoon. The proposed channel restoration could also add recreation, transportation, and tourism opportunities for the San Juan area.

1.3 AUTHORITY AND PURPOSE

Initial efforts for the CMP improvements date back to the 1970s. The USACE has been working with the non-Federal sponsor on several issues since 2000. Two of the USACE's previous reports are particularly relevant: (1) the March 2001 Caño Martín Peña Project Design Report conducted under the Support for Others Program and (2) the July 2004 Section 905(b) Analysis for Caño Martín Peña, Puerto Rico, Ecosystem Restoration prepared under the authority of a 25 September 2002 House of Representatives study resolution.

The 110th Congress enacted Public Law (PL) 110–114, known as the "Water Resources Development Act of 2007," or WRDA 2007, on November 8, 2007. Section 5127 directed that:

> *The Secretary shall review a report prepared by the non-Federal interest concerning flood protection and environmental restoration for Caño Martín Peña, San Juan, Puerto Rico, and, if the Secretary determines that the report meets the evaluation and design standards of the Corps of Engineers and that the project is feasible, the Secretary may carry out the project at a total cost of $150,000,000.*

On October 27, 2008 the Director of Civil Works issued an implementation guidance memorandum for Section 5127 of the WRDA 2007, which established that the feasibility study "will follow the requirements set forth in Appendix H of Engineering Regulation (ER) 1105-2-100 for projects authorized without a report and be submitted for approval by the Assistant Secretary of the Army (Civil Works).”

1.4 GENERAL DESCRIPTION OF DREDGED OR FILL MATERIAL

The Engineering Appendix for the CMP-ERP Feasibility Study contains the compilation of the information used for this section, as well as additional information about the project.

1.4.1 General Characteristics of Material

The canal bottom is composed mainly of peat, organic clays, and silts of varying thickness within the proposed dredge footprint. The soil survey calls most of this area “made land”, meaning most of the canal bottom is placed material over the native soils. The sediments that characterize the first 10 feet of the dredged channel are generally formed of soft to very soft black organic mud, clays, and silts with some lenses of sandy material. The sediments that characterize the first 40 feet on the channel banks show a large range of geotechnical conditions from soft to very soft black organic mud, clays, silts with some lenses of sandy material, consistent with the channel, then become stiff sandy clays and stiff silty clays, sandy gravels and clayey gravels. Gravels, cobbles and boulders may be present near the Cantera area. Other than the potential rocks near the Cantera area, there are no grain size issues to limit hydraulic dredging. Due to the high contents of organic silts and clays within the sediment profiles, the liquid limit (LL) and plastic limit (PL) values in the channel and the banks of the CMP tend to be high. The shear strength values for the channel bank do not represent a concern for the dredging of the CMP.

Both the sediments and the sediment pore water of the Caño Martín Peña are characterized by elevated levels of various contaminants. Exceedances of sediment quality guidelines were found for anthracene, antimony, arsenic, copper, dieldrin, lead, mercury, selenium, silver and zinc, along with others.

The pore water within the sediments of the CMP are also characterized by exceedances of relevant criteria for multiple parameters. Problematic results were found for chromium, copper, lead, mercury, nickel, and zinc; however, dilution processes involved with the formation of the slurry for hydraulic dredging should reduce pore water concentrations of chromium, lead, nickel and zinc to values below their relevant water quality criteria, even within the CMP itself. Levels of copper and mercury would likely exceed criteria during the dredging operation, within the area where active dredging would occur. Exceedances for copper and mercury within the actively dredged area would occur mostly due to the fact that the surface waters of Caño Martín Peña and/or San José Lagoon ***already exceed*** relevant criteria. For cyanide, a complication exists in that the relevant standard is for “free” cyanide, while much of the existing water quality is for the larger category of “total” cyanide. Concentrations of total cyanide are expected to exceed the free cyanide surface water quality standards in the area actively being dredged.

Water quality impacts were then assessed based on concentrations expected during sediment disposal within the deep pits of San José Lagoon, but outside of a 1,000-foot mixing zone around those disposal sites. Based on earlier work by Bailey et al. (2002) selenium concentrations would be expected to be reduced by 74 percent outside of a 1,000-foot mixing zone, during sediment disposal activities. After applying the expected 74 percent reduction in selenium to the other metal concentrations, there would be no anticipated exceedances of existing criteria for any of the metals examined outside of a 1,000-foot mixing zone, except for the ongoing impairments for copper and mercury of the waters of the San José Lagoon itself.

After the completion of the sediment disposal activities into the San José Lagoon pits, Bailey et al. (2002) also anticipated that a sediment cap of clean sand would reduce the "migration" of selenium into the overlying water column by approximately 90 percent. After applying a 90 percent reduction in expected metal concentrations, based on results previously proposed for selenium, there would be no anticipated exceedances of existing criteria for any of the metals examined in the waters of San José Lagoon, even inside of the previously described 1,000-foot mixing zone used during sediment disposal operation. Exceptions would be for the ongoing impairments for copper and mercury of the waters of the San José Lagoon itself.

The sediments themselves also exceed relevant guidance criteria; however, features associated with the option of ocean disposal and/or disposal within the deep pits of the San José Lagoon may limit the environmental impact of sediment contamination. The extreme depths of the Ocean Disposal site (averaging in excess of 900 feet) would likely result in a dispersion of sediments such that the distribution of sediments, once they reach the sea floor, would be dispersed enough to not cause adverse environmental impacts. A combination of sediment fate modeling and bioassays would be required to verify this outcome. As well, sediment disposal within the deep pits of the San José Lagoon may not cause adverse environmental impacts, as the waters of the pits are anoxic below a depth of about 6 feet, and bioaccumulation is unlikely to occur in a location of such limited biological activity.

Channel and lagoon sediment results from the 2011 monitoring event were compared to the toxicity characteristic values of hazardous waste under 40 CFR 261.24, the Universal Treatment Standards (Land Disposal Restrictions for hazardous waste) under 40 CFR 268.48, and the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) Regional Screening Levels for groundwater protection. This evaluation of existing analytical data provided a scientific basis for estimating approximate locations and concentrations of affected sediment areas within the CMP-ERP project area and disposal locations. Approximate toxicity characteristic leaching procedure (TCLP) values were calculated from the 2011 data using the approved method described in USEPA Method 1311. When a waste is 100 percent solid as defined under the TCLP method, then the results of the total constituent analysis may be divided by 20 to convert the total results into a maximum leachable concentration. Dry weight samples were not reviewed during this initial screening, and since the Method 1311 calculation is performed on wet samples in this thermal stability analysis (TM) analysis, the determined TCLP values serve only as a rough estimate. Screening of the total metals concentrations via USEPA Method 1311 suggested that hazardous concentrations of lead may be present in the canal sediments.

1.4.2 Quantity of Material

The National Ecosystem Restoration (NER) Plan is dredging the CMP Channel to 100 feet width by 10 feet deep, and the dredged material is estimated at 762,000 cubic yards (cy).

1.4.3 Source of Material

Materials within the Caño Martín Peña include various types of solid waste, debris, and other materials. Such materials will require further testing prior to and/or during project construction, as appropriate, in accordance with an agreed sampling plan. If the testing determines that any materials contain hazardous substances at levels that are not suitable for unregulated disposal, they will be managed in accordance with the applicable laws and regulations of the relevant regulatory agencies. For the CMP-ERP Dredged Material Management Plan (DMMP), dredged material is defined as a collective mix of sediments or soils (“dredged sediments”) and solid waste (“dredged debris”). It is estimated that the dredged debris will make up 10 percent of the total material to be dredged from the CMP. In several cores that have done within the CMP-ERP footprint, debris is noted to appear up to −10 feet deep. Debris and riprap are an important component, again up to 10 percent, of the volumes of material to be dredged or remove from the channel and the channel banks. The solid waste will be separated from the dredged material, collected, transported, and disposed at the Municipality of Humacao Regional Landfill site located approximately 32 miles from the CMP site.

1.5 DESCRIPTION OF THE PROPOSED DISCHARGE SITE

There are total of six artificial depressions (pits) located within San José Lagoon and Los Corozos Lagoon (Figure 2). Five of the six depressions (pits) reside within San José Lagoon and are identified as San José 1 (SJ1 Pit), San José 2 (SJ2 Pit), and San José 3/4/5 (SJ3/4/5 Pits). One artificial depression (pit) is located within Los Corozos Lagoon and is identified as LC Pit. Collectively the six artificial pits would need to have sufficient capacity to receive the full bulked volume (814,000 cy) of sediments to be generated by dredging the CMP, plus the volume of sand needed to cap the geoencapsulated sediments within the artificial pits. The available existing capacities within each artificial pit to a controlled fill depth of −16 feet (for SJ1, SJ2, and SJ3/4/5 Pits) and −6 feet (for LC Pit) are shown in Table 1. For the San José Lagoon artificial pits, a −16-foot top-of-fill was selected to ensure uncontrolled dredged and cap sediments spill over into adjacent pits does not occur.

The total existing capacity (947,549 cy) for the six artificial pits is sufficient to receive nearly all the bulked dredged sediments volume (814,000 cy) from the Tentatively Selected Plan (TSP) CMP configuration. However, additional capacity of approximately 86,000 cy will be needed to allow for the preferred geoencapsulated contaminated sediments to be capped with 2 feet of clean sediments.

This additional capacity can be achieved by modifying the depth and/or width of the artificial pits by excavating sediments from within the pits.

Figure 2. Artificial Pit Locations – San José & Los Corozos Lagoons

Table 1
Artificial Pit Existing Capacities – San José & Los Corozos Lagoons

Artificial Pit	**Existing (Max) Floor Depth (feet)**	**Fill Depth (feet)**	**Existing Pit Capacity (cy)***
SJ1	–27	–16	260,516
SJ2	–27	–16	245,450
SJ3/4/5	–24	–16	275,373
LC	–18	–6	166,210
		TOTAL	**947,549**

* Capacities derived from 1996 bathymetric survey.

1.5.1 Location

Location is the six artificial depressions (pits) located within the San José Lagoon and Los Corozos Lagoon (Figure 3).

1.5.2 Size

The current total existing capacity is 947,549 cy for the six artificial pits (Table 1).

1.5.3 Type of Site

These depressions (pits) were constructed as borrow pits for material to fill nearby uplands.

1.5.4 Type of Habitat

The artificial dredged pits located in San José and Los Corozos Lagoons are depressions from the surrounding bottom, which is approximately 6 feet in depth, and the pits range in depth from approximately 15.5 to 30 feet (Table 1). Both within the dredge pits and outside of them as well, areas of San José and Los Corozos Lagoons deeper than approximately 6 feet in depth are characterized by organic rich sediments with a strong odor of hydrogen sulfide and lacking macrofauna such as mussels, crabs and polycheate worms (Atkins, 2011b).

The basis for the reduced species diversity and macrofaunal abundance appears to be a long-term condition indicative of very low levels (or none) of dissolved oxygen and suggests the presence of dissolved hydrogen sulfide in bottom waters—highly toxic at minute concentrations (2.0 micrograms per liter) to fish and the invertebrates upon which the fish prey. This widespread bottom water hypoxia is in turn most likely due to the strong salinity stratification that keeps separates two distinct layers of water in the Lagoons: above and below 4 to 6 feet in depth. Light transmission below 6 feet is absent, as evidenced by the Secchi disk measurements of this study, which prevents plant growth—the primary producers of most ecosystems on earth, and the only source of oxygen for this water mass isolated from surface air by a halocline (Atkins, 2011b).

1.5.5 Timing and Duration of Discharge

A summary of the construction schedule to implement the CMP's dredging and dredged material disposal plan is provided in Table 2. This schedule is based upon the operational durations for each phase of the plan, with cumulative start and finish days tied to a generic Notice to Proceed (NTP).

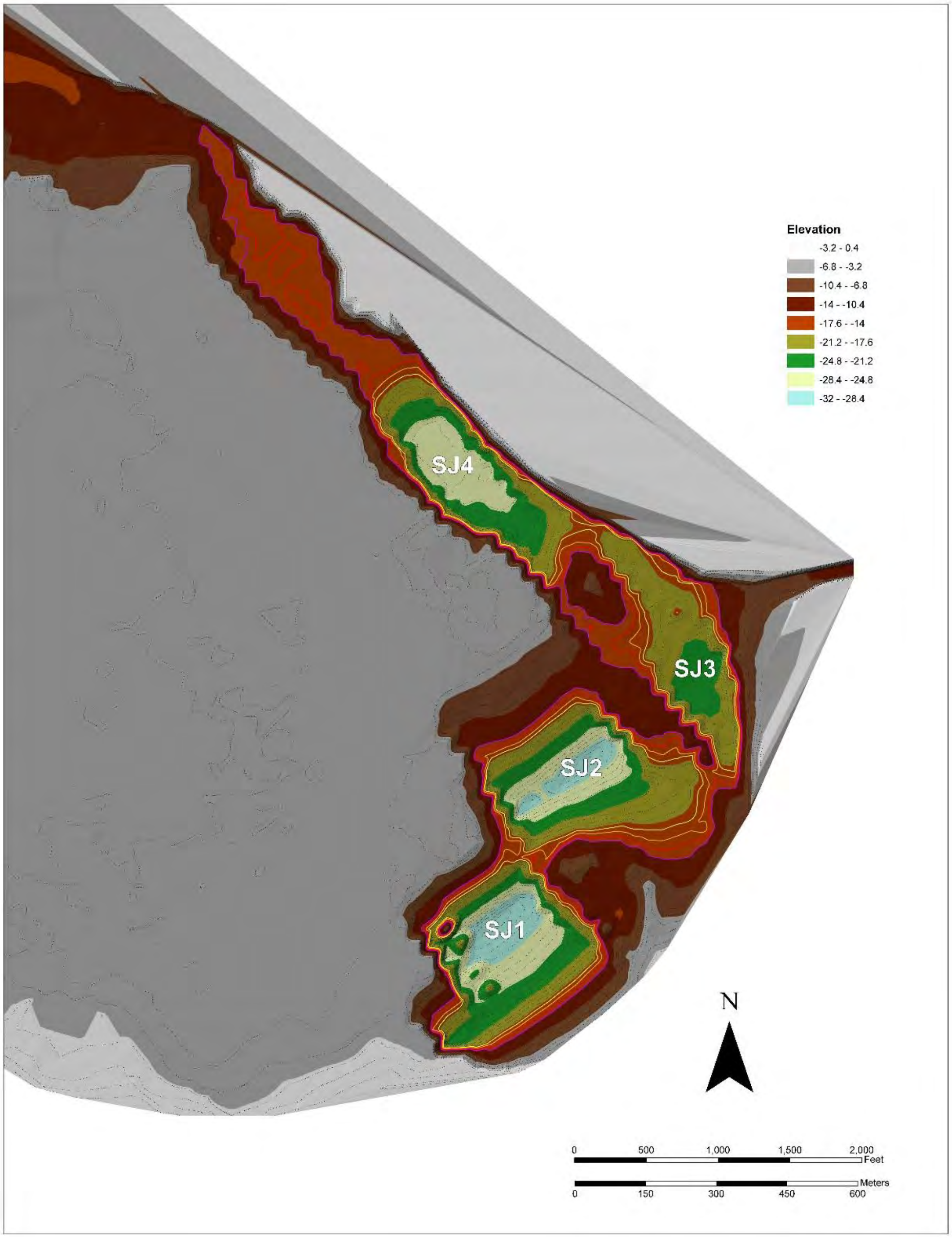

Figure 3
San José Lagoon Existing (1996) Pit Bathymetry (elevations in feet)

Table 2
Dredge Operations Construction Schedule

Dredge/ Disposal Event	Details	Operational Duration (Days)	Operational Start (No. Days From NTP)	Operational Finish (No. Days from NTP)	Calendar Finish Date (Month)
Start Construction		0	0	0	0
Channels and Canals	Mobilization & Site Preparation	150	0	150	5
Channels and Canals	Clearing and Grubbing	213	150	363	13
Channels and Canals	Dredge Excavation and enlarge SJ1 & SJ2 pits	350	163	513	18
Channels and Canals	Dredge, separate solid wastes and haul to Humacao Landfill	520	163	683	23
Channels and Canals	Dredge sediments and place in SJ1 & SJ2 pits	520	163	683	23
Channels and Canals	Upland Excavation and Earthwork	248	193	441	15
Channels and Canals	Install Weir	122	283	405	14
Channels and Canals	Prepare mangrove beds and plant mangroves	90	441	531	189
Recreation	Recreation Structures	720	0	720	24
Bank Stabilization	Sheet Piling	382	283	665	23
Cultural Resource Preservation	Ongoing	810	0	810	27
Complete Construction	Final Inspection, Demob. and Acceptance	90	720	810	27

1.6 DESCRIPTION OF DISPOSAL METHOD

The Engineering Appendix assumes a mix of dredge types would be used to construct the CMP-ERP, but may be modified during the preconstruction engineering and design and/or the construction phase of the project. The mix of dredge types include 1) a mechanical clamshell open bucket to excavate the solid waste and sediments from the CMP; and 2) an environmental bucket to dredge any unconsolidated sediments that could potentially contain elevated levels of contaminants.

It is determined that sand will be the best material to cap the geoencapsulated dredged sediments and, since the availability of sand for capping material is limited and most be transported to the project site, the best combination of pits to modify was determined based upon an objective to minimize the amount of capping material needed resulting from the modifications. This was preliminarily accomplished by comparing the surface area at the final fill depth for each Contained Aquatic Disposal (CAD) site, initially without expanding the pits. Table 3 displays the surface areas for each pit at the targeted fill depths, prior to any expansion or modification.

Based upon surface areas at the targeted fill depths, the combination of SJ1 and SJ2 (prior to expansion) would result in least amount of capping material. Therefore, the SJ1 and SJ2 pits were evaluated to determine the viability of modifying the two pits to increase their cumulative capacity. Modification of the SJ1 and SJ2 pits would entail excavating the pits to their original borrow depths of –32 and –30 feet, respectively. Existing side slopes of 17H:1V would be maintained for stability purposes as the SJ1 and SJ2 pits are deepened. The geoencapsulated dredged sediments would be placed within the modified pits to a fill elevation of –18 feet. The placed geoencapsulated dredged sediments would be capped with 2 feet of clean sand to an unconsolidated fill depth of –16 feet.

Table 3
Surface Areas of Artificial Pits – Prior to Expansion/Modification

Artificial Pit	Existing (Max) Floor Depth (feet)	Fill Depth (feet)	Surface Area (square feet)
SJ1	–27	–16	897,190
SJ2	–27	–16	956,000
SJ3/4/5	–24	–16	1,591,070
LC	–18	–6	1,624,865

Table 4 provides the dimensional and volumetric details of the modified SJ1 and SJ2 pits, up to the fill depth of –18 feet for geoencapsulated dredged sediments.

Table 4
Dredged Sediments – Modified SJ1 and SJ2 Pits to Fill Depth of –18 feet (Side Slopes 17:1)

CAD Site	Modified Bottom Depth (feet)	Fill Depth (Dredged Sediments) (feet)	New Pit Capacity (cy)	Required Capacity (Dredged Sediments Volume) (cy)
SJ1	–31	–18	421,000	421,000
SJ2	–30	–18	459,000	393,000
TOTAL			**880,000**	**814,000**

Table 5 provides the dimensional and volumetric details of the modified SJ1 and SJ2 pit, to accommodate 2 feet of capping material to a fill depth of –16 feet.

Table 5
Cap Material (2 feet) – Modified SJ1 and SJ2 Pits to Fill Depth of –16 feet (Side Slopes 17:1)

CAD Site	Fill Depth (Dredged Sediments) (feet)	Fill Depth (Cap Material) (feet)	Modified Surface Area (square feet)	Cap Material Required Volume (cy)
SJ1	–18	–16	1,296,465	96,034
SJ2	–18	–16	1,381,219	102,313
TOTAL			**2,677,684**	**198,347**

Comparison of the SJ1 and SJ2 modified surface areas with the unmodified SJ3/4/5 and LC surface areas, concludes combining the modified SJ1 and SJ2 pits would remain as the pit combination that would require the least amount as capping material, and would provide the required capacity necessary for disposal and capping of the dredged sediments, without adversely affecting the tarpon feeding zone at the –6-foot halocline interface.

The existing pit capacities for SJ1 and SJ2 to the –16-foot fill depth are 260,516 cy and 245,450 cy, respectively, for a total existing capacity of 505,966 cy. The revised capacities of the modified SJ1 and SJ2 pits to the –16-foot fill depth are 880,000 cy for the dredged sediments and 198,347 cy for the capping material, for a total of 1,078,347 cy. This provides sufficient capacity to place the 814,000 cy of bulked dredged sediments and the 198,347 cy sand cap with an excess capacity of 66,000 cy. Therefore a total of 506,381 cy of sediments will need to be excavated from the SJ1 and SJ2 pits to acquire the total capacity needed to place the geoencapsulated dredged sediments and capping material within the two pits.

It is assumed that the excavated pit material from SJ1 and SJ2 is clean and therefore is suitable for unconfined open water disposal in SJ pits 3/4/5. If the excavated pit material is suitable for use for the sand cap, 198,347 cy less sediments needs to be placed in SJ 3/4/5. If the excavated pit material is not suitable for use for the sand cap, it would be placed in SJ 3/4/5. In such a case, approximately 64,798 cy would not be accommodated and would consume the majority of the 66,000 cy of excess capacity in the SJ1/2 pits.

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2.0 FACTUAL DETERMINATIONS

2.1 PHYSICAL SUBSTRATE DETERMINATIONS.

2.1.1 Substrate Elevation and Slope

As indicated above, use of the artificial dredged pits located in the San José Lagoons will be confined disposal that results in nearly flat or slightly contoured surfaces. The pits would be filled well below surface elevations as indicated above.

2.1.2 Sediment Type

As indicated above, both within the dredge pits and outside of them as well, areas of San José are characterized by organic rich sediments with a strong odor of hydrogen sulfide and lacking macro-fauna such as mussels, crabs and polycheate worms (see Atkins, 2011b).

2.1.3 Dredge/Fill Material Movement

Grain Size Analysis. Grain size analysis is performed to determine the percentage of different grain sizes contained within a sediment column and provides the grain size distribution needed to understand the composition of the sediments. The sediments that characterize the first 10 feet of the dredged channel are generally formed of soft to very soft black organic mud, clays, and silts with some lenses of sandy material. The sediments that characterize the first 40 feet on the channel banks show a large range of geotechnical conditions from soft to very soft black organic mud, clays, silts with some lenses of sandy material, consistent with the channel, then become stiff sandy clays and stiff silty clays, sandy gravels and clayey gravels. Gravels, cobbles and boulders may be present near the Cantera area. Other than the potential rocks near the Cantera area, there are no grain size issues to limit hydraulic dredging.

Atterberg Limits. Atterberg limits provide parameter inputs for the engineering planning, design, construction, operational, and management aspects of dredging and dredged material disposal. They are a set of index tests performed on fine grained silt/clay soils or sediments to determine the relative activity of the soils and their relationship to moisture content. The liquid limit (LL), plastic limit (PL) and shrinkage limits (SL) define the relative stages of behavior when the soil moves from the solid to liquid state. These limits are used to estimate strength and settlement characteristics of the materials and the water content boundaries between non-plastic, plastic, and viscous fluid states. The plasticity index (PI) and liquidity index (LI) are used to identify the potential range of plastic state. This test enables the prediction of the clumping capability in mechanical dredging. LL and PI provide an indication of the “clayeyness” of a soil. Materials with a high LL and PI are normally dense fine sediments that are unsuitable for many construction applications due to the “clayeyness.” The Bailey et al. (2002) report analyzed the Atterberg limits for the sediments collected in the previous studies.

Due to the high contents of organic silts and clays within the sediment profiles, the LL and PI values in the channel and the banks of the CMP tend to be high.

Shear Strength. Shear strength values (τ) have been considered for the channel slopes. Where the channel slopes will be excavated, long-term drained shear strengths are generally considered to be critical. Under these conditions, pore pressures increase with time as the excavated material is relieved of the overburden pressure. This increase in pore pressure reduces the shear strength of the soil. Shear strength values and associated design parameters for channel slopes were derived from the available data including boring logs and laboratory test data, and test pits. Reduced pore pressure can also increase the potential for scour under high flows.

Shear strength values and associated design parameters for channel walls were established in the USACE (2001) report. The analysis was conducted because of the need for information on the lateral loads due to the fact that the channel banks will be lined with a concrete-capped sheet pile system. This information supported the recommended design methods considering the local anomalies. The shear strength values for the channel bank do not represent a concern for the dredging of the channel.

Channel Stability. The USACE (2001) report included the geotechnical design for the sheet pile walls and channel dredging. The channel and channel banks will be dredged considering the local conditions. When dredging, it was determined that temporary construction channel bank slopes of 1V:3H (vertical:height) were considered safe from 0 to –5 feet and dredge slopes of 1V:5H in the channel from –5 to –10 feet were considered acceptable. It was determined that the sheet pile could be installed with a vibratory hammer and a diesel, steam or hydraulic pile hammer for sections of sheet pile that may not be able to be driven completely to the required tip elevation. During dredging operations, temporary slope angles will be maintained until the installation of the sheet pile. These actions will have to be managed from the water or from the shores of the channel.

San José Lagoon Pits Stability. At the disposal site, all final designs are confined and basically level; however, there is insufficient data to characterize the stability of the pits during or after the disposal operation. This should be investigated in more detail with the geotechnical information to prevent potential landslides, mainly slumps during the disposal.

2.1.4 Physical Effects on Benthos

As indicated above, the disposal sites are deep and anoxic, basically devoid of benthos (see Atkins 2011b).

2.2 WATER CIRCULATION, FLUCTUATION AND SALINITY DETERMINATION

2.2.1 Water Column Effects

The San Juan Bay Estuary Program (SJBEP) dataset for San José lagoon comes from two stations located within the open waters of San José Lagoon and one station within Los Corozos Lagoon. For the purposes of this report, data from stations LSJ1 and LSJ2 from 2008 to 2009 were examined. Station LSJ1 is located at the far western edge of San José Lagoon, close to the confluence with the CMP. This station is located close to the USGS long-term water quality station 50049820. The second station within San José Lagoon, LSJ2, is located at the far eastern edge of San José Lagoon, close to the confluence with the Suárez Canal. The SJBEP water quality station located within the CMP is located at the Martí Coll pedestrian bridge (near the Luis Muñoz Rivera Avenue Bridge).

Water quality data for stations LSJ1, LSJ2, and the CMP are shown in Tables 6, 7, and 8, respectively. The red numbers indicate exceedances of Puerto Rico Environmental Quality Board (PREQB) standards.

Table 6. Summary of Water Quality Data for SJBEP Station LSJ1.

		Date										
Field Parameters		**Nov-09**	**Dec-09**	**Jan-10**	**Feb-10**	**Mar-10**	**Apr-10**	**May-10**	**Jun-10**	**Jul-10**	**Aug-10**	**Objective**
Temperature C°		28.3	26.5	27.85	27.2	29.37	28.7	31.3	28.45	27.8	29.9	
Dissolved Oxygen (mg/L)†		8.11	8.71	9.3	11.21	6.77	7.62	2.75	6.3	4.2	3.29	**≤ 5**
Salinity (PSU)		4.27	6.17	4.07	8.2	9.27	10.99	5.68	2.89	2.99	4.5	
Turbidity (NTU)†		13.2	12	6.9	20.5	18.5	12.2	6	16.7	1.0	7.4	**< 10**
pH†		8.4	8.77	7.9	8.5	7.93	8.4	7.75	7.8	7.3	7.5	**6.0-9.0**
Secchi Depth (Meters)•		1.3	0.575	1.19	0.535	0.48	0.58	1.00	0.58	1.30	0.82	**≥ 1**
Laboratory Parameters												
Total Kjeldahl Nitrogen	mg/L †	1.99			1.84			1.65				**< 1**
Nitrate & Nitrite, total	mg/L•	0.03			0.01			0.03				**< 1**
Total Phosphorus	mg/L †	0.356			BDL			BDL				**< 0.5**
Chlorophyll	mg/m^3•	9.32			6.83			8.65				**< 5**
BOD	mg/L	2			7			2				**< 5**
Fecal Coliforms	CFU/100mL†	7900			3200			3300				**< 200**

Table 7. Summary of Water Quality Data for SJBEP Station LSJ2.

		Date										
Field Parameters		**Nov-09**	**Dec-09**	**Jan-10**	**Feb-10**	**Mar-10**	**Apr-10**	**May-10**	**Jun-10**	**Jul-10**	**Aug-10**	**Objective**
Temperature C°		28.1	26.6	27.1	26.92	29.21	28.41	30.3	28.51	27.7	28.9	
Dissolved Oxygen (mg/L)†		4.84	8.54	5.9	9.22	5.08	5.18	5.58	6.87	4.66	2.95	**≤ 5**
Salinity (PSU)		4.5	6.46	4.1	8.5	9.96	11.7	5.6	4.41	3.4	7.5	
Turbidity (NTU)†		16.7	8.4	5.7	13.9	7.4	15.1	4.7	3.1	1.1	7.5	**< 10**
pH†		8.04	8.7	7.46	8.46	7.91	8.11	8.2	8.2	7.2	7.5	**6.0-9.0**
Secchi Depth (Meters)•		0.94	0.655	1.26	0.62	0.765	0.72	1.26	0.89	0.605	0.8	**≥ 1**
Laboratory Parameters												
Total Kjeldahl Nitrogen	mg/L †	1.35			1.84			1.33				**< 1**
Nitrate & Nitrite, total	mg/L•	0			0.01			0.1				**< 1**
Total Phosphorus	mg/L †	0.000			BDL			BDL				**< 0.5**
Chlorophyll	mg/m^3•	25.90			6.83			2.29				**< 5**
BOD	mg/L	3.00			7.00			1.00				**< 5**
Fecal Coliforms	CFU/100mL†	3600			3200			3200				**< 200**

Table 8. Summary of Water Quality Data for SJBEP Station CMP.

		Date										
Field Parameters		**Nov-09**	**Dec-09**	**Jan-10**	**Feb-10**	**Mar-10**	**Apr-10**	**May-10**	**Jun-10**	**Jul-10**	**Aug-10**	**Objective**
Temperature C°		26.5	28.35	27.3	28.1	29.02	28.9	28.22	27.9	27.3	31.5	
Dissolved Oxygen (mg/L)†		1.4	1.85	0.06	2.08	2.85	1	0.22	0.22	2.66	1.18	**≤ 5**
Salinity (PSU)		5.07	35.87	23.05	34.13	33.8	32.5	26.9	20.77	1.6	31.3	
Turbidity (NTU)†		22.1	3.3	8.1	4.4	3.4	4.8	7.1	9.1	4.5	10.4	**< 10**
pH†		6.9	7.8	7.41	7.5	7.5	7.85	7.2	7.1	6.83	7.7	**6.0-9.0**
Secchi Depth (Meters)•		0.81	1.21	1.07	1.445	0.84	0.89	0.94	0.67	0.89	0.865	**≥ 1**
Laboratory Parameters												
Total Kjeldahl Nitrogen	mg/L †	2.24			0.42			1.69			1.71	**< 1**
Nitrate & Nitrite, total	mg/L•	0.21			0.06			0.04			0.06	**< 1**
Total Phosphorus	mg/L †	0.273			BDL			BDL			BDL	**< 0.5**
Chlorophyll	mg/m^3•	1.99			0.30			0.92			6.25	**< 5**
BOD	mg/L	2			3			5			BDL	**< 5**
Fecal Coliforms	CFU/100mL†	80000			2900			15000			2100	**< 200**

Legend for Tables 6, 7, and 8:

† PR Water Quality Standard Regulation, Environmental Quality Board, Act 4282 as amended on May 14, 2003.

• This parameter objective from the SJBEP is not regulated by PREQB.

BDL = Below Detection Limit

2.2.2 Current Patterns and Circulation

As documented in the Engineering Appendix, there is little or no tidal exchange between the San Juan Bay and San José Lagoon through the CMP. Should the CMP be opened up and friction reduced through the removal of material currently clogging the canal, there will be a dramatic increase in tidal amplitude in San José Lagoon. The modeled flow also revealed the following:

- The modeled tide range in San José Lagoon increases with increases in the cross-sectional area of a restored CMP, which is an indication of increased flow in and out of the San José Lagoon.
- Under existing conditions, the average residence time of waters within San José Lagoon is estimated at 16.9 days with a standard deviation of 0.4 day. Estimated residence times ranged between 16.0 and 17.3 days.
- Using modeled channel cross sections of 450, 675, 900, 1,350, and 1,800 square feet, modeled residence times for the San José Lagoon will decrease to 5.0, 3.9, 3.2, 2.7, and 2.4 days, respectively.

Velocity

Table 9 shows that there are particular channel configurations that could be problematic due to peak bottom velocities that could be capable of scouring unconsolidated sediments. The model could only run in increments of 3 feet, hence the differences between descriptions of model runs as they relate to alternatives (9 feet) versus tables that identify alternatives being considered in the feasibility report (10 feet). Velocities in 10-foot-deep channels would be slightly higher than those modeled 9-foot-deep channels.

Table 9. Channel configurations, channel cross-sectional area (square feet), residence time estimates for San José Lagoon (days), and maximum bottom velocities (feet per second) for east and western portions of CMP for various alternatives.

Channel Configuration (depth x width in feet)	**3 x 33***	**9 x 75**	**9 x 100**	**9 x 125**	**15 x 75**	**9 x 150**	**15 x 100**	**9 x 175**	**9 x 200**	**15 x 125**	**15 x 150**
Cross Sectional Area (square feet)	99	675	900	1,125	1,125	1,350	1,500	1,575	1,800	1,875	2,250
Residence Time (days)	16.90	3.86	3.23	2.87	2.61	2.66	2.37	2.49	2.38	2.25	2.19
Max. Bottom Velocity CMP-East (fps)	1.25	4.22	4.09	3.95	4.54	3.85	3.92	3.52	3.13	3.45	3.13
Max. Bottom Velocity CMP-West (fps)	0.74	2.20	2.80	3.25	3.50	3.65	4.06	3.89	NA	4.34	4.49

* = Modeled configuration for existing conditions.
NA = problematic result; potential error.

The channel configurations that result in the two lowest peak channel bottom velocities in the eastern end of the CMP are those where the channel will be 10 feet deep by 200 feet wide and 15 feet deep by 150 feet wide (both at 3.13 feet per second). The channel configurations that result in the two lowest peak channel bottom velocities in the western end of the CMP are those where the channel will be 10 feet deep by 75 feet wide and 10 feet deep by 100 feet wide (2.20 and 2.80 feet per second, respectively). In order to prevent unacceptable bottom velocities in the western CMP, and to protect the foundations for the four existing bridges in the western part of the Project Channel, a weir would be included as part of every alternative channel configuration, with a cross sectional area to match the 75-x-10-foot alternative. The weir would be 115 x 6.5 feet, and then transition into the respective channel configuration of each alternative. The recommended channel configuration of 10 feet deep by 100 feet wide, with the weir, results in acceptable bottom velocities for both the Project Channel and the Western CMP.

Hydrologic Regime

The current condition of the hydrologic regime of the SJBE system is poor because of the lack of flow through the CMP. The proposed project will result in opening the CMP and restoring the flow through the system. The proposed dredging of the CMP will result in an overall improvement in the current condition of the hydrologic regime.

2.2.3 Normal Water Level Fluctuations and Salinity Gradients

Normal Water Level Fluctuations

The modeling effort performed in TECHNICAL MEMORANDUM, Task 6.0 – Hydrodynamic and Water Quality Modeling Efforts, Caño Martín Peña Ecosystem Restoration Project San Juan, Puerto Rico (Atkins, 2011a) quantified the tide range in San José Lagoon both in real numbers and as a percentage of the tide range in San Juan Bay (Figure 5). An increase in tide in San José Lagoon is an indicator of increased water exchange. In the existing conditions, there is very little tide difference in the San José Lagoon between the existing conditions (modeled as a 33-foot-wide by 3-foot-deep channel with very high friction) and the case where the CMP was severed from any connection at all to San José Lagoon. Figure 5 shows the tidal fluctuation comparing the existing conditions run with the totally blocked CMP. It is evident that the CMP provides only a slight influx of tidal waters to the San José Lagoon.

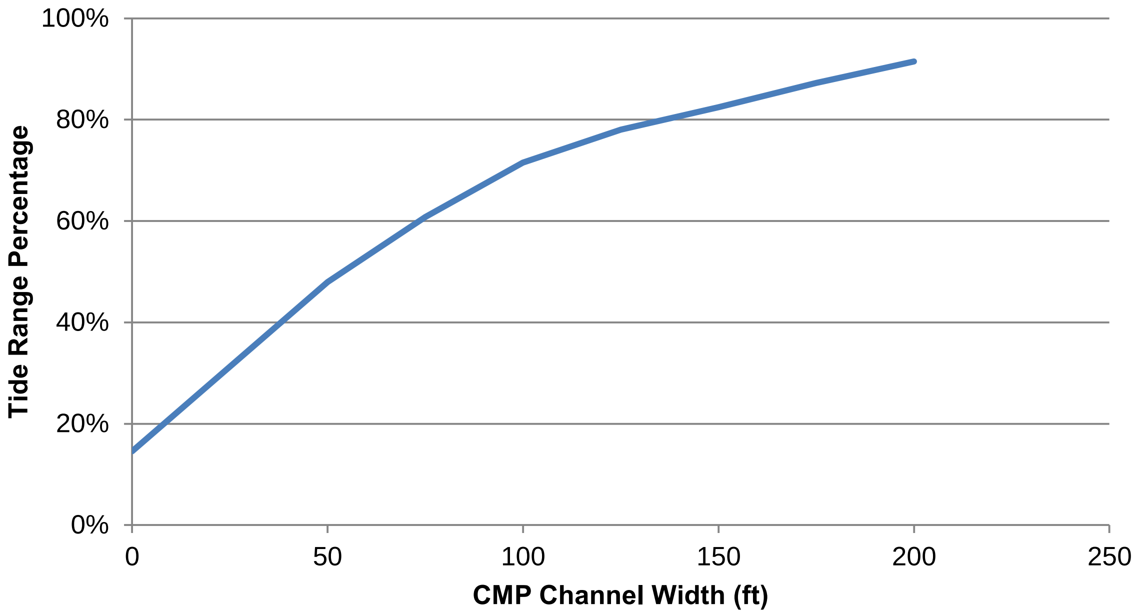

Figure 4. Spring tide range for July 12, 1995 (percentage of San Juan Bay tide range) as a function of channel width (feet) of the Caño Martín Peña (based on 9-foot channel depth).

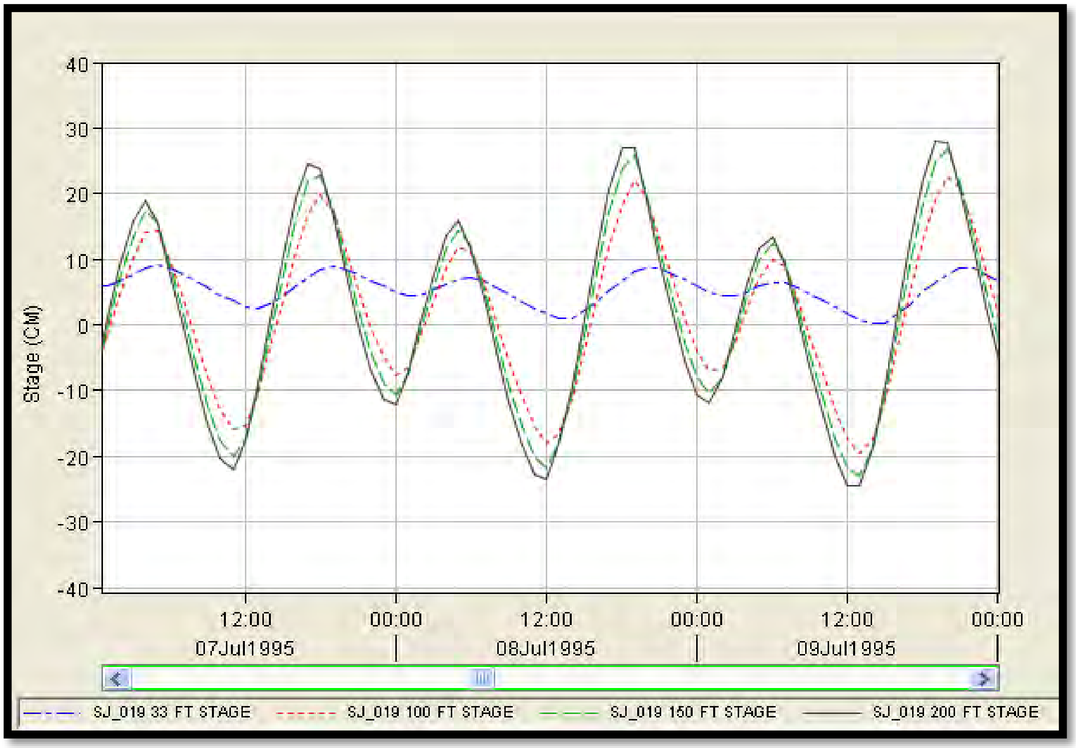

Figure 5. Tide signal in San José Lagoon for three days for existing conditions (blue dot-dash line), 100-x-9-foot channel (red dotted line), 150-x-9-foot channel (green dash line), and 200-x-9-foot channel (black solid line) (Atkins 2011a).

Salinity Gradients

The FINAL TECHNICAL MEMORANDUM, Task 2.6 – Water and Sediment Quality Studies, Caño Martín Peña Ecosystem Restoration Project San Juan, Puerto Rico (Atkins, 2010) investigated trends in the existing data for San José Lagoon. Figure 6 provides the trend of specific conductance (a measure of salinity) at a USGS water quality station (500495280) that is located in San José Lagoon near the confluence with the CMP. The water in San José Lagoon has been generally saline, but highly variable over time with no clear pattern existing to suggest an overall monotonic trend over time. There appears to be some seasonal influence from freshwater inflow. Low values during the late 1990s and early 2000s appear to be lower than the lowest values recorded in the 1970s to 1980s.

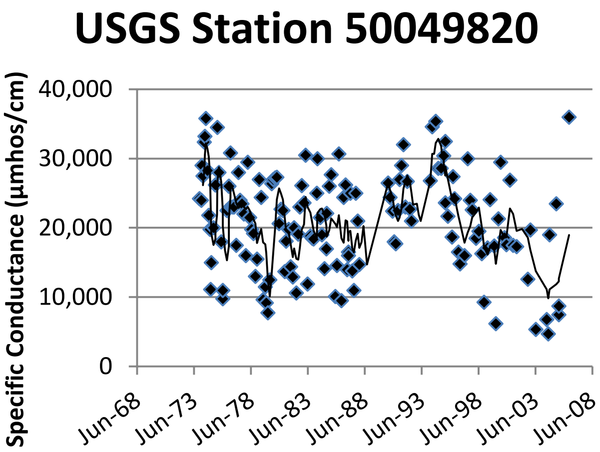

Figure 6. Specific Conductance (µmhos / cm) over the
period of record at USGS station 50049280.
Line is 5-point moving average.

Stratification

The TECHNICAL MEMORANDUM 3.1 – Sport Fisheries Studies Caño Martín Peña Ecosystem Restoration Project San Juan, Puerto Rico (Atkins, 2011b) revealed stratification in the dredge pits of Los Corozos and San José Lagoon and the shallower regions of San José Lagoon with the following findings.

- Within the deep dredge pits of Los Corozos and San José Lagoon, salinity stratification occurs at a water depth of between 4 and 6 feet, with mesohaline salinities in surface waters and polyhaline salinities below the stratification layer.
- Above this salinity stratification layer, or halocline, dissolved oxygen levels are high enough to support diverse and healthy biological communities.
- Below this salinity stratification layer, dissolved oxygen levels are hypoxic to anoxic.

- Assessments of substrate type and biological communities indicated that hypoxic to anoxic conditions are long-term conditions, resulting in a severely depressed biological community at the bottoms of these dredge holes.
- In the shallower regions of San José Lagoon, both adjacent to and away from the deep dredge pits, salinity stratification also occurs at a water depth of between 4 and 6 feet, with mesohaline salinities in surface waters and polyhaline salinities below the stratification layer.
- Above this salinity stratification layer, dissolved oxygen levels are high enough to support diverse and healthy biological communities.
- Below this salinity stratification layer, dissolved oxygen levels are hypoxic to anoxic.
- Assessments of substrate type and biological communities indicate that hypoxic to anoxic conditions are long-term conditions in these shallow areas, with diverse and healthy benthic communities restricted to shallow portions of San José Lagoon, in areas shallower than 4 feet.

TECHNICAL MEMORANDUM, Task 6.0 – Hydrodynamic and Water Quality Modeling Efforts, Caño Martín Peña Ecosystem Restoration Project San Juan, Puerto Rico (Atkins, 2011a) reveals that the restoration of flow through the CMP and the reduction of residence time of water in San José Lagoon will improve bottom condition in San José Lagoon. It will appear that the main process through which benthic conditions will increase with greater flushing rates is a reduction in salinity stratification and a concomitant increase in levels of dissolved oxygen in bottom waters. That is, by increasing the flow of polyhaline waters into San José Lagoon from San Juan Bay, the difference in salinity values between surface and bottom waters in San José Lagoon will likely decrease, and the salinity stratification now seen throughout San José Lagoon (in waters greater than 4 to 6 feet in depth) will lessen. A weakened salinity stratification layer will likely decrease the spatial extent, severity, and duration of stratification-induced bottom water hypoxia, bringing about improved ecological health of benthic communities. This improvement will not occur in the pits which will remain hypoxic to anoxic below approximately 6 foot water depth.

2.3 SUSPENDED PARTICULATE/TURBIDITY DETERMINATIONS

As indicated above, The FINAL TECHNICAL MEMORANDUM, Task 2.6 – Water and Sediment Quality Studies (Atkins 2010) investigated trends in the existing data for San José Lagoon. Figure 7 provides the trend of Secchi disk depth measurement (a measure of water clarity and, thereby, turbidity) at a USGS water quality station (500495280) that is located in San José Lagoon near the confluence with the CMP. In addition, the SJBEP stations within San José Lagoon provide turbidity (NTU) and Secchi disk measurements located in Tables 6, 7, and 8.

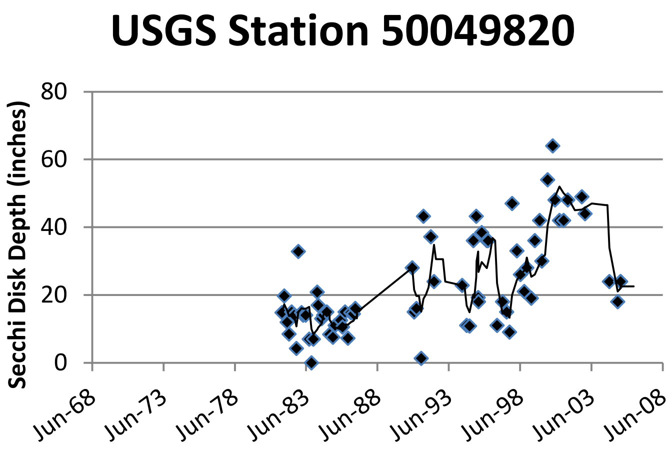

Figure 7. Secchi disk depth (inches) over the period of record at USGS station 50049280. Line is 5-point moving average.

These data suggest that water quality in San José Lagoon is highly variable and do not appear to be trending positively or negatively over time. Both turbidity and Secchi disk measurements are highly variable and both tend to fluctuate above and below the PREQB standards.

2.3.1 Expected Changes in Suspended Particulates and Turbidity Levels in the Vicinity of the Disposal Site

The selected method of disposal includes geoencapsulation of the dredged sediment and confinement and isolating of the disposal area during construction using turbidity curtains. During construction, the dredge area would be confined using turbidity curtains. No changes in chemical or physical properties of the water column are anticipated outside of the immediate work area confined within the turbidity curtains and/or temporary coffer dam(s) at the dredge site and disposal area.

2.3.2 Effects on the Chemical and Physical Properties of the Water Column

The selected methods of disposal include geoencapsulation of the sediment, confinement in submerged pits, and capping the dredged material with clean sand. During construction, the dredge area and disposal area would be confined using turbidity curtains. No changes in chemical or physical properties of the water column are anticipated outside of the immediate work area confined within the turbidity curtains and/or temporary coffer dam(s) at the dredge site or disposal site.

2.3.2.1 Light Penetration

Turbidity and Secchi disk measurements in San José Lagoon are highly variable and both tend to fluctuate above and below the PREQB standards (see above and Atkins, 2010).

2.3.2.2 Dissolved Oxygen

The FINAL TECHNICAL MEMORANDUM, Task 2.6 – Water and Sediment Quality Studies (Atkins, 2010) contained both long term trends in dissolved oxygen. Long term trends in the levels of dissolved oxygen (Figure 8) exhibit a pattern that appears to reflect both an overlying trend of a reduction in the maximum levels recorded, as well as an increase in the minimum levels recorded, when comparing values from the late 1990s to present vs. values in the 1970s and 1980s. These data are suggestive of a situation of reductions in levels of phytoplankton biomass in San José Lagoon over time, as elevated levels of phytoplankton would be expected to bring about both higher high values (through elevated rates of photosynthesis) and lower low values (through greater respiration rates). A moderation of dissolved oxygen values over time suggests that at least portions of San José Lagoon more distant from the CMP might be experiencing reduced levels of eutrophication, even if the average dissolved oxygen concentration has declined over time (i.e., Webb and Gomez-Gomez, 1998).

Data from the SJBEP dataset (Tables 6, 7, and 8) indicates that waters of the Caño Martín Peña have a strong influence on waters of San José Lagoon in terms of dissolved oxygen. The station near the CMP has frequent exceedances, while the stations in San José Lagoon have fewer.

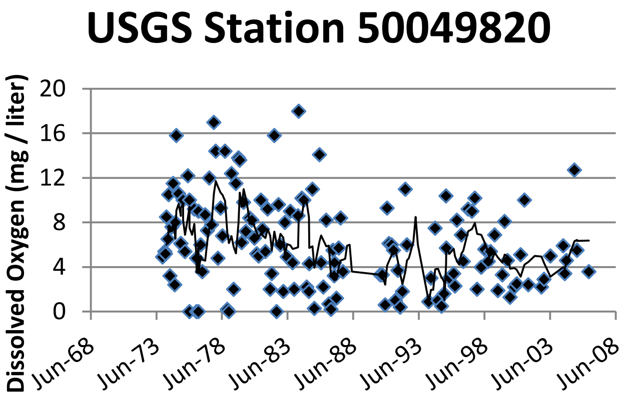

Figure 8. Dissolved oxygen (mg/liter) over the period of record at USGS station 50049280. Line is 5-point moving average.

2.3.2.3 Toxic Metals, Organics, and Pathogens

The FINAL TECHNICAL MEMORANDUM, Task 2.6 – Water and Sediment Quality Studies, Caño Martín Peña Ecosystem Restoration Project San Juan, Puerto Rico (Atkins, 2010) and the TECHNICAL MEMORANDUM, Task 2.05 Hazardous, Toxic, and Radioactive Waste Initial Assessment Documentation Caño Martín Peña Ecosystem Restoration Project San Juan, Puerto Rico (Atkins, 2011e) summarizes the available information on the material proposed to be dredged with the CMP and the placement of the material at the disposal sites. Two studies conducted by the USACE have looked at the use of borrow pits within the San José Lagoon as potential dredge spoil disposal options, specifically as to their capacity to accommodate the quantity of material expected, but also to determine if sediment "capping" would be required and/or possible. Bailey et al. (2002) used a model to determine the dredged materials long-term effects, if any, on the local water quality within San José Lagoon if these dredge holes were to be filled with spoil material and then capped with clean sand.

Detected levels of lead and mercury and lesser concentrations of polycyclic aromatic hydrocarbons (PAH), oil and grease, and residual pesticides were noted in CMP sediments (Webb and Gómez-Gómez 1998). Substantial quantities of Polychlorinated biphenyls (PCBs), PAHs, pesticides, Bis (2-ethylhexyl) phthalate (B2EHP), lead, and mercury were measured within the sediments of the CMP. Sediment cores from six sites in the SJBE and CMP (Webb and Gómez-Gómez 1998) representing time periods of 1925–1949, 1950–1974, 1975–1995, show increases in concentrations of:

- Lead from 30 to 745 micrograms per gram (µg/g)
- Mercury from 0.16 to 4.7 (µg/g)
- PCBs from 12 to 450 micrograms per kilogram (µg/kg)

In contrast to increasing trends for lead, mercury and PCBs, dichlorodiphenyltrichloroethane (DDT) and its derivatives decreased over time, from 46 µg/kg in sediments during the years 1950 to 1974 to 14.6 µg/kg in sediments dated to the years 1975 to 1990.

In 2002 and 2011, elutriate testing of the eastern CMP sediments and sediment pore water confirmed the presence of heavy metals such as lead and mercury, PAHs, PCBs, oil and grease and residual pesticides (Atkins, 2013). Table 2 documents average sediment chemical characteristics from the CMP (and Lagoon Pit sites for comparison), representing time periods from 2002 and 2011. Both the sediments and the sediment pore water of the CMP are characterized by elevated levels of various contaminants. Levels in excess of sediment quality guidelines were found for anthracene, antimony, arsenic, copper, dieldrin, lead, mercury, selenium, silver and zinc, along with others. The pore water within the sediments of the eastern CMP also exceeded criteria for multiple parameters. Problematic results were found for chromium, copper, lead, mercury, nickel, and zinc. Complicating this issue, the surface waters of the CMP and the San José Lagoon already exceed relevant criteria for copper and mercury.

According to Bailey et al. (2002), copper and selenium were determined to be the primary concerns due to their potential to cause impacts to ambient water quality within San José Lagoon. The authors (Bailey et al., 2002) concluded that by capping the dredged material, the potential for metals to leach into the water column would be reduced by more than 95 percent. The encapsulation of dredged sediments in geotextile bags would only further reduce the potential for metals leaching into the water column during placement in the pits, and after a sand cap was placed on top.

The authors (Bailey et al., 2002) found that even with capping (though not including the use of geotextile encapsulation), selenium is predicted to migrate through a potential two-foot thick sediment cap; however, selenium concentrations would be reduced sufficiently via dilution so that pore water concentrations of selenium would be only 20 percent of existing water quality criteria levels in the “biologically active layers” of the sediment cap.

The SJBEP water quality stations contain data on fecal coliform bacteria levels at the three stations. All three locations regularly exceed guidance criteria for fecal coliform bacteria; however, levels in the CMP and at the station in San José Lagoon near the CMP are typically higher by far than values found in San José Lagoon.

For screening purposes only, a rough estimate of the TCLP values from 2011 sediment samples taken from the CMP canal were used as a basis for comparison with regulatory thresholds for management of solid wastes. Results reviewed do not meet the USEPA Method 1311 requirement for a dry sample. Therefore, the results presented and reviewed herein are considered rough estimates only. Screening of the total metals concentrations via USEPA Method 1311 suggests that hazardous concentrations of lead may be present in the canal sediments.

2.3.2.4 Aesthetics

The selected method of disposal includes geoencapsulation of the sediment, confinement in submerged pits, and capping the dredged material with clean sand. The results of disposal would be partially filling of pits within San José Lagoon. No visual change in the aesthetics at this site is anticipated. The overall project would result in improved water quality and overall improved aesthetics.

2.3.3 Effects on Biota

Substrate type and biota observed in the proposed disposal site(s) indicate that hypoxic to anoxic conditions are long-term conditions for the bottom surface at depths greater than 4 to 6 feet, resulting in a severely depressed biological community. Diverse and healthy benthic communities are restricted to areas of the Lagoons shallower than 4 to 6 feet.

As indicated above, the disposal site(s) are located in deep water and the sediment at these sites is in deep water below a salinity stratification layer described above. The sediment is anoxic with little or no benthos (plant or animal).

2.3.3.1 Primary Productivity and Photosynthesis

As discussed in Section 2.3.2.2 on dissolved oxygen, long term trends in the levels of dissolved oxygen (see Figure 8) exhibit a pattern that appears to reflect both an overlying trend of a reduction in the maximum levels recorded, as well as an increase in the minimum levels recorded, when comparing values from the late 1990s to present vs. values in the 1970s and 1980s. These data are suggestive of a situation of reductions in levels of phytoplankton biomass in San José Lagoon over time, as elevated levels of phytoplankton would be expected to bring about both higher high values (through elevated rates of photosynthesis) and lower low values (through greater respiration rates). A moderation of dissolved oxygen values over time suggests that at least portions of San José Lagoon distant from the CMP might be experiencing reduced levels of eutrophication; even if the average dissolved oxygen concentration has declined over time (i.e., Webb and Gomez-Gomez, 1998).

2.3.3.2 Suspension/Filter Feeders

The TECHNICAL MEMORANDUM 3.1 – Sport Fisheries Studies Caño Martín Peña Ecosystem Restoration Project San Juan, Puerto Rico (Atkins, 2011b) contained an assessment of the fouling communities on prop roots of red mangroves which indicated that the filter feeders - sponges, mussels and oysters - are most abundant and diverse in La Torrecilla Lagoon and the Suarez Canal, they become less diverse and abundant within the San José Lagoon. Within the CMP the fouling community of red mangrove prop roots is non-existent or limited indicative of the poor water quality within the CMP and the effects on San José Lagoon.

2.3.3.3 Sight Feeders

The TECHNICAL MEMORANDUM 3.1 – Sport Fisheries Studies Caño Martín Peña Ecosystem Restoration Project San Juan, Puerto Rico (Atkins, 2011b) provides information on the fish and fisheries within San José Lagoon. Most local resident anglers in San José Lagoon target snook (*Centropomus undecimalis*) at locations along the mangrove shorelines on the periphery of the lagoon. Improvements to circulation that would benefit water quality of bottom waters are likely to benefit the fisheries targeted by local resident anglers through increasing the amount of bottom areas capable of supporting healthy biological communities. The recreational tarpon (*Megalops atlanticus*) fishery in San José Lagoon is focused on the areas of the dredge holes, particularly the areas on the periphery of these deep depressions. These dredge holes appear to be important habitats for the recreational tarpon fishery, possibly due to the aggregation of food sources along the haloclines (salinity stratification layers) that occur within the dredge holes.

Dredge hole locations in La Torrecilla Lagoon, which has higher surface water salinities than San José Lagoon, also exhibit salinity stratification. Therefore, salinity stratification of deep dredge holes is expected to continue to occur after restoration of the historical tidal circulation between San Juan Bay and the San José Lagoon.

Despite the significant recreational fishing activities within San José Lagoon, the fish and shellfish of the lagoon are already impacted by various contaminants, with levels of mercury and lead posing a potential risk to human health, and due to the elevated levels of lead in fish tissue, pregnant women and children are recommended to limit fish consumption to approximately one filet per week for fish caught in San José Lagoon.

2.4 CONTAMINANT DETERMINATIONS

The FINAL TECHNICAL MEMORANDUM, Task 2.6 – Water and Sediment Quality Studies, Caño Martín Peña Ecosystem Restoration Project San Juan, Puerto Rico (Atkins, 2010) and the TECHNICAL MEMORANDUM, Task 2.05 Hazardous, Toxic, and Radioactive Waste Initial Assessment Documentation Caño Martín Peña Ecosystem Restoration Project San Juan, Puerto Rico (Atkins 2011e) summarize the available information on the material proposed to be dredged with the CMP and the placement of the material at the disposal site.

In 2002 and 2011, elutriate testing of the CMP sediments and sediment pore water from within the Project Area confirmed the presence of heavy metals such as lead and mercury, PAHs, PCBs, oil and grease and residual pesticides (Atkins, 2011b). Both the sediments and the sediment pore water of the Caño Martín Peña are characterized by elevated levels of various contaminants. Exceedances of sediment quality guidelines were found for anthracene, antimony, arsenic, copper, dieldrin, lead, mercury, selenium, silver and zinc, along with others.

The pore water within the sediments of the CMP are also characterized by exceedances of relevant criteria for multiple parameters. Problematic results were found for chromium, copper, lead, mercury, nickel, and zinc; however, dilution processes involved with the formation of the slurry for hydraulic dredging should reduce pore water concentrations of chromium, lead, nickel and zinc to values below their relevant water quality criteria, even within the CMP itself. Levels of copper and mercury would likely exceed criteria during the dredging operation, within the area where active dredging would occur. Exceedances for copper and mercury within the actively dredged area would occur mostly due to the fact that the surface waters of Caño Martín Peña and/or San José Lagoon exceed relevant criteria. For cyanide, a complication exists in that the relevant standard is for “free” cyanide, while much of the existing water quality is for the larger category of “total” cyanide. Concentrations of total cyanide are expected to exceed the free cyanide surface water quality standards in the area actively being dredged.

Based on earlier work by Bailey et al. (2004), selenium concentrations would be expected to be reduced by 74 percent outside of a 1,000-foot mixing zone, during sediment disposal activities. After applying the expected 74 percent reduction in selenium to the other metal concentrations, there would be no anticipated exceedances of existing criteria for any of the metals examined here outside of a 1,000-foot mixing zone. Bailey et al. (2002) contained recommendations that disposing of dredged materials from the CMP into deep dredge holes within the San José Lagoon would need to be accompanied by sediment capping techniques, to reduce the potential for impacts from various contaminants, notably selenium. Even with capping, selenium was predicted to migrate through a potential two-foot thick sediment cap (Bailey et al., 2002).; however, selenium concentrations would be reduced sufficiently via dilution so that pore water concentrations of selenium would be only 20 percent of existing water quality criteria levels in the “biologically active layers” of the sediment cap. And as has been reported, with the current design, the cap will probably remain in an area of anoxic water quality conditions resulting in the cap being biologically inactive.

Results from the 2011 analysis of sediments from the canal were evaluated for the potential to contain hazardous concentrations of toxic constituents (e.g., 40 CFR Part 261 – Characteristics of Hazardous Waste). Toxicity concentrations are based the toxicity characteristic leaching procedure (TCLP) values. Due to the EPA Method 1311 dry TCLP calculation being used for the wet samples in this TM, there is potential for error between the calculated sample TCLP values and the actual TCLP values. Laboratory data providing the volume of the liquid in the sample as well as the weight of the solid portion of the sample would allow for greater accuracy. Preliminary and approximate screening of the total metals concentrations via EPA Method 1311 suggests that hazardous concentrations of lead may be present in the canal sediments. Additionally, total petroleum hydrocarbons are noted as present in the canal sediments.

2.5 AQUATIC ECOSYSTEM AND ORGANISM DETERMINATIONS

In 2002 (Bailey et al. 2002), elutriate testing confirmed the presence of metals, PAHs, PCBs and several pesticides. At the most-contaminated western end of the CMP-ERP, predicted short-term water quality effects showed that all detected parameters (except selenium) were expected to remain below federal marine chronic toxicity criteria during disposal of the dredged material. A mixing zone 1,000 feet beyond the disposal site was sufficient to achieve selenium water quality standards.

The potential exists for these constituents to be in the dredged material from the CMP that would be placed in the disposal sites. After additional testing and analyses of the dredged material to ensure their compliance with Federal water quality standards, the sediments would be disposed of via geoencapsulation of the sediment and placement of the material within containment using turbidity curtains at the disposal site. The disposal sites will be contained and capped with clean sand.

2.5.1 Effects on Plankton

There may be short-term effects on plankton during the dredging and disposal process. The CMP-ERP, however, is an environmental restoration project which would result in improvement in water and sediment quality in San José Lagoon and the San Juan Bay Estuary system.

2.5.2 Effects on Benthos

Substrate type and biota observed in the proposed disposal sites indicate that hypoxic to anoxic conditions are long-term conditions for the bottom surface at depths greater than 4 to 6 feet, resulting in a severely depressed biological community. Diverse and healthy benthic communities are restricted to areas of the Lagoons shallower than 4 to 6 feet.

As indicated above, the disposal sites are located in deep water and the sediment at these sites is in deep water (greater than 6 feet water depth) below a salinity stratification layer described above. The sediment is anoxic with little or no benthos (plant or animal). This situation will remain within the pits even after their use for disposal of the CMP sediments.

2.5.3 Effects on Nekton

There may be short-term effects on nekton during the dredging and disposal process. The CMP-ERP, however, is an environmental restoration project which would result in improvement in water and sediment quality in San José Lagoon and the San Juan Bay Estuary system. With the current disposal plan, the pits will remain an area used by tarpon.

2.5.4 Effects on the Aquatic Food Web

There may be short-term effects on the aquatic food web during the dredging and disposal process; however, the CMP-ERP is an environmental restoration project that would result in improvement in water and sediment quality in San José Lagoon and the San Juan Bay Estuary system.

2.5.5 Effects on Special Aquatic Sites

2.5.5.1 Hardground and Coral Reef Communities

No coral reef communities or hardground are found within the CMP-ERP or within San José Lagoon. There is nearshore reef and hard bottom habitat located in the nearshore environment around and between the inlets of the SJBE system. This habitat is interconnected to the SJBE system and would benefit from the connection that the CMP-ERP brings to the overall system. This increased interconnectedness of the SJBE system from the reestablishment of the historical tidal connection between San José Lagoon and San Juan Bay would significantly increase the fish and fisheries habitat, including the inshore breeding and development areas for the nearshore reef system. The ecological uplift created in this and other associated habitat is used in the benefits analysis (Atkins, 2013b).

2.5.5.2 Sanctuaries and Refuges

There are no designated sanctuaries or refuges within the project area; however, the CMP-ERP is located with the San Juan Bay National Estuary Program. The CMP and San José Lagoon contain the worst water and sediment quality conditions within San Juan Bay Estuary. Implementation of the restoration CMP-ERP would begin to resolve some of the water and sediment quality issues.

2.5.5.3 Wetlands

A mangrove forest fringe occupies the majority of the banks along the CMP, and within San José Lagoon and Suárez Canal area. This mangrove forest fringe is comprised of black (*Avicennia germinans*), white (*Laguncularia racemosa*), and red (*Rhizophora mangle*) mangroves. Based on historic aerial photograph interpretation, the CMP and the surrounding area was historically an extensive mangrove forest that was progressively cut and filled to accommodate dwellings for the communities currently present along the CMP. This encroachment of housing and development has resulted in a diminished mangrove forest and a drastic reduction of flow within the CMP. Some transitional wetland areas are located adjacent and contiguous to the mangrove wetlands; however, most of the wetland limits or borders are the housing structures themselves. The ecological attributes and biological integrity of the mangrove habitat within the CMP-ERP area are degraded as a consequence of extensive human encroachment, the massive amount of fill material, scrap, trash, and solid waste deposited within the mangroves, the severely degraded water quality from wastewater discharges, and the severely limited tidal flushing within the CMP. These factors severely impair the ability of the mangrove habitat within the CMP to serve as a protected nursery area for fish, crustaceans, and shellfish. In addition, the limited tidal flushing and severely degraded water quality make the mangrove wetlands within the CMP-ERP area inhospitable to larval and juvenile life stages of fish, crustaceans, and shellfish.

In a study done for the TECHNICAL MEMORANDUM, Task 3.3 Sport Fishery Studies, Caño Martín Peña Ecosystem Restoration Project, San Juan, Puerto Rico (Atkins, 2011b), an assessment of the fouling communities on prop roots of red mangroves indicated that sponges, crabs, polychaete worms, mussels and oysters are most abundant and diverse in La Torrecilla Lagoon and the Suárez Canal, they become less diverse and abundant within the San José Lagoon. Within the CMP the fouling community of red mangrove prop roots is non-existent or limited.

Approximately 1 acre of mangrove wetlands would be temporarily impacted at the 5-acre staging area in the 35-acre Ciudad Deportiva Roberto Clemente (CDRC) site, where solid waste debris from dredging activities would be collected and transported for landfill disposal. This temporary wetland impact would be associated with the use of the area as a temporary staging area. At the conclusion of the dredging and disposal activities, the temporary staging area features (e.g., dock) would be removed, and the 1 acre would be restored with mangroves.

Within the Project Channel, construction activities would result in temporary impacts to 33.46 acres of wetlands; however, these impacts are not associated with the disposal of dredged material. Additional information on these wetland impacts can be found in the Environmental Impact Statement and the Wetland Delineation and Determination Report.

2.5.5.4 Mud Flats

Mud flats are associated with the mangrove wetlands. No impact is anticipated to mudflat areas.

2.5.5.5 Vegetated Shallows

The shallow regions of San José Lagoon are sampled and described in the TECHNICAL MEMORANDUM, task 3.3 Sport Fishery Studies, Caño Martín Peña Ecosystem Restoration Project, San Juan, Puerto Rico (Atkins, 2011b). No vegetated (e.g., seagrass) communities were found within the shallow areas. In shallow Lagoon waters, an abundant albeit not very diverse community can be found wherever there is a substrate—be it over soft bottom or mangrove roots. This community which we have called "mussel reef" is overwhelmingly dominated by the false mussel, *Mytilopsis domingensis*, a filter feeder that provides enough of a substrate to shelter motile polychaete worms, shrimp and small fish, such as Gobies.

2.5.5.6 Riffle and Pool Complexes

No riffle and pool complexes are found within the CMP-ERP area.

2.5.6 Endangered and Threatened Species

Listed species within the CMP-ERP dredging area are described in the TECHNICAL MEMORANDUM, Task 3.7 (a & b) Existing Wildlife Habitat and Threatened and Endangered Species Identification (Atkins 2011c). During construction, the Least tern (*Sternula antillarum*), the Roseate tern (*Sterna dougallii dougallii*), the Yellow-shouldered blackbird (*Agelaius xanthomus*), and Puerto Rican Boa *(Epicrates inornatus*) individuals that may be present within the proposed project area may be impacted by the noise, odor, and exhaust generated by the dredging and material handling equipment.; however, all three bird species have the potential to move to suitable, adjacent areas while construction is underway. For Puerto Rican boa, a protocol for their removal is proposed due to its more limited mobility and habits.

No Threatened or Endangered plant species exist within the proposed disposal sites area. The San José and Los Corozos Lagoons could provide feeding, drinking (freshwater source) and protected habitat for the West Indian Manatee (*Trichechus manatus manatus*); however, the access is severely limited through the Suárez Canal and non-existent into and through the CMP; however, once the connection is established by the CMP-ERP, there is a potential for the 1,239 acres of the Lagoons to be utilized as habitat by the West Indian Manatee, which presently uses the San Juan Bay, and has been sighted in the western CMP and the Puerto Nuevo River.

There is a possibility that Manatees may be found within the project area during construction. Standard observation and avoidance practices will be used during construction to prevent interaction with Manatees.

2.5.7 Other Wildlife

Other wildlife and wildlife habitat has been described above. Habitat and species are summarized in TECHNICAL MEMORANDUM, Task 3.3 Sport Fishery Studies, Caño Martín Peña Ecosystem Restoration Project, San Juan, Puerto Rico (Atkins, 2011b) and the TECHNICAL MEMORANDUM, Task 3.7(a & b) Existing Wildlife Habitat and Threatened and Endangered Species Identification (Atkins, 2011c).

2.5.8 Actions to Minimize Impacts

All actions taken to minimize impacts have been previously described above.

2.6 PROPOSED DISPOSAL SITE DETERMINATIONS

2.6.1 Mixing Zone Determination

As indicated in Section 2.4, it is estimated that a 1,000 foot mixing zone at the disposal site would be required for dilution of selenium.

2.6.2 Determination of Compliance with Applicable Water Quality Standards.

As presented in The FINAL TECHNICAL MEMORANDUM, Task 2.6 – Water and Sediment Quality Studies, Caño Martín Peña Ecosystem Restoration Project San Juan, Puerto Rico (Atkins 2010), the story of water quality in the CMP and adjacent San José Lagoon is one of water quality criteria exceedances originating from the polluted waters of the CMP. The Ecosystem Restoration Project will open the CMP and allow flushing of the canal and lagoon improving overall water quality.

Further testing of the sediment and water within the CMP will be performed prior to dredging in coordination with the Puerto Rico Environmental Quality Board, and a Water Quality Certification will be obtained prior to disposal of dredged material into SJ1 and SJ2.; however, with the current, recommended construction precautions, it is predicted that the project will comply with applicable water quality standards.

2.6.3 Potential Effects on Human Use Characteristics

2.6.3.1 Municipal and Private Water Supplies

The dredging or disposal of dredged material would not affect municipal and/or private water supplies. The following information from the TECHNICAL MEMORANDUM, Task 2.10 Environmental Justice Study, Caño Martín Peña Ecosystem Restoration Project San Juan, Puerto Rico (Atkins 2012c) is included demonstrating that the overall intention of the CMP-ERP is to improve the condition surrounding the CMP.

The existing distribution of drinking water (potable water) within the CMP communities does not comply with the rules established by regulatory agencies, as reported by the Department of Health and the Water and Sewerage Authority. Therefore, the first priority is to improve the existing transmission and distribution system for potable water. The improvements would follow established standards from the "Safe Drinking Water Act," including removal of the pipes and systems that contain lead.

Part of the existing transmission and distribution system for drinking water could also interfere with the CMP-ERP and may require relocation. None of the drinking water pipes for the Barrio Obrero community would be affected, while the Marina and Buena Vista-Santurce part of the drinking water system would be affected on South Street ends of Parada 27 has affected pipes passing through two streets, the San José Street and the eastern end of the Santiago Iglesias Street. In the community of Las Monjas, the pipeline that passes through the Prudencio Rivera Martínez Street would be affected. While in Buena Vista-Hato Rey, the North and West ends of some streets are affected. For the community of Israel-Bitumul, it could not be determined whether the drinking water distribution network, along the Barbosa Avenue Bridge and north, would be affected.

Specifically, potable water pipelines to communities south of the CMP, i.e., Argentina, Gardel and Uruguay streets are supplied by the pipeline crossing at the CMP bridges. All these potable water transmission lines must be evaluated for potential relocation before beginning dredging.

2.6.3.2 Recreational and Commercial Fisheries

A modest, but significant, commercial fishery operates out of San Juan. This fishery, however, is restricted to shallower, inshore shelf waters. Mackerel, sardine, snook and snappers constitute the bulk of landings in this fishery. A hand line fishery targeting snappers also operates out of San Juan; this fishery operates primarily in shallower water but extends to depths of approximately 600 feet. In addition, there are numerous private recreational and deep sea charter fishing operations centered at San Juan. Effort is generally directed at billfish, tuna, and other pelagics in this fishery (USEPA, 1982).

There are two main groups of recreational anglers who fish in San José Lagoon: local residents who fish from either boats or the shoreline, and charter boat operators and their customers who always fish from boats. Local residents typically fish between 2 and 8 hours per day at a frequency of 12 to 208 days per year. Local residents typically target common snook (*Centropomus undecimalis*) and blue crab (*Callinectes sapidus*). These local residents typically fish the entire San José Lagoon (including Los Corozos Lagoon) as well as the Suárez Canal. Local residents do not display a strong preference for any particular fishing spots within this overall region.

Currently, commercial fishing is banned from Martín Peña Canal and San José Lagoon, although commercial fishing is allowed within other areas of San Juan Bay (San Juan Bay Estuary Program 2000); however, recreational fishermen heavily utilize the San José Lagoon, Suarez Canal, and La Torrecilla Lagoons, and approximately $11 million is spent on recreational fishery related purchases annually within the SJBE (Yoshiura and Lilyestrom, 1999). Snook and Tarpon are economically important sport fisheries in the San Juan Bay estuary, particularly in San José Lagoon.

Charter boat operators always fish from boats, and their trips typically last between 4 and 8 hours per day. Charter boat operators are out on the water approximately 200 days per year, with the target species being tarpon (*Megalops atlanticus*). These charter boat operators focus their fishing activities at the deep dredged pits along the southern shore of San José Lagoon, as well as the pits located along the northeast shore of San José Lagoon and those in Los Corozos Lagoon as well. Charter operators confirmed the conclusions of Yoshiura and Lilyestrom (1999) in that recreational fishing activities targeting tarpon are an important income generator in San José Lagoon, generating over 1,200 half-day fishing trips, mainly with out-of-town visitors. The current dredging and dredged material disposal plan has been designed to minimize impacts, to the extent practicable, to the recreational fisheries described above.

2.6.3.3 Water Related Recreation

Other than the fishing described above, there is little water related recreational use of the area because of the current condition. The overall plan for the CMP-ERP is to provide recreation access areas along the CMP and make the waterway and surrounding area a more attractive feature.

2.6.3.4 Aesthetics

The TECHNICAL MEMORANDUM, Task 3.02 Aesthetics Studies and Resource Assessment, CMP-ERP San Juan, Puerto Rico (Atkins, 2012h) describes the current conditions and the potential for improvements by the CMP-ERP. The dredging and dredged material disposal would have short-term effects on aesthetics; however, the CMP-ERP as a whole would significantly improve the current condition.

As the analysis shows, the proposed CMP-ERP would create major opportunities to improve the visual quality of the CMP. Without any improvements outside of the Limit of Public Domain, the CMP-ERP would greatly enhance the visual quality of the CMP for the entire community. Major viewpoints from the four bridges would be restored and improved under the CMP-ERP. The proposed CMP-ERP would create access to the water, providing users with views of the CMP and its surroundings. When completed the visual quality for the user, both waterside and landside would be greatly improved. Walking along the Paseo del Caño, the street proposed to be developed along the CMP-MTZ as a public space, visitors would enjoy the newly established mangroves and recreation access areas and parks. The recreation access areas and parks would provide community gathering spaces and quality opportunities to engage the water's edge and surroundings. The facilities proposed for recreation along the CMP would create a very pleasant central feature that would the center piece for the community.

2.6.3.5 Parks, National and Historic Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves

There are no parks, national and historical monuments, national seashores, wilderness areas, and similar preserves within the CMP-ERP area; however, the CMP-ERP is located with the San Juan Bay National Estuary Program and, as such can be considered a Research Site. The CMP and San José Lagoon have the worst water and sediment quality conditions within San Juan Bay Estuary.

Implementation of the CMP-ERP would resolve the water and sediment quality issues and while the dredging and dredged material disposal project would have short-term adverse effects on the area, construction of the CMP-ERP would significantly improve existing conditions.

2.7 DETERMINATION OF CUMULATIVE EFFECTS ON THE AQUATIC ECOSYSTEM

No cumulative effects on the aquatic ecosystem are anticipated as a part of the dredging or dredge material disposal. The CMP-ERP is an Ecosystem Restoration Project and, as such, is required and expected to produce a net benefit to the current condition of the aquatic ecosystem.

2.8 DETERMINATION OF SECONDARY EFFECTS ON THE AQUATIC ECOSYSTEM

No secondary effects on the aquatic ecosystem are anticipated as a part of the dredging or dredged material disposal. The CMP-ERP is an Ecosystem Restoration Project and, as such, is required and expected to produce a net benefit to the current condition of the aquatic ecosystem.

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3.0 FINDINGS OF COMPLIANCE OR NON-COMPLIANCE WITH THE RESTRICTIONS ON DISCHARGE

3.1 ADAPTATION OF THE SECTION 404(B)(1) GUIDELINES TO THIS EVALUATION

Additional information is required to finalize design plans for the overall CMP-ERP; however, at this time, no adaption to the Section 404(b)(1) guidelines are anticipated. The dredged material is being placed in CAD sites; the dredged material will be encapsulated and capped with clean sand material. Best Management Practices (e.g., turbidity curtains) would be used to contain turbidity at the dredging and disposal sites. Short-term impacts may occur, but water quality impacts would be confined within appropriate mixing zones.

This is an Ecosystem Restoration Project and the overall result would be a net benefit to the environment. The impacts to wetlands within the CMP are self-mitigating because of the overall improvement in water quality and restoration of mangrove wetland habitat occurring because of the CMP-ERP.

3.2 EVALUATION OF AVAILABILITY OF PRACTICABLE ALTERNATIVES TO THE PROPOSED DISCHARGE SITE THAT WOULD HAVE LESS ADVERSE IMPACT ON THE AQUATIC ECOSYSTEM

Five categories of dredged material disposal options were considered: CAD, Landfill Disposal, Permanent Upland Disposal (PUD), Ocean Disposal, and Onsite Disposal. Beneficial Use of Dredge Material was considered as a management measure and eliminated earlier in this section. All the disposal options are dependent on dredging of the existing CMP channel. Table 10 displays the different Dredged Disposal Management Options and reasons for elimination. Disposal options were eliminated for a number of reasons, including:

- Insufficient capacity at the site;
- Extent of sediment and solid waste mixing;
- Engineering/infrastructure considerations such as proximity next to flowing water or insufficient roadways;
- Impacts to adjacent communities by noise or air pollution or by undiluted containment of solid waste;
- Elimination of subaqueous, benthic habitat within the estuarine system; and,
- Exposure to wind and wave action that could cause failure of containment.

Table 10. Summary of Elimination of Dredged Disposal Options

Dredged Material Disposal Options	Reason for Elimination					
	Insufficient capacity	Extent of Sediment and Solid Waste Mixing	Engineering/ infrastructure considerations	Impacts to adjacent communities	Elimination of benthic habitat	Exposure to current or wind and wave action
Suarez Canal CAD (sediment and small pieces of debris)	X		X			X
Los Corozos Lagoon CAD pit disposal (sediment and small pieces of debris)	X			X		
Lagoon level bottom capping/containment (sediment and small pieces of debris)					X	X
San José Lagoon CAD with geotextile containment (sediment and small pieces of debris)						
Landfill disposal (sediment and solid waste)			X	X		
Landfill disposal (solid waste only)						
Permanent Upland Disposal (sediment and small pieces of debris)						
Ocean disposal (sediment only)		X				
Onsite Disposal	X		X	X		
Non-Structural	**Refer to text for discussion**					

Based on the possible disposal alternatives described above, the preferred disposal alternative for the CMP sediments was the San José Lagoon pits.

- Solid waste would be transported from the staging area to the municipality of Humacao landfill site, which is located approximately 32 miles from the CMP-ERP site. A total of 6 acres are included within the project footprint of the CDRC staging area on the southeast shore of San José Lagoon. Of these 6 acres, 5 acres are upland habitat and 1 acre is mangrove fringe. The staging area includes a dock for loading/unloading the dredged material to be transported to the landfill. The 5 upland acres are within a previously disturbed 35-acre parcel.
- After screening and removal of solid waste debris, the remaining sediment and smaller pieces of solid waste would be encapsulated within geotextile fabric bags, and transported by shallow draft barges to the San José Lagoon artificial subaqueous pits. Sediments would be placed utilizing contained aquatic disposal in the SJ1 and SJ2 pits. Prior to disposal

operations, both of these sites would be modified to increase capacity to accommodate the majority of dredged sediments and the required 2-foot sand cap. Approximately 517,581 cy of material would be removed from SJ1 and SJ2 and deposited within the San José 3/4/5 artificial subaqueous pits. During the CMP-ERP disposal operations, approximately 648,000 cy of in situ sediments would be placed in the SJ1 and SJ2; however, additional water quality and sediment testing, such as bioassays, would be conducted prior to placement to ensure their suitability for disposal. Approximately 37,800 cy of in-situ sediments would be used to complete the sheet pile construction and mangrove bed restoration.

- The SJ1 and SJ2 contained aquatic disposal sites would be capped with a two-foot layer of sand. Material for the sand cap will be quarried from upland quarry sites and transported by trucks to the construction staging area for transfer to dump scows for placement. Silt curtains would also be employed around the CAD pits in the San José Lagoon. In critical areas, the curtains may double ring the active area for additional precautions. The curtains would be constructed to the full depth of the water where they are placed.
- For activities related to the installation of the weir in the western end of the Project Channel, an upland staging area near the four western bridges would be used to temporarily stockpile and transfer the collected solid waste excavated during the dredging process. Equipment and materials would be staged on floating barges. After the construction of the weir, and once the dredging from the eastern portion of the Project Channel opened the CMP, the temporary coffer dam would be removed, and the stockpiled solid waste would be placed into shallow-draft barges for transport to the CDRC staging area. At the CDRC staging area, the material would be off-loaded, placed into trucks, and hauled for disposal at the municipality of Humacao Regional Landfill.
- Materials within the Caño Martín Peña include various types of solid waste, debris, and other materials. Such materials will require further testing prior to and/or during project construction, as appropriate, in accordance with an agreed sampling plan. If the testing determines that any materials contain hazardous substances at levels that are not suitable for unregulated disposal, they will be managed in accordance with the applicable laws and regulations of the relevant regulatory agencies.

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4.0 COMPLIANCE WITH APPLICABLE STATE WATER QUALITY STANDARDS

As presented in The TECHNICAL MEMORANDUM, Task 2.6 – Water and Sediment Quality Studies, Caño Martín Peña Ecosystem Restoration Project San Juan, Puerto Rico (Atkins, 2010), waters in and around the CMP and adjacent San José Lagoon currently do not meet Puerto Rico Water Quality Standard Regulation, Environmental Quality Board or San Juan Bay Estuary Program recommended standards. The overall purpose of the CMP-ERP is to restore flow and tidal flushing to the area improving water quality.

4.1 COMPLIANCE WITH APPLICABLE TOXIC EFFLUENT STANDARD OR PROHIBITION UNDER SECTION 307 OF THE CLEAN WATER ACT

Compliance with Section 404 of the Clean Water Act is anticipated. The dredged material would be tested to ensure compliance with Federal water quality standards prior to geoencapsulation, placement in CAD sites, and capping with clean material. Best Management Practices (e.g., turbidity curtains) would be used to contain turbidity at the dredging and disposal sites. Short-term impacts may occur, but water quality impacts would be confined within appropriate mixing zones.

4.2 COMPLIANCE WITH ENDANGERED SPECIES ACT OF 1973

No impacts to species listed under the Endangered Species Act of 1973 are anticipated. There is a possibility that West Indian manatee may be found within the CMP-ERP area during construction. Standard observation and avoidance practices would be used during construction to prevent interaction with manatees.

4.3 COMPLIANCE WITH SPECIFIED PROTECTION MEASURES FOR MARINE SANCTUARIES DESIGNATED BY THE MARINE PROTECTION. RESEARCH, AND SANCTUARIES ACT OF 1972

The CMP-ERP is in compliance with specified protection measures for marine sanctuaries designated by the Marine Protection, Research, and Sanctuaries Act of 1972. The project is located with the San Juan Bay National Estuary Program (SJBEP) and, as such, can be considered a Research Site. The CMP and San José Lagoon contain the worst water and sediment quality conditions within SJBE. Both the CMP restoration project and the San José Lagoon CAD pits disposal site are priority action items in the Comprehensive Conservation Management Plan. Implementation of the CMP-ERP would begin to resolve the water and sediment quality issues. The dredging and dredged material disposal would have short-term effects on the area; however, the CMP-ERP as a whole would significantly improve the existing condition.

Additionally the CMP-ERP will not promote the introduction or spread of invasive in United States, or international waters, as specified by Executive Order (E.O.) 13112.

4.4 EVALUATION OF EXTENT OF DEGRADATION OF THE WATERS OF THE UNITED STATES

4.4.1 Significant Adverse Effects on Human Health and Welfare

4.4.1.1 Municipal and Private Water Supplies

The dredging and disposal of dredged material would not affect municipal and/or private water supplies.

4.4.1.2 Recreation and Commercial Fisheries

The current dredging and dredged material disposal plan has been designed to minimize impacts to recreational fisheries, though the disposal operations would temporarily restrict fishing within the pits.

4.4.1.3 Plankton

There may be short-term effects on plankton during the dredging and disposal process. The CMP-ERP, however, is an environmental restoration project that would result in improvement in water and sediment quality in San José Lagoon and the SJBE system.

4.4.1.4 Fish

There may be short-term effects on fish species during the dredging and disposal process. The CMP-ERP, however, is an environmental restoration project that would result in improvement in water and sediment quality in San José Lagoon and the SJBE system. The CMP-ERP would significantly improve the connectivity of the San Juan Bay Estuary system and thereby improve fish and fishery species through improvement to their habitat.

4.4.1.5 Shellfish

There may be short-term effects on shellfish species during the dredging and disposal process. The CMP-ERP, however, is an environmental restoration project that would result in improvement in water and sediment quality in San José Lagoon and the SJBE system.

4.4.1.6 Wildlife

There may be short-term effects on wildlife during the dredging and disposal process. The CMP-ERP, however, is an environmental restoration project that would result in improvement in water and sediment quality in San José Lagoon and the SJBE system.

4.4.1.7 Special Aquatic Sites

Other than wetlands, there are no other designated Special Aquatic Sites (e.g., sanctuaries and refuges, mud flats, vegetated shallows, coral reefs, and riffle and pool complexes) within the CMP-ERP project area; however, the CMP-ERP is located with the San Juan Bay National Estuary Program. The CMP and San José Lagoon have the worst water and sediment quality conditions within San Juan Bay Estuary. Implementation of the restoration CMP-ERP would resolve the water and sediment quality issues. The CMP-ERP is a priority action item in the Comprehensive Conservation Management Plan. The dredging and dredged material disposal would have temporary, short-term effects on the area; however, the CMP-ERP would dramatically improve existing conditions.

Approximately 1 acre of mangrove wetlands would be temporarily impacted adjacent to the 5-acre upland staging area in the 35-acre CDRC site, where solid waste debris from dredging activities would be collected and transported for landfill disposal. This temporary wetland impact would be associated with the disposal of dredged material. At the conclusion of the dredging and disposal activities, the temporary staging area features (e.g., dock) would be removed, and the 1 acre would be restored with mangroves. The upland areas of the staging area would be re-vegetated with native vegetation.

Within the Project Channel, construction activities would result in temporary impacts to 33.46 acres of wetlands; however, these impacts are not associated with the disposal of dredged material. Additional information on these wetland impacts can be found in the Environmental Impact Statement (EIS) and the Wetland Delineation and Determination Report. There are no designated Special Aquatic Sites within the CMP-ERP area; however, the CMP-ERP is located with the SJBEP. The CMP and San José Lagoon have the worst water and sediment quality conditions within San Juan Bay Estuary. Implementation of the restoration CMP-ERP would resolve the water and sediment quality issues. The CMP-ERP is a priority action item in the Comprehensive Conservation Management Plan. The dredging and dredged material disposal would have short-term effects on the area; however, the CMP-ERP would dramatically improve existing conditions.

4.4.2 Significant Adverse Effects on Life Stages of Aquatic Life and Other Wildlife Dependent on Aquatic Ecosystems

There may be short-term effects on the life stages of aquatic life and other wildlife dependent on these portions of the SJBE system during the dredging and disposal process; however, no significant adverse effects are expected or anticipated. The CMP-ERP, however, is an environmental restoration project that would result in improvement in water and sediment quality in San José Lagoon and the SJBE system.

4.4.3 Significant Adverse Effects on Aquatic Ecosystem Diversity, Productivity and Stability

There may be short-term effects on the aquatic ecosystem diversity, productivity, and stability in these portions of the SJBE system during the dredging and disposal process; however, no significant adverse effects are expected or anticipated. The CMP-ERP, however, is an environmental restoration project that would result in improvement in water and sediment quality in San José Lagoon and the SJBE system. The basis of environmental benefits for the CMP-ERP is an elevation in the Biotic Index values as explained in TECHNICAL MEMORANDUM, Task 6.0 – Hydrodynamic and Water Quality Modeling Efforts, Caño Martín Peña Ecosystem Restoration Project San Juan, Puerto Rico (Atkins, 2011a). Greater aquatic ecosystem diversity, productivity, and stability are anticipated as a result of the ecosystem restoration CMP-ERP.

4.4.4 Significant Adverse Effects on Recreational, Aesthetic, and Economic Values

The CMP-ERP is anticipated to produce significant positive effects on recreation, aesthetics, and economic value for the communities surrounding the CMP, San José Lagoon and the SJBE system. The placement of fill material will not result in significant adverse effects on human health and welfare, including municipal and private water supplies, recreational and commercial fishing, plankton, fish, shellfish, wildlife, and special aquatic sites. The life stages of aquatic species and other wildlife will not be adversely affected. Significant adverse effects on aquatic ecosystem diversity, productivity and stability, and recreational, aesthetic, and economic values will not occur.

4.5 APPROPRIATE AND PRACTICABLE STEPS TAKEN TO MINIMIZE POTENTIAL ADVERSE IMPACTS OF THE DISCHARGE ON THE AQUATIC ECOSYSTEM

The selected method of disposal includes CAD sites which will be geoencapsulated and capped with clean sand to prevent migration of contaminants from the disposal sites. During construction, the dredge area would be confined using turbidity curtains. No changes in chemical or physical properties of the water column are anticipated outside of the immediate work area confined within the turbidity curtains and/or temporary coffer dam(s) at the dredge site and the disposal sites.

4.6 CONCLUSION

On the basis of the guidelines, the proposed disposal of dredged material within SJ1 and SJ2 is specified as complying with the requirements of these guidelines, with the inclusion of appropriate and practical conditions to minimize pollution or adverse effects on the aquatic ecosystem.

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Appendix H4

Wetland Delineation and Determination

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DRAFT
WETLAND DELINEATION AND DETERMINATION
CAÑO MARTÍN PEÑA ECOSYSTEM RESTORATION PROJECT
SAN JUAN, PUERTO RICO

Prepared for:

Corporación del Proyecto ENLACE del Caño Martín Peña
Apartado Postal 41308
San Juan, Puerto Rico 00940-1308

September 2015

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Executive Summary

The Corporación del Proyecto ENLACE del Caño Martín Peña (ENLACE) proposes the Caño Martín Peña (CMP) Ecosystem Restoration Project (CMP-ERP). ENLACE is a public corporation created under Law 489 to lead the implementation of the *Land Use and Comprehensive Development Plan for the Special Planning District of the Caño Martín Peña*, which includes the dredging and environmental restoration of the CMP. The CMP is part of the San Juan Bay Estuary (SJBE), the only tropical estuary that is part of the U.S. Environmental Protection Agency (USEPA) National Estuary Program. The restoration project focuses on the eastern 2.2-mile-long segment of the CMP and adjacent areas. The proposed action is to dredge the eastern segment of the CMP in order to achieve its environmental restoration and as secondary goals, reduce flooding, allow for environmentally sound waterway transportation, and promote recreation and tourism. ATKINS Caribe, LLP (formerly PBS&J) was contracted to prepare a Feasibility Report and the Draft Environmental Impact Statement (FR-DEIS) for this Project. A Wetland Jurisdictional Determination and Delineation Study (JD) for the Project Area were conducted in collaboration with Ambienta, Inc.

The larger dominant vegetative communities within the Project Area consist of mangrove forest/ forested swamp and unmanaged pastures, which consist mostly of marshes and transitional secondary forests. The Project Area natural landscape (i.e., its ecological attributes and biological integrity) is currently extremely degraded as a result of extensive alterations, impacts, the current uses of the area, and the lack of adequate infrastructure.

Upland and wetland areas (mostly wetlands) were found throughout the Project Area. Based on the interpretation of historic aerial photographs, the Project Area used to be an extensive mangrove forest that was cut and filled progressively over time.

The CMP-ERP will temporarily impact approximately 33.46 acres of jurisdictional wetlands in the Project Channel. The resulting net wetland acreage is dependent upon the selected width (75, 100, or 125 feet wide) of the channel (39.62, 34.48, and 29.08 acres, respectively). The CMP-ERP will also temporarily impact approximately 1 acre of wetland in the Ciudad Deportiva Roberto Clemente (CDRC) staging area. This impacted wetland will be restored after the project completion. With the removal of the land set aside for recreational amenities (~5 acres), only the 75-foot and 100-foot options would result in an overall surplus of wetland acres; the 125-foot alternative results in an overall deficit of wetland acres.

The CMP-ERP will impact approximately 7.40 acres of open water habitat. However, the open water habitat acreage of the Proposed Project increases under every scenario (20.42 to 30.97 acres of open water resulting from the 75-foot and 125-foot channel, respectively).

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Resumen Ejecutivo

La Corporación del Proyecto ENLACE del Caño Martín Peña (ENLACE) propone el Proyecto para la Rehabilitación Ambiental del Caño Martín Peña (CMP-ERP). ENLACE es una corporación pública creada en virtud de la Ley 489 para dirigir la implementación del Plan de Desarrollo Integral para el Distrito Especial de Planificación del Caño Martín Peña, que incluye el dragado y la canalización del CMP. El CMP es parte del Estuario de la Bahía de San Juan (EBSJ), el único estuario tropical que forma parte del Programa Nacional de Estuarios de la Agencia Federal de Protección Ambiental de los Estados Unidos (USEPA, por sus siglas en inglés). Las 2.2 millas que comprenden el área este del CMP y las zonas adyacentes son el foco principal (área de estudio) para el proyecto de restauración. La acción propuesta consiste en dragar el segmento oriental del CMP para lograr la restauración del medio ambiente y como objetivos secundarios, reducir las inundaciones y permitir el transporte fluvial, promover la recreación y el turismo, con el mínimo impacto negativo al ecosistema y las comunidades adyacentes. ATKINS Caribe, LLP fue contratado para preparar el Estudio de Viabilidad y la Declaración de Impacto Ambiental Preliminar para este proyecto. Los estudios para la Determinación de Jurisdicción (JD) de Humedales y la Delineación de Humedales de la zona de estudio se llevó a cabo en colaboración con Ambienta, Inc.

Las comunidades de vegetación más dominantes en el área de estudio consisten de bosques de mangle, ciénagas, pastos y bosques secundarios de transición. Las condiciones existentes en el área de estudio, en especial sus atributos ecológicos e integridad biológica, se encuentran extremadamente degradadas como resultado del uso actual, continuas alteraciones e impactos al paisaje natural y la carencia de una infraestructura adecuada.

Se identificaron terrenos elevados y zonas de humedales (en su mayoría humedales) en el área de estudio. A través de la interpretación de la fotografía histórica aérea se observa que el área de estudio fue un extenso bosque de mangle que con el tiempo fue rellenado progresivamente a ambos lados del CMP.

El CMP-ERP impactará aproximadamente 33.46 acres de humedales jurisdiccionales en el área del CMP. El área neta de humedales resultantes dependerá del ancho (75, 100, o 125 pies) de canal seleccionado (39.62, 34.48 y 29.08 acres, respectivamente). El CMP-ERP también impactará temporeramente 1 acre de humedal en la Ciudad Deportiva Roberto Clemente (CDRC). Este impacto será restaurado luego de la construcción del proyecto. Con la remoción de los terrenos a ser utilizados para facilidades recreativas (~5 acres), sólo las alternativas de 75 y 100 pies de canal resultarán en exceso de humedales, mientras que la alternativa de 125 pies resultaría en déficit de área de humedales.

El CMP-ERP impactará un área aproximada de hábitat de aguas abiertas de 7.40 acres. El área de aguas abiertas del proyecto propuesto va a ser mayor que lo existente bajo todos los escenarios (entre 20.42 a 30.97 acres de aguas abiertas como resultado del canal de 75 pies y 125 pies, respectivamente).

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Acronyms and Abbreviations

°C	Degrees Celsius
CDRC	Ciudad Deportiva Roberto Clemente
cm	Centimeter
CMP	Caño Martín Peña
CMP-ERP	Caño Martín Peña Ecosystem Restoration Project
CWA	Clean Water Act
dbh	Diameter at breast height
DO	Dissolved oxygen
ENLACE	Corporación del Proyecto ENLACE del Caño Martín Peña
ENLACE Project	Caño Martín Peña ENLACE Project
ERDC	USACE’s Engineer Research and Development Center
°F	Degrees Fahrenheit
ESI	Environmental Sensitivity Index
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
GIS	Geographic Information System
GPS	Global Positioning System
ha	hectare
JD	Jurisdictional Determination
m^2	Square meters
MTZ	Maritime Terrestrial Zone
NOAA	National Oceanic and Atmospheric Administration
NWI	National Wetland Inventory
ppt	Parts per thousand
SCS	Soil Conservation Service
SJBE	San Juan Bay Estuary
SJBEP	San Juan Bay Estuary Program
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VES	Visual Encounter Survey

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1.0 BACKGROUND

This report addresses Items 2.11 (g) in the Agreement between the Corporación del Proyecto ENLACE del Caño Martín Peña (ENLACE) and Atkins to prepare a study in compliance with Clean Water Act Section 404 (b)(1) including mapping existing wildlife habitats, determining functional value of wetlands through a method acceptable to U.S. Army Corps of Engineers (USACE) and local agencies, delineation of jurisdictional (JD) wetlands, and proposed avoidance, minimization and mitigation for the identified impacts, if necessary.

ENLACE proposes the Caño Martín Peña (CMP) Ecosystem Restoration Project (CMP-ERP). The CMP is a tidal channel approximately 4 miles long, connecting the San Juan Bay and the San José Lagoon in metropolitan San Juan, Puerto Rico. CMPis part of the San Juan Bay Estuary (SJBE), the only tropical estuary that is part of the U.S. Environmental Agency (USEPA) National Estuary Program. The SJBE and its associated marine ecosystems are considered the “Study Area” because the proposed CMP-ERP is expected to have direct, indirect, and cumulative beneficial effects on this region as a whole. The “Project Area,” which mostly lays out the construction footprint, has been defined as the Project Channel, where dredging would take place, the adjacent delimitation of the public domain lands within the Maritime Terrestrial Zone (MTZ) of the CMP, where relocations are scheduled to occur. Also included in the Project Area is the 6-acre dredged material staging area within the 35-acre Ciudad Deportiva Roberto Clemente (CDRC) site, the boating routes from the eastern limit of the CMP to the CDRC, which includes the five pits in San José Lagoon (Figure 1).

This report is organized into seven (7) sections: 1) background, 2) site description, 3) jurisdictional delineation, 4) wetlands and impacts, 5) conclusions and recommendations, 6) supporting technical evaluation, and 7) avoidance/minimization/mitigation recommendations. The results and conclusions of this study are supported with the field information summarized in the appendices of this report.

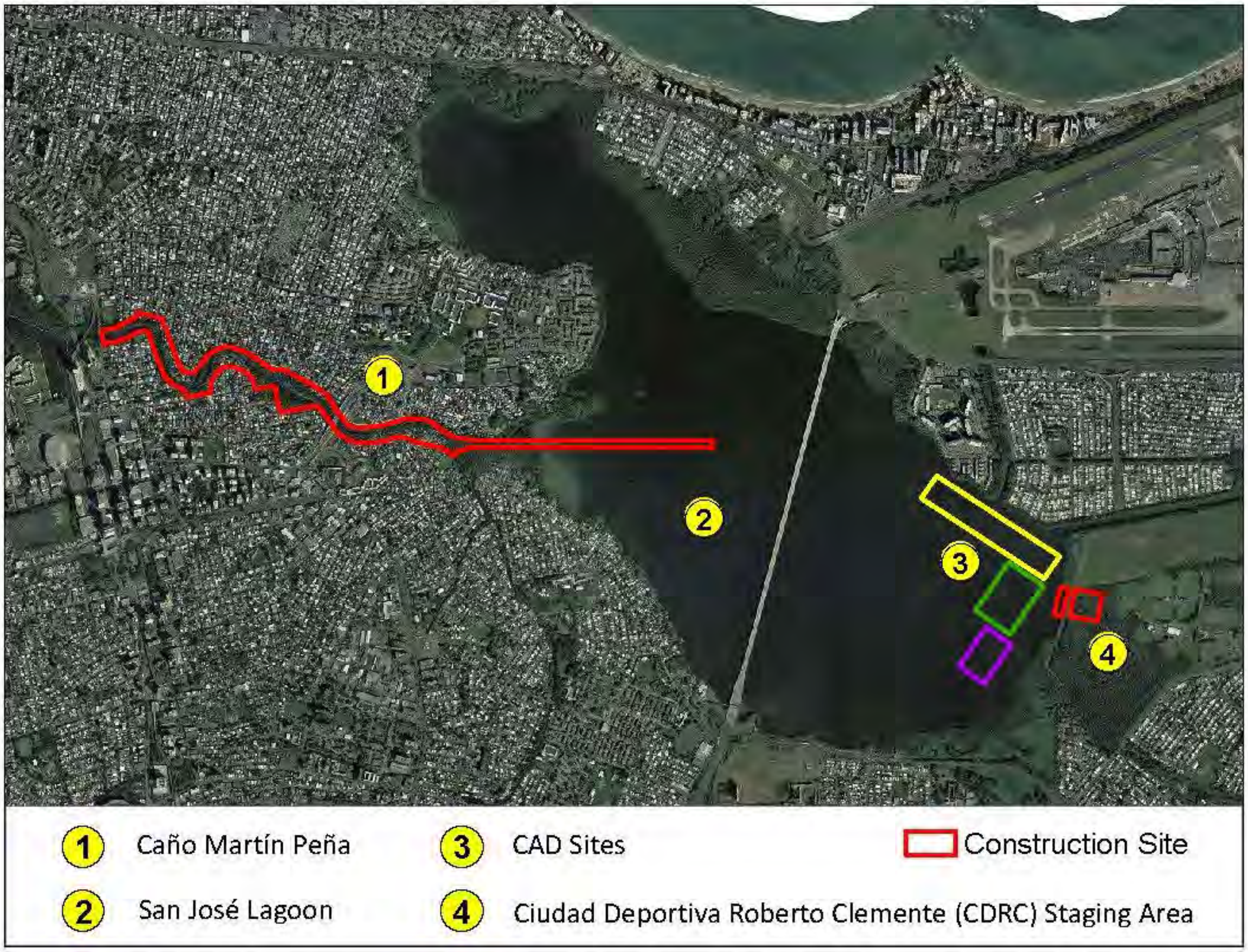


Figure 1. The Caño Martín Peña Ecosystem Restoration Project Area

2.0 SITE DESCRIPTION

The site description is essential to properly assess and evaluate the Project Area, and most importantly, to delineate the presence of jurisdictional wetlands within its limits. For the purposes of this delineation, efforts were focused on the Project Channel and the CDRC staging area of the Project Area, as the remaining elements of the Project Area (e.g., barge routes from the CMP to the CDRC staging area and to the San Jose Lagoon pits) are open water. This information, combined with a detailed field investigation and analysis that takes into account the three jurisdictional wetland criteria (presence of hydrophytic vegetation, wetland hydrology, and hydric soils) is fundamental in the delineation of jurisdictional wetlands. Within this section of the report various figures are presented in order to supplement the site description.

1. **Location**: The CMP is a tidal channel approximately 4 miles long, connecting the San Juan Bay and the San José Lagoon in the metropolitan area of San Juan, Puerto Rico. It is part of the SJBE, the only tropical estuary within the USEPA's National Estuary Program. The eastern 2.2-mile-long segment of the CMP and adjacent areas are the main focus of this study. Figure 2 [U.S. Geological Survey (USGS) Quadrangle Map] shows the location of the Project Channel. The Project Channel center coordinates are: Latitude N18°25'49.64"; Longitude W65°02'56.03". The staging area lies at the southwestern shore of the San José Lagoon, approximately 350 meters south of the Suárez Canal. The staging area's coordinates are Latitude N18°42'07.9", Longitude W66°01'04.1". Figure 3 (USGS Quadrangle Map) shows the location of the staging area. This location can be accessed through the CDRC Complex.
2. **Topography**: The Project Channel is practically level, with elevations averaging 3 feet above mean lower low water. The CDRC staging area is located at a level area that has been previously filled with debris.
3. **Soils**: Based on the U.S. Department of Agriculture (USDA) Soil Conservation Service (SCS) Soil Survey of the San Juan Area of North Puerto Rico, the Project Channel lies within an area identified as Soil not Surveyed (SNS); this classification characterizes lands that have not been studied and thus are not included in the *Soil Survey of the San Juan Area of Eastern Puerto Rico* that was prepared by the USDA in 1977. Although there is no official classification to the soils within the Project Channel, based on field observations and soil series present within similar nearby areas, the soil could be classified as part of the Hydraquantes saline ***(Hy)*** series, which are classified as hydric soils in the *Hydric Soils of the Caribbean Area* (USDA-SCS, 1995). Hydraquantes saline soils are nearly level, very poorly drained soils found in lagoon like depressions adjacent to the coast. These soils are covered with brackish water most of the year and are frequently flooded. Permeability and runoff are very slow and the available water capacity is very high. Reclamation is very difficult and costly. These soils support mostly mangrove trees and other halophytic vegetation. They have severe limitations for most urban uses because they are very poorly drained and subject to frequent overflow. The CDRC staging area consists of soils classified as ***Md***, or "Made Land," classifying the zone as a previously, filled or impacted wetland.

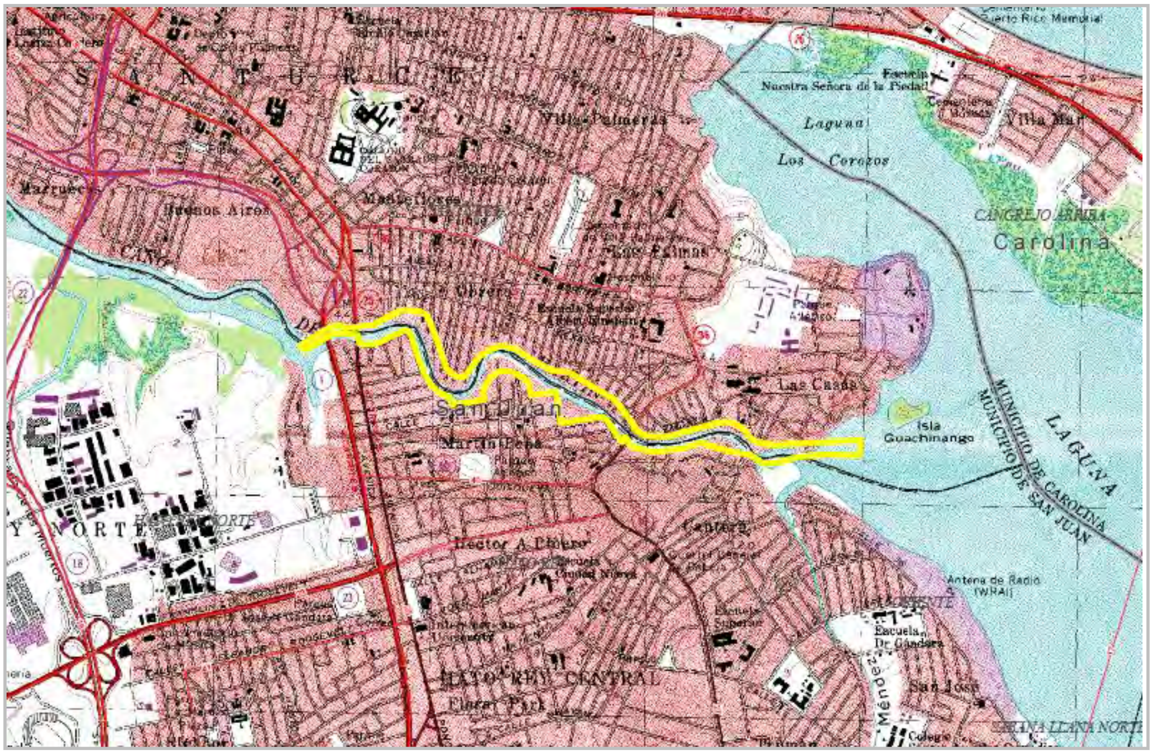


Figure 2. USGS Location Map of the Project Channel

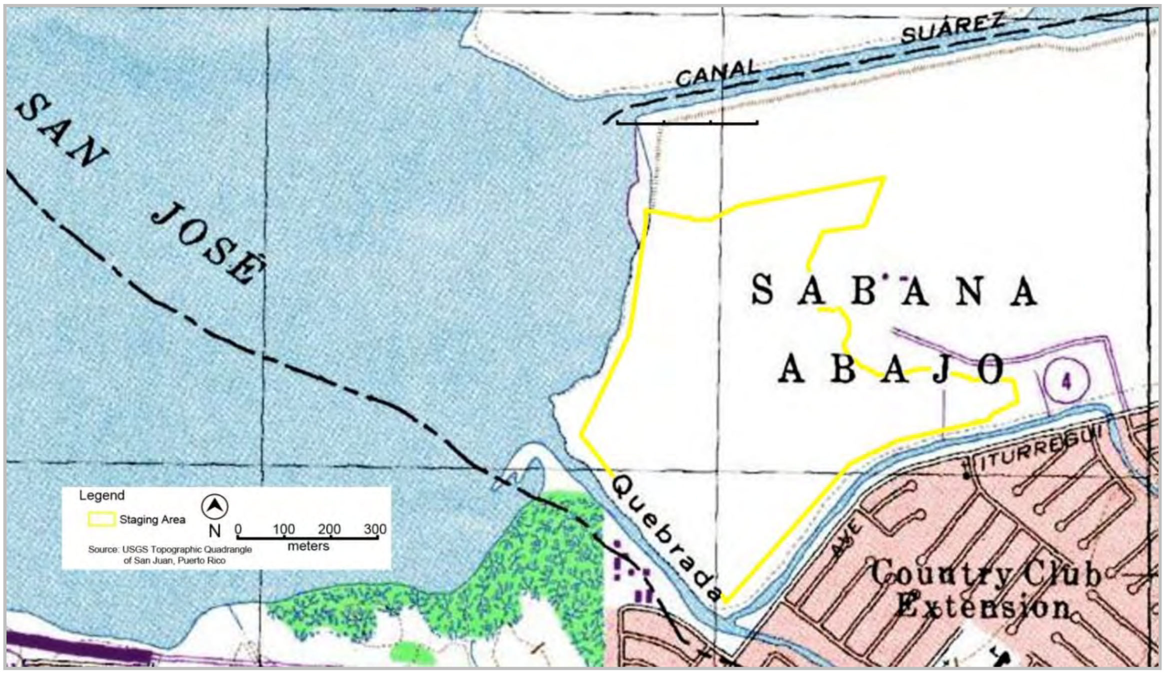


Figure 3. USGS Location Map of the CDRC Staging Area

Figure 4 shows the Soil Survey Map of the Project Channel; Figure 5 shows the Soil Survey Map of the CDRC Staging Area.

4. **Hydrology**: The CMP is an approximately 4-mile-long tidal channel connecting the San Juan Bay and the San José Lagoon in the metropolitan area of San Juan, Puerto Rico. The drainage area of the CMP is about four square miles (2,500 acres). Originally, it had a width of at least 200 feet; however, since the 1920s, the channel and its wetlands began to be modified as result of development pressures that were exerted by the growth in the area. The CMP's ability to convey flows has been almost completely blocked as a result of siltation, solid waste accumulation, and structure encroachments. The baseline sampling during the development of the hydrodynamic model by the USACE Environment Research and Development Center (ERDC) confirmed the current negligible tidal exchange between the San José Lagoon and the San Juan Bay. This situation is exacerbated by the lack of adequate infrastructure, an existing combined (stormwater and sewerage) sewer system, leaching from on-site septic systems, and many direct discharges of untreated sewage discharges into the CMP.

   Encroachment along the eastern half of CMP has increased the intensity and frequency of flooding, affecting nearby communities with a combination of stormwater and untreated sanitary sewerage water. Wildlife habitat loss has occurred within the system as a result of direct (e.g., construction, dredging, filling) and indirect impacts. Increased sediment runoff and eutrophication (organic and inorganic nutrients in the water promote an environment that favors algae growth) have increased water turbidity to the extent that benthic primary production is no longer possible in many locations within the Project Channel. Water quality is extremely poor in some areas of the system due to eutrophication and fecal coliform bacteria contamination, though the overall trend in water quality within the San Juan Bay Estuary is improving as a result of implementation of pollution prevention projects that began in the 1970s. The quality of the mangrove community both as individual plant species and a habitat for other organisms has been affected considerably by these changes.

5. **Climate**: Both the Study Area and the Project Area are located in the subtropical moist zone. The range of mean monthly temperatures in San Juan is only 3.2 degrees Celsius (°C) between the warmest month, August (27.1°C) and the coolest months, January and February (23.9°C). Mean annual rainfall ranges from 150 centimeters (cm) near the coast in the San Juan area to 210 cm in the uplands that define the southern boundary of the watershed.

6. **Biotic Components**: According to *Ewel and Whitmore (1973)*, the Study Area is located in a life zone classified as a subtropical moist forest zone (SMFZ). The SMFZ, with its intermediate moisture conditions—neither excessive rainfall nor high irrigation requirements—is the life zone in Puerto Rico and the Virgin Islands that is best adapted for a wide variety of land use systems, many of which offer potentially high crop yields. Intensive food production on the flats, forage production on the moderate slopes, and managed tree crops on the steep slopes are all possible in this life zone. In addition, this life zone provides a much-needed supply of water on some of the drier islands, such as the Virgin Islands and Vieques. Most of this life zone attributes are limited by the soils and saline water intrusion.

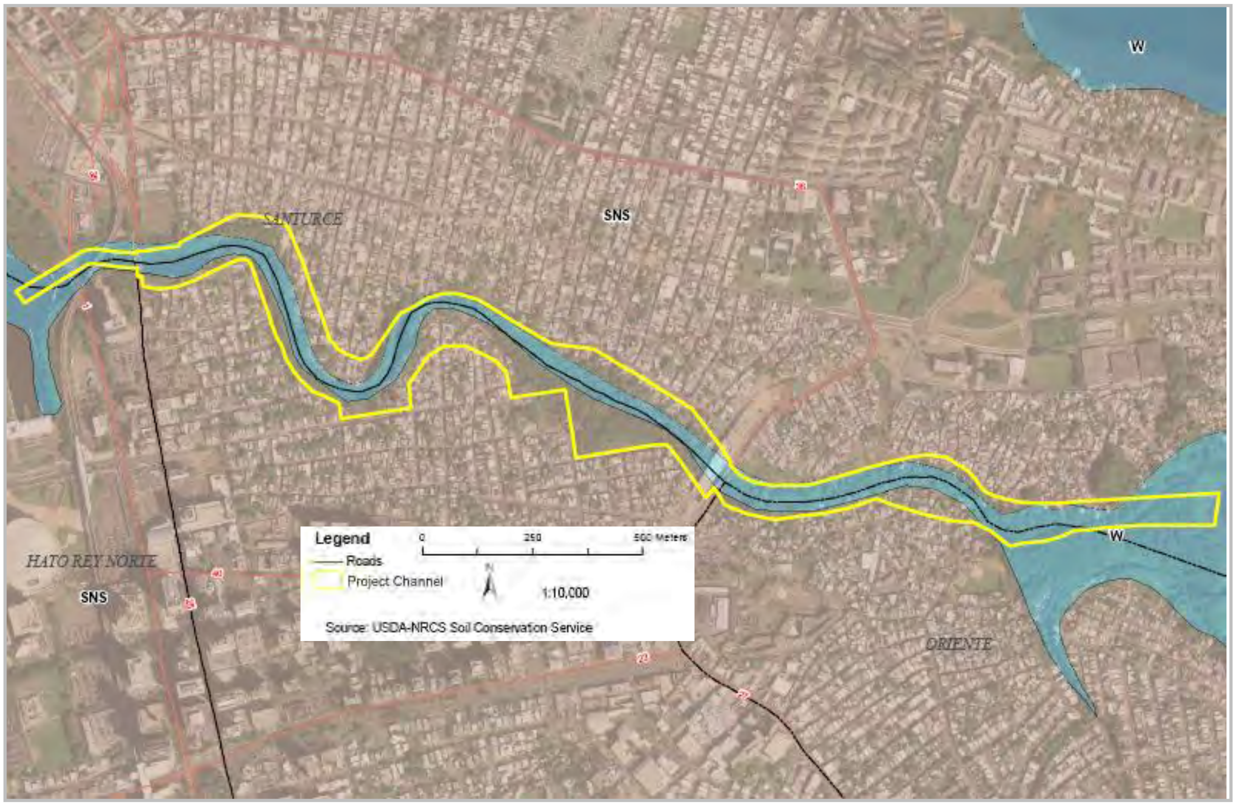


Figure 4. Soil Survey Map of the Project Channel

Figure 5. Soil Survey Map of the CDRC Staging Area

Mangroves and forested wetlands are found along the coast in the SMFZ where they appear to grow taller than in the subtropical dry forest zone, which is the only other sea-level life zone found in Puerto Rico and the Virgin Islands. Just inland from the mangrove forests are alluvial soils where the groundwater may be slightly brackish. Most of these soils were cleared for agriculture long ago. The Project Area has severe limitations for most urban uses, because most areas are estuarine mangroves and palustrine wetlands, contain very poorly drained soils and are subject to frequent flooding making reclamation very difficult and costly. The once extensive mangrove forest was cut and filled progressively to accommodate houses or buildings in the communities that were established on both sides of the CMP.

The 6-acre CDRC staging area consists mainly of a previously filled wetland, evident by the non-typical soil and the amount of debris that exists at root level. A stand of *Albizia procera* (albizia) dominates the upland portion of the staging area, and a mangrove stand borders this upland area on the edge of the San José Lagoon.

7. **Aquatic Resources**: The aquatic resources within the Project Channel and the CDRC staging area can be summarized as follows:

   a. **Forested Wetlands**: These wetlands, which consist mostly of mangroves, are located along both sides of the Project Channel and are dominated by *Laguncularia racemosa* (white mangrove), *Avicennia germinans* (black mangrove), *Rhizophora mangle* (red mangrove) and *Acrostichum aureum* (swamp fern). Trees and palms from the species *Calophyllum antillanum* (antilles calophylum), *Andira inermis* (cabbage angelin), *Thespesia populnea* (portia tree), *Terminalia catappa* (Indian almond), *Peltophorum pterocarpum* (yellow flamboyant), *Roystonea borinquena* (royal palm) and *Coccos nucifera* (coconut palm) are also found scattered within the mangrove habitat. These wetland resources are the small remains of larger mangroves areas that were cut and filled to build houses. These species are classified as obligate wetland (OBL) (a wetland obligate plant is a species that occurs in wetlands 99% of the time or more) or facultative wetland (FAC) (a facultative plant occurs in wetlands 34–66% of the time) in the *1995 Revision to the National List of Plants Species that Occur in Wetlands: Caribbean (Region C) [Supplement to Biological Report 88 (26.12) May 1988].*

      Along the CDRC staging area's shoreline, the woody composition is mainly *Laguncularia racemosa* (white mangrove), *Avicennia germinans* (black mangrove) and *Rhizophora mangle* (red mangrove), which are classified as OBL, as well as *Thespesia populnea* (portia tree), which is classified as FAC.

- **b. Emergent Wetlands**: These wetlands, which are the smallest aquatic resource within the Project Channel, consist of scattered patches of marshes and are mostly located between the mangroves and the houses on the north bank of the CMP, specifically in its easternmost portion. These wetlands are dominated *by Acrostichum aureum* (swamp fern)*, Brachiaria purpurascens* (para grass)*, Commelina diffusa* (climbing dayflower)*, Paspalum fasciculatum* (Mexican crowngrass)*, and Ipomoea tiliacea* (ipomoea). These species are classified as OBL, FACW or FAC in *the 1995 Revision to the National List of Plants Species that Occur in Wetlands: Caribbean (Region C) [Supplement to Biological Report 88 (26.12) May 1988].*

- **c. Open Water**: During the field surveys for this study, the CMP was almost completely clogged in some areas by mangroves, sediment, and solid waste. Floating vegetation was present in open water areas where the CMP is clogged. The dominant species of floating vegetation within these areas are: *Eichhornia crassipes* (water hyacinth), *Lemna aequinoctialis* (lesser duckweed) and *Pistia stratiotes* (water lettuce). These resources must be managed, and the flow and vegetation restored in order to reach high ecological, cultural and recreational value.

8. **National Wetland Inventory (NWI) Map**: The NWI Map from the U.S. Fish and Wildlife Service (USFWS) identifies most vegetative communities within the Project Channel as wetland. Based on the Cowardin classification (1979) of the NWI Map, the wetlands within the Project Channel are classified as: Palustrine, emergent, persistent, seasonally flooded (PEM1C); estuarine, intertidal, forested, broad-leaved evergreen, irregularly exposed (E2FO3M); and estuarine, subtidal, unconsolidated bottom, subtidal (E1UBL). Outside of the Project Channel, near the beginning and end, wetlands areas are classified as estuarine, intertidal, emergent, persistent, irregularly exposed (E2M1M). Wetlands within the CDRC staging area are classified as E2EM1/FO3M. Figure 6 shows the National Wetland Inventory Map of the Project Channel; Figure 7 shows the National Wetlands Inventory Map for the CDRC staging area.

9. **Flood Zones**: Based on the Flood Insurance Rate Maps (FIRM) of the Federal Emergency Management Agency (FEMA) (FEMA, 2005), the entire Project Area is classified in one flood zone: Zone A, where no base flood elevation is determined and represents an area subject to flooding by the 1% annual chance flood. Figures 8 and 9 illustrate the Flood Insurance Rate Maps from FEMA for the Project Area and the CDRC staging area.

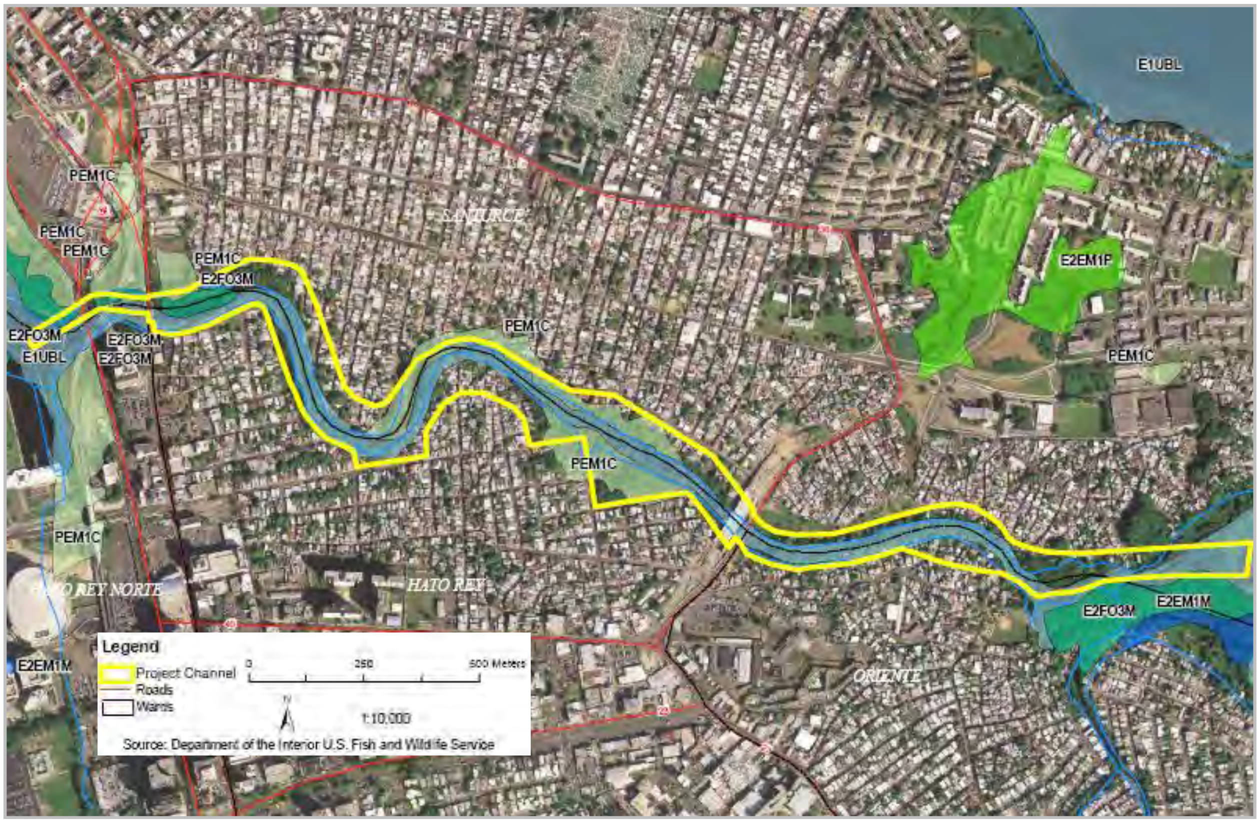


Figure 6. National Wetland Inventory Map of the Project Channel

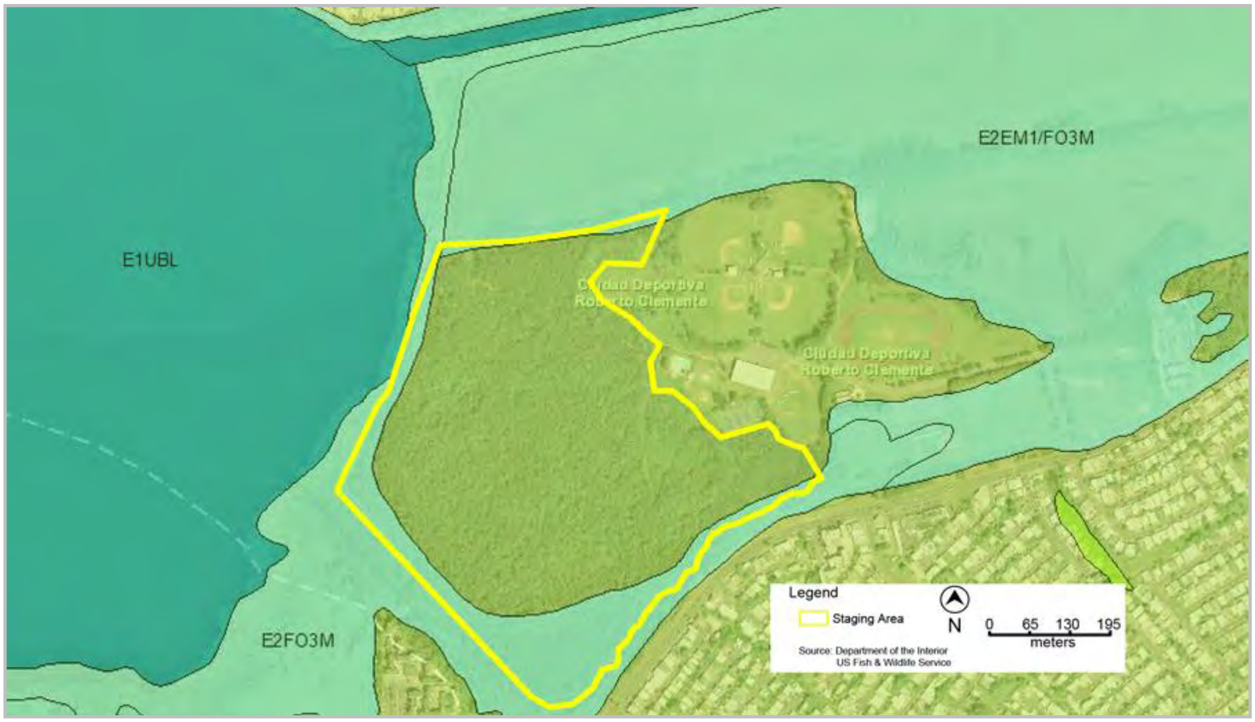
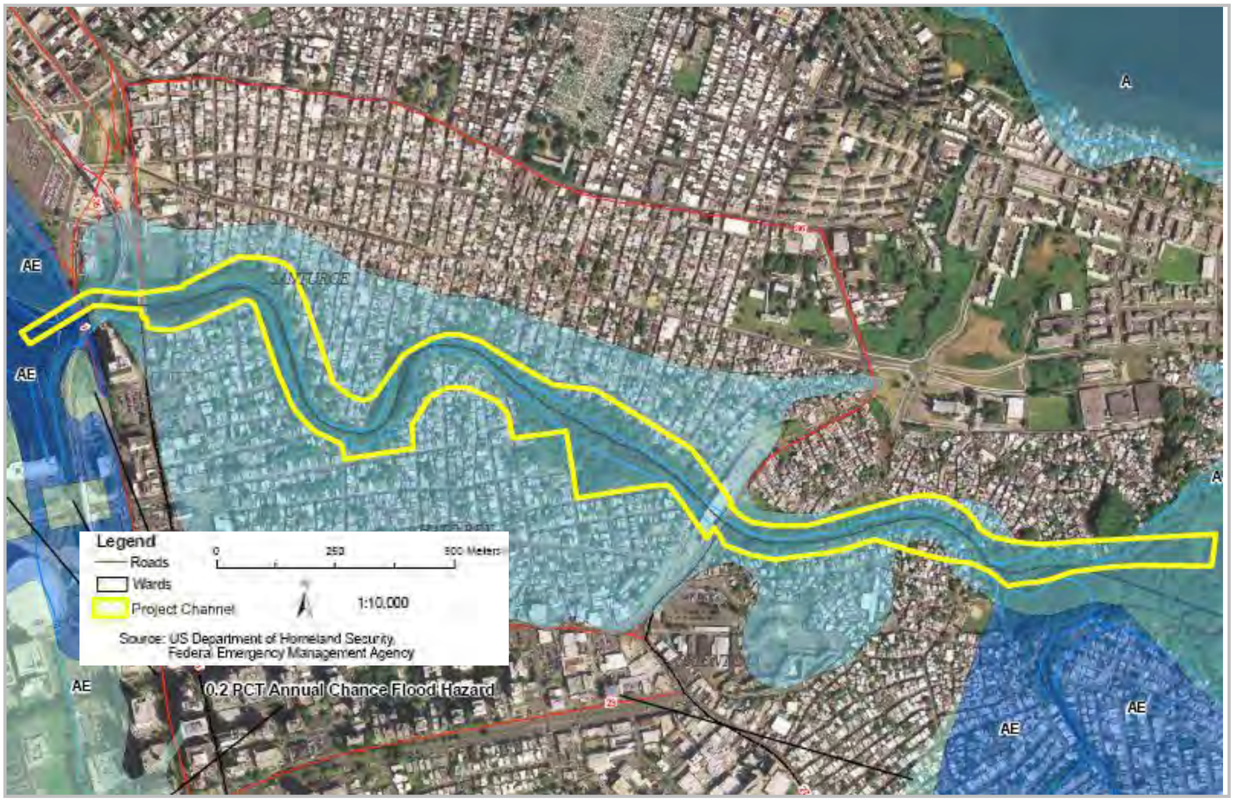
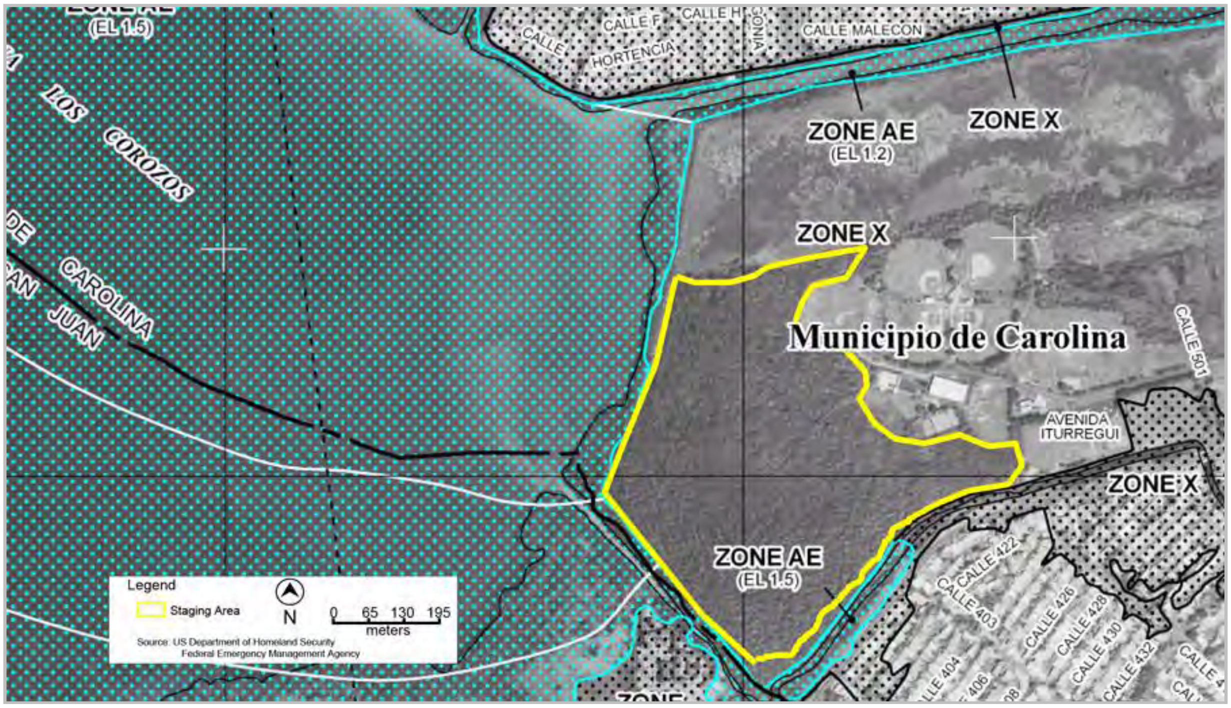


Figure 7. National Wetland Inventory Map of the CDRC Staging Area



Source: US Department of Homeland Security, Federal Emergency Management Agency

Figure 8. FEMA FIRM-Flood Zones for the Project Area



Source: US Department of Homeland Security, Federal Emergency Management Agency

Figure 9. FEMA FIRM-Flood Zones for the Staging Area

A four-phase study approach was used for the Wetland Jurisdictional Determination and Delineation Study (JD) performed for the Project Area. The technical approach utilized followed the determination method described in the *Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Caribbean Islands Region (the Caribbean supplement).*

During Phase 1 of the study, a screening level analysis was performed to identify those areas within the Project Area regarded as potential jurisdictional wetlands under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act. The screening level analysis was performed using Geographic Information Systems (GIS) loaded with the following data:

- Topography;
- Soil Survey;
- National Wetland Inventory (NWI) Map;
- Flood Zones and Hydrography; and
- Aerial Photographs.

The results from this phase of the investigation provided specific and important information for the design of the field reconnaissance and data collection effort.

Phase 2 of the study consisted of a series of preliminary site visits, including the inspection of previously identified potential wetland areas. These visits helped validate data that was gathered during the previous phase. They also contributed to a better understanding of the environmental conditions at the site in order to develop a fieldwork plan.

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3.0 JURISDICTIONAL DELINEATION

3.1 METHODOLOGY

Phase 3 of the study included the delineation field visits to map any and all jurisdictional wetlands within the Project Area. Each delineation visit included a description of the hydrology, soil and dominant vegetation at representative sampling locations on established transects. Appendix A includes the transcripts of the Wetland Determination Data Forms from the Caribbean Supplement of the Wetland Delineation Manual.

The following tasks were carried out during this phase:

- Establishment of sampling transects;
- Visual inspection of the site and identification of landscape features;
- Identification of plant communities;
- Selection of a representative area within each plant community to establish a sampling point and dig a soil pit to determine the soil properties and water content;
- Identification of dominant plant species from the various strata around the soil pit;
- Classification of plant species using the *1995 Revision to the National List of Plants Species that Occur in Wetlands: Caribbean (Region C) [Supplement to Biological Report 88 (26.12) May 1988];*
- Description of the hydrology within and around the soil pit;
- Characterization of the soil using *Munsell Soil Color Chart*;
- Completion of the Wetland Determination Data Forms from the Caribbean Supplement of the Wetland Delineation Manual with data collected at each sampling point;
- Photographic documentation of the site, the soil pits and its surrounding vegetation;
- Field delineation of wetland areas using the aerial photographs and a Global Positioning System (GPS) unit.

For the purposes of this study, one sampling transect was established along the Project Area. Since this is a linear project, the Project Channel was used as the main sampling transect. A total of 21 sampling points were established throughout the Project Channel. Wetland limits were recorded with a GPS unit and using the most recent aerial photographs available. Most areas were walked and inspected in detail, with the exception of areas where houses were located immediately adjacent to the channel providing limited access, or in areas where the physical integrity of the field personnel was considered at risk. For the CDRC staging area, sampling points were established at the proposed site east of the Ciudad Deportiva Roberto Clemente Complex, on the southeastern shore of the San José Lagoon.

Phase 4 of the study comprised the final analysis of the data gathered during the inspection and delineation visits, and the drafting of this Wetland Jurisdictional Determination and Delineation Report. The final wetland boundary determination was based on a combination of all the available evidence. The field reconnaissance and assessment efforts for this Study started on February 1, 2011, and ended on February 8, 2011.

During the site reconnaissance and jurisdictional wetland determination and delineation field visits, wetland areas were located and identified. Field reconnaissance and analysis revealed that, within the Project Area, wetlands present in the NWI Maps were mostly jurisdictional wetlands. Figure 10 and 11 illustrate the wetland delineation of the Project Area over aerial photographs.

As mentioned above, the dominant vegetative communities within the Project Area consist of forested wetlands composed mostly of mangroves, emergent wetlands consisting mostly of marshes and transitional secondary forests. The dominant species found at the mangrove forests are: *Laguncularia racemosa* (white mangrove), *Avicennia germinans* (black mangrove), *Rhizophora mangle* (red mangrove) and *Acrostichum aureum* (swamp fern). The dominant species found in marshes area are: *Acrostichum aureum* (swamp fern), *Brachiaria purpurascens* (para grass), *Commelina diffusa* (climbing dayflower), *Paspalum fasciculatum* (Mexican crowngrass), *Paspalum millegrana* (paja brava), *Cyperus alternifolius* (umbrella plant), *Colocasia esculenta* (taro) and *Ipomoea tiliacea* (ipomoea); while the dominant species in the transitional secondary forest are *Thespesia populnea* (portia tree), *Terminalia catappa* (Indian almond), *Roystonea borinquena* (royal palm) and *Coccos nucifera* (coconut palm). In addition, an immature *Pterocarpus officinalis* (dragonsblood tree) stand with strong evidence of recruitment, consisting of approximately 0.21 acre, was found outside the Project Area on the south bank at the easternmost section of CMP (see Figure 10).

3.2 RESULTS

Based on the 1995 Revision to the National List of Plants Species that Occur in Wetlands: Caribbean (Region C) [Supplement to Biological Report 88 (26.12) May 1988], the classification for the dominant plants found in the wetland areas and based on their occurrence are as follow: *Laguncularia racemosa* (white mangrove), *Avicennia germinans* (black mangrove), *Acrostichum aureum* (swamp fern), *Rhizophora mangle* (red mangrove) and *Colocasia esculenta* (taro) OBL; *Brachiaria purpurascens* (para grass), *Paspalum fasciculatum* (Mexican crowngrass), *Paspalum milegrana* (paja brava) and *Ipomoea tiliacea* (ipomoea) FACW; and *Terminalia catappa* (Indian almond) and *Commelina diffusa* (climbing dayflower) FAC.

Upland and wetland areas (mostly wetlands) were found throughout the Project Area. Based on the historic aerial photograph interpretation, the Project Channel was an extensive mangrove forest cut and filled progressively to accommodate housing now standing on both sides of the CMP. The historic photographs also show the diminishing mangrove forests, the growth of the communities, and the clogging of the CMP. Although some transitional wetland areas were found adjacent to the existing communities, most of the wetland limits or borders are contiguous with existing housing structures. The huge amount of solid waste deposited over wetland areas is evident throughout the Project Channel.

Wetlands found within major vegetative communities can be categorized as estuarine forested, palustrine forested/emergent, palustrine emergent, and open water wetlands. The main wetland areas and aquatic resources under the jurisdiction of *Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act* consist of estuarine forested wetlands (mangrove swamps), palustrine forested/emergent wetlands, palustrine emergent wetlands, and estuarine open water areas.

Based on the measurements performed with GPS and with GIS analysis, the total area of jurisdictional wetlands and U.S. Waters within and adjacent to the Project Channel and CDRC staging area is 45.86 acres. Of those 45.86 acres, 20.53 acres are estuarine forested, 17.87 acres are palustrine forested/emergent, 7.40 acres are estuarine open water, and 0.06 acre are palustrine emergent. Wetlands within the limits of these areas can be described as follows:

Estuarine Forested Wetlands (20.53 acres): These wetlands consist of a mangrove forest fringe along most areas of the Project Channel bank, a large stand in the eastern portion of the Project Channel, and a 5-acre mangrove fringe along the San José Lagoon shore of the CDRC staging area. They are similarly dominated by mangroves from the species *Avicennia germinans* (black mangrove) (OBL), *Laguncularia racemosa* (white mangrove) (OBL) and *Rhizophora mangle* (red mangrove) (OBL), *Terminalia catappa* (Indian almond) (FAC), *Coccos nucifera* (coconut palm) (FACU) and *Thespesia populnea* (portia tree) (FAC) are also very abundant within the CMP. The Cowardin classification (1979) for these areas is estuarine, intertidal, forested, broad-leaved evergreen, and irregularly exposed (E2FO3M). These wetlands are influenced by tidal fluctuations.

Palustrine Forested Wetlands (17.87 acres): Palustrine forested wetlands share the same vegetation composition but with some differences in their structure. Estuarine forested wetlands have a higher abundance and dominance of the species *Avicennia germinans* (black mangrove) (OBL), while in palustrine forested/emergent wetlands *Avicennia germinans* (black mangrove) had a relatively low abundance and dominance and in some cases was absent; while the abundance of emergent vegetation, mostly *Acrostichum aureum* (swamp fern), is noticeable. The Cowardin classification (1979) for these areas is Palustrine, forested, broad-leaved evergreen/emergent, persistent, and seasonally flooded (PFO3/EM1C). These wetlands are connected to the CMP and are influenced by runoff and tidal fluctuations.

Palustrine Emergent Wetlands (0.06 acre): These wetland areas are mostly dominated by *Colocasia esculenta* (taro) (OBL) *Brachiaria purpurascens* (para grass) (FACW), *Commelina diffusa* (climbing dayflower) (FAC), *Paspalum fasciculatum* (Mexican crowngrass) (FACW) *and Ipomoea* *tiliacea* (ipomoea) (FACW). The Cowardin classification (1979) for these areas is palustrine, emergent, persistent and seasonally flooded (PEM1C). These areas are located mostly between the mangroves and the houses in the north bank of the CMP, specifically in its easternmost portion. These seasonal wetlands can be described as follows: Surface water is present for extended periods, particularly early in the growing season, but is absent by the end of the growing season in most years. The water table, after the flooding ceases, is variable, from saturated to the surface to a water table level well below the ground surface.

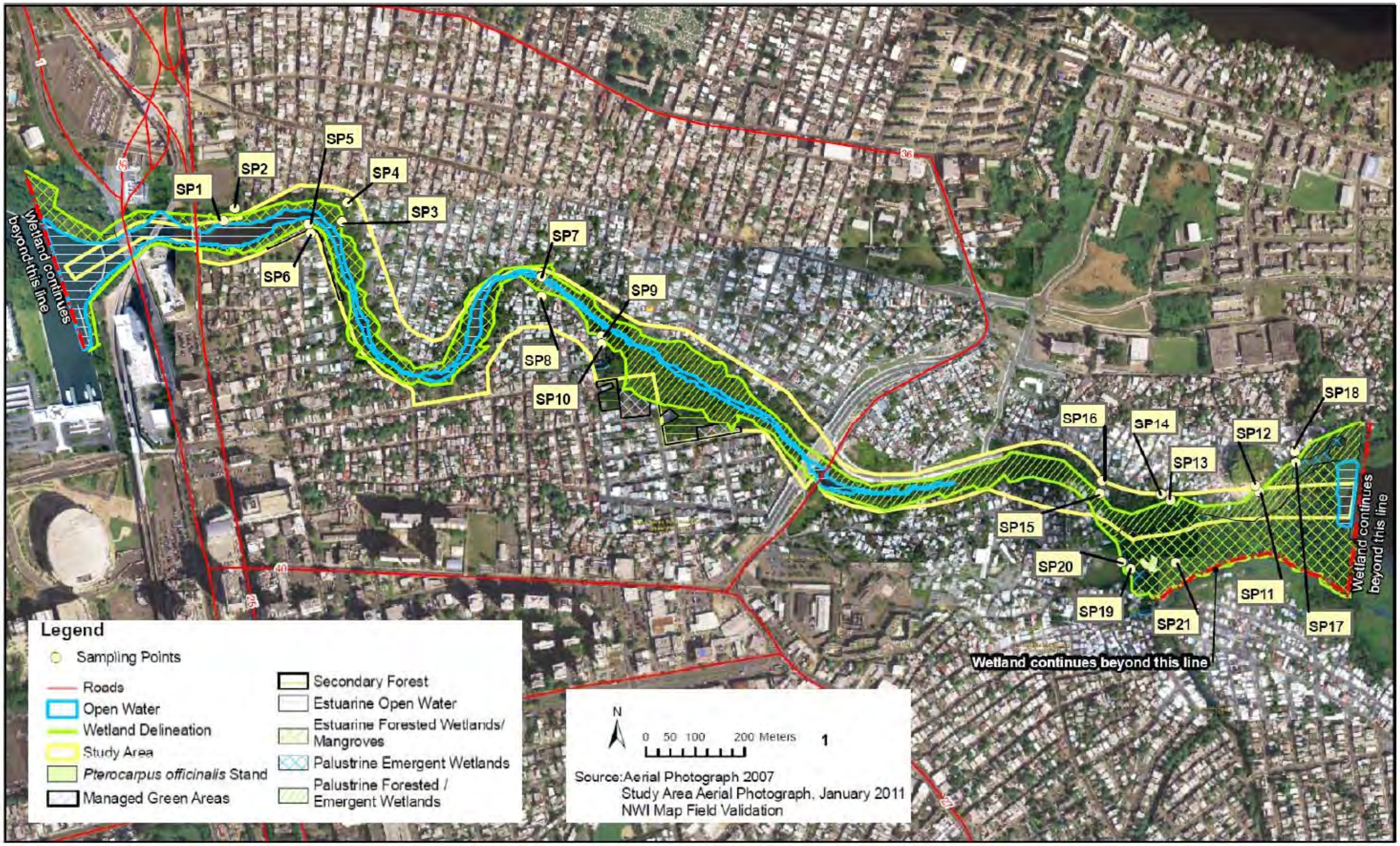
Estuarine Open Water (7.40 acres): These open water areas consist of the CMP and its connection to San José Lagoon and to San Juan Bay. The Cowardin classification (1979) for these areas is estuarine, sub-tidal, unconsolidated bottom, and sub-tidal (E1UBL). In some open water locations, floating vegetation was present where the CMP channel is clogged. The dominant species within these areas are: *Eichhornia crassipes* (water hyacinth), *Lemna aequinoctialis* (lesser duckweed), and *Pistia stratiotes* (water lettuce). In some locations where open water areas are covered with vegetation, the Cowardin classification could be estuarine, sub-tidal, aquatic bed, floating vascular/unconsolidated bottom, and sub-tidal (E1AB4/UBL); but due to the fact that the vegetation is associated to areas of the channel that are clogged under abnormal circumstances, open water areas are classified as E1UBL for the purpose of this study.

Wetlands found within the Project Channel are located at both banks of the CMP channel, reaching the houses that are located in the filled wetland. Some of the palustrine forested and palustrine emergent wetlands seem to have a tidal influence but others are located in areas with lower elevations that collect runoff and storm water from adjacent developed upland areas.

Most sampling points within the Project Channel meet the 3 criteria of a jurisdictional wetland. Table 1 summarizes the Jurisdictional Wetland criteria that each one of the 24 sampling points met and the final decision on whether the area should be considered or not as a jurisdictional wetland. Sampling point locations are shown in Figures 10 and 11.

Table 1
Wetland Criteria Status for the Sampling Points

Sampling Point	Hydrophytic Vegetation	Hydric Soil	Wetland Hydrology	Wetland Determination
SP-1	Yes	Yes	Yes	Yes
SP-2	No	No	No	No
SP-3	Yes	Yes	Yes	Yes
SP-4	No	No	No	No
SP-5	Yes	Yes	Yes	Yes
SP-6	No	No	No	No
SP-7	Yes	Yes	Yes	Yes
SP-8	No	No	No	No
SP-9	Yes	Yes	Yes	Yes
SP-10	No	No	No	No
SP-11	Yes	Yes	Yes	Yes
SP-12	No	No	No	No
SP-13	Yes	Yes	Yes	Yes
SP-14	No	No	No	No
SP-15	Yes	Yes	Yes	Yes
SP-16	No	No	No	No
SP-17	Yes	Yes	Yes	Yes
SP-18	No	No	No	No
SP-19	Yes	Yes	Yes	Yes
SP-20	No	No	No	No
SP-21	Yes	Yes	Yes	Yes
SP-22	Yes	Yes	Yes	Yes
SP-23	No	Yes	Yes	No
SP-24	No	No	No	No



Source: Aerial Photograph 2007
Study Area Aerial Photograph, January 2011
NWI Map Field Validation

Figure 10. Wetland Jurisdictional Delineation Map and Habitat Characterization of the Project Channel

Source: Aerial Photograph, 2007
NWI Map, Field Validation

Figure 11. Wetland Jurisdictional Delineation Map of the Staging Area

Of a total of 24 established sampling points, 12 are within wetland areas. Based on field observations of vegetative communities found in various sampling points, the delineated wetlands seem to have regular hydroperiods. This suggests that these wetlands are flooded long enough to meet wetland criteria and to sustain a healthy wetland vegetative community.

Considering the degraded state of the habitat, i.e., the amount of solid waste and noticeable detrimental low water quality, functions and values within the Project Channel are limited. Some of their possible functions are: surface water storage, groundwater recharge, element transformation and cycling, dissolved substances retention and removal and the accumulation of inorganic sediments. These functions serve to reduce the impact from floodwaters, while increasing sediment deposition, maintaining water quality and replenishing the water supply.

Under normal circumstances, the combination of these habitats comprising a whole ecosystem and natural corridor would possess a considerably high ecological value for wildlife utilization, but the massive amounts of solid waste, in combination with raw domestic waste discharges, negatively affects wildlife utilization of these habitats. The actual condition of the Project Channel, its ecological attributes and biological integrity are visibly degraded due to the extensive alterations and impacts to the natural landscape, as well as the lack of infrastructure and current use of the area.

3.3 CONCLUSIONS

The wetland jurisdictional determination and delineation study shows that there are 40.86 acres of wetlands and aquatic resources under the jurisdiction of the U.S. Army Corps of Engineers (USACE), within the 68.47-acre Project Channel and adjacent project area. An additional 5 acres of wetlands under the jurisdiction of the U.S. Army Corps of Engineers (USACE) are located in the 35-acre CDRC site. These conclusions are supported by:

- The presence of hydrophytic vegetation, wetland hydrology and hydric soil indicators;
- Superficial hydrological connections with other wetlands and/or U.S. Waters;
- Aerial Photographs, Hydric Soil Maps, NWI Maps and Photographic documentation; and
- Data forms completed during site reconnaissance.

Impacts to jurisdictional wetlands can be avoided through comprehensive planning and incorporating these areas within the Project design. Wetlands and U.S. Waters provide functions and possess attributes that may well enhance the Project landscape and can offer areas for recreation and education, among other social services.

It is the policy of the USACE and the and the USEPA that, a sequence of steps have to be considered during the design of any project impacting jurisdictional wetlands, the first of which is an attempt to develop a design that avoids impacting the wetland area. Since this is not possible for the CMP-ERP, an attempt to minimize them to a practicable extent should be made. Those steps are followed by mitigation actions for the wetlands that are going to be inevitably impacted.

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4.0 WETLAND IMPACTS

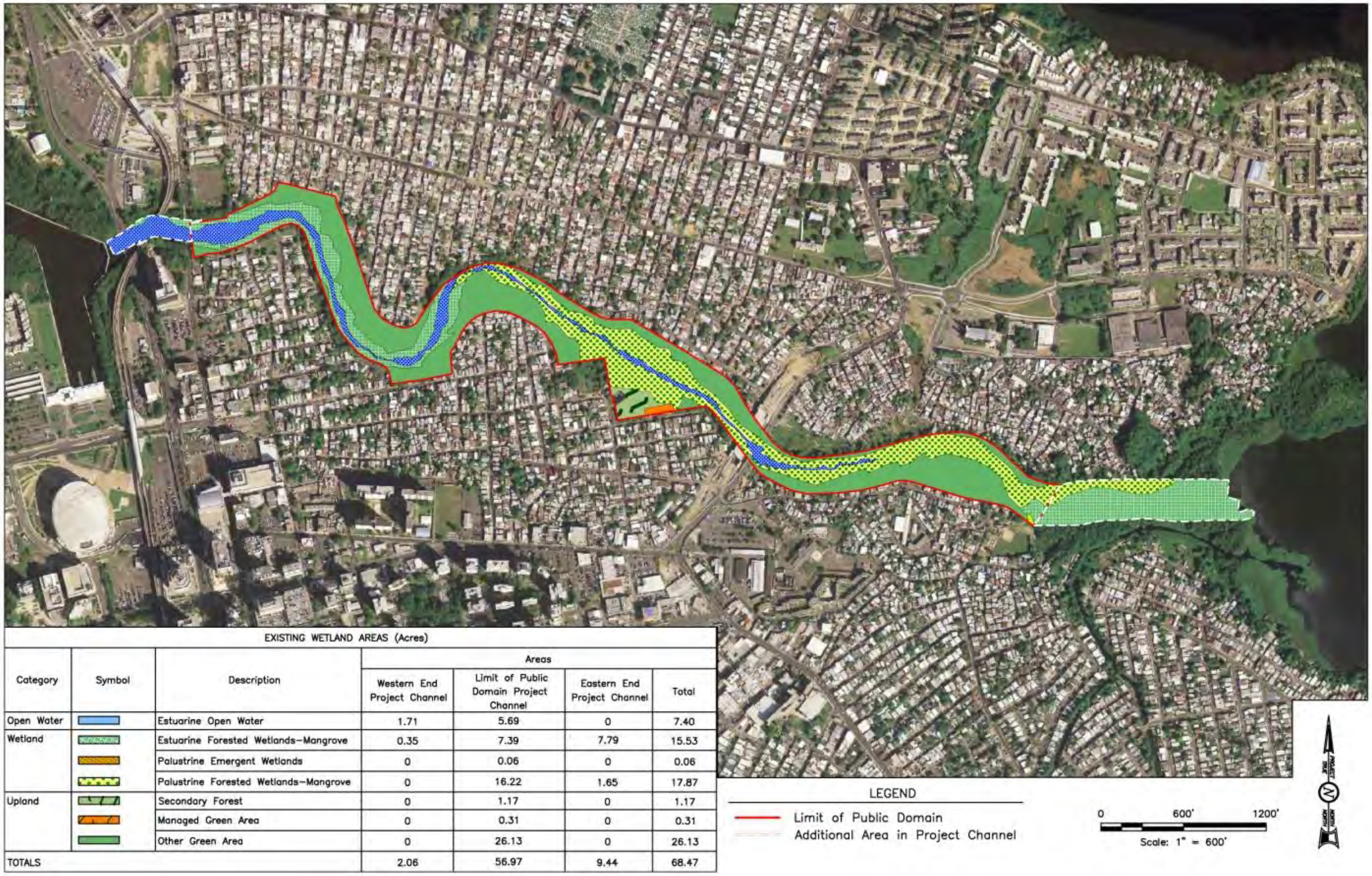
4.1 RESULTS

Table 2 provides the estimated wetland losses and gains for each alternative channel width, for each project component (channel, recreation areas and constructed wetland), for the two major categories of wetland within the project area: open water and wetlands (predominantly, estuarine forested wetlands).

There presently are approximately 33.46 acres of wetland and 7.40 acres of open water (see Figure 12, Table 2, and Appendix E) under existing conditions that would be temporarily impacted. With the removal of the land set aside for recreational amenities (5 acres), only the 75-foot and 100-foot alternatives result in an excess of constructed, restored wetlands; the 125-foot alternative results in a deficit of wetland acres.

The acres of open water habitat increase from the existing condition (7.40) to any alternative channel width (20.42 to 30.97, reflecting the 75-foot to 125-foot alternatives).

One acre of wetlands that fringes the 5-acre upland CDRC staging area will be temporarily impacted during construction, but restored after project completion. The upland staging area would be restored with native upland vegetation after disposing of all solid waste to the Humacao landfill.



EXISTING WETLAND AREAS (Acres)

Category	Symbol	Description	Areas			
			Western End Project Channel	Limit of Public Domain Project Channel	Eastern End Project Channel	Total
Open Water	🟦	Estuarine Open Water	1.71	5.69	0	7.40
Wetland	▨	Estuarine Forested Wetlands–Mangrove	0.35	7.39	7.79	15.53
	🟧	Palustrine Emergent Wetlands	0	0.06	0	0.06
	▨	Palustrine Forested Wetlands–Mangrove	0	16.22	1.65	17.87
Upland	▨	Secondary Forest	0	1.17	0	1.17
	▨	Managed Green Area	0	0.31	0	0.31
	🟩	Other Green Area	0	26.13	0	26.13
TOTALS			2.06	56.97	9.44	68.47

Figure 12. Existing Condition Wetland Analysis

Table 2. Estimates of wetland losses and gains with the width options for the Caño Martín Peña Ecosystem Restoration project.

LOSSES / GAINS SUMMARY			
DESCRIPTION	**EXISTING**	**PROPOSED**	**NET (INCREASE OR LOSS)**
75-FOOT CHANNEL	**ACRES**	**ACRES**	**ACRES**
OPEN WATER	7.40	20.42	13.02
WETLANDS/MANGROVES	33.46	39.62	6.16
UPLAND	27.61	3.43	-24.18
UPLAND (RECREATION)		5.00	5.00
TOTALS	**68.47**	**68.47**	**0.00**
100-FOOT CHANNEL			
OPEN WATER	7.40	25.57	18.17
WETLANDS/MANGROVES	33.46	34.48	1.02
UPLAND	27.61	3.42	-24.19
UPLAND (RECREATION)		5.00	5.00
TOTALS	**68.47**	**68.47**	**0.00**
125-FOOT CHANNEL			
OPEN WATER	7.40	30.97	23.57
WETLANDS/MANGROVES	33.46	29.08	-4.38
UPLAND	27.61	3.42	-24.19
UPLAND (RECREATION)		5.00	5.00
TOTALS	**68.47**	**68.47**	**0.00**

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5.0 CONCLUSIONS AND RECOMMENDATIONS

Based on historical aerial photographs, site reconnaissance and assessment, since the 1920s, the CMP channel and its wetlands have been constantly modified as result of development pressures exerted mostly by urban growth in the area. The wetlands adjacent to the San Juan Bay and along CMP were used as a disposal site for the material that was dredged from the San Juan Harbor Project affecting more than 80% of the original mangrove acreage found in this part of the estuary.

There presently are approximately 33.46 acres of wetland and 7.40 acres of open water (see Table 2) under existing conditions that would be temporarily impacted in the Project Channel. With the removal of the land set aside for recreational amenities, only the 75-foot and 100-foot alternatives result in an excess of constructed, restored wetlands; the 125-foot alternative results in a deficit of wetland acres.

The acres of open water habitat increase from the existing condition (7.40) to any alternative channel width (13.02 to 30.97, reflecting the 75-foot to 125-foot alternatives).

One acre of wetlands that fringe the 6-acre upland CDRC staging area will be temporarily impacted during construction, but restored after project completion.

The CMP-ERP will potentially cause temporary and permanent impacts on the terrestrial flora and fauna during the construction phase. Nevertheless, these impacts can be avoided, minimized, and mitigated with the adequate preparation and the application of appropriate architectural and engineering practices. In addition, the implementation of mitigation, conservation and management plans, programs and practices is an essential key for conservation and impact minimization. Since the actual ecological attributes, biological integrity and environmental health of the ecosystem is severely altered and damaged, the proposed action foresees a lift in the functions and values of the ecosystem once the natural hydrologic connectivity is restored and mitigation actions are implemented.

The main impact on the flora will result from the removal of vegetation and earth for site grading. Consequently, the most direct effects on wildlife will be caused by the elimination, alteration, and/or fragmentation of habitats as a result of the project construction. These effects should be minimized and mitigated with habitat creation, rehabilitation, and conservation, which should be incorporated in the Project Master Plan; however, the impacts of the CMP-ERP are expected to be minimal and short-term with the implementation of appropriate protective, mitigation, and management measures.

The preparation and implementation of a conservation and management plan is recommended. This plan should include strategies such as the salvage and transplantation of native flora species to areas selected for conservation and to nurseries for later usage in mitigation actions. The management plan could also include the designation of a conservation area suitable for habitat creation, rehabilitation, and conservation within or nearby the project.

Some of the fauna inhabiting the Project Area could be temporarily displaced during the construction phase of the project. It is possible that these species will settle in nearby or adjacent habitats; however, due to the fact that nearby or adjacent habitats have fauna populations already established, the displaced individuals will probably have to compete for resources with current residents of these areas, which could lead to the temporary disappearance of displaced species inside the Project Area. Temporary competition for resources in demand is anticipated, because these tend to be limited; however the competition is expected only for common and abundant species which could recolonize habitats within the Project Area after construction activities end. In addition, the use of less favorable sheltering or foraging areas could lead to an exposure to predators, which could temporally reduce population sizes.

The revision of the existing literature suggests the presence of listed flora and fauna species within the Project Area and its vicinity. Listed species that were heard during site reconnaissance was the *Vireo latimeri* (Puerto Rican Vireo). It is classified as “Least Risk” and dependent of Conservation in the Commonwealth scope with no Federal designation. Even though any *Vireo latimeri* (Puerto Rican Vireo) that happens in the area would be temporary displaced during Project’s construction, it is highly probable that they would settle in nearby adjacent habitats and are expected to return once mitigation actions are completed.

Dendrocygna arborea (West Indian Whistling-Duck), which is classified as Critically Endangered in the Commonwealth scope, has been reported by the *Sociedad Ornitológica Puertorriqueña* (SOPI) in the vicinity of Parque Central, which lies just west of the Project Area. In order to avoid any impacts to this species, it is recommended to prepare and implement a management and conservation protocol that includes an educational component to the Project’s workers and the inspection of areas to be cleared for potential nest locations. It is also recommended that as many royal palm specimens (mature and saplings) as possible be salvaged and transplanted and later incorporated during the mitigation actions.

It is probable that the reptile species *Epicrates inornatus* (Puerto Rican Boa) could be present within the Project Area. Potential impacts to this species could be minimized by preparing and implementing a management and conservation protocol which should include an educational component to project workers, the inspection of heavy machinery before daily operations and areas to be cleared in addition to the relocation of located specimens.

The actual condition of the Project Area, its ecological attributes and biological integrity are extremely degraded due to extensive alterations and impacts to the natural landscape, its current uses (dense population encroaching upon the wetland, trash and debris disposal), and lack of adequate wastewater infrastructure.

In conclusion, the project operation is not expected to have significant adverse impacts on the wetland flora and fauna, as long as it includes the implementation of management, protection and mitigation measures, as well as those that might be suggested by the pertinent agencies in order to minimize possible impacts.

Immediate measures to minimize direct and indirect impacts to natural ecosystems should involve the implementation of soil stabilization techniques during construction, as well as other practical improvements to control erosion. This would help minimize sediment and polluted air flow to the environment in and near the Project Area. Soil stabilization techniques should be implemented before and after construction, particularly in areas susceptible to erosion and in wetland areas.

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6.0 SUPPORTING TECHNICAL EVALUATION

The following sections describe in detail the findings within the Project Channel and the CDRC staging area. Gentry Transect Survey results and results of the literature review were segregated. Additional findings include terrestrial flora and fauna documented within the transects, in their vicinity, or in other parts within the Project Area, and were recorded throughout the duration of the Study through a Visual Encounter Survey (VES) or by other means.

The methodology employed for this Study consisted of a preliminary screening of existing literature to identify the reported Federal and Commonwealth location of species listed as critical, threatened, vulnerable, endangered as well as the area's natural systems, followed by field reconnaissance and assessment. Most areas were walked and inspected in detail, with the exception of areas where the houses were right at the edge of the channel and limited the access, or in areas were personal security was at risk.

6.1 REVIEW OF EXISTING LITERATURE AND INTERVIEWS

Multiple sources of literature were consulted for the preparation of this Study: Regulation 6766 to rule the vulnerable and endangered species of the Commonwealth of Puerto Rico from the Department of Natural and Environmental Resources (DNER), the *Natural Heritage Office Maps* from the DNER, the *Endangered and Threatened Species List* of the U.S. Fish and Wildlife Service (USFWS); the *Critical Habitat Designations for Puerto Rico and the Virgin Islands*, from USFWS; the *Puerto Rico Critical Wildlife Areas* from the DNER, the *Environmental Sensitivity Index (ESI) Atlas* from the National Oceanic and Atmospheric Administration (NOAA); and the *Caribbean Endangered Species Map* from the USFWS. Additional references are listed in the Reference section of this Study report.

6.2 THREATENED AND ENDANGERED SPECIES

This section identifies Commonwealth or federally listed wildlife species that may be found within the vicinity Study Area at any time or period of time within the currently known distribution of the species. Since the best information available is scarce in many cases, the information provided is not based on the absolute distribution of any particular species and additional sightings of the species may occur. Due to the Study Area location, or that the Study Area or its vicinity represent a suitable habitat, these species have at least some potential of being present at times. Additional information, and in some cases, specialized surveys may be required to determine presence/absence of the listed species that were not sighted during the course of this Study and are not included on the Fauna Survey Inventory. According to the *Puerto Rico Critical Wildlife Areas (DNER)* and to the *Critical Habitat Designations for Puerto Rico and the U.S. Virgin Islands*, *(USFWS)* there are critical habitats for *A. palmata* and *A. cervicornis* within the Study Area (nearshore reefs), though none of these species are found in the CMP or the San José Lagoon. In addition, local residents were interviewed in order to obtain information relevant to this section.

6.2.1 Species of Special Concern

6.2.1.1 Federally Listed Species

The USFWS Caribbean Endangered Species Map (2012) provides the latest official reference for the identification of general locations (municipalities) where federally listed species may be found.[1] This publication presents the best information available to the Service, although it does not represent the absolute distribution of a particular species since additional sightings may occur. There are 19 federally listed species in the Study Area (Table 3).

Table 3
Federally Threatened and Endangered Listed Species in the Study Area

SCIENTIFIC NAME	COMMON NAME (ENGLISH / SPANISH)	GROUP	STATUS	GENERAL DISTRIBUTION
Banara vanderbiltii	No common name / Palo de Ramón	Plant	E	Karst and volcanic forests
Goetzea elegans	Beautiful goetzea	Plant	E	Karst forests
Schoepfia arenaria	No common name / Arana	Plant	T	Karst and coastal forests
Stahlia monosperma	No common name / Cóbana negra	Plant	T	Coastal forests
Chelonia mydas	Green sea turtle / Peje blanco	Reptile	T	Nearshore waters
Dermochelys coriacea	Leatherback sea turtle / Tinglar	Reptile	E	Ocean waters
Eretmochelys imbricata	Hawksbill sea turtle / Carey	Reptile	E	Nearshore waters
Epicrates inornatus	Puerto Rican boa / Boa puertorriqueña	Reptile	E	Forested hills
Trichechus m. manatus	Antillean manatee / Manatí	Mammal	E	Nearshore waters
Agelaius xanthomus	Yellow-shouldered black bird / Mariquita	Bird	E	Coastal forests
Sterna dougallii	Roseate tern / Palometa	Bird	T	Coastal waters
Calidris canutus	Red knot / Playero gordo	Bird	T	Tidal sands or mudflats
Acropora palmata	Elkhorn coral / Coral cuerno de alce	Coral	T	Nearshore waters
Acropora cervicornis	Staghorn coral / Coral cuerno de ciervo	Coral	T	Nearshore waters
Dendrogyra cylindrus	Pillar coral/Coral pilar	Coral	T	Nearshore waters
Mycetophyllia ferox	Rough cactus coral/Coral cactus áspero	Coral	T	Nearshore waters
Orbicella annularis	Lobed star coral/Coral estrella	Coral	T	Nearshore waters
Orbicella faveolata	Mountainous star coral/Coral Estrella laminar	Coral	T	Nearshore waters
Orbicella franksi	Knobby star coral/Coral Estrella masivo	Coral	T	Nearshore waters

Legend: E – Endangered; T – Threatened

Source: ERS, 2013; Rivera-Herrera, L.J., 2013 (personal communication); USFWS, 2012.

Federally Threatened and Endangered Flora

None of the four federally listed plant species identified for the Study Area are found within the Project Area. *Banara vanderbiltii* was originally reported in the early twentieth century in the

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[1] http://www.fws.gov/caribbean/es/PDF/Map.pdf

“mogotes” adjacent to the CMP. This species, however, has not been documented ever since in this vicinity, probably eliminated due to limestone and fill mining, and the consequent destruction of these “mogotes” during the mid-decades of that century. It is believed to no longer persist in this area (USFWS, 2014). Also in the early twentieth century, *Schoepfia arenaria* was first documented in the sandy coastal thickets north of the San José Lagoon, but it has not been recorded ever since in that area.

Although not included in the USFWS Caribbean Endangered Species Map (2011) for the Study Area, several *Stahlia monosperma* and Beautiful goetzea (*Goetzea elegans*) trees are found immediately west of the San José Lagoon. *S. monosperma* is a federally threatened listed species and *G. elegans* is a federally endangered listed species. These trees were planted with other species as part of a restoration project conducted by the SJBEP during the early 2000s, in an upland buffer strip between the mangrove fringing the lagoon and a local road adjoining Las Margaritas Public Housing Project, in the Cantera community.

Federally Threatened and Endangered Fauna

Of the four species of seaturtles known to inhabit Puerto Rican waters, three have been reported in the nearshore waters at the Study Area. All of these are found in marine habitats: *Chelonia mydas* inhabits and feeds on seagrass beds; *Eretmochelys imbricata* is found in coral reefs and other hard bottom communities; and *Dermochelys coriacea* is a pelagic species. *E. imbricata* has been sighted foraging in the rocky shores of Boca del Morro, at the outlet of San Juan Bay, as well as in the nearshore coral reefs within the Study Area. There are records of *D. coriacea* nesting in the sandy beaches that are also part of the Study Area (CSA Architects & Engineers, LLP, 2014; Environmental Resources Management (ERM), 2013; Glauco A. Rivera & Associates, 2011; CFMC, 2004).

Leatherback marine turtles approach the north shore of Puerto Rico during their nesting season (March–June) and may be present in offshore waters during this time, but basically spend the rest of their adult lives as a pelagic species in deep waters of the Atlantic Ocean. Juvenile green and hawksbill turtles may be found off the northern shore of Puerto Rico, associated with rafts of *Sargassum.* It is also highly improbable for sea turtles to use or be present in the CMP and the San José Lagoon given that it does not provide habitat conditions for nesting or their sustenance.

The Antillean manatee (*Trichechus manatus manatus*) has been documented in ocean waters within the Study Area. It has been observed in the San Juan Bay and the estuary portion of the Puerto Nuevo River. The Antillean Manatee ranges freely between marine and freshwater habitats. This species has specific habitat requirements that include adequate feeding areas, freshwater drinking sources and areas protected from surf and wind where they can rest. Manatees are herbivores that feed opportunistically on a wide variety of marine, estuarine, and freshwater plants, including submerged, floating, and emergent vegetation, including: cord grass, algae, turtle grass, shoal grass, manatee grass, eel grass, water hyacinth, water lettuce and other plant types, some of which are found within the Project Area. In addition, there are a number of freshwater sources, such as stormwater discharges and those from the Juan Méndez and San Antón creeks, that discharge into the San José Lagoon and that this species could use for drinking, although not suitable due to their poor quality. However, access is limited through the La Torrecilla Lagoon at the Boca de Cangrejos outlet; more so through the mid-section of the Suárez Canal where the Baldorioty De Castro's Bridge pilings severely restrict flow. There is no access for manatees into or through the Project Channel. As a result, it is extremely unlikely for manatees to be found in those sections of the Project Area where most of the proposed construction activities would take place within the Project Channel and the San José Lagoon.

No Puerto Rican boas (*Epicrates inornatus*) have been reported in the Project Area. Although suitable but limited habitat for this boa exists in the remaining haystack hills or "mogotes" found close to the Project Channel, these have been isolated for many years due to urban encroachment. The latest may have become a physical barrier that could have limited this species dispersal into other forested areas nearby, resulting in no reports of its presence in the mangroves fringing the channel.

The endemic yellow shouldered black bird (*Agelaius xanthomus*) occurs regularly, but only locally, along the southwestern coast of Puerto Rico and on Mona Island. It is decidedly uncommon elsewhere. The species is found primarily in mangroves and arid scrublands, foraging both in trees and on the ground, feeding on insects, seeds and nectar. The yellow shouldered black bird is critically endangered mostly due to nest parasitism, but also as a result of expansive habitat loss. Other threats include mongoose and rat predation (Raffaele et al., 1998). In the Study Area, it has been reported in Las Cucharillas Marsh and in the Piñones-Vacía Talega-Torrecillas complex; the latter has suitable, ample habitat for this species. *A. xanthomus* was documented at the western half of the CMP in the early 1980s, (Rivera Herrera, 1996). Habitat loss from severe urban encroachment, the improper disposal of household waste and predation by rats, could have deterred its presence in the Project Channel and the San José Lagoon, where no sightings have been reported.

The Federally listed threatened West Indies subspecies of the roseate tern is found in coastal areas, harbors and lagoons, nesting in a sand or coral scrape, or in a rock depression, usually in colonies on an offshore cay. The Virgin Islands and islets off southwestern Puerto Rico support the largest population of roseate tern in the tropical Atlantic (Raffaele et al., 1998). The subspecies has been documented in the Piñones-Vacía Talega-Torrecillas complex, at the eastern end of the Study Area. In the early 1980s, it was sighted with other terns, gulls and shorebirds on the mudflats that once existed in the western end of the CMP, at its outlet to the San Juan Bay (Rivera Herrera, 1996). This tern subspecies has not been reported in the Project Channel or the San José Lagoon. Poor water quality (i.e., low dissolved oxygen [DO]) and its detrimental effect over fish populations, low water transparency with difficult visibility, and thus, fish capture opportunities, present marginal to poor feeding habitat conditions for this species in these two water bodies.

The red knot (*Calidris canutus*) is a threatened species considered one of the longest distance migrants in the animal kingdom. Depends on horseshoe crabs' eggs for the energy it needs to make its twice-yearly trips between South America and the Canadian Arctic. Thus, as crab populations decline due to harvest by the fishing and biomedical industries, so do the red knot's. The bird is also threatened by habitat destruction and climate change. It is generally rare through the West Indies in September and October during its southbound migration. It apparently flies long distances between stops, many birds likely overflying the region. It is generally found in sandy tidal flats (Raffaele, H., et al., 1998). In the early 1980s, it was sighted with other shorebirds on the mudflats that once existed in the western end of the CMP, at its outlet to the San Juan Bay (Rivera Herrera, 1996). It has not been sighted since then in the Study Area. Its occurrence in the Project Area is unlikely due to the absence of proper habitat conditions to support its presence.

The elkhorn coral (*Acropora palmata*), the staghorn coral (*Acropora cervicornis*), the pillar coral (*Dendrogyra cylindrus*), the rough cactus coral (*Mycetophyllia ferox*), the lobed star coral (*Orbicella annularis*), the mountainous star coral (*Orbicella faveolata*) and the knobby star coral (*Orbicella franksi*) are seven federally threatened listed species found in nearshore waters within the northern limits of the Study Area, north of the SJBE. None, however, have been identified or found within the Project Area, since it does not present suitable conditions for their development. NOAA has identified a number of threats to coral ecosystems, some of the most serious of which are: impacts related to climate change (rising ocean temperatures, ocean acidification, and disease), ecological effects of fishing, and poor land-use practices.

Elkhorn coral was formerly the dominant species in shallow water reefs 3 to 16 feet deep throughout the Caribbean, forming extensive, densely aggregated thickets (stands) in areas of heavy surf. Coral colonies prefer exposed reef crest and fore reef environments in depths of less than 20 feet, although isolated corals may occur to depths of 65 feet. Over the last 10,000 years, this species has been one of the three most important Caribbean corals contributing to reef growth and development, providing essential fish habitat.[2] The staghorn coral is also another of the three most important Caribbean corals in terms of its contribution to reef growth and fish habitat found in reefs within the Study Area. This species occur in back reef and fore reef environments from 1 to 100 feet deep. The upper limit is defined by wave forces, and the lower limit is controlled by suspended sediments and light availability.[3] Critical habitat for these two species has been designated to include colonized bedrock and pavements, and linear, patch and scattered reef formations that may be found at the Boca del Morro outlet and along the coast within the northern limits of the Study Area. It also includes other coastal areas around the Island with suitable requirements for these to thrive (i.e., heavy surf, clear-low nutrient ocean-water salinity conditions) (USACE & USEPA, 2011).

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[2] http://www.nmfs.noaa.gov/pr/species/invertebrates/elkhorncoral.htm
[3] http://www.nmfs.noaa.gov/pr/species/invertebrates/staghorncoral.htm

The pillar coral has been reported in most reef environments, although in some regions it appears to be absent in nearshore hard bottoms, nearshore patch reefs, and backreef environments and more common on forereef spurand-groove habitats. It has been reported in water depths ranging from 6.6 to 82.0 feet. The rough cactus coral has been reported in shallow reef environments, in water depths ranging from 16.4 to 98.4 feet (Brainard, R.E., et al*.,* 2011).

Orbicella spp. are a common, often dominant component of Caribbean mesophotic reefs suggesting the potential for deep refugia (Smith et al., 2010 as cited in Brainard et al., 2011). The lobed star coral has historically been one of the primary reef framework builders of the western Atlantic and Caribbean, ranging in depths 3.3 to 98.4 feet, and has been considered a highly plastic species with multiple growth forms ranging from columnar, to massive, to platy. The mountainous star coral has been reported in most reef habitats, often the most abundant forereef coral. It is mostly found in nearshore waters between 32.8 and 65.6 feet deep, but also at those ranging from 1.6 to 131.2 feet. The knobby star coral occupies most reef environments, and has been reported from water depths ranging from 16.4 to 164.0 feet. It tends to have a deeper distribution than the other two species in the *Orbicella* complex (Brainard, R.E., et al*.,* 2011).

As a result, none of these species are found in the CMP or the San José Lagoon. Critical habitat, however, may be located at the Boca del Morro outlet and along colonized bedrock and pavements, and in linear, patch and scattered reef formations fringing the coast within the northern limits of the Study Area (USACE & USEPA, 2011).

6.2.1.2 Commonwealth Listed Species

The DNER has designated 39 species of special concern under the Regulation for Threatened and Endangered Species of the Commonwealth of Puerto Rico (Reg. 6766). These include 19 species listed by the USFWS, in addition to 9 other species that have been designated as threatened, endangered or critically endangered by the DNER. The remaining 11 species have been designated or classified under other categories (see Table 4).

Table 4
Species Reported in the Study Area That are Listed in the Regulation for Threatened and Endangered Species of the Commonwealth of Puerto Rico

SCIENTIFIC NAME	COMMON NAME (ENGLISH / SPANISH)	GROUP	STATUS	GENERAL DISTRIBUTION
Hippocampus spp.	Sea horses / Caballitos de mar	Fish	VU	Marine
Ammondramus savanarum	Grasshopper sparrow / Gorrión chicharra	Bird	DD	Savannas
Nomonix dominica	Masked duck / Pato dominico	Bird	EN	Ponds
Oxyura jamaicensis	Ruddy duck / Pato chorizo	Bird	VU	Coastal lagoons
Dendrocygna arborea	West Indian whistling duck / Chiriría antillana	Bird	CE	Coastal lagoons
Charadrius alexandrinus	Snowy plover / Playero blanco	Bird	CE	Sand, mud, salt flat
Anas bahamensis	White-cheeked pintail / Pato quijada colorada	Bird	VU	Coastal swamps
Icterus dominicensis	Black cowled oriole / Calandria	Bird	DD	Forested areas
Falco peregrinus	Peregrine falcon / Halcón peregrine	Bird	CE	Coast
Vireo latimeri	Puerto Rican vireo / Bienteveo	Bird	LR	Forested areas
Sterna a. antillarum	Least tern / Gaviota chica	Bird	DD	Coast
Patagioenas leucocephala	White-crowned pigeon / Paloma cabeciblanca	Bird	DD	Coastal forests
Fulica caribaea	Caribbean coot / Gallinazo antillano	Bird	VU	Swamp, marsh
Pelecanus occidentalis	Brown pelican / Pelícano pardo	Bird	EN	Coast
Trachemys s. stejnegeri	Puerto Rican slyder / Jicotea	Reptile	DD	Waterbodies
Uca sp.	Fiddler crab / Cangrejo violinsta	Crab	LR / DD	Mangroves
Goniopsis cruentata	Mangrove root crab / Cangrejo de mangle	Crab	LR	Mangroves
Aratus pisonii	Mangrove tree crab / Juey de mangle	Crab	DD	Mangroves
Cardisoma guanhumi	Common land crab / Juey común	Crab	LR	Coastal wetland
Ucides cordatus	Swamp ghost crab / Juey pelú	Crab	LR	Mangroves

DD – Data deficient; LR – Minor Risk; VU – Threatened; EN – Endangered; CE – Critically Endangered

Threatened and Endangered Flora

No Commonwealth threatened or endangered designated species of plants, other than those already listed by the Federal government, have been identified in the Study Area.

Threatened and Endangered Fauna

The two species of seahorses reported for Caribbean waters, although uncommon to rare, include the lined seahorse (*Hippocampus erectus*) and the longsnout seahorse (*Hippocamus reidi*) (Humman, 1994). Seahorses have been designated as a threatened species by the Commonwealth of Puerto Rico government. These use gorgonians branches, seagrass leaves as holdfasts, and occasionally can be seen floating free over seagrass, reefs, and in sargasum. Seahorse individuals have been reported in the Study Area, within the Condado Lagoon, where seagrasses and coral communities are present. These might also be found in nearby ocean waters north of SJBE where suitable habitat conditions exist. As such, it is improbable that seahorses inhabit the CMP and the San José Lagoon, since habitat requirements are not available.

The grasshopper sparrow (*Ammondramus savanarum*) is a secretive, small bird and year-round resident, not designated as threatened or endangered due to lack of data on its population status. It has been documented at the eastern and western ends of the Study Area, in Las Cucharillas Marsh and the Piñones-Vacía Talega-Torrecillas complex, respectively, where suitable habitat such as marshes and pastures with tall grasses abound (Raffaele et al., 1998). With the exception of a small and limited weedy field adjoining the southeastern, landward side of the San José Lagoon, between the mangroves and an adjoining state road (Road PR #8) this type of habitat is not found in the Project Area. As a result, it is unlikely to found grasshopper sparrows in the Project Area. There is no record for this species in the Project Area.

The masked duck (*Nomonix dominica*), designated as an endangered species by the Commonwealth's government, has been documented in the Study Area, but only in the Piñones-Vacía Talega-Torrecillas complex (Rivera Herrera, 1996). It is a rare native species that frequents thick, aquatic vegetation in fresh water swamps and canals (Raffaele et al., 1998). These same habitat characteristics are found in the southern and eastern sections of the Piñones-Vacía Talega-Torrecillas complex, where seasonal ponds and drainage canals exist (SJBEP, 2000). The outlets of the Juan Méndez and San Antón creeks flowing into the San José Lagoon tend to accumulate floating vegetation, although these covered a relatively small surface area. Besides being estuarine or brackish in nature, this portion is also more of an open water habitat. The lack of a historical single record and proper habitat characteristics could explain the absence of the masked duck in the Project Area.

The ruddy duck (*Oxyura jamaicensis*), listed as a threatened species by the Commonwealth's government, has been reported in a man-made fresh water lagoon at Las Cucharillas Marsh, within the Study Area (Rivera-Herrera, 1996). Native to Puerto Rico, it is a diving duck, found predominantly in deep, open freshwater bodies but also in brackish lagoons (Raffaele et al., 1998). Even though the San José Lagoon presents, at the least, marginal habitat requirements for this species, its low water quality and overall poor natural condition may have precluded the ruddy duck from the Project Area. There is no record for this species in the Project Area.

Native to Puerto Rico, the West Indian whistling duck (*Dendrocygna arborea*) is a rare and local species, listed as critically endangered by the Commonwealth's government. Its decline appears primarily due to habitat destruction, hunting, and to a lesser extent, introduced predators. Flocks are observed most regularly in early evening flying form mangroves or freshwater swamps where they roost during the day to nocturnal feeding grounds which include stands of the royal palm (*Roystonea borinquena*) and agricultural fields. Besides mangroves, its habitat includes wooded swamps, lagoons and uplands (Raffaele et al., 1998). The West Indian whistling duck has been reported in Las Cucharillas Marsh and the Piñones-Vacía Talega-Torrecillas complex, where a matrix of mangroves, lagoons, swamps (*Pterocarpus offinalis*), fresh water ponds, marshes and grasslands of considerable size and in close connection can still be found (SJBEP, 2000; Rivera Herrera, 1996). The overall degradation of forested wetlands in the Project Area due to urban encroachment and improper household waste disposal, in addition to the resulting fragmentation of the natural landscape and high numbers of introduced predators (i.e., rats and cats), may have been enough of a cause for the absence of a single record for the West Indian whistling duck in this area, even though there seems to be at least marginal habitat characteristics to sustain its presence.

The snowy plover (*Charadrius alexandrinus*) has been listed as critically endangered by the Commonwealth's government. In the Study Area, it was found in the early 1980s at the western end of the CMP, in the mudflats that once existed at the channel's outlet to the San Juan Bay (SJBEP, 2000; Rivera Herrera, 1996). It inhabits, primarily, beaches and lagoon borders with extensive salt flats. None of these habitat requirements are found in the Project Channel and the San José Lagoon, possibly explaining the reason why no snowy plovers have ever been recorded to this date (Raffaele et al*.,* 1998).

The Commonwealth's government has classified the white-cheeked pintail (*Anas bahamensis*) as a threatened listed species. In the Study Area, it is found in Las Cucharillas Marsh and the Piñones-Vacía Talega-Torrecillas complex. In the early 1980s, it was reported at the western half of the CMP (Rivera Herrera, 1996). Locally uncommon in the Island, it is a surface feeder, primarily on fresh water, but also salt ponds (Raffaele et al*.,* 1998). Low water quality, depth and overall poor natural condition may have deterred its presence in the Project Channel and the San José Lagoon, from which there are no records of its presence.

The black cowled oriole (*Icterus dominicensis*) has been reported at the Study Area, in the western half of the CMP and the Piñones-Vacía Talega-Torrecillas complex, but not in Project Channel and the San José Lagoon (Rivera Herrera, 1996). This endemic species is found in forests, forest edges, woodlands and gardens from the coast to mid-elevations in the mountains, particularly where palms are available for nest sites. It feeds on fruits, insects, flowers and nectar, often on the undersides of palm fronds (Raffaele et al., 1998). The black cowled oriole has been heavily affected by bird parasitism and may be in decline. As such, the Commonwealth government has designated it as a species of concern until data deficiencies on its population status are addressed.

The peregrine falcon (*Falco peregrinus*) was de-listed from Federal regulations on October, 2006 due to its population recovery (71 *Federal Register* [FR] 60563). However, it is still classified as critically endangered by the Commonwealth of Puerto Rico's government. This species is decidedly uncommon to rare, and a local non-breeding winter resident throughout the West Indies primarily from October to April. Peregrine falcons are found in offshore cays and rocks, wetlands, and sometimes inland, including high buildings and church steeples, hunting for seabirds, shorebirds, waterfowl and rock doves (*Columba livia*), among other birds these can prey, accordingly (Raffaele et al., 1998). It has been recorded in Las Cucharillas Marsh, the Piñones-Vacía Talega-Torrecillas complex and flying over the CMP and the San José Lagoon (INCICO & Expediciones Península, 2011; Rivera Herrera, 1996).

The Puerto Rican vireo (*Vireo latimeri*) has been observed in the Study Area in Las Cucharillas Marsh, in the mangroves of the Piñones-Vacía Talega-Torrecillas complex where it is common, and in the western half of the CMP. It has also been documented in the Project Channel as part of the fauna field studies conducted for this Draft EIS (Atkins, 2011c; Rivera Herrera, 1996). This endemic species is found in forests of all types and at all elevations, including mangroves, dry coastal scrub, moist limestone hills and wet mountain forests, including shade coffee plantations. It avoids open areas. It is most common in the haystack hills of the north coast and in the more heavily forested valleys among the hills of the south coast of the Island. Puerto Rican vireos forages at all levels, but more frequently near the ground. It feeds primarily on insects, but eats some plant matter (Raffaele et al., 1998). As such, habitat in the Project Channel and the San José Lagoon is of poor to marginal conditions due to overall environmental degradation (e.g., improper household waste disposal, high numbers of introduced predators such as rats and cats, etc.), may be limiting the presence of the species in this area. The Puerto Rican vireo has been listed as a low risk species by the Commonwealth's government.

The least tern's (*Sterna a. antillarum*) habitat includes coastal areas, harbors and lagoons. It is a generally common, but local breeding resident in the Greater Antilles and in some of the Lesser Antilles, where it is otherwise uncommon. It is widespread and local in North America. The least tern race inhabiting the West Indies also breeds on both coasts of the United States where some local populations are considered endangered. While human disturbance and introduced predators have doubtless impacted the West Indian population, the limited information available on the bird's status in the Caribbean does not warrant this tern being classified as threatened (Raffaele et al., 1998). Accordingly, the Commonwealth's government has designated the least tern as a species of concern until data deficiencies on its population status are addressed.

In the Study Area, the least tern has been observed in the San Juan Bay, the Piñones-Vacía Talega-Torrecillas complex, and the western half of the CMP. In has also been observed flying over the San José Lagoon (INCICO & Expediciones Península, 2011; Rivera Herrera, 1996). Poor water quality (i.e., low DO) and its detrimental effect over fish populations, low water transparency, which makes visibility difficult, and thus fish capture opportunities, present marginal to poor feeding habitat conditions for this species in the Project Channel and the San José Lagoon.

The white-crowned pigeon (*Patagioenas leucocephala*) is a highly gregarious, arboreal species typically occurring in flocks, primarily on coastal woodlands and mangroves when breeding, but also well inland into the mountains as they follow available food resources in the non-breeding season. It is a locally common resident remaining year-round in Puerto Rico. Formerly abundant through most of its range, this species has declined dramatically due to habitat loss, severe over-hunting, harvesting of nestlings for food and introduced predators (Raffaele et al., 1998). The Commonwealth of Puerto Rico has designated the white-crowned pigeon as a species of concern until data deficiencies related to its population status are addressed. In the Study Area, the species has been reported in the Piñones-Vacía Talega-Torrecillas complex, as well as in the San José Lagoon (INCICO & Expediciones Península, 2011; Rivera Herrera, 1996). Urban encroachment and overall habitat degradation could be significant factors that have discouraged or limited its presence in the Project Channel and the San José Lagoon.

The Caribbean coot (*Fulica caribaea*) is an uncommon and local year-round resident in Puerto Rico, primarily found in open freshwater bodies where it dives proficiently. This species has apparently diminished greatly throughout the West Indies because of hunting, habitat degradation and due to introduced predators (Raffaele et al., 1998). The Commonwealth's government, as a result, has designated the Caribbean coot as threatened. In the Study Area, this species has been located in Las Cucharillas Marsh, the Piñones-Vacía Talega-Torrecillas complex, and the San José Lagoon (INCICO & Expediciones Península, 2011; Rivera Herrera, 1996). Less than marginal habitat conditions in the San José Lagoon, to even poorer in the CMP due to low water quality and overall natural degradation could presently be discouraging or severely limiting Caribbean coots in these two water bodies.

The brown pelican (*Pelecanus occidentalis)* is a common year-round resident or native species in Puerto Rico and seen throughout the Study Area (Rivera Herrera, 1996). In the Island, it is found in bays, lagoons, other protected coastal areas and calm ocean waters, and sometimes inland in freshwater reservoirs. The brown pelican makes spectacular aerial dives for fish, its entire body sometimes disappearing beneath the surface momentarily. Fish are snared in its bill, the water drained, and the fish then swallowed whole (Raffaele et al., 1998). In the Study Area, it is mostly seen flying across or roosting in the top branches of mangroves and other trees fringing the shores of the SJBE waterbodies, or flying close to the shore over ocean and coastal waters, north, within the Study Area. The CMP and the San José Lagoon offer suboptimal roosting characteristics for the brown pelican due to urban encroachment and it only provides very marginal feeding habitat conditions. Poor water quality (i.e., low DO) limits fish populations and low water transparency severely hampers visibility, and thus, fish capture opportunities. As a result, the Project Channel and the San José Lagoon present marginal to poor feeding habitat conditions for this species. The brown pelican was delisted from the Federal regulations on November 2009, due to its population recovery (74 FR 59444 59472). The Commonwealth's government has listed it as endangered.

Besides avifauna populations, herpetofauna is also present in the Study Area, although not as common in the Project Area. Particularly, the Puerto Rican slyder (*Trachemys s. stejnegeri*) is found in fresh (i.e., rivers, streams, creeks, ponds and drainage channels) and brackish (i.e., lagoons) waterbodies all around the coast, mostly at low elevations, although some populations have also been reported in the Island's interior. The species, however, is restricted to those waterbodies with abundant aquatic plants and soft soils in their banks. With the possible exception of the San Juan Bay, the Puerto Rican slyder can be sighted in the rest of the Study Area, where it is quite common, including the CMP and the San José Lagoon.

This fresh water turtle has been affected by loss or degradation of habitat and the predation of its eggs by the introduced mongoose (*Herpestes javanicus*). Other introduced predators that may be affecting the Puerto Rican slyder include the spectacled caiman (*Caiman cocodrilus*) (León, A. and R.L. Joglar, 2005). The Commonwealth's government has designated the Puerto Rican slyder as a listed species, although lack of data limits a determination on the status of its population. The main reason for concern is habitat competition and possible hybridization with the Red-eared slyder (*Trachemys scripta elegans*) an exotic, fresh water turtle introduced as a pet that has been successfully established in the Island.

Very few sites in the Project Area, especially within the CMP, display the faunal communities typically associated with mangrove wetlands due to the huge amount of fill material, scrap and trash deposited. Virtually absent are the fiddler crabs of the genus *Uca*, the mangrove crabs of the genus *Goniopsis*, *Aratus* and *Ucides*, and the land crab of the genera *Cardisoma*. This condition, although much less severe, is still apparent in the San José Lagoon. Mangrove forests and other vegetated areas are more extensive in this lagoon when compared to that of the Project Channel, providing more fauna habitat and refuge from the encroaching urban landscape. However, low water quality is still pervasive. Although classified as low risk by the Commonwealth government, and thus, not listed as threatened or endangered, it is worth noticing that these crab species are food staples for egrets, herons and other wetland dwellers, contributing to the overall food web, and as a result, are an essential component of the mangrove forest ecosystem.

6.2.2 Critical Elements

Ceiba pentandra, Coccoloba rugosa, Guaiacum officinale and *Psychotria ligustrifolia* are four species of plants identified as critical elements (e.g., of special concern) by the DNER. These are found immediately adjacent or within the Project Area. *C. pentandra, C. rugosa* and *G. officinale* are planted immediately west of the San José Lagoon, in uplands between the mangroves fringing the lagoon and a local road adjoining Las Margaritas Public Housing Project, in the Cantera community, where the SJBEP conducted a restoration project during the early 2000s. Individuals of *C. rugosa* and *P. ligustrifolia* have been found in uplands at the Guachinanga islet (Instituto de Ciencias para la Conservación de Puerto Rico (INCICO) and Corporación Proyecto Península de Cantera, 2009). The latest is a limestone outcrop surfacing the San José Lagoon, close to its western shore and next to the CMP's eastern outlet.

C. pentandra is a tree native to tropical America. In Puerto Rico, it is more abundant in the dry south, generally found in forests on hillsides and river banks, at lower elevations. *C. rugosa* is an endemic, small tree, local and uncommon in moist coastal and lower Cordillera forests, including the karst region. *G. officinale* is a tree native to tropical America. In Puerto Rico, is normally found in woodlands, thickets, on plains and hillsides, at lower elevations, in the dry southern and southwestern region of Puerto Rico. *P. ligustrifolia* is found in the Greater Antilles, Florida, the Bahamas and Bermuda. In Puerto Rico, it grows in thickets and hillsides at lower to middle elevations, in moist parts of the northern and western regions (Liogier, H.A., and L.F. Martorell, 2000).

Table 5
Species Identified as Critical Elements by the DNER that are Found in the Study Area

Scientific Name	Common Name (English / Spanish)	Group	General Distribution
Ceiba pentandra	Silk-cotton tree / Ceiba	Plant	Forest, riverbanks
Coccoloba rugosa	Tree / Ortegón	Plant	Karst, coastal forests
Guaiacum officinale	Lignum vitae / Guayacán	Plant	Forest, thickets
Psychotria ligustrifolia	Bahama wild coffee /	Plant	Hillsides, thickets

6.3 SITE RECONNAISSANCE AND ASSESSMENT

Field reconnaissance and assessment efforts for this Study started on February 1, 2011, when biologists Walter E. Soler-Figueroa, from Ambienta, Inc., and Jaime Pabón from Atkins Caribe, in addition to other scientists and technicians from both firms, visited the Project Area in order to ascertain the natural characteristics, wildlife and working conditions, and establish task management procedures. Different locations were visited to acquire a perspective of the entire Project Area and the CDRC staging area to verify the different vegetation communities present at possible transect sites, and confirm available accesses to the area.

This procedure utilized for the Biological Characterization of the CMP includes an inventory of flora and fauna based on species richness of the Project Area. The main emphasis was the presence or absence of sensitive species or those that are listed in the federal and commonwealth scopes. Different approaches were used during data collection to allow inclusion of as many of the species present as possible. Species identification was primarily carried out through field recognition around the Project Area.

In order to characterize habitat composition and density, a modified *Gentry 0.1 ha sampling methodology* was implemented. In this methodology, the basic sampling unit is a census of trees, palms and woody plants with a height ≥2 meters within a linear transect of 50 meters in length and 2 meters in width. Twelve 50-meter-long by 2-meter-wide modified Gentry transects were distributed randomly in the Project Channel. A 50-meter tape marked the middle of the long axis of each transect; individual trees, palms and woody plants with a height ≥2 meters within a linear transect of 50 meters were identified and measured for DBH (diameter at breast height) and height, if they lay within 1m of either side of the tape (subject to the rules discussed below). Geographic coordinates were also obtained with a hand-held GPS at the beginning, and at the end of 50-meter transect. In addition, weather conditions were recorded at the beginning of each transect. Figure 13 includes the Gentry transect locations over the aerial photograph.

All woody growth forms—trees, shrubs, lianas and hemiepiphytes—were included in the census. Inclusion criteria differed according to its growth habit. Trees and shrubs were counted if the center of the base of the trunk lay within 1 meter of either side of the tape and with a height >2 meters. DBH was defined at 1.3 meters from the base of the trunk—not necessarily above the ground, at the higher elevation or up in the slope; thus, live, rooted trees pressed flat to the ground (e.g., by branch falls) are also included if their trunks were of sufficient thickness at 1.3 meters from the base. For hemiepiphytes, a plant was included if any part of the aerial root (in the case of primary hemiepiphytes, such as *Clusia* sp. or *Ficus* sp.) or rhizome (for secondary hemiepiphytes, such as most *Araceae*) was within the horizontal boundaries of the line. Lianas were counted if one or more of their roots entered the soil anywhere within the horizontal limits of the line (i.e., within 1 meter either side of the midline). Stems were tallied as separate individuals if they were not obviously connected above the ground. This undoubtedly overestimates the number of individuals within transects, but avoids counting as "individuals" instances where multiple above-ground divisions of a single trunk were found Basal area can be calculated for a given individual by adding the basal areas of its constituent stems. Terrestrial flora and fauna sighted within transects and their vicinity was also recorded.

Figure 13. Gentry Transect Locations Within the Project Channel

Field work for the fauna species inventory included the combination of several techniques. The most widely used was the Visual Encounter Survey (VES), as described by Heyer et al. (1994). For a VES, field personnel walk through an area or habitat for a prescribed time period systematically searching for animals. For this particular Study, three VES sampling designs were used: the randomized-walk design, the quadrant design and the transect design. A VES is a useful method to help determine the species richness of an area and to compile a species list, among others, but not for determining population densities for specific species. In addition, secretive, fossorial (burrowing), canopy-dwelling, and deep-water species are more difficult to inventory and require specialized searching methods. Search methods were standardized among fieldworkers to reduce bias in the results. During the performed VES, all possible microhabitats were searched at an intermediate intensity in order to prevent habitat disturbance. The searches covered the ground, water, tree trunks, stems, upper and lower surfaces of leaves, over and under leaf litter and under rocks and logs. The VES was validated by repeated sampling of the same areas.

To identify birds, morning and evening census were carried out using both linear transects and point-count methodologies, whereby the name of each species observed and/or heard during a fixed time period for each transect is written down, as described by Wunderle (1994). For amphibian and reptile searches, care was taken in combing through potential or appropriate habitats, such as under tree trunks, dry and fallen leaves, in and around rocks, on the soil and in humid or wetland areas, as described by Rivero and Brunner (1998) and Heyer et al. (1994). Field work started as early as 7:00 AM until 5:00 PM. Due to security concerns and escort logistics, dawn, dusk and nighttime fauna surveys were not performed.

6.4 GENTRY TRANSECT SURVEY

Twelve 50-meter-long by 2-meter-wide (100 m^2) modified Gentry transects were distributed randomly in the Project Channel. Although, some considerations were taken for the actual locations, such as 1) alignment: transects were established parallel to CMP bank, and as close to the water as possible without going in to it; 2) habitat type: transects were established within wetland areas to evaluate the same vegetative community; and 3) security: transects were established were it was viable depending of the amount of solid waste within the wetland, or where personal security concerns were not an issue. Based on these considerations, the results for this Gentry Survey represent or characterize the vegetative community found immediately adjacent to CMP channel banks.

The overall results of the Gentry Transect Survey were as follows: within 616 flora individuals and 15 species identified among eleven families, thirteen are tree species and two are palm species. To see the complete census information, refer to the Gentry Transect Survey Census List in Appendix B, which includes the diameter at breast height (DBH) in centimeters, its estimated height in meters, and its basal area in square meters (m^2) calculated by the formula: [(DBH^2) (0.00007854)] for each individual basal area is considered to be absolute dominance.

In Appendix C, the Species Ranking and Forest Community Composition Values includes the scientific name of the species, abundance, absolute abundance, relative abundance (%), density (individuals/ha), relative density (%), absolute frequency, frequency, relative frequency (%), absolute dominance (m^2), dominance (m^2/ha), relative dominance (%), importance value, as well as the numbers of the transects in which each species is present (Transect #).

The following sections summarize the Survey Results according to abundance and density, frequency, dominance, and importance value as they appear in Galeano (1998). The Gentry Transect Survey Summary Tables (tables 6, 7, and 8), shows all the species that were included in the Gentry Transect Survey, their common names in Spanish and their taxonomical family, among other information.

Tree or vine species that were present within the Project Area but did not meet the criteria of size and proximity to the transect, among other factors, were not included in the *Gentry Transect Survey*. These species were included in the Terrestrial Flora Inventory Survey List (Appendix D).

6.4.1 Gentry Transect Survey Summary: Abundance and Density

The most abundant species identified throughout the Project Area with an abundance of 616 which translates to a density (D.) of 2,475 individuals per hectare and with a relative abundance (R.A.) of 47.98%, was *Laguncularia racemosa* (white mangrove) followed by *Avicennia germinans* (black mangrove) (133 individuals, thus D. = 1,108.33 individuals per hectare, and R.A. = 21.49%), *Thespesia populnea* (portia tree) (80 individuals, thus D. = 666.667 individuals per hectare, and R.A. = 13.41%), *Rhizophora mangle* (red mangrove) (55 individuals, thus D. = 458.33 individuals per hectare, and R.A. = 8.85%), *Calophyllum antillanum* (antilles calophylum) (14 individuals, thus D. = 116.67 individuals per hectare, and R.A. = 2.27%) and *Roystonea borinquena* (royal palm) (11 individuals, thus D. = 91.67 individuals per hectare, and R.A. = 2.26%).

Table 6 shows the number of individuals counted overall, or abundance; the absolute abundance, or total number of stems of a species present per transect and the relative abundance or total number of stems of a species present per transect divided by the total number of stems inventoried on all transects expressed as a percentage, or multiplied by 100. It also includes the density, or amount of individuals of a certain species divided by the total area of the transects and given as individuals per hectare, and the relative density, or density of a single species divided by the sum of all species densities and multiplied by 100.

Table 6
Gentry Transect Survey Summary Table: Abundance and Density

Scientific Name	**Common Name**	**Abundance**	**Absolute Abundance**	**Relative Abundance (%)**	**Density (indiv./ hectare)**	**Relative Density (%)**
Bucida buceras	oxhorn bucida	1	1	0.16	8.33	0.1623
Coccos. nucifera	coconut palm	1	1	0.16	8.33	0.1623
Piper aduncum	matico tree	1	1	0.16	8.33	0.1623
Albizia lebbeck	albizia tree	2	2	0.32	16.67	0.3247
Delonix regia	flamboyant	2	2	0.32	16.67	0.3247
Melicoccus bijugatus	spanish lime	3	3	0.48	25.00	0.487
Peltophorum pterocarpum	golden flamboyant	4	4	0.65	33.33	0.6493
Pithecellobium dulce	monkeypod	4	4	0.65	33.33	0.6493
Terminalia catappa	Indian almond	8	8	1.29	66.67	1.2988
Roystonea borinquena	royal palm	11	11	1.78	91.67	1.7857
Calophyllum antillanum	antilles calophylum	14	14	2.26	116.67	2.2728
Rhizophora mangle	red mangrove	55	55	8.85	458.33	8.9285
Thespesia populnea	portia tree	80	83	13.41	666.67	12.9871
Avicennia germinans	black mangrove	133	133	21.49	1,108.33	21.5908
Laguncularia racemosa	white mangrove	297	297	47.98	2,475.00	48.2143
	Total:	**616**	**619**	**100**	**5,133.33**	**100**

6.4.2 Gentry Transect Survey Summary: Frequency and Dominance

The species present in the greatest number of transects or with the highest Frequency (F.) of 100%, the highest absolute frequency (A.F.) of twelve and the highest Relative Frequency (R.F.) of 21.05% were *Laguncularia racemosa* (white mangrove) followed by *Avicennia germinans* (black mangrove), *Rhizophora mangle* (red mangrove) and *Thespesia populnea* (portia tree) (F. = 66.6%, A.F. = 8, R.F. = 14.03%), *Roystonea borinquena* (royal palm) (F. = 33.33%, A.F. = 4, R.F. = 7.024%) and *Terminalia catappa* (Indian almond) (F. = 25%, A.F. = 3, R.F. = 5.26. The absolute frequency is the total number of transects in which a single species is present; the frequency is the absolute frequency of a single species divided by the total number of transects inventoried and multiplied by 100; and the relative frequency is the absolute frequency of a single species divided by the sum of all species' absolute frequencies and multiplied by 100.

Because of its basal area, the species with the highest absolute dominance (A.D.) of 7.94 square meters (m^2), which translates to a Dominance (Do.) of 66.18 square meters per hectare (m^2/ha), and a relative dominance (R.D.) of 56.13% was once again *Laguncularia racemosa* (white mangrove), followed by *Avicennia germinans* (black mangrove) (A.D. = 3.29 m^2, Do. = 27.44 m^2/ha, and R.D. = 23.27%), *Thespesia populnea (portia tree)* (A.D. = 1 m^2, Do. = 8.33 m^2/ha, and R.D. = 7.07%) *Terminalia catappa* (Indian almond) (A.D. = 0.71 m^2, Do. = 5.90 m^2/ha, and R.D. = 5%), *Roystonea borinquena* (royal palm) (A.D. = 0.5419 m^2, Do. = 4.52 m^2/ha, and R.D. = 3.83%) and *Rhizophora mangle* (red mangrove) A.D. = 0.3839 m^2, Do. = 3.2 m^2/ha, and R.D. = 2.7%). Absolute dominance is the sum of the basal areas of all individuals of a single species expressed in square meters; dominance is the absolute dominance of a single species divided by the total area of the inventoried transects expressed in square meters per hectare; and relative dominance is the absolute dominance of a single species divided by the sum of the absolute dominances of all the species inventoried and multiplied by 100. Table 7, shows information related to frequency and dominance.

6.4.3 Gentry Transect Survey Summary: Importance Value

Since Curtis and McIntosh formulated in 1951 the concept of Importance Value (I.V.), it has been used extensively as a mean of assessing the biological contribution of arborescent species to the forest community (Skeen, 1973). The species with the highest importance value (I.V.) of 125.93 is *Laguncularia racemosa* (white mangrove), followed by *Avicennia germinans* (black mangrove) (I.V. = 58.89), *Thespesia populnea (portia tree)* (I.V. = 34.08), *Rhizophora mangle* (red mangrove) (I.V. = 25.67), *Roystonea borinquena* (royal palm) (I.V. = 12.64), *Terminalia catappa* (Indian almond) (I.V. = 11.56) and *Calophyllum antillanum* (antilles calophylum) (I.V. = 5.85). The importance value for each species is the sum of the species relative density, relative frequency and relative dominance in the community in a scale from 0 to 300. The larger the importance value of a species, the more dominant that species is in that particular community. Table 8 shows all the species found in the Gentry Transect Study in order of descending importance value, as well as the species' relative density, relative frequency and relative dominance.

Table 7
Gentry Transect Survey Summary Table: Frequency and Dominance

Scientific Name	Common Name	Frequency	Absolute Frequency	Absolute Dominance (basal area in m²)	Dominance (m²/ha)	Relative Dominance (%)
Bucida buceras	oxhorn bucida	8.33	1	0.0003	0.0025	0.0021
Coccos nucifera	coconut palm	8.33	1	0.0001	0.0008	0.0007
Piper aduncum	matico tree	8.33	1	0.0002	0.0017	0.0014
Albizia lebbeck	albizia tree	8.33	1	0.0113	0.0942	0.0799
Delonix regia	flamboyant	16.66	2	0.1594	1.3283	1.1265
Melicoccus bijugatus	spanish lime	16.66	2	0.0039	0.0325	0.0002
Peltophorum pterocarpum	golden flamboyant	16.66	2	0.0899	0.7491	0.6353
Pithecellobium dulce	monkeypod	16.66	2	0.0049	0.0408	0.0346
Terminalia catappa	Indian almond	25.00	3	0.7083	5.9025	5.0056
Roystonea borinquena	royal palm	33.33	4	0.5419	4.5158	3.8297
Calophyllum antillanum	antilles calophylum	16.66	2	0.0097	0.0808	0.0686
Rhizophora mangle	red mangrove	66.66	8	0.3839	3.1992	2.7137
Thespesia populnea	portia tree	66.66	8	1	8.3333	7.0671
Avicennia germinans	black mangrove	66.66	8	3.2925	27.4375	23.2685
Laguncularia racemosa	white mangrove	100.00	12	7.9417	66.1808	56.125

6.5 TERRESTRIAL FLORA INVENTORY SURVEY RESULTS

The Terrestrial Flora Inventory Survey Results include a list of the vascular plants found in the Project Area, the species identified in the Gentry Transect Survey, and the ones observed during the field reconnaissance. The Study's overall results were as follows: 152 species of vascular plants were identified among 61 families. Appendix D shows the Terrestrial Flora Inventory Survey List. The listed information for each species includes its scientific name, its Spanish common name, its botanical family and its actual status in Puerto Rico (e.g., Native, Introduced, or Endemic). Of the 152 plant species present, 68, or 44.74%, have been introduced in Puerto Rico while 84 species, or 55.26%, are native to the island. There were no Commonwealth or federally listed terrestrial flora species found within the Project Area.

Table 8
Gentry Transect Survey Summary Table: Importance Value

Scientific Name	Common Name	# of trees	Relative Density (%)	Relative Dominance (%)	Importance Value
Bucida buceras	oxhorn bucida	1	0.1623	0.0021	1.913
Coccos nucifera	coconut palm	1	0.1623	0.0007	1.9137
Piper aduncum	matico tree	1	0.1623	0.0014	1.9144
Albizia lebbeck	albizia tree	2	0.3247	0.0799	2.1546
Melicoccus bijugatus	spanish lime	3	0.487	0.0002	3.9972
Peltophorum pterocarpum	golden flamboyant	4	0.6493	0.6353	4.1939
Pithecellobium dulce	monkey pod	4	0.6493	0.0346	4.7946
Delonix regia	flamboyant	2	0.3247	1.1265	4.9612
Calophyllum antillanum	antilles calophylum	14	2.2728	0.0686	5.8514
Terminalia catappa	Indian almond	8	1.2988	5.0056	11.5644
Roystonea borinquena	royal palm	11	1.7857	3.8297	12.6354
Rhizophora mangle	red mangrove	55	8.9285	2.7137	25.6722
Thespesia populnea	portia tree	80	12.9871	7.0671	34.0842
Avicennia germinans	black mangrove	133	21.5908	23.2685	58.8893
Laguncularia racemosa	white mangrove	297	48.2143	56.125	125.3893

6.5.1 Results

The VES was used for the fauna species inventory. Fauna species that could not be identified in the field were photographed for later identification or, when applicable, their calls recorded. No fauna species were collected for identification purposes. The identified fauna species list was later analyzed using relevant taxonomical literature (see References) and corroborated by consensus of several consulted specialists. A total of 127 fauna species were identified among 59 families. Of these, 91 are birds species classified within nineteen families; six are amphibian species classified within three families; nine are reptilian species classified within five families, and three are mammal species classified within three families. Appendix D shows the fauna inventory list.

One species not observed during the survey, but reported by residents and documented during other field work, is the *Caiman crocodilus* (common Caiman). This is an adaptable omni-carnivore whose diet includes a variety of aquatic invertebrates and vertebrates, including terrestrial insects. This medium-sized, exotic crocodilian, that reaches a total length of up to 6 feet, can occupy almost any body of water, natural or man-made. Its snout is not as broad and round as in *Alligator mississippiensis* (American alligator), it has a unique bony ridge in front of and between the eyes, has a dorsal coloration that ranges from greenish, brownish, or yellowish gray with darker crossbands. *Caiman crocodilus* (common Caiman) is indigenous to southern Mexico, Central America, and northern South America, including Trinidad and Tobago, as far south as northern Argentina, with occasional vagrants showing up at Grenadines and the Lesser Antilles. Females lay hard-shelled eggs in terrestrial mounds constructed of surrounding vegetation. The nests may be guarded by the mother, opened by either parent to assist neonates during hatching, and additional parental care extended toward the young for several months afterwards (USGS, 2011).

6.6 HABITAT CHARACTERIZATION RESULTS

Based on site reconnaissance and the performed vegetation assessment in combination with aerial photography interpretation, four major types of habitats where identified within the Project Area. These habitats are: swamps (forested wetlands/mangroves), marshes (emergent wetlands), open water (CMP channel), and transitional secondary forest. In addition, managed green areas (mostly passive recreational urban parks) were included and characterized since to some extent they provide habitat for wildlife species. Based on the Cowardin classification (Cowardin et al. 1979), the forested wetlands could be classified as estuarine and palustrine and the emergent wetlands as palustrine. Figure 12 includes the habitat characterization within the Project Channel. The palustrine system includes all non-tidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean derived salts is below 0.5 part per thousand (ppt). The estuarine wetlands are tidal habitats that are usually semi-enclosed by land but have open, partly obstructed or sporadic access to the ocean with ocean-derived water occasionally diluted by inland freshwater runoff. Based on the measurements performed with GPS and GIS analysis, the total area of jurisdictional wetlands and U.S. Waters within and adjacent to the Project Channel and CDRC staging area is 45.86 acres. Of those 45.86 acres, 20.53 acres are estuarine forested, 17.87 acres are palustrine forested/emergent, 7.40 acres are estuarine open water, and 0.06 acre are palustrine emergent.

Estuarine and palustrine forested wetlands share the same vegetation composition, but with some differences in their structure. Dominant species found within the forested wetlands are: *Laguncularia racemosa* (white mangrove), *Avicennia germinans* (black mangrove), *Rhizophora mangle* (red mangrove), *Thespesia populnea* (portia tree), *Terminalia catappa* (Indian almond), *Roystonea borinquena* (royal palm), *Coccos nucifera* (coconut palm) and *Acrostichum aureum* (swamp fern). Based on the data from the Gentry Transect Survey, estuarine forested wetlands have a higher abundance and dominance of the species *Avicennia germinans* (black mangrove), although it had a relatively low abundance and dominance (and in some cases absent) from palustrine forested wetlands. In addition, palustrine forested wetlands have a noticeable abundance of emergent vegetation, mostly *Acrostichum aureum* (swamp fern), and could be classified as a palustrine forested/emergent wetland. Palustrine emergent wetlands consist of scattered fringe patches of vegetation, (barely noticeable in the aerial photographs), located in the backyard of some of the houses within the Project Channel, in transitional areas between existing structures (houses and roads) and in forested wetlands. The dominant species within these wetlands are: *Acrostichum* *aureum* (swamp fern), *Brachiaria purpurascens* (para grass), *Commelina diffusa* (climbing day-flower), *Paspalum fasciculatum* (Mexican crowngrass), *Paspalum millegrana* (paja brava), *Ipomoea tiliacea* (ipomoea) and various species belonging to the Cyperaceae family.

Transitional secondary forests consist of narrow corridors of immature secondary forest dominated mostly by introduced species such as *Terminalia catappa* (Indian almond), *Thespesia populnea* (portia tree) and *Coccos nucifera* (coconut palm). Other species such as *Roystonea borinquena* (royal palm), *Calophyllum antillanum* (antilles calophyllum), *Delonix regia* (flamboyant), *Peltophorum pterocarpum* (golden flamboyant), *Pithecellobium dulc*e (monkeypod) and *Melicoccus bijugatus* (spanish lime) are present within these narrow areas between the existing development and the forested wetlands.

The managed green areas consists mostly of passive urban parks and pasture areas where the ornamental vegetation is managed (herbaceous vegetation is mowed and trees are pruned). The dominant species within these areas are: *Veitchia merrillii* (manila palm), *Lagerstroemia speciosa* (queen's crape myrtle), *Zoysia matrella* (manila grass), *Megathyrsus maximus* (guinea grass), *Thespesia populnea* (portia tree), *Roystonea borinquena* (royal palm) and *Coccos nucifera* (coconut palm).

Within some of the open water areas, floating vegetation was present where the CMP channel is clogged. The dominant species of floating vegetation were *Eichhornia crassipes* (water hyacinth), *Lemna aequinoctialis* (lesser duckweed) y *Pistia stratiotes* (water lettuce).

Under normal circumstances, the combination of these habitats conforming a whole ecosystem and natural corridor could possess a considerably high ecological value for wildlife utilization. Presently, ecological attributes and biological integrity are extremely degraded as consequence of the extensive alterations and impacts to the natural landscape due to present uses of the area and lack of adequate infrastructure. Massive amounts of solid waste in combination with raw sewage water are altering and damaging these fragile habitats.

7.0 AVOIDANCE, MINIMIZATION, AND MITIGATION

The following measures are proposed for implementation during construction of the proposed project. Additional measures will result from the Adaptive Management strategy required by the USACE for the construction project.

- Minimize the impact area by clearly marking the dredging and construction footprint so impacts to the existing riparian mangrove forests are kept to a minimum.
- Dredge and construct from the water to avoid impacting additional land areas. Clearly mark the upland limits of the public domain areas to minimize impacts outside the project's designated limits.
- Construction impacts are temporary in nature; therefore, efficient scheduling that reduces the construction period will avoid and minimize all related impacts.
- After the dredged material has been screened for debris, the suitable material should be re-claimed for use within the project footprint in order to minimize the amount for disposal, thereby minimizing impacts associated with such activities.
- To protect the wetland that lies north of the proposed CDRC staging area site, staging activities should be restricted further south to keep a thick vegetation buffer between the location and the adjacent wetland. This would prevent further sedimentation at the San José Lagoon, as well as prevent damaging the existing wetland.
- Develop a variety of applicable habitats within the mitigation areas in order to mimic conditions normally associated with such wetlands, to improve wetland function and to enhance its ecological diversity. For example, variations in micro-topography such as the creation of islands or inlets will encourage colonization by several grasses and succulent herbs, even though they may be eventually displaced by shading as the mangroves mature. Wildlife diversity, as well as many wetland functions, is enhanced by the diversity of habitats created by transitional zones.
- Provide an adequate tidal connection through the sheet-pile to allow an exchange of water from the CMP canal to the mitigation areas. This will provide for recruitment of larval or juvenile stages of appropriate species to the mangrove roots and the use of the mangrove root ecosystem by fish and benthic organisms.
- The removal of trees is regulated in Puerto Rico. A tree census of the areas to be impacted must be conducted prior to construction. All trees to be removed with a basal diameter greater than 4 inches must be mitigated at appropriate ratios.

The proposed development should incorporate an educational component for the construction workers, employees and visitors during the construction phase so as to acquaint persons with the critical, threatened or endangered species that can be found within the Study Area during particular seasons. These measures would increase the conservation of natural resources within the project and minimize its temporary impact. Although part of the terrestrial flora and fauna species within the Project Area are expected to be impacted, the recommended measures could minimize or even eliminate these impacts and propitiate the fastest recovery possible.

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Appendix A

Transcripts of Sampling Point Data Forms for Routine Wetland Determination

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WETLAND DETERMINATION DATA FORM – Caribbean Islands Region

Project/Site: Caño Martín Peña Ecosystem Restoration Project Municipality/Town: San Juan Sampling Date: February 1, 2011

Applicant/Owner: Corporación del Proyecto ENLACE del Caño Martin Peña PR or USVI: PR Sampling Point: SP1 (Wp121)

Investigator(s): Walter Soler/José Fonseca/Jaime Pabón Ward/Estate: Santurce

Landform (hillslope, terrace, etc.): Channel Bank Local relief (concave, convex, none): ______ Slope (%): 0

Lat: 18.43395 N Long: 66.05912 W Datum: Nad 83

Soil Map Unit Name: Soil not surveyed; possibly Hydraquents (Hy) NWI classification: PEMC1

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation No, Soil Yes, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____

Hydric Soil Present? Yes X No ____

Wetland Hydrology Present? Yes X No ____

Is the Sampled Area within a Wetland? **Yes** X **No** ____

Remarks:

Based on historic aerial photograph and site assessment, the sampling point is located within the remnants of a mangrove forest which was cut and filled progressively to accommodate houses of the community now establish in the area.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30)			
1. Laguncularia racemosa	80%	Yes	OBL
2. Rhizophora mangle	20%	Yes	OBL
3.			
4.			
5.			
	100% = Total Cover		
Sapling/Shrub Stratum (Plot size: N/A)			
1. N/A			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: N/A)			
1. N/A			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		
Woody Vine Stratum (Plot size: N/A)			
1. N/A			
2.			
3.			
4.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	100	x 1 =	100
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	100 (A)		100 (B)

Prevalence Index = B/A = 1

Hydrophytic Vegetation Indicators:

- ☑ Rapid Test for Hydrophytic Vegetation
- ☑ Dominance Test is >50%
- ☑ Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: SP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]		
6	10 YR 3/1	90					Organic/Clay	

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

☐ Histosol (A1)
☐ Histic Epipedon (A2)
☐ Black Histic (A3)
☐ Hydrogen Sulfide (A4)
☐ Organic Bodies (A6)
☐ 5 cm Mucky Mineral (A7)
☑ Muck Presence (A8)
☑ Depleted Below Dark Surface (A11)
☑ Thick Dark Surface (A12)
☐ Sandy Gleyed Matrix (S4)
☐ Sandy Redox (S5)
☐ Stripped Matrix (S6)
☐ Dark Surface (S7)
☐ Loamy Gleyed Matrix (F2)
☐ Depleted Matrix (F3)
☐ Redox Dark Surface (F6)
☐ Depleted Dark Surface (F7)
☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

☐ Stratified Layers (A5)
☑ Very Shallow Dark Surface (TF12)
☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____

Depth (inches): ____

Hydric Soil Present? Yes X **No** ____

Remarks:

Soil profile very difficult to assess because the presence of trash, scrap metal and debris deposited in to the area for filling purposes. Only the top layer was characterized.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

☐ Surface Water (A1)
☑ High Water Table (A2)
☑ Saturation (A3)
☑ Water Marks (B1)
☑ Sediment Deposits (B2)
☐ Drift Deposits (B3)
☐ Algal Mat or Crust (B4)
☐ Iron Deposits (B5)
☐ Inundation Visible on Aerial Imagery (B7)
☑ Water-Stained Leaves (B9)
☑ Aquatic Fauna (B13)
☑ Hydrogen Sulfide Odor (C1)
☑ Oxidized Rhizospheres on Living Roots (C3)
☐ Presence of Reduced Iron (C4)
☐ Recent Iron Reduction in Tilled Soils (C6)
☐ Thin Muck Surface (C7)
☐ Fiddler Crab Burrows (C10)
☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

☐ Surface Soil Cracks (B6)
☐ Sparsely Vegetated Concave Surface (B8)
☐ Drainage Patterns (B10)
☐ Dry-Season Water Table (C2)
☐ Saturation Visible on Aerial Imagery (C9)
☐ Geomorphic Position (D2)
☐ Shallow Aquitard (D3)
☑ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ____

Water Table Present? Yes X No ____ Depth (inches): 12

Saturation Present? (includes capillary fringe) Yes X No ____ Depth (inches): 2

Wetland Hydrology Present? Yes X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Appendix B

Gentry Transect Survey Census List

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Gentry I	**0m**	**18.43578**	**066.05920**
WP 333-334	**50m**	**18.43585**	**066.05882**

Spp. ID	*Scientific Name*	Common Name	DBH	High (meters)	Basal Area (m²)
1	*Thespesia populnea*	Emajagüilla	17,14	7	.0227,.0154
2	*Thespesia populnea*	Emajagüilla	1	2	0.0001
3	*Thespesia populnea*	Emajagüilla	24,23.5	8	.0452,.0434
4	*Laguncularia racemosa*	Mangle blanco	24.5	10	0.0471
5	*Laguncularia racemosa*	Mangle blanco	7	8	0.0038
6	*Laguncularia racemosa*	Mangle blanco	17	9	0.0227
7	*Laguncularia racemosa*	Mangle blanco	4	5	0.0013
8	*Thespesia populnea*	Emajagüilla	1	2	0.0001
9	*Thespesia populnea*	Emajagüilla	4	4	0.0013
10	*Laguncularia racemosa*	Mangle blanco	18	2	0.0254
11	*Laguncularia racemosa*	Mangle blanco	7	7	0.0038
12	*Laguncularia racemosa*	Mangle blanco	15.5	8	0.0189
13	*Laguncularia racemosa*	Mangle blanco	9.5	9	0.0071
14	*Laguncularia racemosa*	Mangle blanco	23.5	11	0.0434
15	*Laguncularia racemosa*	Mangle blanco	1	2	0.0001
16	*Laguncularia racemosa*	Mangle blanco	20	11	0.0314
17	*Thespesia populnea*	Emajagüilla	13	8	0.0133
18	*Thespesia populnea*	Emajagüilla	1	2	0.0001
19	*Thespesia populnea*	Emajagüilla	2	4	0.0003
20	*Laguncularia racemosa*	Mangle blanco	33	11	0.0855
21	*Laguncularia racemosa*	Mangle blanco	15	9	0.0177
22	*Thespesia populnea*	Emajagüilla	7,5	5	0.0038,0.0020
23	*Thespesia populnea*	Emajagüilla	21	9	0.0346
24	*Thespesia populnea*	Emajagüilla	3.5	5	0.0010
25	*Thespesia populnea*	Emajagüilla	10	9	0.0079
26	*Thespesia populnea*	Emajagüilla	4	5	0.0013
27	*Laguncularia racemosa*	Mangle blanco	30	11	0.0707
28	*Thespesia populnea*	Emajagüilla	9	8	0.0064
29	*Thespesia populnea*	Emajagüilla	22,14.5	8	0.452,0.0165
30	*Thespesia populnea*	Emajagüilla	14.5	9	0.0165
31	*Thespesia populnea*	Emajagüilla	9.5	7	0.0071
32	*Thespesia populnea*	Emajagüilla	10	8	0.0079
33	*Laguncularia racemosa*	Mangle blanco	8	8	0.0050
34	*Laguncularia racemosa*	Mangle blanco	24	11	0.0452
35	*Rhizophora mangle*	Mangle rojo	7	5	0.0038
36	*Avicennia germinans*	Mangle negro	25	12	0.0491
37	*Avicennia germinans*	Mangle negro	29	14	0.0661
38	*Avicennia germinans*	Mangle negro	16.5	6	0.0214
39	*Thespesia populnea*	Emajagüilla	9.5	5	0.0071
40	*Thespesia populnea*	Emajagüilla	6.5	5	0.0033
41	*Thespesia populnea*	Emajagüilla	2	5	0.0003
42	*Laguncularia racemosa*	Mangle blanco	24	15	0.0452
43	*Laguncularia racemosa*	Mangle blanco	6	7	0.0028
44	*Laguncularia racemosa*	Mangle blanco	3.5	6	0.0010
45	*Laguncularia racemosa*	Mangle blanco	14	15	0.0154
46	*Laguncularia racemosa*	Mangle blanco	4	5	0.0013
47	*Laguncularia racemosa*	Mangle blanco	7	9	0.0038
48	*Avicennia germinans*	Mangle negro	1.5	3	0.0002
49	*Avicennia germinans*	Mangle negro	5	5	0.0020
50	*Laguncularia racemosa*	Mangle blanco	20	15	0.0314
51	*Avicennia germinans*	Mangle negro	25	4	0.0491

Gentry II		**0m**	**18.43602**	**066.05772**	
WP 335-336		**50m**	**18.43608**	**066.05733**	

Spp. ID	***Scientific Name***	**Common Name**	**DBH**	**High (feets)**	**Basal Area (m²)**
1	*Thespesia populnea*	Emajagüilla	4	5	0.0013
2	*Laguncularia racemosa*	Mangle blanco	9	6	0.0064
3	*Laguncularia racemosa*	Mangle blanco	8	8	0.0050
4	*Laguncularia racemosa*	Mangle blanco	6	6	0.0028
5	*Laguncularia racemosa*	Mangle blanco	2	2	0.0003
6	*Laguncularia racemosa*	Mangle blanco	7.5	8	0.0044
7	*Laguncularia racemosa*	Mangle blanco	11.5	7	0.0104
8	*Laguncularia racemosa*	Mangle blanco	6.8	8	0.0036
9	*Avicennia germinans*	Mangle negro	5	6	0.0020
10	*Laguncularia racemosa*	Mangle blanco	28	15	0.0616
11	*Laguncularia racemosa*	Mangle blanco	18.5	11	0.0269
12	*Laguncularia racemosa*	Mangle blanco	10.5	10	0.0087
13	*Rhizophora mangle*	Mangle rojo	1	2	0.0001
14	*Rhizophora mangle*	Mangle rojo	1	2	0.0001
15	*Avicennia germinans*	Mangle negro	4	5	0.0013
16	*Laguncularia racemosa*	Mangle blanco	12	11	0.0113
17	*Avicennia germinans*	Mangle negro	27	14	0.0573
18	*Laguncularia racemosa*	Mangle blanco	13	4	0.0133
19	*Laguncularia racemosa*	Mangle blanco	8.5	8	0.0057
20	*Laguncularia racemosa*	Mangle blanco	12.5	4	0.0123
21	*Laguncularia racemosa*	Mangle blanco	9	9	0.0064
22	*Avicennia germinans*	Mangle negro	4	5	0.0013
23	*Laguncularia racemosa*	Mangle blanco	26	8	0.0531
24	*Avicennia germinans*	Mangle negro	1	4	0.0001
25	*Laguncularia racemosa*	Mangle blanco	16	15	0.0201
26	*Avicennia germinans*	Mangle negro	24.5	15	0.0471
27	*Avicennia germinans*	Mangle negro	5	5	0.0020
28	*Avicennia germinans*	Mangle negro	19.5	10	0.0299
29	*Avicennia germinans*	Mangle negro	19.5	15	0.0299
30	*Avicennia germinans*	Mangle negro	19	11	0.0284
31	*Rhizophora mangle*	Mangle rojo	1.5	9	0.0002
32	*Avicennia germinans*	Mangle negro	11	9	0.0095
33	*Avicennia germinans*	Mangle negro	8.5	4	0.0057
34	*Avicennia germinans*	Mangle negro	9.5	5	0.0071
35	*Laguncularia racemosa*	Mangle blanco	8.5	5	0.0057
36	*Rhizophora mangle*	Mangle rojo	2.5	2	0.0005
37	*Laguncularia racemosa*	Mangle blanco	24	14	0.0452
38	*Avicennia germinans*	Mangle negro	8	9	0.0050
39	*Pithecellobium dulce*	Guamá americano	4	6	0.0013
40	*Avicennia germinans*	Mangle negro	9	8	0.0064
41	*Melicoccus bijugatus*	Quenepa	2	2	0.0003
42	*Terminalia catappa*	Almendro	10	9	0.0079
43	*Terminalia catappa*	Almendro	6	5	0.0028
44	*Avicennia germinans*	Mangle negro	3.5	5	0.0010
45	*Laguncularia racemosa*	Mangle blanco	18	10	0.0254
46	*Laguncularia racemosa*	Mangle blanco	21	9	0.0346
47	*Laguncularia racemosa*	Mangle blanco	22	10	0.0380
48	*Laguncularia racemosa*	Mangle blanco	20	8	0.0314
49	*Laguncularia racemosa*	Mangle blanco	13.5	8	0.0143
50	*Laguncularia racemosa*	Mangle blanco	8.5	5	0.0057
51	*Avicennia germinans*	Mangle negro	9.5	6	0.0071
52	*Avicennia germinans*	Mangle negro	12.5	8	0.0123
53	*Avicennia germinans*	Mangle negro	13	6	0.0133

Gentry II	**0m**	**18.43602**	**066.05772**
WP 335-336	**50m**	**18.43608**	**066.05733**

Spp. ID	*Scientific Name*	Common Name	DBH	High (feets)	Basal Area (m²)
54	*Avicennia germinans*	Mangle negro	8	5	0.0050
55	*Avicennia germinans*	Mangle negro	9.5	7	0.0071
56	*Terminalia catappa*	Almendro	6.5	7	0.0033
57	*Avicennia germinans*	Mangle negro	25	12	0.0491
58	*Avicennia germinans*	Mangle negro	23	8	0.0415

Gentry III	**0m**	**18.43539**	**066.05643**
WP 337-338	**50m**	**18.43501**	**066.05649**

Spp. ID	*Scientific Name*	Common Name	DBH	High (feets)	Basal Area (m²)
1	*Avicennia germinans*	Mangle negro	23	8	0.0415
2	*Avicennia germinans*	Mangle negro	2	2	0.0003
3	*Avicennia germinans*	Mangle negro	16.5	9	0.0214
4	*Avicennia germinans*	Mangle negro	23	14	0.0415
5	*Laguncularia racemosa*	Mangle blanco	25	14	0.0491
6	*Avicennia germinans*	Mangle negro	3	5	0.0007
7	*Avicennia germinans*	Mangle negro	24	11	0.0452
8	*Laguncularia racemosa*	Mangle blanco	13	8	0.0133
9	*Avicennia germinans*	Mangle negro	13	6	0.0133
10	*Laguncularia racemosa*	Mangle blanco	14	12	0.0154
11	*Laguncularia racemosa*	Mangle blanco	14	12	0.0154
12	*Avicennia germinans*	Mangle negro	11	8	0.0095
13	*Laguncularia racemosa*	Mangle blanco	30	13	0.0707
14	*Avicennia germinans*	Mangle negro	16.5	11	0.0214
15	*Laguncularia racemosa*	Mangle blanco	13	8	0.0133
16	*Avicennia germinans*	Mangle negro	11.5	9	0.0104
17	*Laguncularia racemosa*	Mangle blanco	7	7	0.0038
18	*Laguncularia racemosa*	Mangle blanco	32	15	0.0804
19	*Avicennia germinans*	Mangle negro	9	8	0.0064
20	*Avicennia germinans*	Mangle negro	7	7	0.0038
21	*Avicennia germinans*	Mangle negro	10	7	0.0079
22	*Avicennia germinans*	Mangle negro	4	5	0.0013
23	*Avicennia germinans*	Mangle negro	2.5	4	0.0005
24	*Laguncularia racemosa*	Mangle blanco	9	5	0.0064
25	*Laguncularia racemosa*	Mangle blanco	27.5	13	0.0594
26	*Thespesia populnea*	Emajagüilla	5	5	0.0020
27	*Avicennia germinans*	Mangle negro	6.5	5	0.0033
28	*Rhizophora mangle*	Mangle rojo	3	2	0.0007
29	*Thespesia populnea*	Emajagüilla	2.5	5	0.0005
30	*Laguncularia racemosa*	Mangle blanco	6.5	5	0.0033
31	*Laguncularia racemosa*	Mangle blanco	23.5	11	0.0434
32	*Avicennia germinans*	Mangle negro	27	12	0.0573
33	*Rhizophora mangle*	Mangle rojo	3.5	4	0.0010
34	*Laguncularia racemosa*	Mangle blanco	11.5	12	0.0104
35	*Laguncularia racemosa*	Mangle blanco	15.5	13	0.0189
36	*Laguncularia racemosa*	Mangle blanco	5.5	6	0.0024
37	*Laguncularia racemosa*	Mangle blanco	11	9	0.0095
38	*Avicennia germinans*	Mangle negro	3	5	0.0007
39	*Avicennia germinans*	Mangle negro	15	8	0.0177
40	*Avicennia germinans*	Mangle negro	16.5	11	0.0214
41	*Laguncularia racemosa*	Mangle blanco	5	7	0.0020
42	*Avicennia germinans*	Mangle negro	23	11	0.0415
43	*Thespesia populnea*	Emajagüilla	11	8	0.0095
44	*Laguncularia racemosa*	Mangle blanco	19	9	0.0284
45	*Thespesia populnea*	Emajagüilla	6	7	0.0028
46	*Thespesia populnea*	Emajagüilla	10	7	0.0079
47	*Laguncularia racemosa*	Mangle blanco	8	7	0.0050
48	*Laguncularia racemosa*	Mangle blanco	19	11	0.0284
49	*Laguncularia racemosa*	Mangle blanco	22	11	0.0380
50	*Avicennia germinans*	Mangle negro	27	9	0.0573
51	*Laguncularia racemosa*	Mangle blanco	36	11	0.1018
52	*Laguncularia racemosa*	Mangle blanco	18	12	0.0254
53	*Thespesia populnea*	Emajagüilla	18	6	0.0254

	Gentry III	**0m**	**18.43539**	**066.05643**	
	WP 337-338	**50m**	**18.43501**	**066.05649**	
54	*Laguncularia racemosa*	Mangle blanco	10.5	10	0.0087
55	*Laguncularia racemosa*	Mangle blanco	16	11	0.0201
56	*Laguncularia racemosa*	Mangle blanco	23	5	0.0415
57	*Thespesia populnea*	Emajagüilla	2	4	0.0003
58	*Avicennia germinans*	Mangle negro	14	11	0.0154
59	*Avicennia germinans*	Mangle negro	26	10	0.0531

Gentry IV	**0m**	**18.43366**	**066.05433**
WP 339-340	**50m**	**18.43326**	**066.05459**

Spp . ID	***Scientific Name***	**Common Name**	**DBH**	**High (feets)**	**Basal Area (m²)**
1	*Thespesia populnea*	Emajagüilla	5	5	0.0020
2	*Laguncularia racemosa*	Mangle blanco	27	11	0.0573
3	*Laguncularia racemosa*	Mangle blanco	30	12	0.0707
4	*Laguncularia racemosa*	Mangle blanco	17	8	0.0227
5	*Laguncularia racemosa*	Mangle blanco	23	9	0.0415
6	*Laguncularia racemosa*	Mangle blanco	29	9	0.0661
7	*Rhizophora mangle*	Mangle rojo	4	5	0.0013
8	*Laguncularia racemosa*	Mangle blanco	16	8	0.0201
9	*Laguncularia racemosa*	Mangle blanco	36.5	12	0.1046
10	*Laguncularia racemosa*	Mangle blanco	24	9	0.0452
11	*Laguncularia racemosa*	Mangle blanco	24	9	0.0452
12	*Laguncularia racemosa*	Mangle blanco	23	8	0.0415
13	*Laguncularia racemosa*	Mangle blanco	22	9	0.0380
14	*Cocos nucifera*	Palma de Coco	1	2	0.0001
15	*Laguncularia racemosa*	Mangle blanco	1.5	4	0.0002
16	*Laguncularia racemosa*	Mangle blanco	2	4	0.0003
17	*Laguncularia racemosa*	Mangle blanco	16.5	6	0.0214
18	*Laguncularia racemosa*	Mangle blanco	16	7	0.0201
19	*Laguncularia racemosa*	Mangle blanco	17	7	0.0227
20	*Laguncularia racemosa*	Mangle blanco	7.5	6	0.0044
21	*Laguncularia racemosa*	Mangle blanco	11	5	0.0095
22	*Laguncularia racemosa*	Mangle blanco	9.5	4	0.0071
23	*Laguncularia racemosa*	Mangle blanco	11.5	5	0.0104
24	*Laguncularia racemosa*	Mangle blanco	11	5	0.0095
25	*Laguncularia racemosa*	Mangle blanco	13.5	3	0.0143
26	*Laguncularia racemosa*	Mangle blanco	9.4	5	0.0069
27	*Laguncularia racemosa*	Mangle blanco	9	5	0.0064
28	*Laguncularia racemosa*	Mangle blanco	6.2	3	0.0030
29	*Laguncularia racemosa*	Mangle blanco	12	6	0.0113
30	*Laguncularia racemosa*	Mangle blanco	15.5	14	0.0189
31	*Laguncularia racemosa*	Mangle blanco	17	6	0.0227
32	*Laguncularia racemosa*	Mangle blanco	17.5	5	0.0241
33	*Laguncularia racemosa*	Mangle blanco	4.5	3	0.0016
34	*Avicennia germinans*	Mangle negro	6.5	3	0.0033
35	*Laguncularia racemosa*	Mangle blanco	4	6	0.0013
36	*Rhizophora mangle*	Mangle rojo	5	4	0.0020
37	*Laguncularia racemosa*	Mangle blanco	13	5	0.0133
38	*Rhizophora mangle*	Mangle rojo	6	6	0.0028
39	*Rhizophora mangle*	Mangle rojo	4	5	0.0013
40	*Laguncularia racemosa*	Mangle blanco	5	5	0.0020
41	*Laguncularia racemosa*	Mangle blanco	23.5	7	0.0434
42	*Laguncularia racemosa*	Mangle blanco	9	6	0.0064
43	*Laguncularia racemosa*	Mangle blanco	25.5	11	0.0511
44	*Laguncularia racemosa*	Mangle blanco	22.5	9	0.0398
45	*Rhizophora mangle*	Mangle rojo	7	5	0.0038
46	*Laguncularia racemosa*	Mangle blanco	14.5	8	0.0165
47	*Laguncularia racemosa*	Mangle blanco	14	9	0.0154
48	*Laguncularia racemosa*	Mangle blanco	7.5	3	0.0044
49	*Avicennia germinans*	Mangle negro	23.4	5	0.0430
50	*Thespesia populnea*	Emajagüilla	2	3	0.0003
51	*Thespesia populnea*	Emajagüilla	20	8	0.0314
52	*Laguncularia racemosa*	Mangle blanco	19	9	0.0284

Gentry V	**0m**	**18.43569**	**066.05704**
WP 341-342	**50m**	**18.43501**	**066.05677**

Spp. ID	***Scientific Name***	**Common Name**	**DBH**	**High (feets)**	**Basal Area (m²)**
1	*Thespesia populnea*	Emajagüilla	21	8	0.0346
2	*Thespesia populnea*	Emajagüilla	8.5	7	0.0057
3	*Laguncularia racemosa*	Mangle blanco	3.5	4	0.0010
4	*Laguncularia racemosa*	Mangle blanco	17	6	0.0227
5	*Laguncularia racemosa*	Mangle blanco	19	10	0.0284
6	*Laguncularia racemosa*	Mangle blanco	6	7	0.0028
7	*Avicennia germinans*	Mangle negro	10.5	9	0.0087
8	*Laguncularia racemosa*	Mangle blanco	15	12	0.0177
9	*Laguncularia racemosa*	Mangle blanco	18	12	0.0254
10	*Rhizophora mangle*	Mangle rojo	8.5	6	0.0057
11	*Avicennia germinans*	Mangle negro	2	4	0.0003
12	*Laguncularia racemosa*	Mangle blanco	13	8	0.0133
13	*Laguncularia racemosa*	Mangle blanco	20	8	0.0314
14	*Avicennia germinans*	Mangle negro	18	12	0.0254
15	*Laguncularia racemosa*	Mangle blanco	15	9	0.0177
16	*Laguncularia racemosa*	Mangle blanco	15	12	0.0177
17	*Laguncularia racemosa*	Mangle blanco	21	12	0.0346
18	*Rhizophora mangle*	Mangle rojo	5.5	7	0.0024
19	*Laguncularia racemosa*	Mangle blanco	8.5	5	0.0057
20	*Avicennia germinans*	Mangle negro	12.5	6	0.0123
21	*Laguncularia racemosa*	Mangle blanco	11.5	11	0.0104
22	*Rhizophora mangle*	Mangle rojo	6	5	0.0028
23	*Rhizophora mangle*	Mangle rojo	2	4	0.0003
24	*Laguncularia racemosa*	Mangle blanco	20	5	0.0314
25	*Laguncularia racemosa*	Mangle blanco	19	12	0.0284
26	*Laguncularia racemosa*	Mangle blanco	19.5	9	0.0299
27	*Laguncularia racemosa*	Mangle blanco	19	9	0.0284
28	*Avicennia germinans*	Mangle negro	12.5	5	0.0123
29	*Avicennia germinans*	Mangle negro	25	11	0.0491
30	*Rhizophora mangle*	Mangle rojo	6	3	0.0028
31	*Laguncularia racemosa*	Mangle blanco	18	6	0.0254
32	*Thespesia populnea*	Emajagüilla	20	9	0.0314
33	*Rhizophora mangle*	Mangle rojo	7	5	0.0038
34	*Avicennia germinans*	Mangle negro	30	12	0.0707
35	*Thespesia populnea*	Emajagüilla	17.5	7	0.0241
36	*Avicennia germinans*	Mangle negro	12.5	6	0.0123
37	*Thespesia populnea*	Emajagüilla	5	4	0.0020
38	*Laguncularia racemosa*	Mangle blanco	26	9	0.0531
39	*Laguncularia racemosa*	Mangle blanco	28.5	12	0.0638
40	*Rhizophora mangle*	Mangle rojo	4	6	0.0013
41	*Avicennia germinans*	Mangle negro	13	10	0.0133
42	*Rhizophora mangle*	Mangle rojo	6	7	0.0028
43	*Rhizophora mangle*	Mangle rojo	28	11	0.0616
44	*Avicennia germinans*	Mangle negro	19	10	0.0284
45	*Avicennia germinans*	Mangle negro	32	10	0.0804
46	*Laguncularia racemosa*	Mangle blanco	16	10	0.0201
47	*Avicennia germinans*	Mangle negro	12.5	8	0.0123
48	*Avicennia germinans*	Mangle negro	26	12	0.0531
49	*Thespesia populnea*	Emajagüilla	1	3	0.0001
50	*Avicennia germinans*	Mangle negro	17	12	0.0227
51	*Avicennia germinans*	Mangle negro	2	4	0.0003
52	*Avicennia germinans*	Mangle negro	19	12	0.0284
53	*Laguncularia racemosa*	Mangle blanco	19	12	0.0284

Gentry V	**0m**	**18.43569**	**066.05704**
WP 341-342	**50m**	**18.43501**	**066.05677**

Spp. ID	***Scientific Name***	**Common Name**	**DBH**	**High (feets)**	**Basal Area (m²)**
54	*Laguncularia racemosa*	Mangle blanco	11	11	0.0095
55	*Avicennia germinans*	Mangle negro	17	10	0.0227
56	*Avicennia germinans*	Mangle negro	13.5	10	0.0143
57	*Peltophorum pterocarpum*	Flamboyán amarillo	23	12	0.0415
58	*Laguncularia racemosa*	Mangle blanco	20.5	5	0.0330
59	*Laguncularia racemosa*	Mangle blanco	12	5	0.0113
60	*Laguncularia racemosa*	Mangle blanco	10.5	7	0.0087
61	*Avicennia germinans*	Mangle negro	21.5	11	0.0363
62	*Avicennia germinans*	Mangle negro	22	9	0.0380
63	*Thespesia populnea*	Emajagüilla	4	6	0.0013
64	*Laguncularia racemosa*	Mangle blanco	7	8	0.0038
65	*Avicennia germinans*	Mangle negro	19	8	0.0284
66	*Thespesia populnea*	Emajagüilla	14	8	0.0154
67	*Laguncularia racemosa*	Mangle blanco	26	9	0.0531
68	*Avicennia germinans*	Mangle negro	17	11	0.0227
69	*Rhizophora mangle*	Mangle rojo	8	7	0.0050
70	*Rhizophora mangle*	Mangle rojo	7	7	0.0038
71	*Avicennia germinans*	Mangle negro	19	11	0.0284
72	*Laguncularia racemosa*	Mangle blanco	7	8	0.0038
73	*Avicennia germinans*	Mangle negro	26	12	0.0531
74	*Laguncularia racemosa*	Mangle blanco	10.5	5	0.0087
75	*Rhizophora mangle*	Mangle rojo	11.5	7	0.0104
76	*Avicennia germinans*	Mangle negro	7	5	0.0038
77	*Rhizophora mangle*	Mangle rojo	16	10	0.0201
78	*Laguncularia racemosa*	Mangle blanco	17.5	10	0.0241
79	*Laguncularia racemosa*	Mangle blanco	13.5	3	0.0143
80	*Rhizophora mangle*	Mangle rojo	10.5	5	0.0087
81	*Rhizophora mangle*	Mangle rojo	14.5	9	0.0165
82	*Avicennia germinans*	Mangle negro	14.5	8	0.0165
83	*Thespesia populnea*	Emajagüilla	11.5	6	0.0104
84	*Laguncularia racemosa*	Mangle blanco	23.5	12	0.0434

Gentry VI	**0m**	**18.43454**	**066.05671**
WP 343-344	**50m**	**18.43431**	**066.05651**

Spp. ID	***Scientific Name***	**Common Name**	**DBH**	**High (feets)**	**Basal Area (m²)**
1	*Thespesia populnea*	Emajagüilla	15	8	0.0177
2	*Laguncularia racemosa*	Mangle blanco	2.5	5	0.0005
3	*Avicennia germinans*	Mangle negro	17	11	0.0227
4	*Avicennia germinans*	Mangle negro	6	6	0.0028
5	*Laguncularia racemosa*	Mangle blanco	14.5	12	0.0165
6	*Laguncularia racemosa*	Mangle blanco	20	8	0.0314
7	*Rhizophora mangle*	Mangle rojo	25	2	0.0491
8	*Avicennia germinans*	Mangle negro	8.5	8	0.0057
9	*Avicennia germinans*	Mangle negro	10	8	0.0079
10	*Avicennia germinans*	Mangle negro	19	9	0.0284
11	*Laguncularia racemosa*	Mangle blanco	28	12	0.0616
12	*Laguncularia racemosa*	Mangle blanco	38	12	0.1134
13	*Avicennia germinans*	Mangle negro	4	5	0.0013
14	*Avicennia germinans*	Mangle negro	25	12	0.0491
15	*Thespesia populnea*	Emajagüilla	17	8	0.0227
16	*Avicennia germinans*	Mangle negro	22	14	0.0380
17	*Laguncularia racemosa*	Mangle blanco	12	6	0.0113
18	*Rhizophora mangle*	Mangle rojo	13	8	0.0133
19	*Laguncularia racemosa*	Mangle blanco	17	5	0.0227
20	*Laguncularia racemosa*	Mangle blanco	16	12	0.0201
21	*Laguncularia racemosa*	Mangle blanco	16	11	0.0201
22	*Rhizophora mangle*	Mangle rojo	8	8	0.0050
23	*Laguncularia racemosa*	Mangle blanco	15	9	0.0177
24	*Laguncularia racemosa*	Mangle blanco	2.5	4	0.0005
25	*Laguncularia racemosa*	Mangle blanco	1	2	0.0001
26	*Laguncularia racemosa*	Mangle blanco	17	9	0.0227
27	*Laguncularia racemosa*	Mangle blanco	8.5	5	0.0057
28	*Laguncularia racemosa*	Mangle blanco	4	5	0.0013
29	*Laguncularia racemosa*	Mangle blanco	19	7	0.0284
30	*Avicennia germinans*	Mangle negro	18	9	0.0254
31	*Thespesia populnea*	Emajagüilla	2	5	0.0003
32	*Thespesia populnea*	Emajagüilla	3.5	6	0.0010
33	*Thespesia populnea*	Emajagüilla	25	11	0.0491
34	*Laguncularia racemosa*	Mangle blanco	38	10	0.1134
35	*Avicennia germinans*	Mangle negro	4.5	5	0.0016
36	*Avicennia germinans*	Mangle negro	4	5	0.0013
37	*Thespesia populnea*	Emajagüilla	2	9	0.0003
38	*Laguncularia racemosa*	Mangle blanco	15	5	0.0177
39	*Thespesia populnea*	Emajagüilla	15.5	8	0.0189
40	*Thespesia populnea*	Emajagüilla	15	9	0.0177
41	*Avicennia germinans*	Mangle negro	18	6	0.0254
42	*Thespesia populnea*	Emajagüilla	14.5	11	0.0165
43	*Laguncularia racemosa*	Mangle blanco	33	12	0.0855
44	*Avicennia germinans*	Mangle negro	28	11	0.0616
45	*Rhizophora mangle*	Mangle rojo	15	8	0.0177
46	*Laguncularia racemosa*	Mangle blanco	22	9	0.0380
47	*Thespesia populnea*	Emajagüilla	15	8	0.0177
48	*Thespesia populnea*	Emajagüilla	20	12	0.0314
49	*Avicennia germinans*	Mangle negro	21	8	0.0346
50	*Laguncularia racemosa*	Mangle blanco	34	8	0.0908
51	*Laguncularia racemosa*	Mangle blanco	6.5	8	0.0033
52	*Laguncularia racemosa*	Mangle blanco	13	11	0.0133
53	*Avicennia germinans*	Mangle negro	18	11	0.0254

Gentry VI	**0m**	**18.43454**	**066.05671**
WP 343-344	**50m**	**18.43431**	**066.05651**

Spp. ID	*Scientific Name*	Common Name	DBH	High (feets)	Basal Area (m²)
54	*Laguncularia racemosa*	Mangle blanco	17	8	0.0227
55	*Laguncularia racemosa*	Mangle blanco	13	8	0.0133
56	*Avicennia germinans*	Mangle negro	12.5	9	0.0123
57	*Avicennia germinans*	Mangle negro	18	8	0.0254
58	*Rhizophora mangle*	Mangle rojo	13	9	0.0133
59	*Avicennia germinans*	Mangle negro	10	6	0.0079
60	*Avicennia germinans*	Mangle negro	33	9	0.0855
61	*Avicennia germinans*	Mangle negro	28	12	0.0616
62	*Thespesia populnea*	Emajagüilla	12	6	0.0113
63	*Avicennia germinans*	Mangle negro	24	9	0.0452
64	*Rhizophora mangle*	Mangle rojo	12	9	0.0113
65	*Rhizophora mangle*	Mangle rojo	12	9	0.0113

Gentry VII	**0m**	**18.43321**	**066.05579**
WP 345-346	**50m**	**18.43295**	**066.05565**

Spp. ID	***Scientific Name***	**Common Name**	**DBH**	**High (feets)**	**Basal Area (m²)**
1	*Avicennia germinans*	Mangle negro	5.5	5	0.0024
2	*Laguncularia racemosa*	Mangle blanco	18	9	0.0254
3	*Laguncularia racemosa*	Mangle blanco	21	11	0.0346
4	*Laguncularia racemosa*	Mangle blanco	3.5	3	0.0010
5	*Laguncularia racemosa*	Mangle blanco	3	5	0.0007
6	*Laguncularia racemosa*	Mangle blanco	2	5	0.0003
7	*Laguncularia racemosa*	Mangle blanco	2	4	0.0003
8	*Laguncularia racemosa*	Mangle blanco	1	4	0.0001
9	*Laguncularia racemosa*	Mangle blanco	1	4	0.0001
10	*Avicennia germinans*	Mangle negro	30	12	0.0707
11	*Laguncularia racemosa*	Mangle blanco	1	2	0.0001
12	*Rhizophora mangle*	Mangle rojo	1	2	0.0001
13	*Laguncularia racemosa*	Mangle blanco	7	8	0.0038
14	*Avicennia germinans*	Mangle negro	3	6	0.0007
15	*Avicennia germinans*	Mangle negro	38	12	0.1134
16	*Avicennia germinans*	Mangle negro	12	8	0.0113
17	*Avicennia germinans*	Mangle negro	11	7	0.0095
18	*Avicennia germinans*	Mangle negro	17.5	11	0.0241
19	*Rhizophora mangle*	Mangle rojo	2.5	4	0.0005
20	*Laguncularia racemosa*	Mangle blanco	16.5	11	0.0214
21	*Laguncularia racemosa*	Mangle blanco	20.5	12	0.0330
22	*Avicennia germinans*	Mangle negro	9	8	0.0064
23	*Avicennia germinans*	Mangle negro	5	8	0.0020
24	*Avicennia germinans*	Mangle negro	20	11	0.0314
25	*Avicennia germinans*	Mangle negro	17	9	0.0227
26	*Avicennia germinans*	Mangle negro	24	12	0.0452
27	*Rhizophora mangle*	Mangle rojo	5	5	0.0020
28	*Avicennia germinans*	Mangle negro	26	12	0.0531
29	*Avicennia germinans*	Mangle negro	11.5	7	0.0104
30	*Terminalia catappa*	Almendro	35	14	0.0962
31	*Avicennia germinans*	Mangle negro	24	6	0.0452
32	*Laguncularia racemosa*	Mangle blanco	28	6	0.0616
33	*Terminalia catappa*	Almendro	35	12	0.0962
34	*Avicennia germinans*	Mangle negro	4	5	0.0013
35	*Laguncularia racemosa*	Mangle blanco	4	5	0.0013
36	*Rhizophora mangle*	Mangle rojo	11	9	0.0095
37	*Laguncularia racemosa*	Mangle blanco	16	9	0.0201
38	*Terminalia catappa*	Almendro	31	14	0.0755
39	*Laguncularia racemosa*	Mangle blanco	14	10	0.0154
40	*Avicennia germinans*	Mangle negro	12	7	0.0113
41	*Laguncularia racemosa*	Mangle blanco	4	5	0.0013
42	*Laguncularia racemosa*	Mangle blanco	18	11	0.0254
43	*Laguncularia racemosa*	Mangle blanco	15	11	0.0177
44	*Laguncularia racemosa*	Mangle blanco	19.5	6	0.0299
45	*Laguncularia racemosa*	Mangle blanco	18	8	0.0254
46	*Laguncularia racemosa*	Mangle blanco	27	9	0.0573
47	*Avicennia germinans*	Mangle negro	18	8	0.0254
48	*Laguncularia racemosa*	Mangle blanco	20	6	0.0314
49	*Laguncularia racemosa*	Mangle blanco	23	11	0.0415
50	*Avicennia germinans*	Mangle negro	22	11	0.0380
51	*Laguncularia racemosa*	Mangle blanco	12	6	0.0113
52	*Laguncularia racemosa*	Mangle blanco	26	7	0.0531
53	*Laguncularia racemosa*	Mangle blanco	25.5	8	0.0511

Gentry VII		**0m**	**18.43321**	**066.05579**	
WP 345-346		**50m**	**18.43295**	**066.05565**	

Spp. ID	***Scientific Name***	**Common Name**	**DBH**	**High (feets)**	**Basal Area (m²)**
54	*Avicennia germinans*	Mangle negro	19	8	0.0284
55	*Laguncularia racemosa*	Mangle blanco	24.5	8	0.0471
56	*Laguncularia racemosa*	Mangle blanco	18	8	0.0254
57	*Laguncularia racemosa*	Mangle blanco	16	8	0.0201
58	*Laguncularia racemosa*	Mangle blanco	19.5	8	0.0299
59	*Laguncularia racemosa*	Mangle blanco	21	8	0.0346
60	*Laguncularia racemosa*	Mangle blanco	20	8	0.0314
61	*Avicennia germinans*	Mangle negro	4	5	0.0013
62	*Laguncularia racemosa*	Mangle blanco	13	8	0.0133
63	*Avicennia germinans*	Mangle negro	15	5	0.0177
64	*Laguncularia racemosa*	Mangle blanco	4	4	0.0013
65	*Laguncularia racemosa*	Mangle blanco	26	6	0.0531
66	*Avicennia germinans*	Mangle negro	4	4	0.0013

Gentry VIII	**0m**	**18.43157**	**066.04779**
WP 347-348	**50m**	**18.43182**	**066.04809**

Spp. ID	***Scientific Name***	**Common Name**	**DBH**	**High (feets)**	**Basal Area (m²)**
1	*Delonix regia*	Flamboyán	45	9	0.1590
2	*Laguncularia racemosa*	Mangle blanco	1	4	0.0001
3	*Calophyllum antillanum*	María	1.5	2	0.0002
4	*Calophyllum antillanum*	María	1.5	2	0.0002
5	*Calophyllum antillanum*	María	4.5	4	0.0016
6	*Calophyllum antillanum*	María	5	5	0.0020
7	*Calophyllum antillanum*	María	1	2	0.0001
8	*Calophyllum antillanum*	María	1.5	3	0.0002
9	*Laguncularia racemosa*	Mangle blanco	1	2	0.0001
10	*Laguncularia racemosa*	Mangle blanco	1.5	4	0.0002
11	*Laguncularia racemosa*	Mangle blanco	26	8	0.0531
12	*Laguncularia racemosa*	Mangle blanco	32	9	0.0804
13	*Laguncularia racemosa*	Mangle blanco	29	8	0.0661
14	*Laguncularia racemosa*	Mangle blanco	26.5	8	0.0552
15	*Laguncularia racemosa*	Mangle blanco	24	8	0.0452
16	*Laguncularia racemosa*	Mangle blanco	13	8	0.0133
17	*Laguncularia racemosa*	Mangle blanco	31.5	9	0.0779
18	*Laguncularia racemosa*	Mangle blanco	11.5	8	0.0104
19	*Laguncularia racemosa*	Mangle blanco	24	9	0.0452
20	*Laguncularia racemosa*	Mangle blanco	29	9	0.0661
21	*Laguncularia racemosa*	Mangle blanco	30	9	0.0707
22	*Laguncularia racemosa*	Mangle blanco	30	9	0.0707
23	*Laguncularia racemosa*	Mangle blanco	12.5	8	0.0123
24	*Laguncularia racemosa*	Mangle blanco	21	8	0.0346
25	*Laguncularia racemosa*	Mangle blanco	14.5	9	0.0165
26	*Laguncularia racemosa*	Mangle blanco	26	9	0.0531
27	*Laguncularia racemosa*	Mangle blanco	24	3	0.0452
28	*Laguncularia racemosa*	Mangle blanco	12.5	3	0.0123
29	*Laguncularia racemosa*	Mangle blanco	17	5	0.0227
30	*Laguncularia racemosa*	Mangle blanco	2.5	5	0.0005
31	*Calophyllum antillanum*	María	4.5	5	0.0016
32	*Laguncularia racemosa*	Mangle blanco	3	5	0.0007
33	*Laguncularia racemosa*	Mangle blanco	4	5	0.0013
34	*Laguncularia racemosa*	Mangle blanco	1	2	0.0001
35	*Thespesia populnea*	Emajagüilla	2	2	0.0003
36	*Laguncularia racemosa*	Mangle blanco	2	3	0.0003
37	*Laguncularia racemosa*	Mangle blanco	1	3	0.0001
38	*Laguncularia racemosa*	Mangle blanco	5	5	0.0020
39	*Laguncularia racemosa*	Mangle blanco	5	6	0.0020
40	*Laguncularia racemosa*	Mangle blanco	3	5	0.0007
41	*Laguncularia racemosa*	Mangle blanco	3	5	0.0007
42	*Laguncularia racemosa*	Mangle blanco	6	6	0.0028
43	*Laguncularia racemosa*	Mangle blanco	5	5	0.0020
44	*Laguncularia racemosa*	Mangle blanco	2.5	2	0.0005
45	*Laguncularia racemosa*	Mangle blanco	4	5	0.0013
46	*Laguncularia racemosa*	Mangle blanco	4	2	0.0013
47	*Thespesia populnea*	Emajagüilla	7.5	8	0.0044
48	*Laguncularia racemosa*	Mangle blanco	4	5	0.0013
49	*Laguncularia racemosa*	Mangle blanco	8	7	0.0050
50	*Roystonea borinquena*	Palma Real	18.5	5	0.0269
51	*Roystonea borinquena*	Palma Real	44.5	12	0.1555
52	*Laguncularia racemosa*	Mangle blanco	24	9	0.0452
53	*Laguncularia racemosa*	Mangle blanco	15.5	9	0.0189

Gentry VIII	**0m**	**18.43157**	**066.04779**
WP 347-348	**50m**	**18.43182**	**066.04809**

Spp. ID	***Scientific Name***	**Common Name**	**DBH**	**High (feets)**	**Basal Area (m^2)**
54	*Calophyllum antillanum*	María	1	2	0.0001
55	*Laguncularia racemosa*	Mangle blanco	26.5	10	0.0552
56	*Laguncularia racemosa*	Mangle blanco	21	11	0.0346
57	*Laguncularia racemosa*	Mangle blanco	29	11	0.0661
58	*Laguncularia racemosa*	Mangle blanco	15	5	0.0177

	Gentry IX	**0m**	**18.43357**	**066.05143**	
	WP 349-350	**50m**	**18.43323**	**066.05120**	
Spp. ID	***Scientific Name***	**Common Name**	**DBH**	**High (feets)**	**Basal Area (m²)**
1	*Laguncularia racemosa*	Mangle blanco	33	11	0.0855
2	*Laguncularia racemosa*	Mangle blanco	32	8	0.0804
3	*Laguncularia racemosa*	Mangle blanco	20.5	9	0.0330
4	*Laguncularia racemosa*	Mangle blanco	28.5	9	0.0638
5	*Laguncularia racemosa*	Mangle blanco	30.5	8	0.0731
6	*Laguncularia racemosa*	Mangle blanco	22	9	0.0380
7	*Laguncularia racemosa*	Mangle blanco	25.5	10	0.0511
8	*Laguncularia racemosa*	Mangle blanco	38	10	0.1134
9	*Laguncularia racemosa*	Mangle blanco	13.5	8	0.0143
10	*Laguncularia racemosa*	Mangle blanco	34.5	8	0.0935
11	*Laguncularia racemosa*	Mangle blanco	35	9	0.0962
12	*Laguncularia racemosa*	Mangle blanco	13.5	6	0.0143
13	*Laguncularia racemosa*	Mangle blanco	39	10	0.1195
14	*Laguncularia racemosa*	Mangle blanco	29	9	0.0661
15	*Laguncularia racemosa*	Mangle blanco	10.5	4	0.0087
16	*Laguncularia racemosa*	Mangle blanco	8	5	0.0050
17	*Laguncularia racemosa*	Mangle blanco	16.5	5	0.0214
18	*Laguncularia racemosa*	Mangle blanco	4	6	0.0013
19	*Laguncularia racemosa*	Mangle blanco	17.5	5	0.0241
20	*Roystonea borinquena*	Palma Real	10	4	0.0079
21	*Roystonea borinquena*	Palma Real	39	10	0.1195
22	*Roystonea borinquena*	Palma Real	30	6	0.0707
23	*Roystonea borinquena*	Palma Real	31	6	0.0755

Gentry X	**Start**	**18.43229**	**066.04992**	
WP 351-352	**End**	**18.43212**	**066.04958**	

Spp. ID	***Scientific Name***	**Common Name**	**DBH**	**High (feets)**	**Basal Area (m²)**
1	*Albizia lebbeck*	Acacia amarilla	29	15	0.0661
2	*Peltophorum pterocarpum*	Flamboyán amarillo	24	15	0.0452
3	*Peltophorum pterocarpum*	Flamboyán amarillo	4	5	0.0013
4	*Peltophorum pterocarpum*	Flamboyán amarillo	4.8	5	0.0018
5	*Melicoccus bijugatus*	Quenepa	6.5	6	0.0033
6	*Pithecellobium dulce*	Guamá americano	4.5	5	0.0016
7	*Pithecellobium dulce*	Guamá americano	2.5	5	0.0005
8	*Pithecellobium dulce*	Guamá americano	4.5	2	0.0016
9	*Roystonea borinquena*	Palma Real	11	5	0.0095
10	*Melicoccus bijugatus*	Quenepa	2	4	0.0003
11	*Laguncularia racemosa*	Mangle blanco	22	8	0.0380
12	*Laguncularia racemosa*	Mangle blanco	19	10	0.0284
13	*Roystonea borinquena*	Palma Real	9	3	0.0064
14	*Roystonea borinquena*	Palma Real	21	5	0.0346
15	*Roystonea borinquena*	Palma Real	16	4	0.0201
16	*Piper aduncum*	Higuillo	1.5	3	0.0002
17	*Albizia lebbeck*	Acacia amarilla	8.5	7	0.0057

Gentry XI	**0m**	**18.43195**	**066.04847**
WP 353-354	**50m**	**18.43159**	**066.04825**

Spp. ID	***Scientific Name***	**Common Name**	**DBH**	**High (feets)**	**Basal Area (m²)**
1	*Laguncularia racemosa*	Mangle blanco	31	10	0.0755
2	*Thespesia populnea*	Emajagüilla	1.5	2	0.0002
3	*Laguncularia racemosa*	Mangle blanco	10.5	7	0.0087
4	*Laguncularia racemosa*	Mangle blanco	37	12	0.1075
5	*Calophyllum antillanum*	María	1	9	0.0001
6	*Thespesia populnea*	Emajagüilla	2.5	5	0.0005
7	*Thespesia populnea*	Emajagüilla	2	5	0.0003
8	*Thespesia populnea*	Emajagüilla	1.5	4	0.0002
9	*Thespesia populnea*	Emajagüilla	2	5	0.0003
10	*Laguncularia racemosa*	Mangle blanco	17	9	0.0227
11	*Laguncularia racemosa*	Mangle blanco	16.8	8	0.0222
12	*Thespesia populnea*	Emajagüilla	2	2	0.0003
13	*Thespesia populnea*	Emajagüilla	2.5	3	0.0005
14	*Laguncularia racemosa*	Mangle blanco	24	9	0.0452
15	*Laguncularia racemosa*	Mangle blanco	31	9	0.0755
16	*Delonix regia*	Flamboyán	2	5	0.0003
17	*Thespesia populnea*	Emajagüilla	2	4	0.0003
18	*Thespesia populnea*	Emajagüilla	2.5	4	0.0005
19	*Thespesia populnea*	Emajagüilla	1	3	0.0001
20	*Thespesia populnea*	Emajagüilla	2	4	0.0003
21	*Thespesia populnea*	Emajagüilla	2	4	0.0003
22	*Thespesia populnea*	Emajagüilla	2	4	0.0003
23	*Thespesia populnea*	Emajagüilla	1	3	0.0001
24	*Thespesia populnea*	Emajagüilla	1.5	4	0.0002
25	*Thespesia populnea*	Emajagüilla	2.5	5	0.0005
26	*Thespesia populnea*	Emajagüilla	2.5	5	0.0005
27	*Thespesia populnea*	Emajagüilla	17	5	0.0227
28	*Thespesia populnea*	Emajagüilla	3	5	0.0007
29	*Laguncularia racemosa*	Mangle blanco	8.5	6	0.0057
30	*Laguncularia racemosa*	Mangle blanco	30.5	9	0.0731
31	*Laguncularia racemosa*	Mangle blanco	31	5	0.0755
32	*Laguncularia racemosa*	Mangle blanco	5	5	0.0020
33	*Laguncularia racemosa*	Mangle blanco	12	8	0.0113
34	*Laguncularia racemosa*	Mangle blanco	10	6	0.0079
35	*Thespesia populnea*	Emajagüilla	2.5	5	0.0005
36	*Thespesia populnea*	Emajagüilla	1.5	5	0.0002
37	*Bucida buceras*	Ucar	2	4	0.0003
38	*Roystonea borinquena*	Palma Real	14	5	0.0154
39	*Thespesia populnea*	Emajagüilla	7.5	4	0.0044
40	*Laguncularia racemosa*	Mangle blanco	17	4	0.0227
41	*Terminalia catappa*	Almendro	70	12	0.3848
42	*Terminalia catappa*	Almendro	23	10	0.0415
43	*Calophyllum antillanum*	María	1	2	0.0001
44	*Laguncularia racemosa*	Mangle blanco	23	9	0.0415
45	*Laguncularia racemosa*	Mangle blanco	20	8	0.0314
46	*Laguncularia racemosa*	Mangle blanco	22	9	0.0380
47	*Laguncularia racemosa*	Mangle blanco	12.5	5	0.0123
48	*Laguncularia racemosa*	Mangle blanco	19	6	0.0284
49	*Thespesia populnea*	Emajagüilla	2.5	5	0.0005
50	*Thespesia populnea*	Emajagüilla	2.5	5	0.0005
51	*Thespesia populnea*	Emajagüilla	10	8	0.0079
52	*Calophyllum antillanum*	María	2	4	0.0003
53	*Calophyllum antillanum*	María	2.5	5	0.0005
54	*Calophyllum antillanum*	María	6	5	0.0028
55	*Calophyllum antillanum*	María	1	3	0.0001
56	*Laguncularia racemosa*	Mangle blanco	5	6	0.0020
57	*Laguncularia racemosa*	Mangle blanco	7	6	0.0038

Gentry XII	**0m**	**18.43008**	**066.04046**
WP 357-358	**50m**	**18.42999**	**066.04292**

Spp. ID	***Scientific Name***	**Common Name**	**DBH**	**High (feets)**	**Basal Area (m²)**
1	*Laguncularia racemosa*	Mangle blanco	15.4	3	0.0186
2	*Rhizophora mangle*	Mangle rojo	2.5	1	0.0005
3	*Rhizophora mangle*	Mangle rojo	4.5	2	0.0016
4	*Rhizophora mangle*	Mangle rojo	1.5	1	0.0002
5	*Rhizophora mangle*	Mangle rojo	2.5	1	0.0005
6	*Rhizophora mangle*	Mangle rojo	14	3	0.0154
7	*Rhizophora mangle*	Mangle rojo	15	3	0.0177
8	*Rhizophora mangle*	Mangle rojo	12.5	2	0.0123
9	*Avicennia germinans*	Mangle negro	16.5	3	0.0214
10	*Avicennia germinans*	Mangle negro	22	3	0.0380
11	*Rhizophora mangle*	Mangle rojo	7.25	3	0.0041
12	*Avicennia germinans*	Mangle negro	9.5	2	0.0071
13	*Rhizophora mangle*	Mangle rojo	5	2	0.0020
14	*Rhizophora mangle*	Mangle rojo	6	2	0.0028
15	*Avicennia germinans*	Mangle negro	20	3	0.0314
16	*Rhizophora mangle*	Mangle rojo	7	2	0.0038
17	*Rhizophora mangle*	Mangle rojo	7	2	0.0038
18	*Rhizophora mangle*	Mangle rojo	13.5	2	0.0143
19	*Avicennia germinans*	Mangle negro	17.5	3	0.0241
20	*Rhizophora mangle*	Mangle rojo	6	2	0.0028
21	*Avicennia germinans*	Mangle negro	0.5	2	0.0000
22	*Rhizophora mangle*	Mangle rojo	0.6	3	0.0000
23	*Avicennia germinans*	Mangle negro	35.5	4	0.0990
24	*Avicennia germinans*	Mangle negro	19.5	3	0.0299
25	*Rhizophora mangle*	Mangle rojo	8	2	0.0050
26	*Rhizophora mangle*	Mangle rojo	7.5	6	0.0044

Appendix C

Species Ranking and Forest Community Composition Values

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APPENDIX C : SPECIES RANKING AND FOREST COMMUNITY COMPOSITION VALUES

	Scientific Name	**Common Name**	**Family**	**Abundance**	**Absolute Abundance**	**Relative Abundance (%)**	**Density (indiv. /hectare)**	**Relative Density (%)**	Absolute Frequency	Frequency	Relative Frequency (%)	**Absolute Dominance (m^2) (Basal Area)**	**Dominance (m^2/ha)**	**Relative Dominance (%)**	**Importance value**	**Transect Location**
1	*Bucida buceras*	Ucar	Combretaceae	1	1	0.16	8.33	0.1623	1	8.33	1.75	0.0003	0.0025	0.0021	1.913	XII
2	*Cocos nucifera*	Palma de Coco	Arecaceae	1	1	0.16	8.33	0.1623	1	8.33	1.75	0.0001	0.0008	0.0007	1.9137	IV
3	*Piper aduncum*	Higuillo	Piperaceae	1	1	0.16	8.33	0.1623	1	8.33	1.75	0.0002	0.0017	0.0014	1.9144	XII
4	*Albizia lebbeck*	Acacia amarilla	Mimosoideae	2	2	0.32	16.67	0.3247	1	8.33	1.75	0.0113	0.0942	0.0799	2.1546	X
5	*Delonix regia*	Flamboyán	Caesalpinioideae	2	2	0.32	16.67	0.3247	2	16.66	3.51	0.1594	1.3283	1.1265	4.9612	VIII, XI
6	*Melicoccus bijugatus*	Quenepa	Sapindaceae	3	3	0.48	25.00	0.487	2	16.66	3.51	0.0039	0.0325	0.0002	3.9972	II,X
7	*Peltophorum pterocarpum*	Flamboyán amarillo	Fabaceae	4	4	0.65	33.33	0.6493	2	16.66	3.51	0.0899	0.7491	0.6353	4.1939	V,X
8	*Pithecellobium dulce*	Guamá americano	Mimosoideae	4	4	0.65	33.33	0.6493	2	16.66	3.51	0.0049	0.0408	0.0346	4.7946	II, X
9	*Terminalia catappa*	Almendro	Combretaceae	8	8	1.29	66.67	1.2988	3	25.00	5.26	0.7083	5.9025	5.0056	11.5644	II, V, XI
10	*Roystonea borinquena*	Palma Real	Arecaceae	11	11	1.78	91.67	1.7857	4	33.33	7.02	0.5419	4.5158	3.8297	12.6354	VIII, IX, X, XI
11	*Calophyllum antillanum*	María	Clusiaceae	14	14	2.26	116.67	2.2728	2	16.66	3.51	0.0097	0.0808	0.0686	5.8514	VII, XI
12	*Rhizophora mangle*	Mangle rojo	Rhizophoraceae	55	55	8.85	458.33	8.9285	8	66.66	14.03	0.3839	3.1992	2.7137	25.6722	I, II, III, IV, V, VI, VII, XII
13	*Thespesia populnea*	Emajagüilla	Malvaceae	80	83	13.41	666.67	12.9871	8	66.66	14.03	1	8.3333	7.0671	34.0842	I, II, III, IV, V, VI, VII, XII
14	*Avicennia germinans*	Mangle negro	Avicenniaceae	133	133	21.49	1108.33	21.5908	8	66.66	14.03	3.2925	27.4375	23.2685	58.8893	I, II, III, IV, V, VI, VIII, XI
15	*Laguncularia racemosa*	Mangle blanco	Combretaceae	297	297	47.98	2475.00	48.2143	12	100.00	21.05	7.9417	66.1808	56.125	125.3893	I, II, III, IV, V, VI, VII, VIII, IX, X, XI, XII

Appendix D

Terrestrial Flora & Fauna Inventory

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APPENDIX D : TERRESTRIAL FLORA INVENTORY SURVEY LIST

	Scientific Name	Spanish Common Name	Botanical Family	Status
1	*Achrostichum aureum*	Palmita de río	Polypodiaceae	Native
2	*Achyranthes aspera*	Rabo de gato	Amaranthaceae	Native
3	*Adianthum pyramidale* .	Helecho de pozo	Polypodiaceae	Native
4	*Adiantum petiolatum*	n/a	Polypodiaceae	Native
5	*Albizia lebbeck*	Acacia amarilla	Mimosoideae	Introduced
6	*Albizia procera*	Albizia	Mimosoideae	Introduced
7	*Alocasia cucullata*	n/a	Araceae	Introduced
8	*Alocasia macrorrhiza*	Alocasia gigante	Araceae	Introduced
9	*Amaranthus dubius*	Bledo	Amaranthaceae	Native
10	*Andira inermis*	Moca	Papilionoideae	Native
11	*Annona glabra*	Cayur	Annonaceae	Native
12	*Annona muricata*	Guanábana	Annonaceae	Native
13	*Ardisia eliptica*	Mameyuelo	Myrsinaceae	Introduced
14	*Artocarpus altilis*	Pana	Urticaceae	Introduced
15	*Avicennia germinans*	Mangle negro	Avicenniaceae	Native
16	*Bidens alba*	Margarita silvestre	Asteraceae	Native
17	*Brachiaria purpurascens*	Malojillo	Gramineae	Native
18	*Bromelia Sp.*	n/a	Bromeliaceae	Native
19	*Bucida buceras*	Ucar	Combretaceae	Native
20	*Bursera simaruba*	Almácigo	Burseraceae	Native
21	*Caesalpinia pulcherrima*	Clavellina	Fabaceae	Introduced
22	*Calistemon citrinus*	Cepillo	Myrtaceae	Introduced
23	*Calophyllum antillaunum*	María	Clusiaceae	Native
24	*Calophyllum inophyllum*	Santa María	Clusiaceae	Introduced
25	*Canna indica*	Maraca	Cannaceae	Native
26	*Capsicum annuum*	Ají	Solanaceae	Native
27	*Casearia decandra*	Caracolillo	Flacourtiaceae	Native
28	*Casuarina equisetifolia*	Pino Australiano	Casuarinaceae	Introduced
29	*Ceiba pentandra*	Ceiba	Bombacaceae	Native
30	*Cestrum diurnum*	Galán de día	Solanaceae	Native
31	*Chloris sagraeana*	n/a	Poaceae	Native
32	*Citharexylum fruticosum*	Péndula	Verbenaceae	Native
33	*Citrus Sp.*	n/a	Rutaceae	Introduced
34	*Coccoloba uvifera*	Uva de playa	Polygonaceae	Native
35	*Cocos nucifera*	Palma de Coco	Arecaceae	Introduced
36	*Colocasia esculenta*	Malanga	Araceae	Introduced
37	*Commelina diffusa*	Cohitre	Commelinaceae	Native
38	*Commelina erecta*	Cohitre azul	Commelinaceae	Native
39	*Cordia dentata*	Capá blanco	Boraginaceae	Native
40	*Costus speciosus*	n/a	Zingiberaceae	Introduced
41	*Costus spicatus*	Caña amarga	Lythraceae	Native
42	*Cuphea micrantha*	n/a	Lythraceae	Native
43	*Cyperus alternifolius*	Paraguita	Cyperaceae	Native
44	*Cyperus haspan*	n/a	Cyperaceae	Native
45	*Cyperus imbricatus*	n/a	Cyperaceae	Introduced
46	*Cyperus iria*	n/a	Cyperaceae	Native
47	*Cyperus ligularis*	n/a	Cyperaceae	Native
48	*Cyperus odoratus*	n/a	Cyperaceae	Native
49	*Cyperus polystachyos*	n/a	Cyperaceae	Native
50	*Cyperus rotundus*	Coquí	Cyperaceae	Native

APPENDIX B : TERRESTRIAL FLORA INVENTORY SURVEY LIST

	Scientific Name	**Spanish Common Name**	**Botanical Family**	**Status**
51	*Dalbergia ecastaphyllum*	Maray-Maray	Papilionoideae	Native
52	*Delonix regia*	Flamboyán	Caesalpinioideae	Introduced
53	*Dicffenbachia maculata*	Rábano ornamental	Araceae	Introduced
54	*Dicffenbachia seguine*	Rábano cimarrón	Araceae	Native
55	*Digitaria ciliaris*	Yerba de juey	Poaceae	Native
56	*Echinochloa polystachya*	Yerba de río	Poaceae	Native
57	*Echinocloa colona*	Arrocillo	Poaceae	Introduced
58	*Elaeocharis mutata*	n/a	Cyperaceae	Native
59	*Eleocharis cellulosa*	Junco fino	Cyperaceae	Native
60	*Eleusine indica*	Pata de gallina	Poaceae	Introduced
61	*Enterolobium cyclocarpum*	Guanacaste	Fabaceae	Introduced
62	*Erythrina peoppigiana*	Bucayo gigante	Papilionoideae	Introduced
63	*Eugenia monticola*	Hoja menuda	Myrtaceae	Native
64	*Euphorbia heterophylla*	Lechecilla	Euphorbiaceae	Native
65	*Ficus citrifolia*	Jagüey macho	Moraceae	Native
66	*Ficus elastica*	Arbol de goma	Moraceae	Introduced
67	*Ficus lancifolia*	Ficus lancelado	Moraceae	Introduced
68	*Gossypium hirsutum*	Algodón	Malvaceae	Introduced
69	*Hydrocotyle umbrellata*	Sombrilla de agua	Umbelliferae	Introduced
70	*Ipomoea tiliacea*	Bejuco de puerco	Convolvulaceae	Native
71	*Ixora ferrea*	Palo de hierro	Rubiaceae	Native
72	*Jatropha curcas*	Tartago	Euphorbiaceae	Introduced
73	*Lagerstroemia speciosa*	Reina de las flores	Lythraceae	Introduced
74	*Laguncularia racemosa*	Mangle blanco	Combretaceae	Native
75	*Lemna perpusilla*	Yerba de pato	Lemnaceae	Native
76	*Leucaena leucocephala*	Botón de cadete	Lamiaceae	Introduced
77	*Livingstonia chinensis*	Livingstonia	Arecaceae	Introduced
78	*Ludwigia octovalvis*	Yerba de clavo	Onagraceae	Native
79	*Malachra capitata*	Malvavisco	Malvaceae	Native
80	*Malpighia emarginata*	Acerola	Malpighiaceae	Native
81	*Mangifera indica*	Mangó	Anacardiaceae	Introduced
82	*Megathyrsus maximus*	Yerba de guinea	Poaceae	Introduced
83	*Melanthera aspera*	Yerba de cabra	Asteraceae	Native
84	*Melicoccus bijugatus*	Quenepa	Sapindaceae	Introduced
85	*Merremia umbellata*	Aguinaldo amarillo	Convolvulaceae	Native
86	*Mimosa pellita*	n/a	Mimosoideae	Introduced
87	*Mimosa pudica*	Moriviví	Mimosoideae	Native
88	*Momordica charantia*	Cundeamor	Cucurbitaceae	Introduced
89	*Morinda citrifolia*	Noni	Rubiaceae	Introduced
90	*Murraya exotica*	Café de la India	Rutaceae	Introduced
91	*Musa paradisiaca*	Guineo	Musaceae	Introduced
92	*Mutingia calabura*	Capulín	Elaeocarpaceae	Native
93	*Nephrolepis multiflora*	Helecho común	Polypodiaceae	Native
94	*Nephrolepsis exaltata*	Helecho espada	Polypodiaceae	Native
95	*Neptunia plena*	Desmanto amarillo	Fabaceae	Native
96	*Ochna jabotapita*	n/a	Ochnaceae	Introduced
97	*Oeceoclades maculata*	Orquídea	Orchidaceae	Introduced
98	*Paspalum conjugatum*	Horquetilla blanca	Poaceae	Native
99	*Paspalum fasciculatum*	Yerba venezolana	Poaceae	Native
100	*Paspalum millegrana*	Cortadora	Poaceae	Native

APPENDIX B : TERRESTRIAL FLORA INVENTORY SURVEY LIST

	Scientific Name	**Spanish Common Name**	**Botanical Family**	**Status**
101	*Paulinnia pinnata*	Bejuco de paloma	Sapindaceae	Native
102	*Peltophorum pterocarpum*	Flamboyán amarillo	Fabaceae	Introduced
103	*Persea americana*	Aguacate	Lauraceae	Introduced
104	*Petiveria alliacea*	Anamú	Phytolaccaceae	Introduced
105	*Philodendron radiatum*	n/a	Araceae	Introduced
106	*Phyla nodiflora*	Yerba de sapo	Verbenaceae	Native
107	*Phyllanthus acidus*	Grosella	Euphorbiaceae	Introduced
108	*Phyllanthus juglandifolius*	Quinino del pobre	Euphorbiaceae	Native
109	*Pimenta racemosa*	Malagueta	Myrtaceae	Native
110	*Piper aduncum*	Higuillo	Piperaceae	Native
111	*Pithecellobium dulce*	Guamá americano	Mimosoideae	Introduced
112	*Psidium guajava*	Guayaba	Myrtaceae	Native
113	*Pterocarpus officinalis*	Palo de pollo	Papilionoideae	Native
114	*Ptychosperma macarthurii*	Palma Macarthur	Arecaceae	Introduced
115	*Pueraria phaseoloides*	Kudzú tropical	Papilionoideae	Introduced
116	*Ravenala madagascariensis*	Palma de viajero	Musaceae	Introduced
117	*Rhizophora mangle*	Mangle rojo	Rhizophoraceae	Native
118	*Rhynchospora nervosa*	Yerba de estrella	Cyperaceae	Native
119	*Ricinus communis*	Higuereta	Euphorbiaceae	Introduced
120	*Roystonea borinquena*	Palma Real	Arecaceae	Native
121	*Roystonea regia*	Palma Real Cubana	Arecaceae	Introduced
122	*Ruellia brittoniana*	A-las-doce-me-voy	Acanthaceae	Introduced
123	*Ruellia tuberosa*	n/a	Acanthaceae	Introduced
124	*Saccharum officinarum*	Caña	Poaceae	Introduced
125	*Sansevieria trifasciata*	Lengua de suegra	Liliaceae	Introduced
126	*Schefflera actinophylla*	Cheflera	Araliaceae	Introduced
127	*Senna alata*	Talantala	Caesalpinioideae	Introduced
128	*Senna bicapsularis*	n/a	Caesalpinioideae	Native
129	*Senna siamea*	Casia amarilla	Caesalpinioideae	Native
130	*Serjania polyphylla*	Bejuco de canastas	Sapindaceae	Native
131	*Sesbania sericea*	Papagayo	Papilionoideae	Introduced
132	*Sida acuta*	Escoba blanca	Malvaceae	Native
133	*Sida rhombifolia*	Escoba colorada	Malvaceae	Native
134	*Sideroxylon salicifolium*	Sanguinaria	Sapotaceae	Native
135	*Solanum torvum*	Berenjena cimarrona	Solanaceae	Native
136	*Sorghum halepense*	Yerba Johnson	Poaceae	Introduced
137	*Spathodea campanulata*	Tulipan africano	Bignoniaceae	Introduced
138	*Spondias dulcis*	Jobo de la India	Anacardiaceae	Introduced
139	*Sterculia apetala*	Anacagüita	Sterculiaceae	Introduced
140	*Syngonium podophyllum*	Malanga trepadora	Araceae	Introduced
141	*Syzygium jambos*	Pomarrosa	Myrtaceae	Introduced
142	*Tabebuia heterophylla*	Roble nativo	Bignoniaceae	Native
143	*Tamarindus indica*	Tamarindo	Caesalpinioideae	Introduced
144	*Terminalia catappa*	Almendro	Combretaceae	Introduced
145	*Thespesia populnea*	Emajagüilla	Malvaceae	Native
146	*Tillandsia Sp.*	n/a	Bromeliaceae	Native
147	*Triumfetta semitriloba*	Cadillo de perro	Tiliaceae	Native
148	*Typha domingensis*	Yerba de eneas	Typhaceae	Native
149	*Veitchia merrillii*	Palma de Adonidia	Arecaceae	Introduced
150	*Wedelia trilobata*	Manzanilla de playa	Asteraceae	Native
151	*Zantedeschia aethiopica*	Lirio de cala	Araceae	Introduced
152	*Zoysia matrella*	Yerba de manila	Poaceae	Introduced

APPENDIX D : TERRESTRIAL FAUNA INVENTORY SURVEY LIST

	Family	Scientific Name	Spanish Common Name	English Common Name
1	Accipitridae	*Buteo jamaicensis*	Guaraguao colirrojo	Red-tailed Hawk
2	Alcedinidae	*Ceryle alcyon*	Martín pescador	Belted Kingfisher
3	Anatidae	*Dendrocygna arborea*	Chiriría Caribeña	West Indian Whistling-Duck
4	Anatidae	*Anas platyrhynchos*	Pato Cabeciverde	Mallard
5	Anatidae	*Aythya affinis*	Pato Pechiblanco	Lesser Scaup
6	Ardeidae	*Egretta thula*	Garza blanca	Snowy Egret
7	Ardeidae	*Egretta caerulea*	Garza Azul	Little Blue Heron
8	Ardeidae	*Bubulcus ibis*	Garza ganadera	Cattle Egret
9	Ardeidae	*Egretta tricolor*	Garza pechiblanca	Tricolored Heron
10	Ardeidae	*Ardea alba*	Garza real	Great Egret
11	Ardeidae	*Butorides striatus*	Martinete	Green-backed Heron
12	Ardeidae	*Butorides virescens*	Martinete verde	Green Heron
13	Ardeidae	*Ixobrychus exilis*	Martinetito	Least Bittern
14	Ardeidae	*Nyctanassa violacea*	Yaboa Común	Yellow-crowned Night Heron
15	Ardeidae	*Nyctanassa violacea*	Yaboa Común	Yellow-crowned Night-Heron
16	Caprimulgidae	*Chordeiles gundlachii*	Querequequé Antillano	Antillean Nighthawk
17	Cardinalidae	*Passerina cyanea*	Gorrión Azul	Indigo Bunting
18	Charadriidae	*Pluvialis squatarola*	Chorlo Cabezón	Black-bellied Plover
19	Charadriidae	*Charadrius wilsonia*	Chorlo Marítimo	Wilson’s Plover
20	Charadriidae	*Charadrius vociferus*	Chorlo sabanero	Killdeer
21	Charadriidae	*Charadrius semipalmatus*	Playero acollarado	Semipalmated Plover
22	Coerebidae	*Coereba flaveola*	Reinita común	Bananaquit
23	Columbidae	*Columba livia*	Paloma doméstica	Rock Dove
24	Columbidae	*Columbina passerina*	Rolita	Common Ground-Dove
25	Columbidae	*Zenaida asiatica*	Tórtola aliblanca	White-winged Dove
26	Columbidae	*Zenaida aurita*	Tórtola cardosantera	Zenaida Dove
27	Cuculidae	*Crotophaga ani*	Judío	Smooth-billed Ani
28	Cuculidae	*Coccyzus minor*	Pájaro bobo menor	Mangrove cuckoo
29	Emberizidae	*Sicalis flaveola*	Pinzón Azafrán	Saffron Finch
30	Emberizidae	*Parkesia noveboracensis*	Pizpita de mangle	Northern waterthrush
31	Emberizidae/Fringillidae	*Tiaris bicolor*	Gorrión negro	Black-faced Grassquit
32	Emberizidae/Fringillidae	*Molothrus bonariensis*	Tordo lustroso	Shiny Cowbird
33	Emberizidae/Icteridae	*Quiscalus niger*	Chango	Greater Antillean Grackle
34	Emberizidae/Parulidae	*Parula americana*	Reinita pechidorada	Northern Parula
35	Emberizidae/Thraupidae	*Spindalis portoricensis*	Reina Mora de PR	Puerto Rican Spindalis
36	Estrildidae	*Lonchura cucullata*	Diablito	Bronze Mannikin
37	Estrildidae	*Padda oryzivora*	Gorrión Arrocero	Java Sparrow
38	Estrildidae	*Lonchura punctulata*	Gorrión canela	Nutmeg Mannikin
39	Estrildidae	*Lonchura malabarica*	Gorrión pico plata	Silverbill Finch
40	Estrildidae	*Estrilda melpoda*	Veterano	Orange-cheeked Waxbill
41	Falconidae	*Falco sparverius*	Falcón común	American Kestrel
42	Falconidae	*Falco columbarius*	Falcón migratorio	Merlin
43	Falconidae	*Falco peregrinus*	Falcón Peregrino	Peregrine Falcon
44	Fregatidae	*Fregata magnificens*	Tijereta	Magnificent Frigatebird
45	Hirundinidae	*Pterochelidon fulva*	Golondrina de cuevas	Cave Swallow
46	Hirundinidae	*Hirundo rustica*	Golondrina Horquillada	Barn Swallow

APPENDIX D : TERRESTRIAL FAUNA INVENTORY SURVEY LIST

	Family	**Scientific Name**	**Spanish Common Name**	**English Common Name**
47	Icteridae	*Icterus icterus*	Turpial	Venezuelan Troupial
48	Laridae	*Thalasseus maximus*	Charrán Real	Royal Tern
49	Laridae	*Sternula antillarum*	Charrán Pequeño	Least Tern
50	Laridae	*Larus atricilla*	Gaviota gallega	Laughing Gull
51	Mimidae	*Mimus polyglottos*	Ruiseñor	Northern Mockingbird
52	Mimidae	*Margarops fuscatus*	Zorzal pardo	Pearly-eyed Thrasher
53	Muscicapidae	*Turdus plumbeus*	Zorzal de patas coloradas	Red-legged thrush
54	Pandionidae	*Pandion haliaetus*	Águila Pescadora	Osprey
55	Parulidae	*Seiurus aurocapilla*	Pizpita Dorada	Ovenbird
56	Parulidae	*Dendroica petechia*	Reinita Amarilla	Yellow Warbler
57	Parulidae	*Setophaga ruticilla*	Reinita Candelita	American Redstart
58	Parulidae	*Dendroica discolor*	Reinita Galana	Prairie Warbler
59	Parulidae	*Protonotaria citrea*	Reinita Protonotaria	Prothonotary Warbler
60	Parulidae	*Dendroica striata*	Reinita Rayada	Blackpoll Warbler
61	Parulidae	*Dendroica tigrina*	Reinita Tigre	Cape May Warbler
62	Parulidae	*Mniotilta varia*	Reinita Trepadora	Black-and-white Warbler
63	Parulidae	*Wilsonia citrina*	Reinita Viuda	Hooded Warbler
64	Passeridae	*Passer domesticus*	Gorrión inglés	House Sparrow
65	Pelicanidae	*Pelicanus occidentalis*	Pelícano	Brown Pelican
66	Phasianidae	*Gallus gallus*	Gallo/Gallina Silvestre	domestic junglefowl
67	Picidae	*Melanerpes portoricensis*	Carpintero de PR	Puerto Rican Woodpecker
68	Ploceidae	*Euplectes franciscanus*	Obispo colorado	Orange Bishop
69	Ploceidae	*Vidua macroura*	Viuda colicinta	Pin-tailed Whydah
70	Podicipedidae	*Podilymbus podiceps*	Zaramago	Pied-billed Grebe
71	Procellariidae	*Puffinis lherminieri*	Pampero de Audubon	Audubon's Shearwater
72	Psittacidae	*Brotogeris versicolurus*	Periquito Aliamarillo	White-winged Parakeet
73	Rallidae	*Gallinula chloropus*	Gallareta común	Common Moorhen
74	Rallidae	*Fulica americana*	Gallinazo Americano	American Coot
75	Recurvirostridae	*Himantopus mexicanus*	Viuda Mexicana	Black-necked Stilt
76	Scolopacidae	*Actitis macularia*	Playero coleador	Spotted Sandpiper
77	Scolopacidae	*Calidris pusilla*	Playero Gracioso	Semipalmated Sandpiper
72	Scolopacidae	*Tringa melanoleuca*	Playero Guineilla Grande	Greater Yellowlegs
79	Scolopacidae	*Tringa flavipes*	Playero Guineilla Pequeño	Lesser Yellowlegs
80	Scolopacidae	*Calidris minutilla*	Playero Menudillo	Least Sandpiper
81	Scolopacidae	*Calidris mauri*	Playero Occidental	Western Sandpiper
82	Scolopacidae	*Tringa solitaria*	Playero solitario	Solitary Sandpiper
83	Sulidae	*Sula leucogaster*	Boba Parda	Brown Booby
84	Trochilidae	*Anthracothorax dominicus*	Zumbador dorado	Antillean Mango
85	Trochilidae	*Anthracothorax viridis*	Zumbador verde	Green Mango
86	Trochilidae	*Eulampis holosericeus*	Zumbadorcito de pecho azul	Green-throated Carib
87	Tyranidae	*Elaenia martinica*	Juí blanco	Caribbean Elaenia
88	Tyranidae	*Myiarchus antillarum*	Jui de Puerto Rico	Puerto Rican Flycatcher
89	Tyranidae	*Tyrannus dominicensis*	Pitirre gris	Gray Kingbird
90	Vireonidae	*Vireo latimeri*	Bien-te-veo	Puerto Rican Vireo
91	Vireonidae	*Vireo altiloquus*	Julián chiví bigotinegro	Black-whiskered Vireo

APPENDIX D : TERRESTRIAL FAUNA INVENTORY SURVEY LIST

	Family	Scientific Name	Spanish Common Name	English Common Name
92	Viverridae	*Herpestes auropunctatus*	Mangosta	Small Asian Mongoose
93	Felidae	*Felis domesticus*	Gato Asilvestrado	House Cat
94	Muridae	*Rattus norvegicus*	Rata	Norway Rat

	Family	Scientific Name	Spanish Common Name	English Common Name
95	Ampuyariidae	*Poamea cumngy*	Caracol	n/a
96	Ampuyariidae	*Marisa cornuarietis*	Caracol cuerno de carnero	Giant Ramshorn Snail
97	Camaenidae	*Caracolus carocolla*	Caracol	n/a
98	Camaenidae	*Caracolus marginella*	Caracol	n/a

	Family	Scientific Name	Spanish Common Name	English Common Name
99	Apidae	*Apis melifera*	Abeja	Honeybee
100	Blattidae	*Periplaneta americana*	Cucaracha	American Cockroach
101	Culicidae	*Aedes aegyptii*	Mosquito	Mosquito
102	Danaidae	*Danaus plexipus*	Mariposa	Monarch Butterfly
103	Formicidae	*Solenopsis invicta*	Hormiga	Red Imported Fire Ant
104	Formicidae	*Paratrechina longicornis*	Hormiga	Crazy Ant
105	Muscidae	*Mosca domestica*	Mosca	Housefly
106	Pieriidae	*Phoebis sp.*	Mariposa	n/a
107	Termitidae	*Nasutitermes costalis*	Comején	Tree Termite

	Family	Scientific Name	Spanish Common Name	English Common Name
108	Centropomidae	*Cenropomus undecimalis*	Robalo	Snook
109	Cichlidae	*Oreochromis mossambicus*	Tilapia	Mozambique Tilapia
110	Elopifor	*Megalops atlanticus*	Sabalo	Tarpon
111	Poeciliidae	*Poecilia reticulata*	Gupi	Guppy

	Family	Scientific Name	Spanish Common Name	English Common Name
112	Bufonidae	*Bufo marinus*	Sapo común	Cane Toad
113	Leptodactylidae	*Eleutherodactylus coqui*	Coquí	n/a
114	Leptodactylidae	*Eleutherodactylus antillensis*	Coquí churí	n/a
115	Leptodactylidae	*Eleutherodactylus brittoni*	Coquí de las yerbas	n/a
116	Leptodactylidae	*Leptodactylus albilabris*	Rana labio blanco	White-lipped Frog
117	Ranidae	*Rana catesbeiana*	Rana mugidora	American Bullfrog
118	Boidae	*Epicrates inornatus*	Boa de Puerto Rico	Puerto Rican Boa
119	Crocodylidae	*Caiman cocodrilus*	Caiman de Anteojos	Spectacled Caiman
120	Emydidae	*Trachemys stejnegeri stejnegeri*	Jicotea	Puerto Rican Slider
121	Iguanidae	*Anolis cristatelus*	Lagartijo común	Common Anole
122	Iguanidae	*Anolis krugi*	Lagartijo de las yerbas	Lizard
123	Iguanidae	*Anolis pulchellus*	Lagartijo jardinero	Lizard
124	Iguanidae	*Anolis stratulus*	Lagartijo	Lizard
125	Iguanidae	*Iguana iguana*	Iguana común	Green Iguana
126	Teiidae	*Ameiva exsul*	Siguana común	Puerto Rican Ground Lizard

Appendix E

Wetland Analysis for Project Alternatives

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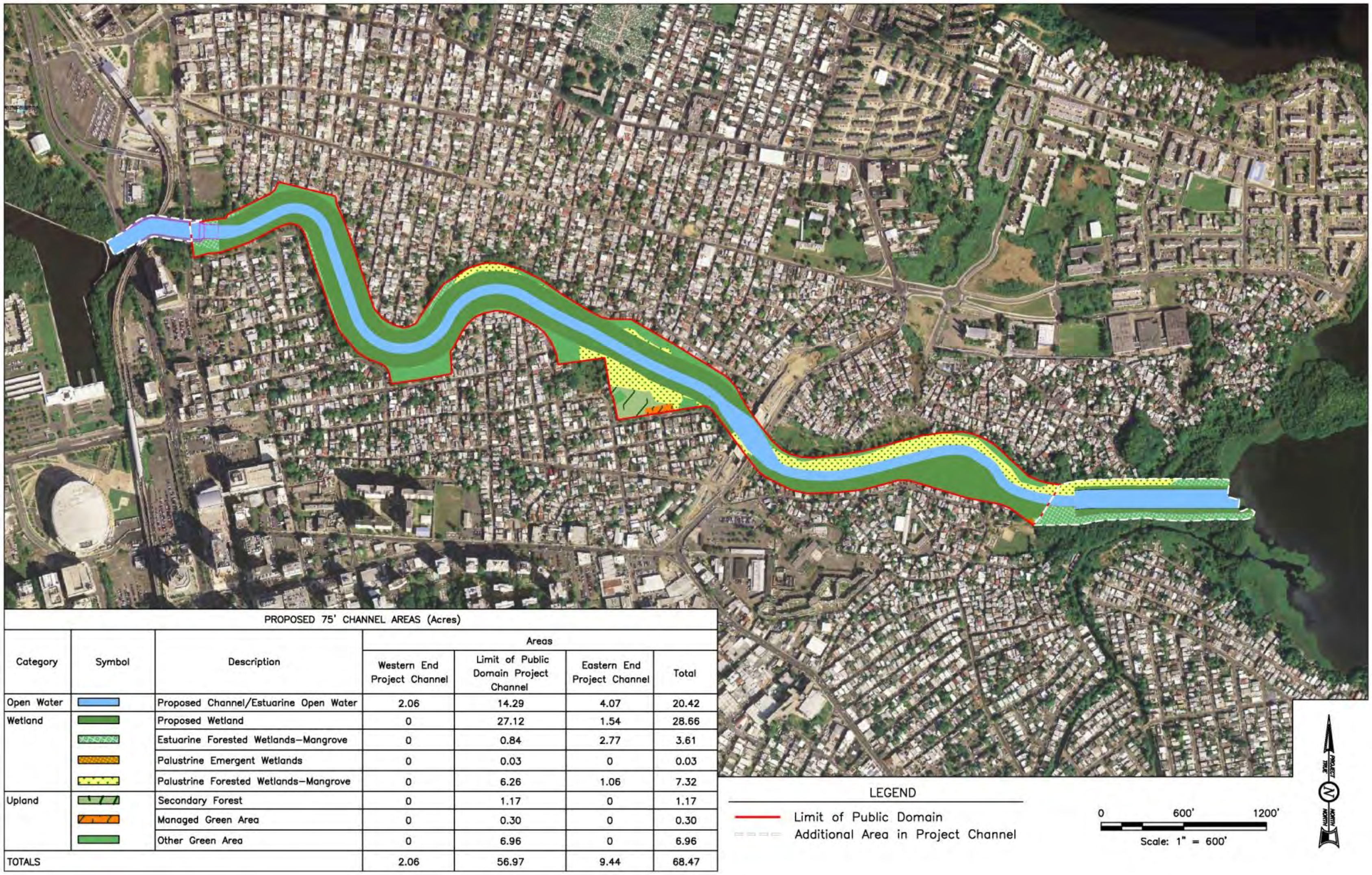
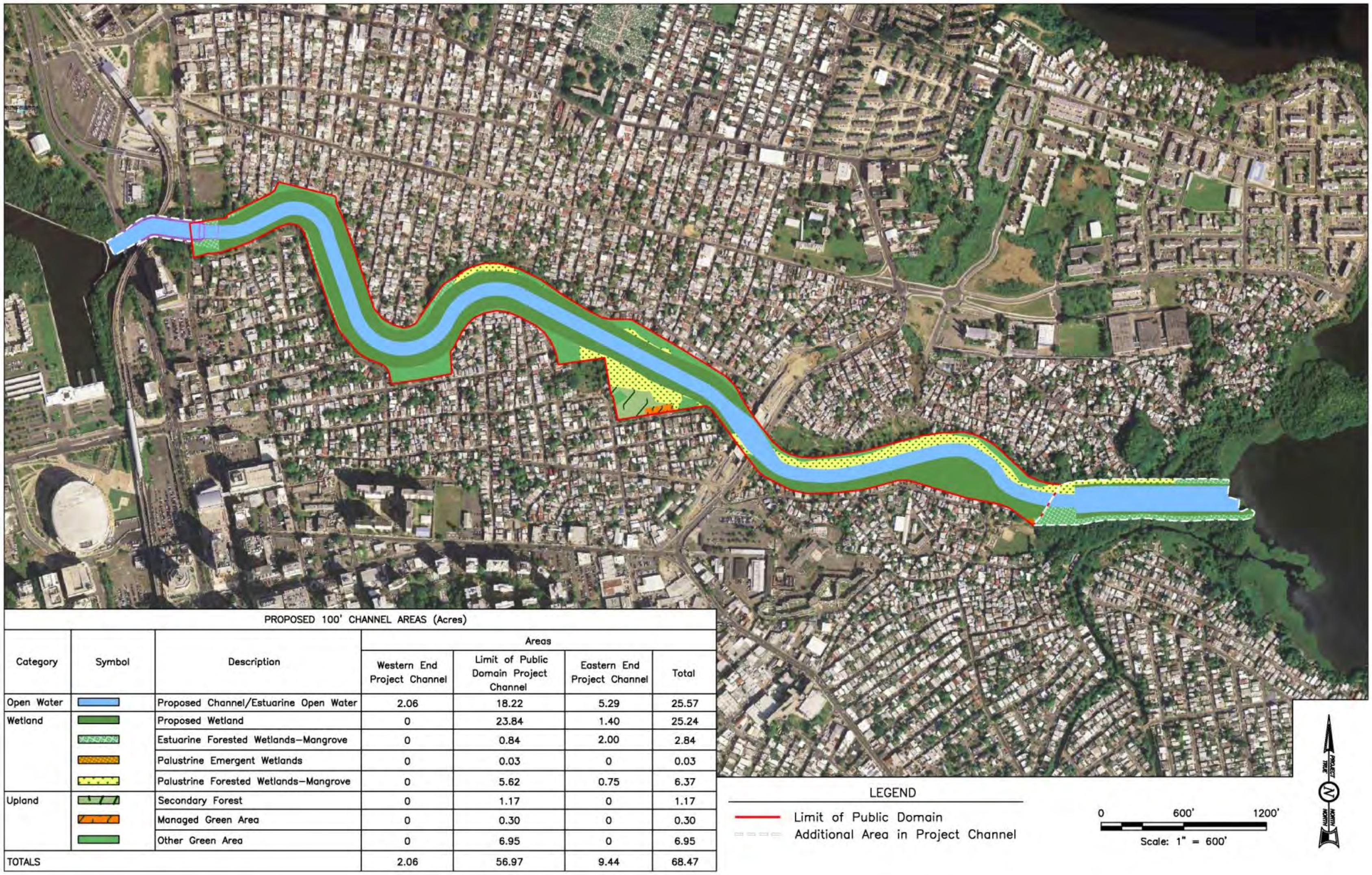


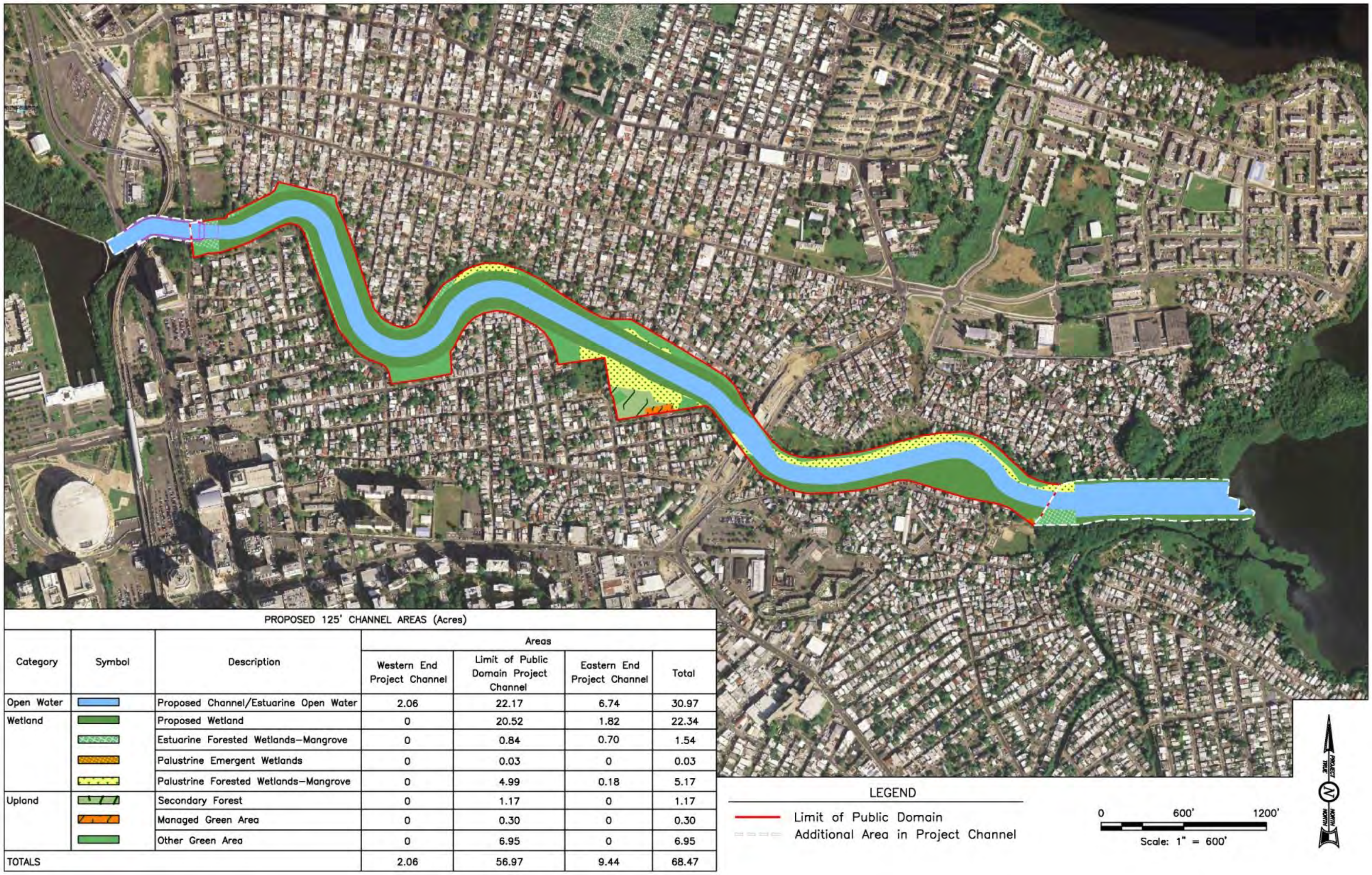
PROPOSED 75' CHANNEL AREAS (Acres)

Category	Symbol	Description	Areas			
			Western End Project Channel	Limit of Public Domain Project Channel	Eastern End Project Channel	Total
Open Water	🟦	Proposed Channel/Estuarine Open Water	2.06	14.29	4.07	20.42
Wetland	🟩	Proposed Wetland	0	27.12	1.54	28.66
	▨	Estuarine Forested Wetlands–Mangrove	0	0.84	2.77	3.61
	🟧	Palustrine Emergent Wetlands	0	0.03	0	0.03
	🟨	Palustrine Forested Wetlands–Mangrove	0	6.26	1.06	7.32
Upland	▨	Secondary Forest	0	1.17	0	1.17
	▨	Managed Green Area	0	0.30	0	0.30
	🟩	Other Green Area	0	6.96	0	6.96
TOTALS			2.06	56.97	9.44	68.47



PROPOSED 100' CHANNEL AREAS (Acres)

Category	Symbol	Description	Areas			
			Western End Project Channel	Limit of Public Domain Project Channel	Eastern End Project Channel	Total
Open Water	🟦	Proposed Channel/Estuarine Open Water	2.06	18.22	5.29	25.57
Wetland	🟩	Proposed Wetland	0	23.84	1.40	25.24
	▨	Estuarine Forested Wetlands–Mangrove	0	0.84	2.00	2.84
	🟧	Palustrine Emergent Wetlands	0	0.03	0	0.03
	🟨	Palustrine Forested Wetlands–Mangrove	0	5.62	0.75	6.37
Upland	▨	Secondary Forest	0	1.17	0	1.17
	▨	Managed Green Area	0	0.30	0	0.30
	🟩	Other Green Area	0	6.95	0	6.95
TOTALS			2.06	56.97	9.44	68.47



PROPOSED 125' CHANNEL AREAS (Acres)

Category	Symbol	Description	Areas			
			Western End Project Channel	Limit of Public Domain Project Channel	Eastern End Project Channel	Total
Open Water	🟦	Proposed Channel/Estuarine Open Water	2.06	22.17	6.74	30.97
Wetland	🟩	Proposed Wetland	0	20.52	1.82	22.34
	▨	Estuarine Forested Wetlands—Mangrove	0	0.84	0.70	1.54
	🟧	Palustrine Emergent Wetlands	0	0.03	0	0.03
	🟨	Palustrine Forested Wetlands—Mangrove	0	4.99	0.18	5.17
Upland	▨	Secondary Forest	0	1.17	0	1.17
	🟧	Managed Green Area	0	0.30	0	0.30
	🟩	Other Green Area	0	6.95	0	6.95
TOTALS			2.06	56.97	9.44	68.47

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Appendix H5

Coastal Zone Management Certification Package

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DRAFT
APPLICATION FOR A CERTIFICATION OF CONSISTENCY WITH THE PUERTO RICO COASTAL ZONE MANAGEMENT PLAN
CAÑO MARTÍN PEÑA
ECOSYSTEM RESTORATION PROJECT
SAN JUAN, PUERTO RICO

Prepared for:

Corporación del Proyecto ENLACE del Caño Martín Peña
Apartado Postal 41308
San Juan, Puerto Rico 00940-1308

September 2015

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Executive Summary

This draft *Application for a Certification of Federal Consistency with the Puerto Rico Coastal Zone Management Plan* has been prepared for the Caño Martín Peña Ecosystem Restoration Project (the Project). The purpose of the application package is to seek a certification that the Project is in compliance with the enforceable policies of the Puerto Rico Coastal Zone Management Program document. The package will be submitted to the Puerto Rico Planning Board once the project has achieved environmental compliance with the National Environmental Policy Act (NEPA), Public Law No. 91-190, as amended, and the Puerto Rico's Environmental Policy Act, Puerto Rico Law No. 416 of 2004, as amended.

The application package consists of the form JP-833 (Rev. March 2005, Application for Certification of Consistency with the Puerto Rico Coastal Management Program) and the appendices required and suggested therein, including:

- 1:20,000 scale, U.S. Geological Survey topographic quadrangular base map of the site.
- Descriptive memorandum, which includes diagrams and a comprehensive description of the Project.
- Figure illustrating Project boundaries and features for newsprint publication (black & white).

Resumen Ejecutivo

Este borrador de *Solicitud para la Certificación de Compatibilidad Federal con el Programa de Manejo de la Zona Costanera de Puerto Rico* se preparó para el Proyecto de Restauración Ecológica del Caño Martín Peña (en adelante, el Proyecto). Los documentos a ser sometidos tienen el propósito de ilustrar que el Proyecto cumple con la política pública promulgada en el documento rector del Programa de Manejo de la Zona Costanera de Puerto Rico. El mismo debe ser sometido a la Junta de Planificación de Puerto Rico una vez el Proyecto haya cumplido con la Ley Federal de Política Pública Ambiental (NEPA, por sus siglas en inglés) y la Ley sobre Política Pública Ambiental de Puerto Rico, Ley Núm. 416 de 22 de septiembre de 2004.

Los documentos a ser entregados consisten del formulario JP-833 (Rev. Marzo 2005, Solicitud de Certificación de Cumplimiento con el Programa de Manejo de la Zona Costanera de Puerto Rico), y los anejos requeridos y sugeridos en el formulario, incluyendo, según enmendada:

- Mapa topográfico del Servicio Geológico de los E.U. del predio en escala 1:20,000.
- Memorial explicativo, que incluye diagramas y una descripción integral del Proyecto.
- Figura apta para publicación en un periódico (blanco & negro) que ilustra los linderos del Proyecto y sus atributos principales.

Contents

Figures

Tables

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Acronyms and Abbreviations

CAD	Contained Aquatic Disposal
CCMP	Comprehensive Conservation and Management Plan
CDRC	Ciudad Deportiva Roberto Clemente
CMP	Caño Martín Peña
CMP-ERP	Caño Martín Peña Ecosystem Restoration Project
EIS	Environmental Impact Statement
ENLACE	Corporación del Proyecto ENLACE del Caño Martín Peña
NEP	USEPA's National Estuary Program
PL	Public Law
PR	Puerto Rico
SJBE	San Juan Bay Estuary
SJL	San José Lagoon
SJMA	San Juan Metropolitan Area
U.S.	United States of America
USACE	U.S. Corps of Engineers
USEPA	U.S. Environmental Protection Agency
WRDA	Water Resources Development Act of 2007

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1.0 INTRODUCTION

The non-Federal sponsor, the *Corporación del Proyecto ENLACE del Caño Martín Peña* (ENLACE), has completed a Draft Feasibility Study and Environmental Impact Statement (FR/EIS) for the Caño Martín Peña Ecosystem Restoration Project (CMP-ERP). The CMP-ERP will be executed pursuant to Section 5127 of the Water Resources Development Act of 2007, Public Law No. 110-114 (WRDA 2007). Section 5127 of WRDA 2007 reads as follows:

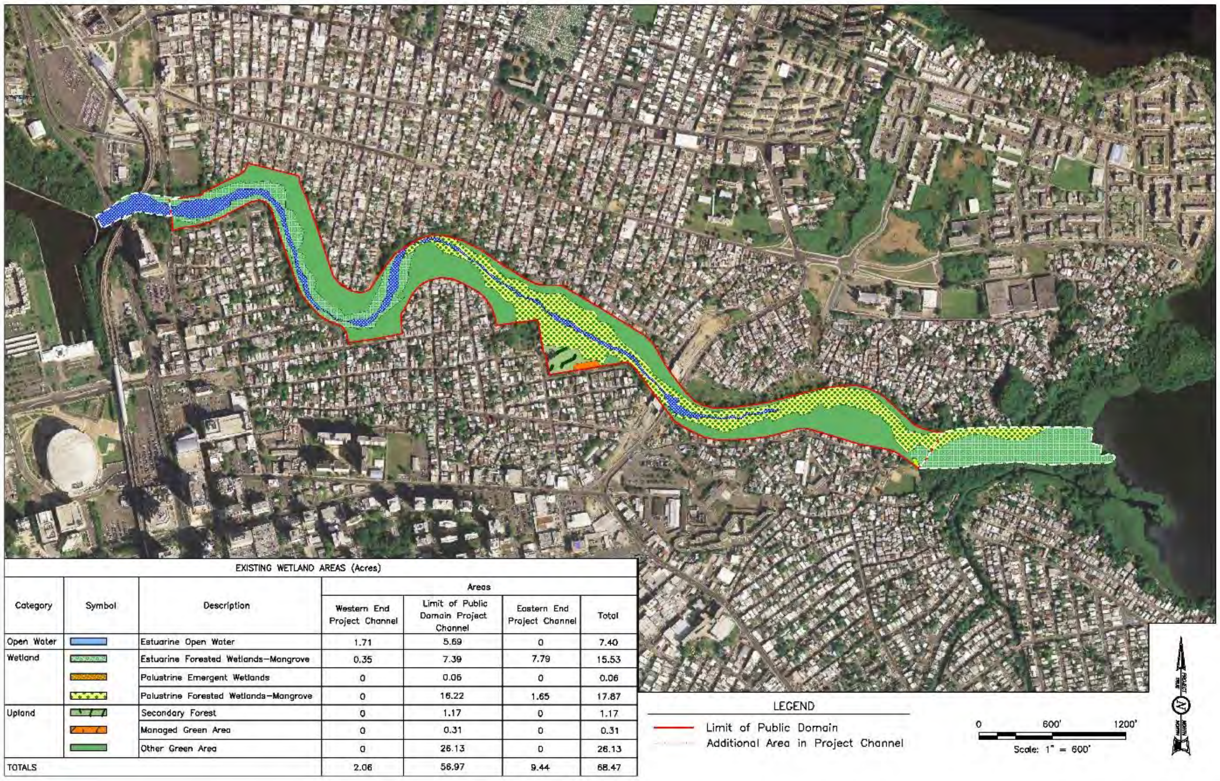
> *"The Secretary shall review a report prepared by the non-Federal interest concerning flood protection and environmental restoration for Caño Martín Pena, San Juan, Puerto Rico, and, if the Secretary determines that the report meets the evaluation and design standards of the Corps of Engineers and that the project is feasible, the Secretary may carry out the project at a total cost of $150,000,000."*

In accordance with Section 5127 of the Water Resources Development Act of 2007 and the subsequent implementation guidance, ENLACE must submit the FR/EIS to the U.S. Army Corps of Engineers (USACE) for review and approval of the Assistant Secretary of the Army (Civil Works). This draft *Application for a Certification of Federal Consistency with the Puerto Rico Coastal Zone Management Plan* is presented as part of the CMP-ERP FR/EIS. The total drainage area of the Caño Martín Peña is about 4 square miles (2,500 acres). The eastern 2.2-mile-long segment of the Caño Martín Peña and adjacent areas, including the San José Lagoon (SJL), are the primary focus of the CMP-ERP; however, restoration benefits are envisioned to occur throughout the Juan Bay Estuary (SJBE) system.

1.1 PROJECT PURPOSE

The CMP-ERP is an urban ecosystem restoration project to restore the Caño Martín Peña (CMP) and surrounding areas of the San Juan Bay Estuary (SJBE). Restoration of the CMP will reestablish the tidal connection between the SJL and the San Juan Bay (SJB), which will improve dissolved oxygen levels and salinity stratification, increase biodiversity by restoring fish habitat and benthic conditions, and improve the functional value of mangrove habitat within the estuary.

The SJBE's watershed covers 97 square-miles and it is heavily urbanized with over 5,000 people per square-mile. The SJBE includes over 33 percent of the mangrove forests on the Island, with over 124 species of fish and 160 of birds. The eastern half of the CMP, historically between 200 and 400 feet wide and navigable, has a current depth of between 3.94 and 0 feet. towards the SJL. Due to years of encroachment and filling of the mangrove swamps along the CMP, the channel no longer serves as a functional connection between the SJB and the SJL. Sedimentation rates within the eastern CMP are nearly twice as high as in other parts of the SJBE due to infilling and extremely limited water flow. Open waters in areas closer to the SJL have been lost, as the area has started transitioning into emergent wetlands and uplands (Figure 1). Sediments include a combination of debris, household refuse, and other waste accounting for 10 percent of its composition. In some sites, thickness of this material is close to 10 feet below the bottom.



EXISTING WETLAND AREAS (Acres)

Category	Symbol	Description	Areas			
			Western End Project Channel	Limit of Public Domain Project Channel	Eastern End Project Channel	Total
Open Water	🟦	Estuarine Open Water	1.71	5.69	0	7.40
Wetland	🟩	Estuarine Forested Wetlands–Mangrove	0.35	7.39	7.79	15.53
	🟧	Palustrine Emergent Wetlands	0	0.06	0	0.06
	🟨	Palustrine Forested Wetlands–Mangrove	0	16.22	1.65	17.87
Upland	🟩	Secondary Forest	0	1.17	0	1.17
	🟧	Managed Green Area	0	0.31	0	0.31
	🟩	Other Green Area	0	26.13	0	26.13
TOTALS			2.06	56.97	9.44	68.47

Figure 1. Wetland Habitat Types and Upland Areas Within the Project Footprint

The conditions within the eastern CMP have led to degradation within the entire SBJE. Connectivity of the ecosystem has been severed and the biodiversity within the SJL has been compromised, as a reduced number of species are found when compared with other lagoons throughout the SJBE. Habitat degradation has in turn decreased the ability of those species still found to respond to natural changes, disease and other stressors, reducing ecosystem functions and values, including losses of economic and recreational opportunities.

For example, water residence time in the SJL is approximately 17 days. This has caused strong salinity stratification, which in turn limits dissolved oxygen levels in the 702 acres of the lagoon's bottom with depths below 4 to 6 feet, severely affecting benthic habitats. Reduced flushing capacity has also led to an increase in sedimentation rates. This, in turn, can limit oxygen exchange between mangrove roots and the surrounding environment, eventually resulting in suffocation. Habitat for many species of fauna is then lost as reduced mangrove coverage and health decreases forage opportunities and reproductive success.

Ecological degradation within the estuary has also begun to affect human health and safety of surrounding communities. Inability to implement flood risk management measures due to the lack of conveyance capacity in the eastern CMP leads to localized flooding. Subsequent human contact with CMP's waters has been associated with higher rates of asthma, dermatitis, and gastrointestinal diseases.

Today, there are eight communities located north and south of the eastern segment of the CMP, whose population, according to the 2010 Census estimates, is 23,420 inhabitants, thousands of which lack access to sewer systems.

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2.0 PROJECT DESCRIPTION

2.1 LOCATION OF ACTION

The CMP is a tidal channel 3.75 miles long in San Juan, Puerto Rico. It is part of the SJBE, found in the northern coast of Puerto Rico and the largest system of its kind in the Island. The SJBE is the only tropical estuary in the USEPA National Estuary Program (NEP), the only one found outside the continental United States, and is located within the San Juan Metropolitan Area (SJMA), the most urbanized and densely populated region in Puerto Rico.

The SJBE and its associated marine ecosystems are considered the “Study Area” (Figure 2). The SJBE’s watershed covers an area of approximately 97 square miles (mi^2). The SJBE is characterized by a network of lagoons, channels, man-made canals, a bay, and wetlands permanently and seasonally flooded with woody and herbaceous plants.

Associated marine ecosystems include those hard and soft substrates found north of the SJBE. These are influenced by the exchange of ocean waters and the discharges of waters exiting the estuarine system. Fresh water flows into the system from the creeks and rivers flowing mostly north from its watershed, which include the Puerto Nuevo River, Juan Méndez Creek, San Antón Creek, and Blasina Creek.

Figure 2. The San Juan Bay Estuary Study Area

The "Project Area" is where relocation, dredging, construction and overall restoration activities would take place (Figure 3). It has been defined as: the eastern CMP, where dredging would take place; the adjacent delimitation of the public domain lands within the maritime terrestrial zone of the CMP, where relocations are scheduled to occur; the SJL southeastern most artificial dredged pits, where dredged sediments would be disposed and turned into a Contained Aquatic Disposal (CAD) site, and the 6-acre Ciudad Deportiva Roberto Clemente (CDRC) dredged material staging area, where trash and debris would be transported to by barges in order to be handled and transferred by trucks for their final disposal at the Humacao Regional Landfill and were the temporary pier/dock would be built as a pontoon system for loading/unloading the dredged material.

Also included are the boating routes from the eastern CMP to the CDRC, through the SJL. The Project Area is divided between the Municipality of San Juan, to the West, and the Municipality of Carolina, to the East.

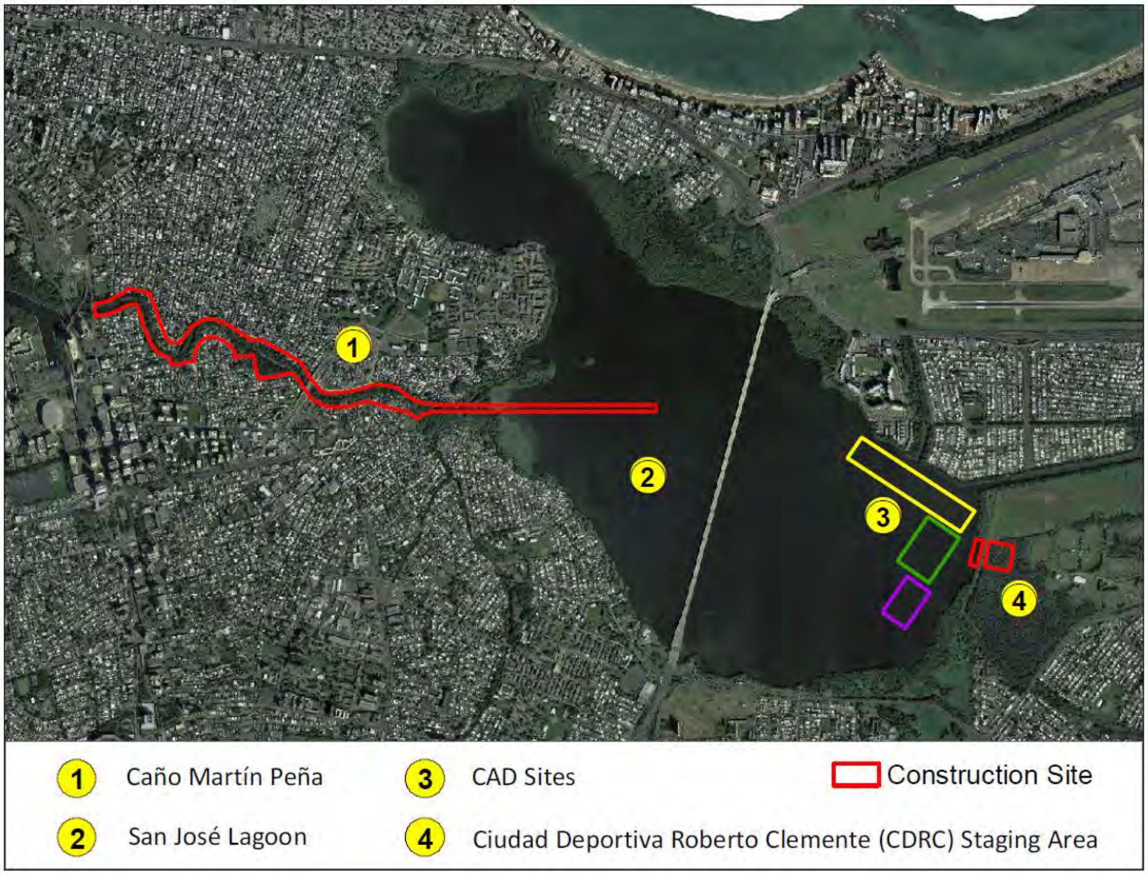

Figure 3. Project Area

2.2 PROJECT COMPONENTS

The proposed CMP-ERP consists of the following components:

Channel: Consists of dredging approximately 2.2 miles of the eastern CMP to a width of 100 feet and a depth of 10 feet. At the terminus of the Project Channel with the SJL, an extended channel would be dredged east into the SJL (over a distance of approximately 4,300 feet) as a hydraulic transition from the CMP. This extended channel would transition from the 10-foot-deep Project Channel to the 6-foot-deep areas of SJL. The extended channel would maintain the Project Channel's 100-foot width but replace its steel sheet pile walls with a trapezoidal configuration with 5- to 1-foot earthen side slopes.

A barge-mounted mechanical clamshell dredge would be used to widen and deepen the CMP, and would place dredged material into dump scows. Of the 762,000 cubic yards (cy) of mixed materials, screens would separate solid waste debris (estimated at 76,200 cy) from sediments. Under this alternative, it is also estimated that the dredged solid waste debris would make up 10 percent of the total material to be dredged from the CMP, and the dredged sediments would bulk up to 126 percent of their in situ volume. Solid waste debris would also be transported by barge to a staging area for subsequent landfill disposal. Sediments would be transported by barge for disposal at the SJ1 and SJ2 CAD pits.

The walls of the channel would be constructed with vertical concrete-capped steel sheet piles with hydrologic connections to the surrounding lands. The sill depth of the window would be set at mean low water so tidal exchanges are facilitated to the mangrove beds.

Sources: Atkins, ENLACE & Puerto Rico Planning Board

Figure 4. Proposed Channel

Mangrove Restoration: Dredging would affect existing mangrove wetlands, albeit of extremely low functional quality. Approximately 34.46 acres of wetlands would be disturbed for construction activities, including 33.46 acres within the CMP and 1 acre at the CDRC staging area. Mangrove wetlands would be re-established in areas along a dredged canal. The north and south slopes of the channel above the sheet pile would be graded to receive tidal influence and then planted with appropriate mangrove species: *Rhizophora mangle* (red mangrove), *Avicennia germinans* (black mangrove), *Laguncularia racemosa* (white mangrove), and the associated species *Conocarpus erectus* (buttonwood). Microtopography would be added to diversify habitat.

The flow of water from the channel to the mangrove planting beds would be facilitated by building hydraulic connections, or windows, in the bulkhead at regular intervals. The sill depth of the window would be set at mean low water so that tidal exchanges are facilitated to the mangrove beds. The width of the planting beds would vary depending upon the land availability, but in general would extend from the channel wall to the line of public domain, excluding only areas set aside for recreation elements. The minimum width for mangrove fringes would be approximately 32 feet on either side of the CMP, as recommended by Fischer and Fischenich (2000).

After dredging and construction of mangrove planting beds, the CMP would consist of 25.57 acres of open water and 34.48 acres of mangroves.

Erosion Control: This alternative would also feature a weir at the western end of the project area for mitigating water flows into the adjacent waterways and to protect the structural integrity of the existing four bridges. The dimensions of the weir (115 x 6.5 feet) would have a cross sectional area of 75 x 10 feet, and would prevent scour around bridges, bulkheads, and other marine structures west of the project area by providing a transition area to reduce unacceptable bottom velocities between the project area and the adjacent channels. The weir would be constructed with an articulated concrete bottom, while the remainder of the eastern CMP would be earthen bottom.

Disposal of dredged sediments: It is estimated that solid waste and debris would make up 10 percent of the total material to be dredged from the CMP and 90 percent would be sediments. Larger, easily accessible pieces of debris that may be found at the surface, such as remains of discarded automobiles and refrigerators, would be collected using hydraulic excavators. Collected debris would be loaded onto trucks, where accessible to uplands, and then transported to the Humacao landfill. Dewatering is not expected to be necessary since solid waste would air dry during transportation to the landfill.

The Humacao landfill, which is located approximately 32 miles from the CMP-ERP site, is the preferred solid waste disposal site for the dredged debris because of the higher certainty it affords to receive all the trash and debris that would be originated from this project.

A barge-mounted mechanical clamshell dredge would be used to widen and deepen the CMP, and would place dredged material into dump scows. Solid waste would be separated from the dredged sediments by a metal sieve that overlays the dump scow opening where the dredged material would be placed after being dredged. The sieve allows the sediments to fall into the hull of the scow while the solid waste and debris remains on top, and can then be collected and removed to an awaiting debris barge. The debris barge would then navigate to the CRDC staging/management area for overland transport of the material to the landfill.

After screening and removal of solid waste debris, the remaining sediments would be transported in barges and disposed in the SJL CAD site. This is the preferred option for the disposal of dredged sediments because is the one that most contribute to ecosystem restoration goal, would allow a beneficial use of the sediments, and is the most complete sediment management option. Prior to disposal of dredged sediment additional water quality and sediment testing, such as bioassays, would be conducted in accordance with Section 404 of the Clean Water Act to confirm that the sediments are suitable to be disposed within the SJL CAD site.

As presented in the Bailey et al. (2002) report, the artificial depressions (pits) within the SJL were analyzed to potentially serve as CAD sites for the CMP dredged sediments not encapsulated with geotextile containers.

Figure 5. Artificial Pits at the SJL

Bailey et al. (2002) concluded that 2 feet of clean sand is necessary to maintain a physical barrier between contaminated dredged sediments to be disposed at the CAD pits and the benthic community above (USACE, 2002). This 2-foot sand cap would contribute in preventing the release of contaminants at concentrations above water quality standards. In addition, an analysis of the currents and water circulation occurring in the lagoon was performed and it was established that the energy within the lagoon and around the CAD sites is low, which means there is a very low risk of erosion of the cap within the CAD sites.

These four man-made depressions found within, or adjacent, to the Project Area have been identified as sources of water quality problems in the Comprehensive Conservation and Management Plan (CCMP) for the SJBE (SJBEP, 2000 p. 96). Filling these man-made depressions has been recommended as one of the most cost-effective alternatives for improving the water and sediment quality in the Project Area (USACE, 2000; SJBEP, 2000). In fact, the SJBEP's CCMP identified the filling of all these pits as a priority and urgent action needed for the improvement of the water quality and habitat conditions of the entire estuarine system (Action WS-6) (SJBEP, 2000). Therefore, the use of the CAD alternative is attractive because it would give the dredged material a beneficial reuse.

Surface areas and total and existing storage volume capacities for the evaluated pits are summarized in Table 1. For the SJL artificial pits, a –16-foot top-of-fill was selected to ensure uncontrolled dredged and cap sediments spill over into adjacent pits does not occur. For the LLC pit, a –6-foot top-of-fill was selected to ensure the dredged and cap sediments do not protrude above the natural bottom depth.

Table 1. Surface Areas and Existing Capacity of Each Artificial Pit

ARTIFICIAL DREDGED PIT	EXISTING (MAX) FLOOR DEPTH (FT)	FILL DEPTH (FT)	SURFACE AREA (SQUARE FT)	EXISTING PIT CAPACITY (CY)*
SJ1	–27	–16	897,190	260,516
SJ2	–27	–16	956,000	245,450
SJ3/4/5	–24	–16	1,591,070	275,373
LCC	–18	–6	1,624,865	166,210
Total Capacity of Combined San José and Los Corozos Lagoon Pits				947,549

*Existing pit capacity in cubic yards (CY) based on bathymetric study references: (USACE, 1996).

The required storage volume for placing all of the bulked dredged sediments is 814,000 cy. The total existing capacity for the six artificial pits is sufficient to receive the bulked dredged sediments volume. However, additional capacity of approximately 86,000 cy would be needed to allow for the geo-encapsulated sediments to be capped with 2 feet of clean sediments. This additional capacity can be achieved by modifying the depth and/or width of the artificial pits by excavating sediments from within the pits.

Based upon a CAD analysis performed by the USACE ERDC in 2002 for the CMP-ERP, sand is the recommended sediment to be used as the capping material. However, since the availability of sand for capping material is limited, the best combination of pits to modify was determined based upon an objective to minimize the amount of capping material needed. The combination of SJ1 and SJ2 (prior to expansion) resulted as the alternative that would need the least amount of capping material.

Modification of the SJ1 and SJ2 pits would entail excavating the pits to their original borrow depths of –32 and –30 feet, respectively. Existing side slopes would be maintained for stability purposes as the SJ1 and SJ2 pits are deepened. The geo-encapsulated-dredged sediments would be placed within the modified pits to a fill elevation of –18 feet. The placed geo-encapsulated dredged sediments would be capped with 2 feet of clean sand to an unconsolidated fill depth of –16 feet. SJ1 and SJ2 would provide the capacity necessary for disposal and capping of the dredged sediments, without adversely affecting the tarpon-feeding zone at the –6-foot halocline interface.

The existing capacities for SJ1 and SJ2 to the −16-foot fill depth are 260,516 cy and 245,450 cy, respectively, for a total capacity of 505,966 cy. The revised capacities of the modified SJ1 and SJ2 pits to the −16-foot fill depth are estimated in 880,000 cy for the dredged sediments and 198,347 cy for the capping material, for a total of 1,078,347 cy. This provides sufficient capacity to place the 814,000 cy of dredged sediments and the 198,347 cy sand cap with an excess capacity of 66,000 cy. Therefore a total of 506,381 cy of sediments would need to be excavated from the SJ1 and SJ2 pits to acquire the total capacity needed to place the geo-encapsulated dredged sediments and capping material within the two pits.

It is assumed that the excavated pit material is clean and therefore is suitable for unconfined open water disposal. If suitable sand is found in the excess material proposed to be removed from the SJ1/2 pits to increase their capacity, it would be utilized because is the most readily accessible and logistically viable cap material source for the SJ1 and SJ2 CAD sites. In that case, 198,347 cy less sediments need be placed in SJ 3/4/5/LC.

If it is definitively determined through future investigations that the excavated pit material is not suitable for use for the sand cap, it would be placed in SJ 3/4/5/LC. Then an upland quarry site would be a reasonable secondary alternative for cap material sand sources.

Recreational features: The recreation plan would consist of three types of recreational access areas, which would allow for major recreational use in some areas and median use in others. Recreational features would include: (1) a linear park, extending from the existing Enrique Marti Coll linear park located to the western CMP. It would be constructed over the sheet pile bulk head in the eastern CMP (with the mangrove fringe between the linear park trail and the Paseo), and would be located on the southern side of the CMP; (2) nine recreation access parks that would provide visual openings through mangrove forest to the CMP, and (3) 12 recreation parks that would be smaller in scale than the proposed recreational access park, and would be scaled to accommodate less persons for passive recreation. The natural mangrove forest would serve as a backdrop; the 12 recreation parks would be strategically located along the Paseo del Caño walkway corridor to serve immediately adjacent blocks. In six of the recreation parks, a trail would be built through the forest to allow access to CMP.

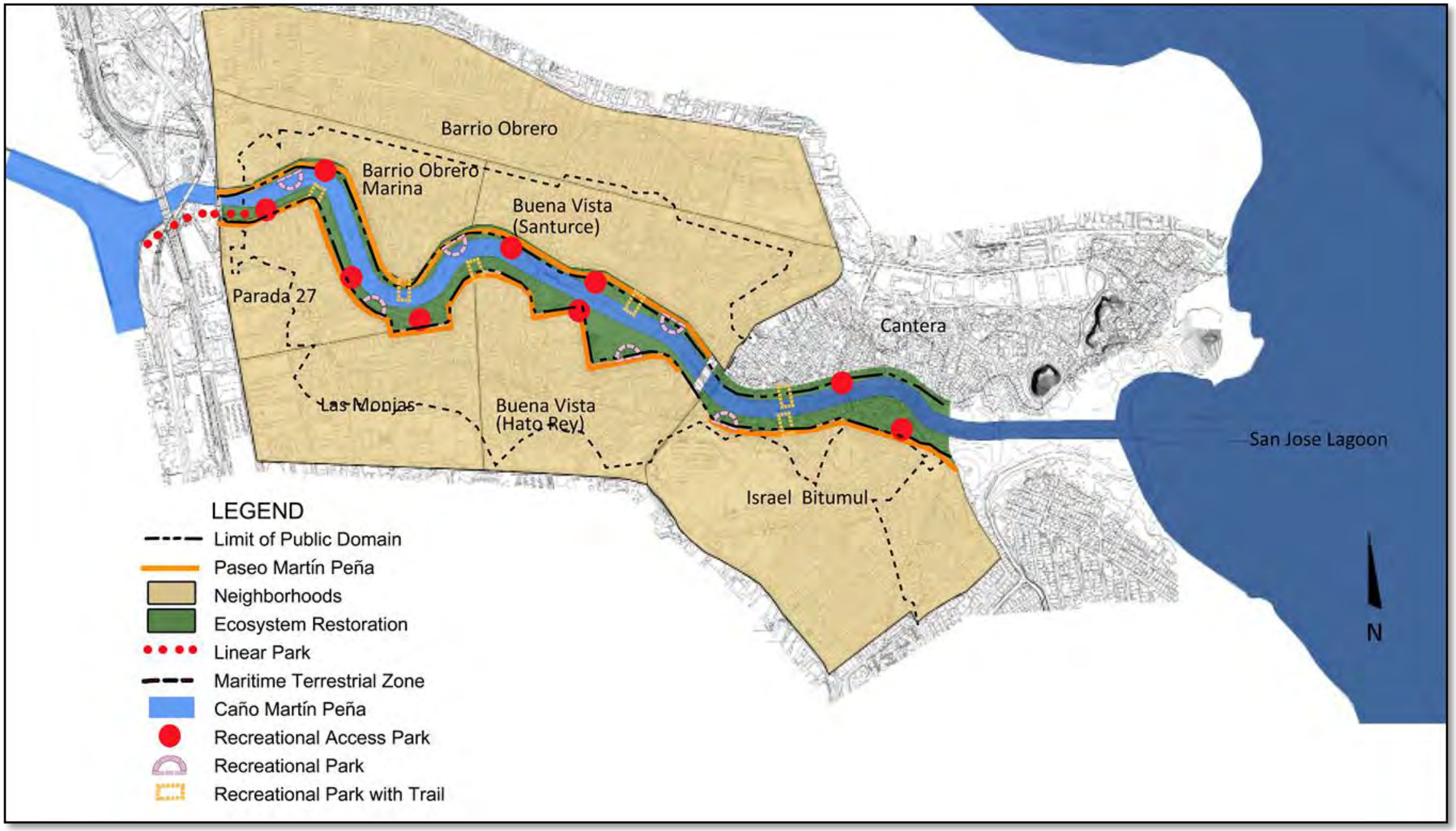

Figure 6. Proposed Federal Recreation Plan

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Non-Structural Measures: There are no non-structural measures for the dredging of the CMP. Other measures included: the acquisition of approximately 434 residential structures and 390 relocations within the confines of the Federal project. Other measures independent of the Federal project would be implemented by the non-Federal sponsor and adjacent communities, such as enforcement of illegal dumping, storm water and sewage improvements, and community education.

Proposed Schedule: Total construction time would be approximately 27 months, from October 2018 to December 2020. The duration of the benefits for the restoration of the action is anticipated to be approximately 50 years.

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Appendix H6

Hazardous, Toxic, and Radioactive Waste Assessment

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DRAFT
HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE
INITIAL ASSESSMENT DOCUMENTATION
CAÑO MARTÍN PEÑA ECOSYSTEM RESTORATION PROJECT
SAN JUAN, PUERTO RICO

Prepared for:

Corporación del Proyecto ENLACE del Caño Martín Peña
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September 2015

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Executive Summary

The Caño Martín Peña (CMP) ecosystem restoration project (CMP-ERP) aims to restore the tidal function between San Juan Bay and the San José Lagoon by reestablishing the tidal connection and restoring the ecological habitat previously lost due to decades of fill material disposed at the site, which currently clogs the waterway. This project will focus on dredging the eastern 2.2 miles of the approximately 4-mile canal as part of a comprehensive restoration project. This Hazardous, Toxic, and Radioactive Waste (HTRW) Initial Assessment (IA) was prepared with the intent for use in the Feasibility Report and Draft Environmental Impact Statement.

This HTRW IA is specific to the proposed dredging project. By definition of dredged material in accordance with U.S. Army Corps of Engineers (USACE) Engineering Regulation (ER) 1165-2-132, sediments beneath navigable waters only qualify as HTRW if they fall within the boundaries of a site designated by the U.S. Environmental Protection Agency (USEPA), or a state, for a response action under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or if the facility is part of a National Priority List. The sediment to be dredged from the CMP canal does not fulfill USACE's definition; therefore, it is not considered an HTRW under this regulation.

This report was conducted in conformance with the scope and limitations of the American Society of Testing and Materials (ASTM) Practice E1527-05, and in accordance with USACE ER 1165-2-132. The site description for this HTRW IA is divided into two areas: project area and study area. The eastern segment of the CMP is approximately 2.2 miles long and of variable width, coinciding with a zone identified as the public domain. In accordance with the ASTM practice, an approximate center point of the project was identified, and a database search was conducted with several federal and commonwealth regulatory agencies for a 1-mile radius

As part of this HTRW IA, aerial photography, government records, and multiple databases were investigated regarding federal and state listings within a 1-mile radius of the dredge location in the project area to assess impacts for "Recognized Environmental Conditions" (REC). HTRWs are defined as posing a substantial or potential threat to public health or to the environment. The criteria includes being listed by the USEPA as a hazardous waste or having such a characteristic (ignitability, corrosivity, reactivity, and/or toxicity). HTRWs are considered a REC, but RECs are not always considered an HTRW.

Data revealed six nearby abandoned or active sites already identified by federal or state agencies (not necessarily indicative of contamination) that are not currently considered to be a REC for this project (minor incident in a high-rise building, petroleum storage permanently out of use, and non-generators). One exception is a pesticide warehouse (0.54 mile south-southwest) that initiated voluntary remedial action in 1996, and could impact the watershed (moderate risk).

As part of the review of previous EAs, reports, and management plans provided by ENLACE and USACE, lagoon dredged material and other soil and sediment along the CMP have been sampled over the years.

- Detected levels of lead and mercury and lesser concentrations of polynuclear aromatic hydrocarbons (PAH), oil and grease, and residual pesticides were noted in canal sediments (1997).
- Sediment cores from six sites in the estuary and CMP (1998) representing time periods of 1925–1949, 1950–1974, 1975–1995, and in the most contaminated site in the CMP samples increased from:

Lead:	30 to 745 micrograms/g
Mercury:	0.16 to 4.7 micrograms/g
Polychlorinated biphenyls (PCB)s:	12 to 450 micrograms/kg
Dichlorodiphenyltrichloroethane (DDT)/ Dichlorodiphenyldichloroethane (DDD)	*decreased* from 46 micrograms/kg to 14.6 micrograms/kg

- In 2002 and 2011, elutriate testing of the eastern CMP sediments and sediment porewater confirmed the presence of heavy metals such as lead and mercury, PAHs, PCBs, oil and grease and residual pesticides. Both the sediments and the sediment porewater of the CMP are characterized by elevated levels of various contaminants. Levels in excess of sediment quality guidelines were found for anthracene, antimony, arsenic, copper, dieldrin, lead, mercury, selenium, silver and zinc, along with others. The porewater within the sediments of the eastern CMP also exceeded relevant criteria for multiple parameters. Problematic results were found for chromium, copper, lead, mercury, nickel, and zinc. The surface waters of the CMP and the San José Lagoon already exceed relevant criteria for copper and mercury.

Compliance of present or past owners or operators and non-ASTM issues (i.e., asbestos, radon, lead-based paint, etc.) were not addressed as they were outside of the scope for this report. The report relies on numerous data provided by other officials along with site observations within the study area, noting that there are hundreds of structures in the vast study area, with limited access. Additionally, the report acknowledges potential data gaps where the investigation did not trace the history of subject properties back to when a property first contained structures or was used for a particular purpose. Fire insurance maps were also not available.

Based on the project area condition and the rules and regulations at the time of this writing, it is our professional opinion that there is no evidence of RECs in connection with the CMP. Possible exceptions to the aforementioned statement are the nondescript solid waste content, discarded appliances, and equipment that are evident at the ground surface. In accordance with the USACE's "Hazardous, Toxic, and Radioactive Waste Guidance for Civil Works Projects," there is no evidence of HTRWs within CMP. Nevertheless, in accordance with ASTM E1527-05, there is evidence of *historical* REC supporting either past or ongoing contamination to the study area; however, the potential for HTRWs within the CMP project area appears to be minimal. Materials within the Caño Martín Peña include various types of solid waste, debris, and other materials. Such materials will require further testing prior to and/or during project construction, as appropriate, in accordance with an agreed sampling plan. If the testing determines that any materials contain hazardous substances at levels that are not suitable for unregulated disposal, they will be managed in accordance with the applicable laws and regulations of the relevant regulatory agencies.

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Resumen Ejecutivo

La intención del Proyecto de Restauración del CMP es recuperar la función de flujo intermareal entre la Bahía de San Juan y la Laguna San José a través de la reconexión de la misma y restaurar el hábitat ecológico, previamente deteriorado, debido a la disposición de material en el canal durante las pasadas décadas provocando la obstrucción del paso del agua. El proyecto está enfocado en dragar el segmento de 2.2 millas del lado este del canal, de aproximadamente 4 millas, como parte integral del Proyecto de Restauración. Esta Evaluación Inicial (EI) de desperdicios peligrosos, tóxicos y radiactivos (HTRW, por sus siglas en inglés) fue preparada con la intención de ser utilizada en el Estudio de Viabilidad del Proyecto (Estudio) y el documento de Declaración de Impacto Ambiental (DIA).

Esta evaluación inicial de HTRW es específica para el proyecto de restauración propuesto. Según la definición de material dragado y en conformidad con el Informe de Ingeniería del Cuerpo de Ingenieros ER1165-2-132, los sedimentos bajo las aguas sólo califican como HTRW si caen dentro de los límites de un sitio designado por la USEPA, un estado, por una acción de respuesta bajo el acta de Respuesta Ambiental, Compensación y Responsabilidad Integral (CERCLA, por sus siglas en inglés), o si la instalación forma parte de la lista de prioridad nacional (NPL, por sus siglas en inglés). El sedimento a ser dragado en el canal del CMP no cumple con esta definición por lo tanto no es considerado bajo esta regulación como un HTRW.

Este informe se llevó a cabo en conformidad con los ámbitos de estudio y las limitaciones de la Norma E1527-05 de la Sociedad Americana de Pruebas y Materiales (ASTM, por sus siglas en inglés). La descripción del sitio para esta EI del HTRW se divide en dos zonas, la zona del proyecto y área de estudio. El segmento del este del CMP es de aproximadamente 2.2 millas de largo con ancho variable que colinda con la zona identificada como la Zona de Dominio Público. En conformidad con la norma de la ASTM, se identifica un punto de referencia en el centro del proyecto y se consulta diferentes bases de datos de las agencias federales y del estado dentro de un radio de 1 milla.

Como parte de esta EI del HTRW, se investigaron fotografías aéreas, documentos oficiales y múltiples base de datos de los listados federales y estatales dentro del radio de 1 milla de la zona de estudio del proyecto para evaluar el impacto de las "Condiciones Ambientales Reconocidas" (REC, por sus siglas en inglés). Los HTRWs se definen como una amenaza substancial o potencial para la salud pública o el medio ambiente. Este criterio incluye el estar en la lista de la USEPA como desechos peligrosos o que tengan una de sus características (inflamabilidad, corrosivitas, reactividad, y/o toxicidad). Los HTRW son considerados como REC, pero no siempre un REC es considerado como un HTRW.

Los datos revelaron seis sitios cercanos, abandonados o activos, ya identificados por las agencias federales o estatales (esto no necesariamente es un indicativo de contaminación), actualmente estos sitios no son considerados como un REC para este proyecto (un pequeño incidente en un edificio, un almacén de petróleo permanentemente fuera de uso y no generadores). Una excepción es un almacén de plaguicidas (0.54 millas Sur/Suroeste) que inició una acción correctiva de forma voluntaria en 1996 y podría afectar la cuenca (con un riesgo moderado).

Como parte de la revisión de Evaluaciones Ambientales anteriores, informes y planes de gestión provistos por ENLACE y el Cuerpo de Ingenieros, se identificó que a través de los años se ha muestreado el material dragado de la laguna y otros suelos y sedimentos a lo largo del CMP.

- La detección de niveles de plomo, mercurio, concentraciones bajas de hidrocarburos aromáticos policíclicos (HAPs), aceites y grasas y residuos de pesticidas se observaron en los sedimentos del canal (1997).
- Las pruebas de sedimentos de seis sitios en el estuario y CMP (1998) representa los períodos de 1925–1949, 1950–1974, 1975–1995, y en el lugar más contaminado del CMP las muestras aumentaron de:

  Plomo: 30 a 745 microgramos/g

  Mercurio: .16 a 4.7 microgramos/g

  PCBs: 12 a 450 microgramos/kg

  DDT/DDD: *disminuyó* de 46 microgramos/kg a 14.6 microgramos/kg

- En el 2002 y 2011, las pruebas de elutriado (decantamiento) del sedimento y del agua de poros del sedimento, del lado este del CMP, confirmaron la presencia de metales, hidrocarburos aromáticos policíclicos (HAPs), policlorobifeniles (PCBs), aceites, grasas y residuos de pesticidas. Ambos, el sedimento y el agua de poros del sedimento del CMP están caracterizados por contener altos niveles de varios contaminantes. Los niveles que excedían los guías de calidad se encontraron para el antraceno, antimonio, arsénico, cobre, dieldrin, plomo, mercurio, selenio, plata y zinc entre otros. El agua de poro del sedimento del área este del CMP también excede los criterios de importancia para múltiples parámetros. Se encontraron resultados alarmantes para cromo, cobre, plomo, mercurio, níquel y zinc. Las aguas superficiales del CMP y la Laguna San José ya exceden criterios de importancia para cobre y mercurio.

El cumplimiento de los dueños actuales o anteriores, o de los operadores y los temas no relacionadas a los ASTM (es decir, el asbesto, el radón, pintura a base de plomo, etc.) no fueron atendidos como parte del ámbito de este informe. Además, el informe reconoce posibles deficiencias en los datos de investigación donde no se rastrea la historia de las propiedades en cuanto a la existencia de estructuras previas y/o sus fines de uso. Los mapas de seguros de incendio no estuvieron disponibles.

Basado en la condición de la zona del proyecto y las normas y reglamentos al momento de esta redacción, es de nuestra opinión profesional, que no existe evidencia alguna que vincule algún REC con el CMP. Posibles excepciones en la declaración antes mencionada son: el contenido de desperdicios no descritos, la disposición de enseres y equipos evidentes en la superficie del suelo. De acuerdo con la guía de orientación del Cuerpo de Ingenieros para Proyectos de Obras Civiles con desperdicios peligrosos, tóxicos y radiactivos, no hay evidencia de HTRWs dentro del CMP. Sin embargo, de acuerdo con la norma ASTM E1527-05, existen pruebas históricas de RECs que apoyan la presencia de contaminación ya sea en el pasado o actualmente dentro del área de estudio. Aún así, la presencia de HTRWs dentro del área del proyecto del CMP parece ser mínima. Los desperdicios sólidos encontrados dentro del área de estudio pudieran incluir desperdicios de construcción y demolición (C&D) y desperdicios domésticos (HW, por sus siglas e inglés) incluyendo desperdicios domésticos de índole peligrosa (HHW, por sus siglas en inglés). Estos materiales no son considerados como HTRW.

En el Caño Martín Peña se pueden encontrar diversos tipos de desperdicios sólidos, escombros y otros materiales. Estos materiales requerirán estudios adicionales antes de y/o durante la construcción del proyecto, según corresponda, de acuerdo con un plan de muestreo acordado. Si los estudios realizados determinan que cualquiera de estos materiales contiene sustancias peligrosas a niveles no aptos para su disposición no regulada, dicho material será manejado de acuerdo a las leyes y los reglamentos de las agencias reguladoras pertinentes, según apliquen.

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Contents

Figures

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Acronyms and Abbreviations

ASTM	American Society for Testing Materials
C&D	Construction and demolition debris material
CDRC	Ciudad Deportiva Roberto Clemente
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
CMP	Caño Martín Peña
CMP-ERP	Caño Martín Peña Ecosystem Restoration Project
CORRACT	Corrective Actions List
CWA	Clean Water Act
DTPW	Puerto Rico Department of Transportation and Public Works
EA	Environmental Assessment
EDR	Environmental Data Resource, Inc.
EIS	Environmental Impact Statement
EMF	Electromagnetic fields
ENLACE	Corporación del Proyecto ENLACE del Caño Martín Peña
ENLACE Project	Caño Martín Peña ENLACE Project
ER	Engineering Regulation
ERDC	USACE Engineer Research and Development Center
ERL	Effects Range–Low
ERM	Effects Range–Medium
ERNS	Federal Emergency Response Notification System
ERP	Ecosystem Restoration Project
HHW	Household hazardous waste
HTRW	Hazardous, Toxic, and Radioactive Waste
HU	Habitat Unit
IA	Initial Assessment
LUST	State Leaking Underground Storage Tank List
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
MPRSA	Marine Protection, Research, and Sanctuaries Act
MTZ-CMP	Public Domain lands within the Caño Martín Peña Maritime Terrestrial Zone
NED	National Economic Development Account
NEP	USEPA’s National Estuary Program
NEPA	National Environmental Policy Act
NER	National Ecosystem Restoration

NPL	National Priority List site under CERCLA
OSC	On-Scene Coordinators
PMP	Project Management Plan
ppm	Parts per million
PR	Commonwealth of Puerto Rico
Project Channel	2.2 miles of the Eastern CMP associated with the CMP-ERP
PRWQSR	Puerto Rico Water Quality Standards Regulation
RCRA	Resource Conservation and Recovery Act
RCRA-G	RCRA Generators List
RCRA-TSD	Treatment, Storage, or Disposal List
REC	Recognized Environmental Conditions
SHWS	State-equivalent CERCLIS/State Hazardous Waste Sites
SJBE	San Juan Bay Estuary
SJBEP	San Juan Bay Estuary Program
SJHP	San Juan Bay Harbor
SQG	Sediment quality guidelines
T&E	Threatened and Endangered Species
TCLP	Toxicity characteristic leaching procedure
TSP	Tentatively Selected Plan
U.S.C.	United States Code
USACE	United States Army Corp of Engineers
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
UST	Underground storage tank
VCS	State voluntary cleanup site
WQC	Water Quality Certification

1.0 INTRODUCTION

The Caño Martín Peña (CMP) is an approximately 4-mile-long tidal canal connecting the San José Lagoon and San Juan Bay, in metropolitan San Juan, Puerto Rico. The CMP is a part of the greater San Juan Bay Estuary and historically provided tidal exchange between San Juan Bay and San José Lagoon. The CMP was reported to have had sufficient width and depth to accommodate small craft navigation during the early 1900s. Since that period, deposition of fill material, construction of urban infrastructure, and encroachment of residential development has constricted the waterway and negatively impacted the CMP. These physical impacts have resulted in restricted flushing and deterioration of both the upland and wetland environment and water quality in the CMP and the San José Lagoon. In addition, the disposal of solid waste and the discharge of untreated combined stormwater and wastewater to the CMP from surrounding residential communities have further degraded conditions.

To reverse these long-term impacts, a comprehensive environmental restoration project is being proposed for the CMP. The proposed project consists of dredging the canal, restoring tidal flushing, improving the coastal ecosystem, and improving general environmental and water quality conditions within the CMP and the San José Lagoon. The restoration of the CMP is anticipated to provide significant environmental benefits to the greater San Juan area.

This Hazardous, Toxic, and Radioactive Waste (HTRW) Initial Assessment (IA) report for the CMP Ecosystem Restoration Project (CMP-ERP), San Juan, Puerto Rico, was prepared for ENLACE. HTRWs are recognized as a potential social public health impact if exposed. The "Project Area," which mostly lays out the construction footprint, has been defined as the Project Channel, where dredging would take place, and the adjacent delimitation of the public domain lands within the Maritime Terrestrial Zone (MTZ-CMP), where relocations are scheduled to occur. Also included in the Project Area is the 6-acre dredged material staging area within the 35-acre Ciudad Deportiva Roberto Clemente (CDRC) site, the boating routes from the eastern limit of the CMP to the CDRC and the nearby San José Lagoon pits, and the five pits in San José Lagoon (see Figure 1).

Figure 1. Project Area Map

2.0 ASSESSMENT FINDINGS

2.1 SUMMARY OF RESULTS

This report was conducted in accordance with the scope and limitations of the American Society of Testing and Materials (ASTM) Practice E1527-05. A summary of the HTRW IA documentation is described below. Exceptions to or deletions from this practice are documented in Section 3.0 of this report. The site description for this HTRW IA is divided into two areas: project area and study area, which are defined in Section 2.3.1.

This assessment has revealed no evidence of Recognized Environmental Conditions (RECs) in connection with the study area, except for the following:

1. Unidentified solid waste disposal adjacent and within CMP.
2. White goods and automobile parts disposed adjacent and within CMP.
3. Presence of Pesticide Warehouse within 0.54 mile of CMP project area.
4. Approximately 92 non-mapped listings could potentially be RECs based on the type of database record.

In accordance with USACE Engineering Regulation (ER) 1165-2-132, "Hazardous, Toxic and Radioactive Waste (HTRW) Guidance for Civil Works Projects" (USACE, 1992), Section 4.a.(2) and described in Section 2.3 of this report, there is no confirmed evidence of HTRWs within the project area. As discussed in Section 2.3, HTRWs are considered a REC, but RECs are not always considered an HTRW.

As discussed in Section 2.4, the sediments to be dredged from the CMP have elevated levels of contaminants. In order to properly assess dredge material disposal options, additional sediment sampling/characterization was conducted by Suelos, Inc., during May 2011. Results from the laboratory tests and boring logs are included in Appendix H6.b. A summary of the results are discussed in Section 3.1.

Since no HTRWs have been documented to affect the project area, the following report items are not required pending sediment sampling and characterization results:

- No considerations are needed for how HTRWs may affect the alternative project plans.
- No preliminary cost estimates are needed of HTRW response actions for each alternative.
- No alternative plans are needed to avoid potential HTRW sites.
- No cost estimates are needed of response actions.

2.2 SCOPE OF SERVICE

The intent of the HTRW IA is to document the current environmental conditions of the study area and the immediate surrounding area in the proper context to be used in a USACE Feasibility Report/Environmental Impact Statement (EIS). Environmental issues within the ASTM standard are referred to as "Recognized Environmental Conditions" in connection with the study area. The term RECs, as defined in ASTM E1527-05, refers to the presence or likely presence of any *hazardous substances or petroleum products* on a *property* under conditions that indicate an existing release, a past release, or a *material threat* of a release of any *hazardous substances or petroleum products* into structures on the *property* or into the ground, ground water, or surface water of the *property*. The term includes *hazardous substances or petroleum products* even under conditions in compliance with laws.

The term is not intended to include “de minimis” conditions that generally do not present a material risk of harm to public health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies. Conditions determined to be “de minimis” are not RECs.

Atkins performed the following tasks as part of this HTRW assessment:

- Obtained and reviewed aerial photographs of the study site and adjacent properties to determine past uses that may have had an environmental impact on the site.
- Performed several site visits to document the site conditions.
- Obtained and reviewed available governmental records to identify use, generation, storage, treatment, and/or disposal of hazardous materials, and release incidents that may impact or have impacted the site.
- Reviewed available reports and other documentation from government agencies on the site and adjacent lands.
- Discussed the current practices within the community with the project’s non-Federal sponsor, ENLACE.

Previous Environmental Assessments (EAs), reports, and management plans with all or portions of the document relating to HTRW were reviewed and are summarized in Section 2.3.4 and listed in Section 4.0.

2.3 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE ASSESSMENT

The term HTRW is defined in USACE Engineering Report (ER) 1165-2-132, “Hazardous, Toxic and Radioactive Waste (HTRW) Guidance for Civil Works Projects” (USACE, 1992). In accordance with the ER, hazardous, toxic, and radioactive wastes include any material listed as “hazardous substance” under the Comprehensive Environmental Response, Compensation, and Liability Act, 42 USC 9601 et seq. (CERCLA). That document goes on to say that dredged material and sediments beneath navigable waters proposed for dredging qualify as HTRW only if they are within the boundaries of a site designated by U.S. Environmental Protection Agency (USEPA) or a state for a response action (either a removal action or remedial action) under CERCLA, or if they are a part of a National Priority List (NPL) site under CERCLA. An HTRW is further defined by the USEPA as a subset of solid wastes that pose substantial or potential threats to public health or the environment and meet any of the following criteria identified 40 CFR 260 and 261.

- It is specifically listed as a hazardous waste by USEPA.
- It exhibits one or more of the characteristics of hazardous waste (ignitability, corrosivity, reactivity, and/or toxicity).
- It is generated by the treatment of hazardous waste; or is contained in a hazardous waste.

In general, HTRWs are considered a REC, but RECs are not always an HTRW. Since this HTRW IA is being conducted for a proposed dredging project, dredged material and sediments beneath navigable waters proposed for dredging qualify as HTRW only if they are within the boundaries of a site designated by the USEPA, or a state, for a response action under CERCLA, or if they are a part of an NPL.

Solid waste is any discarded material, abandoned, inherently waste-like, and not excluded by law. All waste classified as solid waste are regulated by the Resource Conservation and Recovery Act (RCRA) and in Puerto Rico is also regulated by the *Puerto Rico Solid Waste Management Regulation*. RCRA excluded waste are regulated by different laws.

Construction and demolition debris material (C&D) is one type of solid waste. C&D materials consist of the debris generated during the construction, renovation, and demolition of buildings, roads, and bridges. C&D materials often contain bulky, heavy materials, such as concrete, asphalt, wood, metals, glass, and salvaged building components. C&D debris are only regulated to the extent that solid waste landfills must follow a few basic standards outlined at 40 CFR parts 257.

Household waste is another type of solid waste and is any material, garbage, trash, sanitary waste derived from household including single and multiple residence, hotels and motels, bunkhouses, ranger stations, crew quarters, campgrounds, picnic grounds, and day-use recreation areas. Another type inside of household wastes classification is the household hazardous waste (HHW). HHW are leftover household products that may contain corrosive, toxic, ignitable, or reactive ingredients. Examples are paints, cleaners, fluorescent light bulbs, oils, batteries, automotive products, and pesticides. All these household products may contain hazardous chemicals. Hazardous debris, including household hazardous waste items and universal wastes that are extracted from the CMP-ERP during dredging activities, may not meet the exclusion criteria described above. If HHW and universal wastes are not considered exempt, they must be managed in accordance with applicable rules and regulations.

A mix of solid waste with hazardous waste is classified as hazardous waste. "Dredged material that is subject to the requirements of a permit that has been issued under 404 of the Federal Water Pollution Control Act (33 U.S.C. 1344) or section 103 of the Marine Protection, Research, and Sanctuaries Act (MPRSA) of 1972 (33 U.S.C. 1413) is not a hazardous waste." Dredged Material are also excluded from being classified as hazardous waste under 40 CFR 261.4(g). Only hazardous debris (e.g., appliances, batteries, universal wastes, etc.) that are not exempt from regulation will be managed as hazardous waste for this project. Affected dredged sediments are exempt.

Materials within the Caño Martín Peña include various types of solid waste, debris, and other materials. Such materials will require further testing prior to and/or during project construction, as appropriate, in accordance with an agreed sampling plan. If the testing determines that any materials contain hazardous substances at levels that are not suitable for unregulated disposal, they will be managed in accordance with the applicable laws and regulations of the relevant regulatory agencies.

2.3.1 Site Description

The CMP is one of several natural canals in the San Juan area that make up the drainage system for intracoastal waters. The canal extends from the San Juan Bay eastward to the San José Lagoon. Although the CMP followed a similar pattern of development along the entire canal, the western portion of the canal has recently been dredged and developed to serve as a waterway for ships and small craft. The eastern portion was not dredged and has been significantly impacted by the encroachment of local urban development and is the subject of this investigation. The Project Channel is approximately 2.2 miles long and variable width (see Figure 1).

From the approximate center point of the project area, a regulatory agency database search of a maximum 1-mile radius was conducted. A search radius was used to identify and locate facilities that may operate stationary tanks, handle, generate, or dispose of hazardous and/or solid waste, or has reported contamination of soil and/or groundwater. A copy of the 1-mile radius map is included in the Environmental Data Resource, Inc. (EDR) Radius Map Report in Appendix H6.a. Available, historic aerial photography was reviewed and provided a historic perspective of the changes that have occurred over the years (i.e., the filling of the waterway); however, the aerials provided were not of the detail to provide information on the types of materials being placed in the study area.

2.3.2 Standard Environmental Record Sources

The purpose of the HTRW assessment is to identify indicators of potential hazardous materials or waste issues relating to the study area. A review of federal and state regulatory database reports was conducted by EDR dated January 5, 2011. Appendix H6.a contains the regulatory database report summarizing the results of the government databases searched. Note that a listing in the regulatory databases does not necessarily indicate contamination is or is not present at these sites. Furthermore, some sites may be listed in more than one database.

Atkins requested that EDR conduct the standard minimum search radius from the study area for all databases in accordance with ASTM standards. The scope of the regulatory information search included the following federal and state databases:

- Federal National Priority List (NPL);
- Federal Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS) Database;
- Federal Resource Conservation and Recovery Act (RCRA) Corrective Actions List (CORRACT);
- Federal RCRA Treatment, Storage, or Disposal List (RCRA-TSD);
- Federal RCRA Generators List (RCRA-G);
- Federal Emergency Response Notification System (ERNS) list;
- State-equivalent CERCLIS/State Hazardous Waste Sites (SHWS);
- State Underground Leaking Storage Tank List (LUST);
- State Voluntary Cleanup Sites (VCS);
- Other ascertainable records such as RCRA Nongenerators, which do not presently generate hazardous waste.

A total of seven records were identified within the study area with the various regulatory agency database searches. The project area is not listed on any of the federal or state regulatory databases reviewed. Several of the records are associated with the same facility or property (e.g., a facility/property containing multiple petroleum storage tanks is also the site of several reported spills or emergency response actions). The seven database records are associated with a total of six facilities or properties within the study area. On the basis of results of the regulatory agency database searches, the following sites are located within the study area:

- Two CERCLIS sites;
  - R. Maldonado Pesticide Warehouse – ±0.54 mile south-southeast from CMP
  - American International Plaza – ±0.68 mile west-southwest from CMP
- One LUST site;
  - Citibank N.A. – Hato Rey – ±0.68 mile west-southwest from CMP
- Two underground storage tank (UST) facilities;
  - Rod-Rodder Services, Inc. – ±0.38 mile south-southeast from CMP
  - Rosa Elena Jimenez – ±0.49 mile south from CMP
- Two RCRA Nongenerator sites;
  - Texaco PR Inc. – ±0.37 mile south from CMP
  - Rod-Rodder Services, Inc. – ±0.38 mile south-southeast from CMP

There are two listed CERCLIS sites within the study area. CERCLIS contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies, and private persons. CERCLIS sites contain sites that are either proposed to or on the NPL and sites that are in the screening and assessment phase for possible inclusion on the NPL.

R. Maldonado Pesticide Warehouse, one of two CERCLIS sites identified, is described in the EDR database report as an active pesticide packaging facility. The facility was referred to USEPA by the Puerto Rico Department of Agriculture due to the condition of the facility during an inspection. USEPA's On-Scene Coordinators (OSC) issued a field expedited notice letter, and the conditions at the site were corrected under a voluntary cleanup without an order. Emergency "removal" action was started on August 23, 2006. Currently, the non-NPL status is not specified. Based on the inferred hydrologic relationship (higher elevation than CMP) and distance from the project area, it is our opinion that this documented site may present an environmental concern.

The second CERCLIS site, American International Plaza, is described in the database report to have an ethylene glycol release. The plaza is a high-rise building, but no details about the release are included in the report. It mentions that "removal" occurred at the site on March 20, 2008, and no site assessment work was needed. Based on the inferred hydrologic relationship and distance from the project area, it is our opinion that this documented site is not expected to present an environmental concern.

A LUST site was documented at the location for the Citibank N.A. However, the database does not indicate the type, amount, or date of the release. Based on the inferred hydrologic relationship and distance from the project area, it is our opinion that this documented site is not expected to present an environmental concern.

Two facilities are listed with USTs. Rod-Rodder Services, Inc. is listed with diesel and gasoline USTs, and Rosa Elena Jimenez is listed with a used oil UST. All three tanks on both sites are described as "permanently out of use."

Although two sites are designated as RCRA Nongenerator facilities, nongenerators do not presently generate hazardous waste.

EDR also tracks sites that are classified as "nonmapped" sites. These are sites that are located within the same zip code(s) as the study area but may have an irregularity with their reported address. There were a total of 311 nonmapped sites. Of these sites, approximately 92 nonmapped listings could potentially be RECs based on the type of database record.

2.3.3 Site Reconnaissance

Several site visits were performed by Atkins personnel documenting conditions within the CMP. Those visits included one on March 29, 2010 and additional visits February 1–8, 2011 and May 3–12, 2011. Photographs of solid wastes observed from those visits are located in Appendix H6.c.

The surrounding area on both sides of the canal is thickly developed and inhabited. Solid waste disposal practices by local residents and government initiatives have choked many areas along the canal. Wastes include general household refuse, concrete and construction debris, automobile parts, furniture, and white goods. The term "white goods" is a general term to describe appliances such as stoves, refrigerators, hot water heaters, etc. The accumulation of these wastes has resulted in terraces, which once established, are capped with dirt and additional homes are constructed. Historically, the CMP residents made the CMP area habitable first by building their homes on stilts, and afterwards, by depositing vegetative material, HW, and debris into the swamp until it became firm enough to support the makeshift homes they built from salvaged wood and corrugated tin. In addition, as the housing developments lacked basic utilities, such as storm and sanitary sewer systems, and adequate road infrastructure for a proper solid waste collection system, thousands of structures have discarded their refuse into the CMP for decades.

Due to years of infill in the surrounding communities, the CMP no longer serves as a functional connection between San Juan Bay and San José Lagoon. Illegal dumping of solid waste has blocked the free movement of sediment from the San José Lagoon to the San Juan Harbor, thus reducing water velocities and creating stagnating conditions. As a result, most of the solid waste materials and sediments are retained within the CMP.

Today, most of the soils of the Project Area have been severely altered, mainly composed of artificial fill consisting of sand, limestone and volcanic rock. In those areas once occupied by wetlands or open water where substandard housing has been established, the superior soil layers are composed of a combination of sediment and solid waste. In segments such as the Project Channel, the thickness of this material can exceed 10 feet below the surface. Most areas now covered by artificial fill are under laid by swamp deposits. Materials within the Caño Martín Peña include various types of solid waste, debris, and other materials.

Table 1 provides an assessment of those areas determined to be RECs, and their associated potential environmental impacts on the soil and water resources on the project area.

Table 1. Recognized Environmental Conditions (RECs) and
Associated Potential Environmental Impact to the Project Area

Recognized Environmental Condition (REC)	Potential Environmental Impact
Unidentified solid waste disposal adjacent and within CMP.	Low
White goods and automobile parts disposed adjacent to CMP.	Low to Moderate
Presence of Pesticide Warehouse within 0.54 mile of CMP project area.	Moderate
Approximately 92 nonmapped listings could potentially be RECs based on the type of database record.	Low

2.3.4 User Provided Information

Atkins has reviewed information provided by ENLACE and USACE. Also reviewed were interviews with residents and government agencies, as available and provided by the non-Federal sponsor ENLACE. The following is a summary of the results of previous EAs, reports, and management plans with all or portions of the document relating to HTRW. Besides the findings presented on these reports, studies conducted on nearby areas for other USACE-sanctioned projects that required dredging and material disposal did not find cause of concern for HTRW, even though elevated levels of contaminants were found from water samples. A list of the reviewed documents is included in Section 4.0.

2.3.4.1 CMP Preliminary Site Characterization (Roy F. Weston, Inc., 1997)

A Preliminary Site Characterization of the CMP prepared by Roy F. Weston, Inc. for the USACE in 1997 states that:

> *Solid waste disposal represents the most significant problem related to the canal. Local dumping of household waste and construction and demolition debris has resulted in terraces restricting the canal channel and allowing further development of the area. The management of these solid wastes would be subject to RCRA Subtitle C or Subtitle D regulation, depending on the types of waste encountered.*

The report further states that waste accumulation within the CMP consists of two types: 1) primary waste disposal points, and 2) transport of waste by tidal currents and the subsequent deposition due to sinking or accumulation. The first type generally contains large volumes of household items, wood debris, concrete, white goods, furniture, engine parts, and rubbish, and are mostly associated with local dwellings or easy point of access. The second type consists mostly of plastic garbage bags containing household refuse or discarded items with a lesser buoyancy than water, such as furniture, refrigerators, and bottles.

Chemical analysis and geotechnical testing was done from sediment and water samples collected from the CMP (ten samples), adjacent lands (five samples), and the San José Lagoon (five samples).

The tests revealed elevated concentrations of mercury and lead, as well as lesser concentrations of other compounds. Several wastewater and stormwater outfalls were observed across the sampling site. Contaminant levels were similar across the CMP and the San José Lagoon.

Given these findings, the report recommended that the following should be considered for dredging the CMP:

- Consider the potential impacts of the contaminants in the development and implementation of the dredging program;
- Develop engineering controls to separate the solid wastes from the "natural" sediments;
- Implement a waste management program to ensure the proper disposal of the wastes in accordance with local, territorial, and Federal (RCRA) regulations; and
- Use special handling for disposal when encountering certain waste items, such as lead-acid batteries or containers of regulated substances.

2.3.4.2 CMP Environmental Site Assessment (ECG, Inc., 1998)

The CMP Environmental Site Assessment report prepared by ECG, Inc., for the USACE in 1998 also echoes many of the findings in the 1997 Preliminary Site Characterization. Chemical analysis was performed on ten soil samples and ten water samples from the CMP.

The report states the following regarding its findings on the CMP:

> *Although unsightly and highly unsanitary, solid waste material within the organic rich clay layer is non-hazardous. Upland disposal should not pose a threat to environmental integrity or human health and safety.*

The report also deemed the waste layer and surrounding area as non-hazardous, based on its thorough soil and groundwater sampling and analysis. Regarding water and sediment quality, the chemical analysis revealed that, besides barium, no other contaminant from the sample reached detection levels. Also, no leachable contaminants were found in the CMP. Waste found in the CMP is classified as household waste, solid waste, and construction debris. Examples include wood debris, household trash, locally used needles, concrete debris, metal debris, and tires, among others.

From these findings, the report suggested the following measures for material dredging and disposal:

- Site workers should be cautious of their surroundings during construction, since some individual waste items may warrant special consideration (e.g., needles from local drug use);
- Monitor and maintain adequate ventilation during excavation, due to the presence of hydrogen sulfide gas;

- Place an impermeable container above and below the dredged waste to ensure containment of leachable contaminants that may be mobilized due to possible future changing soil chemistry; and
- Consider ocean disposal as an alternative to upland disposal.

2.3.4.3 CMP Draft Phase 1 Environmental Site Assessment (CMA, 2002)

The CMP Draft Phase 1 Environmental Site Assessment prepared by CMA Architects and Engineers, LLP, for the Puerto Rico Highway and Transportation Authority in 2002, sheds further light on the potential for HTRW in the CMP. The Phase 1 Environmental Site Assessment was done in conformance with the scope and limitations of ASTM practice E 1527-00.

Major findings from the report included:

- The main sources of pollution in the CMP are the accumulation of filling material and debris for residential construction purposes and untreated wastewater discharges at the site;
- Filling material and debris used for residential construction purposes may lead to the presence of asbestos-containing materials and lead-based paint, the sedimentation of heavy metals and other chemicals into the channel sludge at the bottom;
- The severity of the water quality in the CMP is mainly due to low levels of dissolved oxygen and the presence of organic pollutants; and
- Several illegal dumping sites were found around the CMP.

2.3.4.4 PUERTO NUEVO RIVER FLOOD CONTROL PROJECT

Currently under construction, the Puerto Nuevo River Flood Control Project is located on the north coast of Puerto Rico within the SJMA. The Puerto Nuevo River (Río Piedras) used to flow into the San Juan Bay, and now flows into the western end of the CMP. The Survey Report for the flood control project was completed in October 1984. The Chief of Engineers Report is dated April 25, 1986. Project construction was authorized under Section 202 of WRDA 1986 (PL 99-662). Improvements to the CMP were not included as part of this authorization.

The improvement plan protects against the 100-year flood (the flood with a 1 percent likelihood of occurring in any year) through the construction of 1.7 miles of earth lined channel, 9.5 miles of concrete lined channels (5.1 of which are high velocity), and two debris basins in the Puerto Nuevo River and its tributaries. The plan also requires the construction of 5 new bridges, the replacement of 17 bridges, and the modification of 8 existing bridges. The project eliminated 20.5 acres of mature mangrove wetlands and the affected area included the Constitution Bridge mudflat and mangroves, a Commonwealth designated Critical Coastal Wildlife Habitat.

The 1984 Survey Report states that elevated levels of contaminants were found in the waters of the project site. Solid waste and sediments were also found at the site; however, these were not deemed hazardous and would be disposed of at the ocean in the EPA-approved ocean disposal site in San Juan, pursuant to Section 103 of the Clean Water Act (CWA).

2.3.4.5 AGUA-GUAGUA PROJECT

In 1982, the Puerto Rico Department of Transportation and Public Works (DTPW) requested that the USACE conduct engineering and design studies for a waterway along the western half of the CMP, from the San Juan Bay to the Hato Rey Financial District, as part of the mass transportation Agua-Guagua Project. A Final Report was completed in August 1983. The Urban Mass Transit Administration provided funding for this project.

Construction began in 1984 and it was completed in 1988 at a cost of $20 million. Work consisted of dredging the western CMP to the dimensions of 200 feet wide and 10 feet deep, ocean disposal of over 1.3 million cubic yards of material dredged from the channel, and construction of 13,000 feet of concrete retaining bulkhead.

In section III.A.5 of the 1983 EIS, it is stated that the western CMP has been plagued by water quality problems, mostly due to the construction of structures over the water, untreated wastewater discharges, and garbage and debris disposal. Elevated levels of contaminants were also found from water samples taken in this area. Even though contaminants were found in the western CMP, the report states that dredged material would be preferably disposed of at the ocean (given that requirements of Section 103 of the CWA were met), while non-dredging waste would be disposed of in the municipal dump.

2.4 RESULTS/RECOMMENDATIONS

ENLACE provided previous EAs, reports, and management plans with all or portions of the document relating to HTRW. In 2002 and 2011, elutriate testing of the CMP sediments and sediment porewater from within the Project Area confirmed the presence of heavy metals such as lead and mercury, PAHs, PCBs, oil and grease and residual pesticides. Both the sediments and the sediment porewater of the Caño Martín Peña are characterized by elevated levels of various contaminants. Exceedances of sediment quality guidelines were found for anthracene, antimony, arsenic, copper, dieldrin, lead, mercury, selenium, silver and zinc, along with others.

The porewater within the sediments of the CMP are also characterized by exceedances of relevant criteria for multiple parameters. Problematic results were found for chromium, copper, lead, mercury, nickel, and zinc; however, dilution processes involved with the formation of the slurry for hydraulic dredging should reduce porewater concentrations of chromium, lead, nickel and zinc to values below their relevant water quality criteria, even within the CMP itself. Levels of copper and mercury would likely exceed criteria during the dredging operation, within the area where active dredging would occur. Exceedances for copper and mercury within the actively dredged area would occur mostly due to the fact that the surface waters of Caño Martín Peña and/or San José Lagoon exceed relevant criteria. For cyanide, a complication exists in that the relevant standard is for “free” cyanide, while much of the existing water quality is for the larger category of “total” cyanide. Concentrations of total cyanide are expected to exceed the free cyanide surface water quality standards in the area actively being dredged.

Water quality impacts were assessed based on concentrations expected during sediment disposal within the dredge material disposal area in the San José Lagoon, but outside of a 1,000-foot mixing zone around those disposal sites. Based on earlier work by Bailey et al. (2004) selenium concentrations would be expected to be reduced by 74 percent outside of a 1,000-foot mixing zone, during sediment disposal activities. After applying the expected 74 percent reduction in selenium to the other metal concentrations, there would be no anticipated exceedances of existing criteria for any of the metals examined here outside of a 1,000-foot mixing zone.

Based on the review of the EDR report dated January 5, 2011, one listed site has a moderate potential for environmental concern as a CERCLIS site; R. Maldonado Pesticide Warehouse is located approximately 0.54 mile south-southeast of the CMP. Although emergency “removal” action was started on August 23, 2006, there is no current status of the facility. This site is not located within the project area.

2.4.1 Sediment and Water Quality Sampling

As part of the geotechnical study deliverable, a series of chemical and physical sample analyses were conducted to evaluate contaminant content of the material to be dredged and disposed, and to evaluate their compatibility with the bottom composition of the San José and Los Corozos lagoons. Chemical analyses were also performed with water column samples, and with elutriated sediment samples to evaluate the contamination potential for criteria contaminants. This allows for the identification of contaminants present in sediments and those that may react when in contact with oxygen and water. Sediment and elutriate samples were collected at 10 locations adjacent to the CMP (Figure 2). Canal samples were composited within cores obtained from depths ranging from –12 feet in most of the CMP stations to –16 feet below the water surface. In addition, one sediment sample was collected in Los Corozos Lagoon and four sediment samples were collected in San José Lagoon (Figure 3). Lagoon samples were composited within cores obtained from depths ranging from –30.5 to –39.5 feet below the water surface. Table 2 summarizes the sediment and water quality test results for the CMP and Table 3 summarizes the lagoon sediment sampling results.

The methodology used was based upon USEPA and USACE testing manual guidance for the Evaluation of Dredge Material Proposed for Ocean Disposal, also known as the Green Book, EPA503/8-91/001. The manual contains technical guidance for determining the suitability of dredged material for ocean disposal through chemical, physical, and biological evaluations. Both physical and chemical analyses were conducted for sediment characterization and elutriate for water column. The standard elutriate test involve mixing dredged material with dredging site water and allowing the mixture to settle. The supernatant remaining after undisturbed settling is chemically analyzed.

Chemical analysis provides information about the chemicals present in the dredged material that, if biologically available, could cause toxicity and/or be bioaccumulated. This information is valuable for exposure assessment and for deciding which of the contaminants present in the dredged material may be measured in tissue samples.

Of the 20 parameters, contaminants within the CMP that are above Puerto Rico water quality standards include ammonia (six locations), copper (four locations), cyanide (nine locations), lead (two locations), mercury (six locations), nickel (one location), TPH GRO (three locations), and di(2-ethylhexyl)phthalate (one location). The water quality sampling locations with the most parameter concentrations above Puerto Rico standards include CMP-05, CMP-06, and CMP-12. Selenium was not detected above water quality standards in any of the sampling locations.

For the sediment, NOAA's sediment quality guidelines (SQG) were used as the comparative value. The SQGs are not promulgated as regulatory criteria or standards. SQGs were only available for trace metals (parts per million [ppm], dry weight), which included nine parameters. Two guideline values are used for each chemical: the Effects Range–Low (ERL) and Effects Range–Median (ERM). It is important to understand that these values were not derived as toxicity thresholds. That is, there is no assurance that there will be a total lack of toxicity when chemical concentrations are less than the ERL values. Similarly, there is no assurance that samples in which ERM values are exceeded will be toxic. Toxicity, or lack thereof, must be confirmed with empirical data from toxicity tests. Chemicals often occur in saltwater sediments as complex mixtures.

Figure 2. CMP Boring Locations

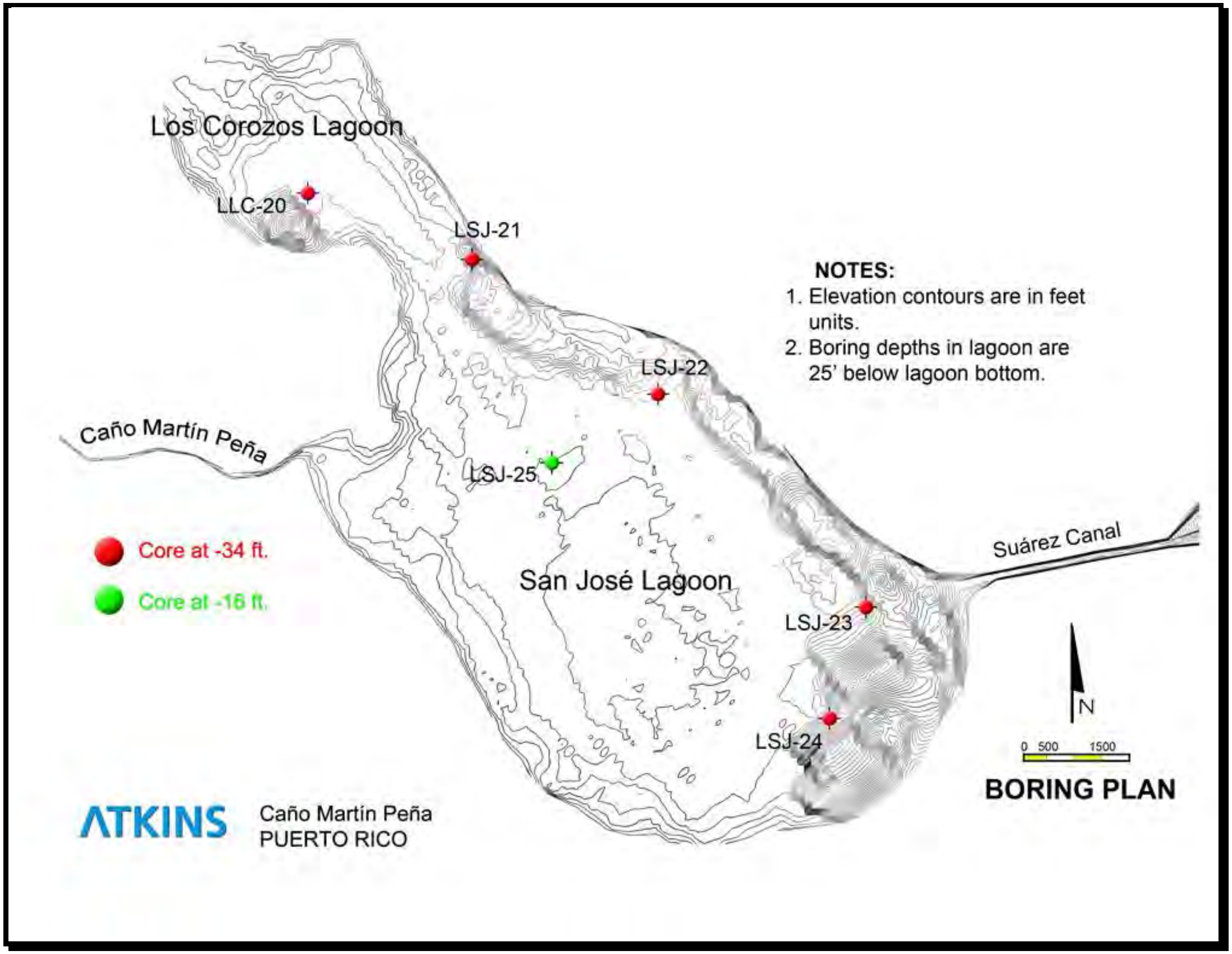

Figure 3. Lagoon Boring Locations

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Table 2. Sediment and Elutriate Sampling Adjacent to Caño Martín Peña

	NOAA SQG[2]		PR Water Quality Standard (mg/L)	CMP-01		CMP-03		CMP-05[5]		CMP-06		CMP-07		CMP-09		CMP-12		CMP-15		CMP-17		CMP-18	
Contaminant[1]	ERL[3] (ppm*)	ERM[4] (ppm)		Sediment (mg/kg)	Elutriate (mg/L)	Sediment (mg/kg)	Elutriate (mg/L)	Sediment (mg/kg)	Elutriate (mg/L)	Sediment (mg/kg)	Elutriate (mg/L)	Sediment (mg/kg)	Elutriate (mg/L)	Sediment (mg/kg)	Elutriate (mg/L)	Sediment (mg/kg)	Elutriate (mg/L)	Sediment (mg/kg)	Elutriate (mg/L)	Sediment (mg/kg)	Elutriate (mg/L)	Sediment (mg/kg)	Elutriate (mg/L)
TOC			n/a	25.00	16.00	29.80	10.20	17.10	8.33	30.50	12.20	22.80	3.84	32.10	11.00	62.70	13.80	55.70	17.70	19.90	7.41	62.40	15.50
Ammonia			5.0	21.20	5.17	64.10	15.50	25.90	2.72	42.90	9.27	35.90	1.29	44.40	4.12	164.00	24.30	195.00	27.20	83.10	7.77	55.30	0.58
Antimony Total			0.64	BDL	0.0055	BDL	0.0032	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Aroclor 1260			n/a	ND	ND	ND	ND	0.02		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		ND	
Arsenic Total	8.2	70	0.036	2.21	BDL	4.87	BDL	3.58	BDL	4.83	BDL	5.93	BDL	3.80	BDL	7.01	BDL	7.98	BDL	14.60	BDL	11.10	BDL
Beryllium			n/a	BDL	BDL	BDL	BDL	BDL		BDL	BDL	BDL		BDL		BDL	BDL	BDL		BDL		BDL	
Cadmium Total	1.2	9.6	0.00885	0.061	BDL	0.784	BDL	0.403	BDL	0.108	BDL	1.30	BDL	1.05	BDL	0.948	BDL	1.06	BDL	1.24	BDL	0.276	BDL
Chromium	81	370	n/a	7.45	0.0045	23.30	BDL	19.30	BDL	15.10	BDL	28.60	BDL	21.30	BDL	29.50	BDL	21.60	BDL	51.40	BDL	22.30	BDL
Chromium $^{+3}$			n/a	7.45	BDL	23.30	BDL	19.30	BDL	15.10	BDL	28.60	BDL	21.30	BDL	29.50	BDL	21.60	BDL	51.40		22.30	
Chromium $^{+6}$			0.05035	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	B	BDL	BDL		BDL	
Copper Total	34	270	0.00373	10.40	BDL	56.60	BDL	42.60	0.0958	10.80	0.0728	67.60	BDL	27.50	BDL	105.00	0.0873	60.80	0.0821	42.40	BDL	33.60	0.0027
Cyanide Total			0.001	BDL	0.0020	BDL	0.0019	BDL	0.0020	BDL	0.0027	BDL	0.0015	BDL	0.0018	BDL	0.0023	BDL	0.0014	0.452	0.0024	BDL	0.0008
Lead	46.7	218	0.00852	12.70	BDL	155.00	0.0032	24.00	BDL	22.50	BDL	89.80	BDL	78.20	0.0246	127.00	0.0227	88.00	BDL	65.30	0.0047	17.10	0.0061
Mercury	0.15	0.71	0.000051	0.117	0.0002	0.760	BDL	0.379	0.0002	0.247	0.0003	1.12	BDL	0.544	0.0002	0.661	0.0002	0.766	BDL	0.640	0.0002	0.257	BDL
Nickel Total	20.9	51.6	0.00828	1.90	BDL	10.30	BDL	7.25	0.0134	4.31	BDL	13.00	BDL	7.41	BDL	11.50	BDL	9.01	BDL	8.96	0.0052	3.88	BDL
Selenium			0.07114	0.63	BDL	2.08	BDL	BDL	BDL	1.48	BDL	BDL	BDL	BDL	BDL	2.26	BDL	1.43	BDL	BDL	BDL	BDL	BDL
Silver total	1.00	3.7	0.00224	0.756	BDL	2.38	BDL	0.665		0.755		1.83		2.35		1.94		1.70		1.88		0.553	
TPH DRO			0	ND	ND	631.00	ND	208.00	ND	ND	ND	381.00	ND	414.00	ND	373.00	ND	531.00	ND	652.00	ND	ND	ND
TPH GRO			0	ND	0.517	0.175	ND	0.0648	0.02	ND	0.119	0.115	ND	ND	ND	0.168	ND	0.694	ND	0.117	ND	0.0806	ND
TPH ORO			0	ND	ND	4,416	ND	1,503	ND	ND	ND	3,253	ND	3,000	ND	2,002	ND	3,034	ND	4,502	ND	1,149	ND
Zinc total	150	410	0.08562	38.10	0.011	197.00	0.006	122.00		63.10	BDL	486.00		134.00		198.00	BDL	276.00		678.00		104.00	
Thallium			0.00047	BDL	BDL	BDL	ND	0.727	BDL	BDL	BDL	1.300	BDL	0.571	BDL	BDL	BDL	BDL	BDL	1.260	BDL	0.546	BDL
Sulfide			4.5	556		295		497		93		809		184		878		1,072		1,240		111	
Di-n-butyl phthalate			0.002	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.554	ND	ND	
Di(2-ehtylhexyl)phthalate			0.022												0.0268								
Total Solids %				73.700		58.000		66.100		65.0		35.5		34.8		49.1		50.7		49.1		34.8	

BDL - below detection limit; ND - not detected

[1] List of contaminants contains only those detected in the sediment composite and elutriate of 2011 sampling effort.

[2] NOAA Sediment Quality Guidelines (SQG) developed for the National Status and Trends Program (6/12/99).

[3] ERL = Effects Range - Low

[4] ERM = Effects Range - Medium

[5] Sea water elutriate test

*ppm = mg/kg

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Table 3. Sediment Sampling at Los Corozos Lagoon and San José Lagoon

	NOAA SQG		Boring				
Contaminant[1]	**ERL (ppm)**	**ERM (ppm)**	**LLC-20 Sediment (mg/kg)**	**LSJ-21 Sediment (mg/kg)**	**LSJ-22 Sediment (mg/kg)**	**LSJ-23 Sediment (mg/kg)**	**LSJ-24 Sediment (mg/kg)**
TOC			3.01	10.10	2.51	14.90	5.02
Ammonia			BDL	26.20	10.20	40.80	22.6
Antimony Total			BDL	BDL	BDL	BDL	BDL
Aroclor 1260			ND	ND	ND	ND	ND
Arsenic Total	8.2	70	0.929	4.62	2.57	7.60	20.9
Beryllium			BDL	BDL	BDL	BDL	BDL
Cadmium Total	1.2	9.6	BDL	BDL	BDL	BDL	BDL
Chromium	81	370	2.92	31.80	19.60	46.40	65.8
Chromium $^{+3}$			2.92	31.80	19.60	46.40	65.8
Chromium $^{+6}$			BDL	BDL	BDL	BDL	BDL
Copper Total	34	270	0.850	19.10	15.10	16.50	21.2
Cyanide Total			BDL	BDL	BDL	BDL	BDL
Lead	46.7	218	1.16	2.34	2.82	3.58	5.47
Mercury	0.15	0.71	0.096	BDL	BDL	0.069	0.204
Nickel Total	20.9	51.6	1.31	2.63	1.56	2.68	3.95
Selenium			BDL	BDL	BDL	BDL	BDL
Silver Total	1.00	3.7	2.31	0.17	BDL	BDL	0.118
TPH DRO			ND	ND	ND	ND	ND
TPH GRO			ND	0.0247	ND	ND	ND
TPH ORO			ND	ND	ND	ND	ND
Zinc Total	150	410	3.28	7.79	23.10	18.80	19.4
Thallium			BDL	0.819	BDL	0.687	1.01
Sulfide							
Di-n-butyl phthalate			0.032	31.300	ND	ND	ND
Total Solids %			73.400	48.900	82.900	69.700	34.8

BDL – below detection limit; ND – not detected

[1] List of contaminants contains only those detected in the sediment composite and elutriate of 2011 sampling effort.

Table 4. Sediment and Elutriate Average Concentration Results

	Sediment average concentrations (mg/kg)			**Elutriate average concentrations (mg/liter)**		**PR EQB Water Quality Standards (2010)**	**Dilution needed to meet PR EQB (2010) criteria**
Contaminant[1]	**CMP 2002[2]**	**CMP 2011**	**Lagoon Pits 2011**	**CMP 2002[2]**	**CMP 2011**		
TOC	9,300.000	35.800	7.108	4.50000	11,598.000	NA	NA
Ammonia (NH_3) [3]	-	73.180	24.950	-	**9.79200**	5.00000	**2.0**
Antimony-Total	1.170	BDL	BDL	0.01200	0.00435	0.64000	NA
Aroclor 1260	-	0.020	ND	-	ND	NA	NA
Arsenic - Total	12.400	6.591	7.324	0.03100	BDL	0.03600	NA
Berylium	-	BDL	BDL	-	ND	NA	NA
Cadmium - Total	9.590	0.723	BDL	-	< 0.0002	0.88500	NA
Chromium (Cr)	47.500	23.985	33.304	< 0.0010	0.00450	0.05035	NA
Chromium (Cr +3)	-	23.985	33.304	< 0.0010	BDL	NA	NA
Chromium (Cr +6)	-	BDL	BDL	-	BDL	0.05035	NA
Copper - Total	181.000	45.730	14.550	< 0.001	**0.06814**	0.00373	**18.3**
Cyanide - Total	-	0.452	BDL	-	**0.00188**	0.00100	**1.9**
Lead	281.000	67.960	3.074	0.00400	**0.01226**	0.00852	**1.4**
Mercury	2.440	0.550	0.120	< 0.00010	**0.00020**	0.00005	**3.9**
Nickel - Total	32.300	7.752	2.426	0.00500	**0.00930**	0.00828	**1.1**
Selenium	1.000	1.576	BDL	**0.10100**	BDL	0.07114	**1.4**
Silver - Total	3.400	1.481	0.866	< 0.002	BDL	0.00224	NA
TPH-DRO	-	456.000	ND	-	ND	NA	NA
TPH-GRO	-	0.000	0.025	-	0.21900	NA	NA
TPH-ORO	-	2,857.000	ND	-	ND	NA	NA
Zinc - Total	1,050.000	230.000	14.000	0.00000	0.00000	0.08562	NA
Thalium [4]	0.300	0.900	0.800	< 0.002	BDL	0.00047	NA
Sulfide [4]	696.000	573.000	-	< 1	-	0.00200	NA
Di-n-butyl phthalate	-	0.554	15.666	-	ND	4.50000	NA
Di(2-ethylhexyl) phthalate	-	ND	-	-	**0.03000**	0.02200	**1.4**
Total Solids (%)	-	52.000	62.000	-	-	NA	NA

The guidelines are commonly used to rank and prioritize sites of concern and chemicals of concern. That is, samples or study areas in which many chemicals exceed the ERM values and exceed them by a large degree may be considered as more contaminated than those in which none of the SQGs are exceeded. Samples in which ERL concentrations are exceeded, but no ERM values are exceeded, might be given intermediate ranks. Similarly, chemicals at concentrations well above the ERM values might be given a higher priority than those at concentrations below the ERLs. Chemical at intermediate concentrations may qualify as a moderate priority. There were no SQG values available for selenium.

Results summarized in Table 2 for the CMP indicated one location (CMP-17) with one parameter that was exceeded by a large degree. Zinc has an ERM value of 410 ppm. CMP-17 sediment was measured with a zinc value of 678 ppm. In Table 3, no parameters for sediments with SQG values for ERM were exceeded in either Los Corozos or San José Lagoons.

Table 4 provides a comparison of available historical water quality data (Bailey et al., 2002) with the average concentrations from the 2011 sampling effort. Exceedances of Puerto Rico water quality standards within the current sampling dataset have been discussed. Note that selenium in the current sampling was predominantly below detection limit.

Results from the 2011 analysis of sediments from the canal were evaluated for the potential to contain hazardous concentrations of toxic constituents (e.g,, 40 CFR Part 261 – Characteristics of Hazardous Waste). Toxicity concentrations are based the toxicity characteristic leaching procedure (TCLP) values. Due to the EPA Method 1311 dry TCLP calculation being used for the wet samples in this TM, there is potential for error between the calculated sample TCLP values and the actual TCLP values. Lab data providing the volume of the liquid in the sample as well as the weight of the solid portion of the sample would allow for greater accuracy. Preliminary and approximate screening of the total metals concentrations via EPA Method 1311 suggests that hazardous concentrations of lead may be present in the canal sediments (Table 5). Additionally, total petroleum hydrocarbons are noted as present in the canal sediments.

2.5 OPINIONS

Atkins has performed a HTRW Initial Assessment in general accordance with ASTM E1527-05 and in accordance with U.S. Army Corps of Engineers (USACE) Engineering Regulation (ER) 1165-2-132, "Hazardous, Toxic and Radioactive Waste (HTRW) Guidance for Civil Works Projects" (USACE, 1992). This assessment has revealed evidence of *historical recognized environmental conditions* or *RECs* in connection with the study area. On the basis of the information obtained to date from the non-Federal sponsor, including interviews with residents and government agencies, Atkins believes there is evidence to support either past or ongoing contamination to the study area. Although Atkins has identified RECs within the study area, the potential for HTRWs within the project area appears to be minimal. Materials within the Caño Martín Peña include various types of solid waste, debris, and other materials. Such materials will require further testing prior to and/or during project construction, as appropriate, in accordance with an agreed sampling plan. If the testing determines that any materials contain hazardous substances at levels that are not suitable for unregulated disposal, they will be managed in accordance with the applicable laws and regulations of the relevant regulatory agencies.

The sediment and water quality sampling conducted for the project was conducted in May 2011. While preliminary and approximate screening of the total metals concentrations via EPA Method 1311 suggests that hazardous concentrations of lead may be present in the canal sediments, the potential for HTRWs within the project area continues to appear minimal.

Table 5. CMP – Canal Sediment Chemical Analysis Results

Boring	CMP '02 results[2]	CMP-01	CMP-03	CMP-05	CMP-06	CMP-07*	CMP-09	CMP-12	CMP-15	CMP-17	CMP-18	Statistics					Sediment Toxicity Threshold	Toxicity Characteristic Values 40 CFR 261	LDR 40 CFR 268	Regional Screening Levels under CERCLA
Contaminant[1]	Sediment (mg/kg)	Sediment (mg/kg)	Sediment (mg/kg)	Sediment (mg/kg)	Sediment (mg/kg)	Sediment (mg/kg)	Sediment (mg/kg)	Sediment (mg/kg)	Sediment (mg/kg)	Sediment (mg/kg)	Sediment (mg/kg)	n	Average	Range Low	Range Hi	Estimated TCLP (value/20)	(mg/l unless otherwise noted)	TCLP mg/L	(mg/kg unless noted as "mg/l TCLP")	SSL protective of Ground-water
TOC	9300	25	30	17	31	23	32	63	56	20	62	10	36	17	63	3.135	NA	--	NA	
Ammonia		21.20	64.10	25.90	42.90	35.90	44.40	164.00	195.00	83.10	55.30	10	73.18	21.20	195.00	9.75	--	--	--	--
Antimony Total	1.17	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0	BDL	0.00	0.00	0	1.15	--	1.15 mg/l TCLP	0.0352
PCB (Aroclor 1260)		ND	ND	0.02	ND	ND	ND	ND	ND	ND	ND	1	0.02	0.02	0.02	0.001	10 mg/kg	--	10	0.0273
Arsenic Total	12.4	2.2	4.9	3.6	4.8	5.9	3.8	7.0	8.0	14.6	11.1	10.0	6.6	2.2	14.6	0.73	5	5	5.0 mg/l TCLP	0.00151
Beryllium		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0	BDL	0.00	0.00	0	1.22	--	1.22 mg/l TCLP	--
Cadmium Total	9.59	0.06	0.78	0.40	0.11	1.30	1.05	0.95	1.06	1.24	0.28	10.00	0.72	0.06	1.30	0.065	1	1	0.11 mg/l TCLP	0.0693 (water)
Chromium	47.5	7.5	23.3	19.3	15.1	28.6	21.3	29.5	21.6	51.4	22.3	10.0	24.0	7.5	51.4	2.57	5	5	0.60 mg/l TCLP	1.8E+05 (water)
Chromium $^{+3}$		7.45	23.30	19.30	15.10	28.60	21.30	29.50	21.60	51.40	22.30	10	23.99	7.45	51.40	2.57	--	--	--	*4040000*
Chromium $^{+6}$		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0	BDL	0.00	0.00	0	5	--	0.60 mg/l TCLP	0.000667
Copper Total	181	10	57	43	11	68	28	105	61	42	34	10	46	10	105	5.25	--	--	--	2.8
Cyanide Total		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.452	BDL	1	0.45	0.45	0.45	0.0226	590 mg/kg	--	590	0.00148
Lead	281	13	155	24	23	90	78	127	88	65	17	10	68	13	155	7.75	5	5	0.75 mg/l TCLP	--
Mercury	2.44	0.12	0.76	0.38	0.25	1.12	0.54	0.66	0.77	0.64	0.26	10.00	0.55	0.12	1.12	0.056	0.2	0.2	0.2 mg/l TCLP	0.00327
Total Metals	--	--	--	--	--	--	--	--	--	--	--						NA	--	NA	N/A

Table 5, cont'd

Boring	CMP '02 results[2]	CMP-01	CMP-03	CMP-05	CMP-06	CMP-07*	CMP-09	CMP-12	CMP-15	CMP-17	CMP-18	Statistics					Sediment Toxicity Threshold	Toxicity Characteristic Values 40 CFR 261	LDR 40 CFR 268	Regional Screening Levels under CERCLA
Contaminant[1]	Sediment (mg/kg)	Sediment (mg/kg)	Sediment (mg/kg)	Sediment (mg/kg)	Sediment (mg/kg)	Sediment (mg/kg)	Sediment (mg/kg)	Sediment (mg/kg)	Sediment (mg/kg)	Sediment (mg/kg)	Sediment (mg/kg)	n	Average	Range Low	Range Hi	Estimated TCLP (value/20)	(mg/l unless otherwise noted)	TCLP mg/L	(mg/kg unless noted as "mg/l TCLP")	SSL protective of Ground-water
Nickel Total	32.3	1.9	10.3	7.3	4.3	13.0	7.4	11.5	9.0	9.0	3.9	10.0	7.8	1.9	13.0	0.65	11	--	11 mg/l TCLP	--
Selenium	1	1	2	BDL	1	BDL	BDL	2	1	BDL	BDL	5	2	1	2	0.113	1	1	5.7 mg/l TCLP	0.0519
Silver total	3	1	2	1	1	2	2	2	2	2	1	10	1	1	2	0.119	5	5	0.14 mg/l TCLP	0.0799
TPH DRO		ND	631.00	208.00	ND	381.00	414.00	373.00	531.00	652.00	ND	7	455.71	208.00	652.00	32.6	NA	--	NA	239
TPH GRO		ND	0.175	0.0648	ND	0.115	ND	0.168	0.694	0.117	0.0806	7	0.20	0.06	0.69	0.0347	NA	--	NA	0.88
TPH ORO		ND	4416.00	1503.00	ND	3253.00	3000.00	2002.00	3034.00	4502.00	1149.00	8	2857.38	1149.00	4502.00	225.1	NA	--	NA	0.145
Zinc Total	1050	38	197	122	63	486	134	198	276	678	104	10	230	38	678	33.9	4.3	--	4.3 mg/l TCLP	37
Thallium	0.3	BDL	BDL	0.7	BDL	1.3	0.6	BDL	BDL	1.3	0.5	5.0	0.9	0.5	1.3	0.065	0.2	--	0.20 mg/l TCLP	0.00142
Sulfide	696	556	295	497	93	809	184	878	1072	1240	111	10	573	93	1240	62	--	--	--	--
Di-n-butyl phthalate	--	ND	ND	ND	ND	ND	ND	ND	ND	0.554	ND	1	0.55	0.55	0.55	0.0277	28 mg/kg	--	28	--
Di(2-ethylhexyl) phthalate	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	ND	0.00	0.00	0	28 mg/kg	--	28 mg/kg	--
Total Solids %	--	74	58	66	65	36	35	49	51	49	35	10	52	35	74	3.685	NA	--	NA	NA

BDL: Below Detection Limit; ND: Not Detected; -- Data not available; NA: Not Applicable

1 List of contaminants contains only those detected in the sediment composite and elutriate of 2011 sampling effort.

2 Design of Contained Aquatic Disposal Pits for Martín Peña Canal, December 2002 report, Appendix B-Elutriate Testing.

Red values indicate exceedance in the allowed maximum concentration established by PRWQSR.

Red values in the TCLP Statistical Column indicate exceedance in the Toxicity Characteristic Threshold Value.

🟦 Indicates non-CERCLA contaminant.

🟩 Indicates Specific CERCLA contaminant.

3.0 LIMITATIONS AND DATA GAPS

3.1 LIMITATIONS

The purpose of this report was to assess the physical characteristics of the study area with respect to the presence in the environment of hazardous waste or material, oil, or petroleum products according to ASTM E1527-05.

No specific attempt was made to check on the compliance of present or past owners or operators of the site with federal, state, or local laws and regulations, environmental or otherwise. Non-ASTM scope issues (i.e., asbestos, lead-based paint, etc.) were not addressed.

The scope of this assessment did not include any additional environmental investigation, which were not outlined herein, or any analysis for the presence or absence of hazardous or toxic materials in the soil, groundwater, surface water, air, in, on, under, or above the project area.

Specifically, Atkins does not and cannot represent that the site contains no hazardous waste or material, oil (including petroleum products), or other latent condition beyond that presented in this assessment.

The observations described in this report were made under the conditions stated therein. Such conclusions are based solely on the site condition, and the rules and regulations in effect at the time of the study. The recommendations and opinions stated herein must be considered not as scientific certainties, but rather as professional opinions regarding the limited data obtained during the course of the environmental site assessment. No other warranty, expressed or implied, is made.

In preparing this report, Atkins relied on certain information provided by federal, state, or local officials and other parties referenced therein. Although there may have been some degree of overlap in the information provided by these various sources, an attempt to independently verify the accuracy or completeness of all information reviewed or received during the course of this site assessment was not made.

Observations were made of the study area and of structures within the study area as indicated within the report. Where access to portions of the study area or to structures within the study area was unavailable or limited, Atkins renders no opinion as to the presence of indirect evidence relating to hazardous waste or material, oil, or other petroleum products in that section of the site or structure. In addition, Atkins renders no opinion as to the presence of hazardous waste or material, oil or other petroleum products, or to the presence of indirect evidence relating to hazardous material, oil, or petroleum products where direct observation of the interior walls, roof, or ceiling of a structure on a site was obstructed by objects or coverings on or over these surfaces.

Unless otherwise specified in the report, Atkins did not perform testing or analyses to determine the presence or concentration of asbestos, radon, formaldehyde, lead-based paint, lead in drinking water, or electromagnetic fields (EMFs) at the site or in the environment at the site.

3.2 DATA GAPS

The ASTM standard requires that the history of the subject property be traced from the present back to when the property first contained structures or was used for residential, commercial, industrial, or governmental purposes. This requires the investigator to review sources that are *publicly available, within a reasonable time and cost, reasonably ascertainable, and considered practically reviewable*, as defined under the ASTM standard. In addition, these criteria are applied keeping in mind sources that are likely to provide information concerning possible recognized environmental conditions at the study area.

Atkins has reviewed all sources of information that are considered to meet these criteria. In cases where history of the property is not traced to a prior or its first developed use, this condition is considered to be a *data gap* and not an exception to the required scope of work.

With regards to deviations from the scope of the HTRW IA, or data gaps (Table 6) as referenced in Section 12.7 of ASTM E1527-05, there are the following:

Table 6. Data Gaps

Resource	Pertinent Information
Fire Insurance Maps	Not available

4.0 REFERENCES AND LITERATURE CITED

ASTM International. 2005. “Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process – E1527-05.” November 1.

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Environmental Data Resources, Inc. (EDR). 2011. “Caño Martín Peña – The EDR Radius Map Report with GeoCheck.” Inquiry Number 2960202.2S. January 5.

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Webb, R.M.T., and F. Gomez-Gomez. 1998. “Trends in Bottom-Sediment Quality and Bottom Sediments, San Juan Bay Estuary System, Puerto Rico, December 1994–July 1995.” Water-Resources Investigations Report 97-4144. U.S. Geological Survey. July.

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Appendix H6.a

Environmental Data Resource, Inc.
Database Report

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Cano Martin Pena
Cano Martin Pena
San Juan, PR 00917

Inquiry Number: 2960202.2s
January 05, 2011

The EDR Radius Map™ Report with GeoCheck®

EDR® Environmental Data Resources Inc

440 Wheelers Farms Road
Milford, CT 06461
Toll Free: 800.352.0050
www.edrnet.com

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GEOCHECK ADDENDUM

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

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This Report contains certain information obtained from a variety of public and other sources reasonably available to Environmental Data Resources, Inc. It cannot be concluded from this Report that coverage information for the target and surrounding properties does not exist from other sources. **NO WARRANTY EXPRESSED OR IMPLIED, IS MADE WHATSOEVER IN CONNECTION WITH THIS REPORT. ENVIRONMENTAL DATA RESOURCES, INC. SPECIFICALLY DISCLAIMS THE MAKING OF ANY SUCH WARRANTIES, INCLUDING WITHOUT LIMITATION, MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE OR PURPOSE. ALL RISK IS ASSUMED BY THE USER. IN NO EVENT SHALL ENVIRONMENTAL DATA RESOURCES, INC. BE LIABLE TO ANYONE, WHETHER ARISING OUT OF ERRORS OR OMISSIONS, NEGLIGENCE, ACCIDENT OR ANY OTHER CAUSE, FOR ANY LOSS OF DAMAGE, INCLUDING, WITHOUT LIMITATION, SPECIAL, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES. ANY LIABILITY ON THE PART OF ENVIRONMENTAL DATA RESOURCES, INC. IS STRICTLY LIMITED TO A REFUND OF THE AMOUNT PAID FOR THIS REPORT.** Purchaser accepts this Report "AS IS". Any analyses, estimates, ratings, environmental risk levels or risk codes provided in this Report are provided for illustrative purposes only, and are not intended to provide, nor should they be interpreted as providing any facts regarding, or prediction or forecast of, any environmental risk for any property. Only a Phase I Environmental Site Assessment performed by an environmental professional can provide information regarding the environmental risk for any property. Additionally, the information provided in this Report is not to be construed as legal advice.

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EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-05) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

CANO MARTIN PENA
SAN JUAN, PR 00917

COORDINATES

Latitude (North):	18.430900 - 18˚ 25' 51.2''
Longitude (West):	66.049500 - 66˚ 2' 58.2''
Universal Tranverse Mercator:	Zone 19
UTM X (Meters):	811695.8
UTM Y (Meters):	2040276.1
Elevation:	0 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property:	N/A
Source:	USGS 7.5 min quad index

TARGET PROPERTY SEARCH RESULTS

The target property was not listed in any of the databases searched by EDR.

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the search radius around the target property for the following databases:

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL	National Priority List
Proposed NPL	Proposed National Priority List Sites
NPL LIENS	Federal Superfund Liens

Federal Delisted NPL site list

Delisted NPL	National Priority List Deletions

EXECUTIVE SUMMARY

Federal CERCLIS list

FEDERAL FACILITY---------- Federal Facility Site Information listing

Federal CERCLIS NFRAP site List

CERC-NFRAP---------------- CERCLIS No Further Remedial Action Planned

Federal RCRA CORRACTS facilities list

CORRACTS------------------ Corrective Action Report

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF----------------- RCRA - Treatment, Storage and Disposal

Federal RCRA generators list

RCRA-LQG------------------ RCRA - Large Quantity Generators
RCRA-SQG------------------ RCRA - Small Quantity Generators
RCRA-CESQG---------------- RCRA - Conditionally Exempt Small Quantity Generator

Federal institutional controls / engineering controls registries

US ENG CONTROLS----------- Engineering Controls Sites List
US INST CONTROL----------- Sites with Institutional Controls

Federal ERNS list

ERNS---------------------- Emergency Response Notification System

State- and tribal - equivalent CERCLIS

SHWS---------------------- This state does not maintain a SHWS list. See the Federal CERCLIS list and Federal NPL list.

State and tribal leaking storage tank lists

INDIAN LUST--------------- Leaking Underground Storage Tanks on Indian Land

State and tribal registered storage tank lists

INDIAN UST---------------- Underground Storage Tanks on Indian Land
FEMA UST------------------ Underground Storage Tank Listing

State and tribal voluntary cleanup sites

INDIAN VCP---------------- Voluntary Cleanup Priority Listing

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS------------ A Listing of Brownfields Sites

EXECUTIVE SUMMARY

Local Lists of Landfill / Solid Waste Disposal Sites

DEBRIS REGION 9	Torres Martinez Reservation Illegal Dump Site Locations
ODI	Open Dump Inventory
INDIAN ODI	Report on the Status of Open Dumps on Indian Lands

Local Lists of Hazardous waste / Contaminated Sites

US CDL	Clandestine Drug Labs
US HIST CDL	National Clandestine Laboratory Register

Local Land Records

LIENS 2	CERCLA Lien Information
LUCIS	Land Use Control Information System

Records of Emergency Release Reports

HMIRS	Hazardous Materials Information Reporting System

Other Ascertainable Records

DOT OPS	Incident and Accident Data
DOD	Department of Defense Sites
FUDS	Formerly Used Defense Sites
CONSENT	Superfund (CERCLA) Consent Decrees
ROD	Records Of Decision
UMTRA	Uranium Mill Tailings Sites
MINES	Mines Master Index File
TRIS	Toxic Chemical Release Inventory System
TSCA	Toxic Substances Control Act
FTTS	FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
HIST FTTS	FIFRA/TSCA Tracking System Administrative Case Listing
SSTS	Section 7 Tracking Systems
ICIS	Integrated Compliance Information System
PADS	PCB Activity Database System
MLTS	Material Licensing Tracking System
RADINFO	Radiation Information Database
FINDS	Facility Index System/Facility Registry System
RAATS	RCRA Administrative Action Tracking System
INDIAN RESERV	Indian Reservations
SCRD DRYCLEANERS	State Coalition for Remediation of Drycleaners Listing
PCB TRANSFORMER	PCB Transformer Registration Database
COAL ASH EPA	Coal Combustion Residues Surface Impoundments List
COAL ASH DOE	Sleam-Electric Plan Operation Data

EDR PROPRIETARY RECORDS

EDR Proprietary Records

Manufactured Gas Plants	EDR Proprietary Manufactured Gas Plants

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were identified in the following databases.

EXECUTIVE SUMMARY

Elevations have been determined from the USGS Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified. Sites with an elevation equal to or higher than the target property have been differentiated below from sites with an elevation lower than the target property.
Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

Unmappable (orphan) sites are not considered in the foregoing analysis.

STANDARD ENVIRONMENTAL RECORDS

Federal CERCLIS list

CERCLIS: The Comprehensive Environmental Response, Compensation and Liability Information System contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). CERCLIS contains sites which are either proposed to or on the National Priorities List (NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL.

A review of the CERCLIS list, as provided by EDR, and dated 01/29/2010 has revealed that there are 2 CERCLIS sites within approximately 0.75 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
R. MALDONADO PESTICIDE WAREHOU	#2 JULIA STREET	SSE 1/2 - 1 (0.540 mi.)	4	10
AMERICAN INTERNATIONAL PLAZA,	250 MUNOZ RIVERA AVENUE	WSW 1/2 - 1 (0.689 mi.)	A6	11

State and tribal leaking storage tank lists

LUST: Leaking Underground Storage Tanks.

A review of the LUST list, as provided by EDR, and dated 03/01/2008 has revealed that there is 1 LUST site within approximately 0.75 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
CITIBANK N.A.- HATO REY	AVE. PONCE DE LEON #252	WSW 1/2 - 1 (0.681 mi.)	A5	11

State and tribal registered storage tank lists

UST: UST Facilities.

A review of the UST list, as provided by EDR, and dated 01/01/2008 has revealed that there are 2 UST sites within approximately 0.5 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
ROD-RODDER SERVICES INC	***FRANKLIN ROOSEVELT***	***SSE 1/4 - 1/2 (0.375 mi.)***	***2***	***8***
ROSA ELENA JIMENEZ	CALLE PARIS #245	S 1/4 - 1/2 (0.485 mi.)	3	10

EXECUTIVE SUMMARY

ADDITIONAL ENVIRONMENTAL RECORDS

Other Ascertainable Records

RCRA-NonGen: RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

A review of the RCRA-NonGen list, as provided by EDR, and dated 02/17/2010 has revealed that there are 2 RCRA-NonGen sites within approximately 0.5 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
TEXACO PR INC - PINERO DEVELOP	*MARGINAL #183 EXTENSION*	*S 1/4 - 1/2 (0.366 mi.)*	*1*	*7*
ROD-RODDER SERVICES INC	*FRANKLIN ROOSEVELT*	*SSE 1/4 - 1/2 (0.375 mi.)*	*2*	*8*

EXECUTIVE SUMMARY

Due to poor or inadequate address information, the following sites were not mapped. Count: 311 records.

Site Name	Database(s)
CORPORACION UNION DE INVERSIONES,	FTTS, HIST FTTS, FINDS
SANDS HOTEL & CASINO	FTTS, HIST FTTS, FINDS
PUBLIC BUILDING AUTHORITY (HOUSING	FTTS, HIST FTTS, FINDS
EDIFICIO ECHEGARRY	FTTS, HIST FTTS, FINDS
LOTERIA DE PUERTO RICO BUILDING	FTTS, HIST FTTS, FINDS
PRAICO	FTTS, HIST FTTS, FINDS
NEW SAN JUAN BUILDING	FTTS, HIST FTTS, FINDS
BANCO CENTRAL	FTTS, HIST FTTS, FINDS
BANCO NATIONAL PLAZA	FTTS, HIST FTTS, FINDS
ELA RETIREMENT SYSTEM ADM	FTTS, HIST FTTS, FINDS
ASOCIACION DE EMPLEADOS DEL ELA DE	FTTS, HIST FTTS, FINDS
SOCIEDAD ESPANOLA DE AUXILIO MUTUO	FTTS, HIST FTTS, FINDS
ROYAL BANK BLDG	FTTS, HIST FTTS, FINDS
CHASE 416	FTTS, HIST FTTS, FINDS
PONCE DE LEON SCHOOL	FTTS, HIST FTTS, FINDS
HOSPITAL SAN FRANCISCO, INC	FTTS, HIST FTTS
EMILIO DEL TORO CUEVAS	FTTS
CENTRO EUGENIO MARIA DE HOSTOS, UR	FTTS
MONTE HATILLO	FTTS
OGDEN AVIATION, INC	HIST FTTS, FINDS
DEPARTAMENTO DEL TRABAGOY RECURSOS	HIST FTTS, FINDS
PRIDCO CENTRAL OFFICE	HIST FTTS
SAN FRANCISCO HOSPITAL	HIST FTTS
SUPERIOR PAINT MFG, INC	RCRA-TSDF, RCRA-NonGen, FINDS, UST
CARIBE PAINT CORP.	CERCLIS, FINDS
PHARMASOL CHEMICAL FACILITY	CERCLIS
LUIS MUNOZ MARIN INTERNATIONAL AIR	CERCLIS
RIO PIEDRAS CDT HOSPITAL MERCURY S	CERCLIS
PARDO RESIDENCE SITE	CERCLIS
CHEMTEX CARIBBEAN INC.	CERCLIS, FINDS
TEXACO OF PR, INC	CERC-NFRAP
"NEW" ARMY AVIATION SUPPORT	CERC-NFRAP
SCORPIO RECYCLING INC	CERC-NFRAP, RCRA-NonGen, FINDS
SHELL S/S #000515	LUST
SHELL S/S #002828	LUST
ESSO S/S CO-023	LUST
SHELL S/S #804797	LUST
RAMON L. RODRIGUEZ S/S #311	LUST
HORACIO PASTRANA S/S	LUST
ESSO S/S CO-042	LUST
GULF #119	LUST
SHELL S/S #000329	LUST
ABU-USBA PETROLEUM	LUST
SHELL S/S # 002887	LUST
ESSO S/S CO-015	LUST
ESSO S/S COB-025	LUST
FOOD & DRUG ADMINISTRATION	LUST
GULF #040	LUST
GULF S/ S #456	LUST
TEXACO # 320 PEDRO CABRERA S/S	LUST
ESSO- HOSP. DEL MAESTRO	LUST
TOTAL 1012	LUST
CONGO GAS???	LUST
ARAMCO GAS STATION	LUST
US ARMY CORPS OF ENGINEERS	LUST
ESSO S/S 2P-187	LUST
ANGELBERTO REYES S/S # 334	LUST
OBRAS PUBLICAS MUNICIPAL	LUST

CHARNECO S/S	LUST
TRUCK STOP CARIBE	LUST
GULF S/S #176	LUST
AMERICAN TRANSMISSION, INC.	LUST
LA NUEVA PUERTA DE SANTURCE, INC.	LUST
GULF S/S#163	LUST
GULF S/S #436	LUST
GULF S/S #458	LUST
QUISQUEYA S/S	LUST
INDUSTRIA LECHERA DE P.R.	LUST
SANTA PAULA OIL	LUST
GULF S/S #399	LUST
HOSPITAL PEDIATRICO UNIVERSITARIO	LUST
CENTERS FOR DISEAS. CONT.& PREV.	LUST
PANADERIA RESTAURANTE LISBOA	LUST
TOTAL PETROLEUM #3304	LUST
ISMAEL GONZALEZ CONST.	LUST
BANCO POPULAR DE P.R.	LUST
CITGO CAIMITO	LUST
L.R. GAS STATION	LUST
RAMON ACOSTA DIAZ	LUST
BONAIRE CLEANERS	LUST
GULF #027	LUST
HOSPITAL SIQUIATRIA RAMON FERNANDE	LUST
ASEM- MEDICAL CENTER-COCINA CENTRA	LUST
FEDERAL PACKING OF PUERTO RICO	LUST
GULF S/S #179	LUST
VALINES INDUSTRIAL LAUNDRY	LUST
SHELL S/S #000019	LUST
TEXACO STOP 6 1/2 S/S # 223	LUST
SHELL S/S 804975	LUST
TEXACO PUERTA DE TIERRA S/S	LUST
SHELL S/S #004031	LUST
US POSTAL SERVICE-VMF FACILITY	LUST
PEPSI COLA BOTTLING CO.-5423000	RCRA-NonGen, FINDS, LUST
SHELL SITE PR. MARINE MANAGEMENT #	LUST
METRO WASTE DISPOSAL - 54215700	LUST
ESSO S/S CO-175	UST
CARIB INN HOTEL	UST
LUIS MUNOZ MARIN INT AIRPORT	UST
POPULAR LEASING	RCRA-NonGen, FINDS, UST
CHARLIE CAR RENTAL INC	UST
SHELL S/S 0590	UST
ASOCIACION HOSPITAL DE MAESTRO	RCRA-NonGen, FINDS, UST
EDUARDO VIERA S/S	UST
GULF SERVICE STATION #148	UST
SHELL S/S #804789	UST
ESSO S/S 2P-341	UST
UNION PLAZA	UST
ESSO- HOSP. DEL MAESTRO	UST
EGIDA DEL ABOGADO	UST
ASOCIACION DE EMPLEADOS DEL ESTADO	UST
SABANA LLANA S/S	UST
L.S. QUILTING & TEXTILES INC.	UST
SHELL S/S #004031	UST
TRIPLE-S	UST
SAMMY MAIZ AND CO.	UST
ARAMCO GAS STATION	UST
EDIFICIO JUAN C. CORDERO DAVILA	UST
ESSO S/S 3P-198	UST
ESSO S/S COB-200	UST
AREA TRANSPORTE- HATO REY	UST

EXECUTIVE SUMMARY

ESSO S/S CO-027	UST
TEXXAN OIL CO.	UST
SHELL SERVICE STATION #001465	UST
GULF S/S #301	UST
POLIDEPORTIVO DE SAN JUAN	UST
CDT. DR.ENRIQUE KOPPISH	UST
VAQUERIA TRES MONJITAS-54295000	UST
ESSO S/S CO-011	UST
ESSO S/S CO-019	UST
ESSO S/S CO-186	UST
ESSO S/S CO-205	UST
CONDOMINIO SEGOVIA	UST
PRECINTO 182-HATO REY ESTE	UST
CDT DR. JAVIER JAVIER ANTON	UST
CHANTRES CLEANERS INC.	UST
CITGO SERVICE STATION	UST
EL MUNDO, INC.	UST
PLAZA LAS AMERICAS INC.	UST
ADMINISTRADOR TERRENOS	UST
EL MUNDO INC.	UST
HORACIO PASTRANA S/S	UST
TEXACO VILLA GRANADA S/S #228	UST
SHELL S/S # 000787	UST
TOTAL PETROLEUM #3289	UST
TEXACO- FERNANDEZ JUNCOS S/S # 203	UST
HATO REY ARMORY	UST
SUIZA DAIRY S/S # 205	UST
GULF S/S #905	UST
BANCO BILBAO VIZCAYA	UST
GOMEZ HERMANOS, INC	UST
AUT. DE COMUNICACIONES	UST
GOMEZ HNOS. INC	UST
SHELL SERVICE STATION #804746	UST
EL MONTE CLEANERS	UST
TREBOL MOTORS	UST
MUNOZ RIVERA S/S #230	UST
CITIBANK N.A.- HATO REY	UST
HATO REY C.O.	UST
SANTIESTEBAN CLEMENTE	UST
SHELL SERVICE STATION #001180	UST
SUCESION MARTI TORRES	UST
PONCE DE LEON S/S #219	UST
RENOVADORA INC.	UST
ESSO S/S CO-023	UST
PLAZA LAS AMERICAS, INC.	UST
PANADERIA ANTIGUA LISBOA	UST
TEXACO- ROOSEVELT & HOSTOS S/S #22	UST
TEXACO- PI ERO DEVELOPMENT S/S #35	UST
SUPERINTENCIA DE LA POLICIA	UST
TOTAL PETROLEUM PUERTO RICO CORP S	RCRA-LQG
NEWBRIDGE NETWORKS INTL CORP	RCRA-NonGen, FINDS
PEP BOYS 930	RCRA-NonGen, FINDS
ESSO STANDARD OIL CO - PR CO-184	RCRA-NonGen, FINDS
ESSO STANDARD OIL CO PR CO-178	RCRA-NonGen
DEPT OF ED - ANTONIO SARRIERA EGOZ	RCRA-NonGen, FINDS
DELIZ PHARMACEUTICAL	RCRA-NonGen
ESSO STANDARD OIL CO PR HERTZ	RCRA-NonGen, FINDS
ESSO STANDARD OILCO - PR CO-199	RCRA-NonGen, FINDS
INTEREXPORT & METALS CORP	RCRA-NonGen, FINDS
ESSO STANDARD OIL CO - PR	RCRA-NonGen, FINDS
CARIBBEAN PETROLEUM LP SS GULF 144	RCRA-NonGen, FINDS
STERLING PRODUCTS INT INC	RCRA-NonGen, FINDS

EXECUTIVE SUMMARY

DEPT OF ED - TRINA PADILLA DE SANZ	RCRA-NonGen, FINDS
A L C AUTO REPAIR	RCRA-NonGen
METRO MOVIL	RCRA-NonGen, FINDS
MINI MARKET	RCRA-NonGen
BARBOSA DIESEL	RCRA-NonGen
EL RAYO AUTO ELECTRIC	RCRA-NonGen
ARCO TRANSMISSIONS	RCRA-NonGen
TEXXAN GARAGE	RCRA-NonGen
SUPER FARMACIA	RCRA-NonGen
GULF STATION	RCRA-NonGen
R & R TRANSMISSION	RCRA-NonGen, FINDS
EDDIE TIRE CENTER INC	RCRA-NonGen
BARBOSA TIRES	RCRA-NonGen
KMART #7783	RCRA-NonGen, FINDS
TROPICOLOR	RCRA-NonGen, FINDS
ANTILLAS EXTERMINATING SERVICE INC	RCRA-NonGen, FINDS
ANTILLAS EXTERMINATING SERVICE INC	RCRA-NonGen, FINDS
MARTIN PRINTING	RCRA-NonGen
OLD MANTECADOS PAYCO BUILDING	RCRA-NonGen, FINDS
PUBLIC BUILDINGS AUTH	RCRA-NonGen, FINDS
MACYS - SAN JUAN #021	RCRA-NonGen
SHELL CO PR LTD SS 0787 REGIS SVC	RCRA-NonGen, FINDS
SRVICIOS RADIOLOGIOS ASOCIADOS	RCRA-NonGen
RADIOLOGY INST IMAGING CENTER	RCRA-NonGen, FINDS
GOVT OF PR HWY & TRANSPORTATION AU	RCRA-NonGen, FINDS
ALCALDE AUTO PARTS	RCRA-NonGen
IBM CORP - HATO REY	RCRA-NonGen, FINDS
B P P R POPULAR CENTER	RCRA-NonGen, FINDS
SAN JUAN JUDICIAL CENTER	RCRA-NonGen, FINDS
PR COMMUNICATION CORP	RCRA-NonGen, FINDS
SHELL CO PR LTD SS 804975 MARTIN P	RCRA-NonGen, FINDS
TEXACO PR INC HATO REY SS	RCRA-NonGen, FINDS
UNION ASSET MANAGEMENT	RCRA-NonGen, FINDS
TROPICOLOR LBA	RCRA-NonGen, FINDS
ALLIED MANAGEMENT	RCRA-NonGen, FINDS
AUTOMECANICA	RCRA-NonGen, FINDS
FULL COLOR	RCRA-NonGen, FINDS
QUISQUEYA SERVICE STATION	RCRA-NonGen, FINDS
DEPT OF ED - NEMESIO R CANALES SCH	RCRA-NonGen, FINDS
US POSTAL SERVICE	RCRA-NonGen, FINDS
TEXACO PR INC ROOSEVELT & HOSTOS S	RCRA-NonGen, FINDS
LANUDRY ANDALUCIA	RCRA-NonGen, FINDS
TEXACO PR - VILLA GRANADA SVC STA	RCRA-NonGen, FINDS
DEPT OF ED - VILLA CAPRI SCHOOL	RCRA-NonGen, FINDS
TRIANGLE DEALERS	RCRA-NonGen, FINDS
ESSO STANDARD OIL CO - PR DO-200	RCRA-NonGen, FINDS
WALGREENS - MUNOZ RIVERA	RCRA-NonGen, FINDS
ESSO STANDARD OIL CO - PR CO-183	RCRA-NonGen, FINDS
BUMPER ROYAL	RCRA-NonGen, FINDS
HOSPITAL SAN FRANCISCO	RCRA-NonGen, MLTS, FINDS
PRASA PRINTING OFFICE	RCRA-NonGen, FINDS
DEPT OF ED - RAFAEL HERNANDEZ SCHO	RCRA-NonGen, FINDS
DEPT OF ED - GASPAR VILA MAYANS SC	RCRA-NonGen, FINDS
DEPT OF ED - CARMEN SANABRIA SCHOO	RCRA-NonGen, FINDS
DEPT OF ED - EVARISTO R CHEVREMONT	RCRA-NonGen, FINDS
DEPT OF ED - JOSE GUALBERTO PADILL	RCRA-NonGen, FINDS
COLEGIO SAN JOSE	RCRA-NonGen, FINDS
DEPT OF ED - ANTONIO SARRIERA	RCRA-NonGen, FINDS
PAGAN AUTO REPAIR	RCRA-NonGen, FINDS
CARIBBEAN DATA GROUP	RCRA-NonGen, FINDS
DON DENNIS SERVICENTER	RCRA-NonGen, FINDS
AUTOCENTRO TOYOTA	RCRA-NonGen, FINDS

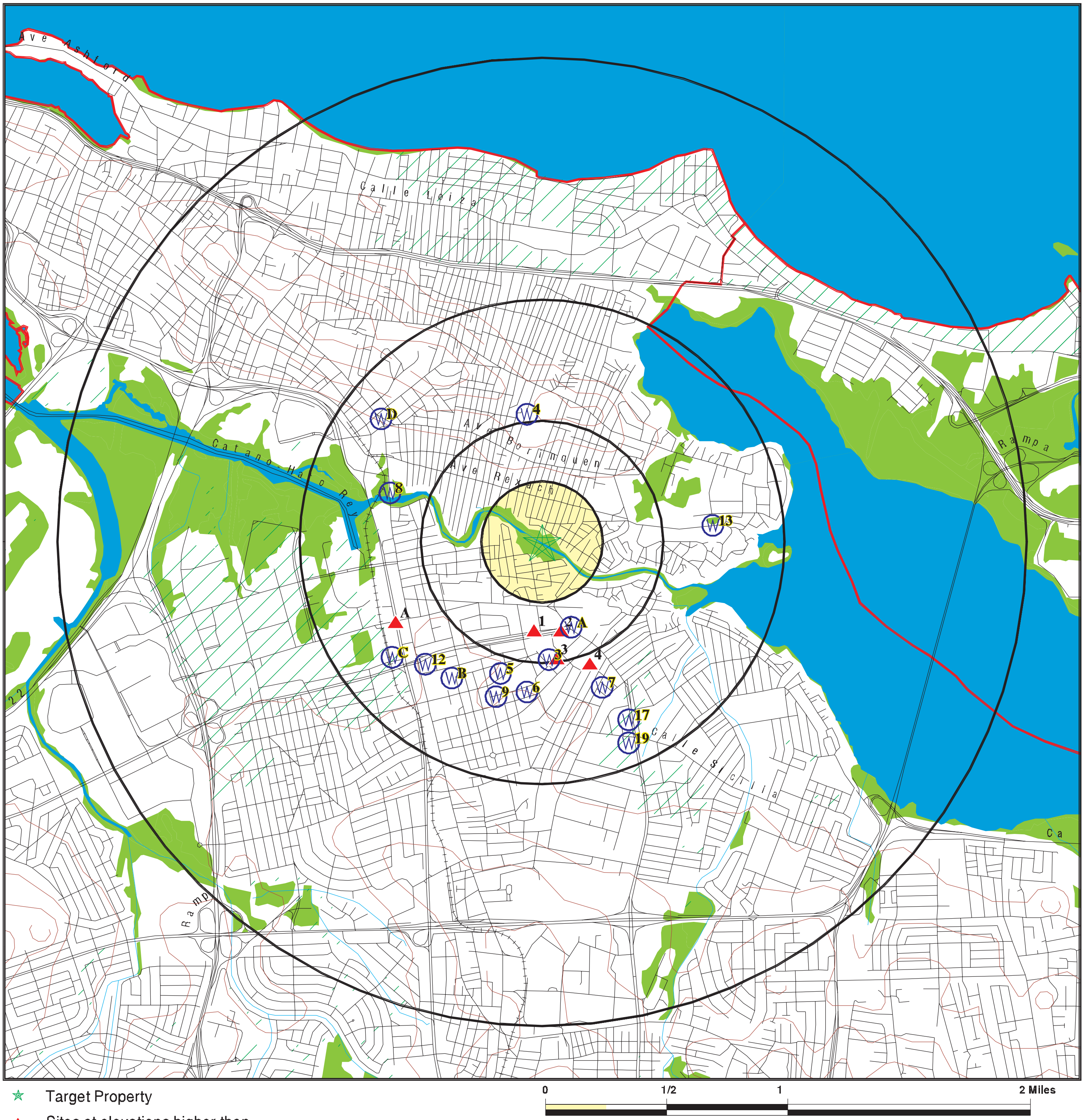
EXECUTIVE SUMMARY

JAIME VICK INC	RCRA-NonGen, FINDS
AUT FINANCIAMIENTO INFRAESTRUCTURA	RCRA-NonGen
GARAGE MORE	RCRA-NonGen, FINDS
CLINICAL RESEARCH PR INC	RCRA-NonGen
PRASA SAN JUAN CHEMICAL LABORATORY	RCRA-NonGen, FINDS
LAUNDRY NEWAY	RCRA-NonGen
EDUARDO VIERA SS	RCRA-NonGen, FINDS
INTER-ISLAND RENTAL	RCRA-NonGen, FINDS
ANGEL SUAREZ & HNOS INC	RCRA-NonGen, FINDS
SHELL CO PR LTD SHELL SS 0019 ALVA	RCRA-NonGen, FINDS
PR PUBLIC HOUSING ADMIN RES BALTOL	RCRA-NonGen, FINDS
CARIBBEAN PETROLEUM LP - SS GULF 4	RCRA-NonGen, FINDS
DEPT OF ED - ALBERT EINSTEIN SCHOO	RCRA-NonGen, FINDS
NIANI SERVICE STATION GULF	RCRA-NonGen, FINDS
SAN JUAN HEALTH CENTRE LAB	RCRA-NonGen, FINDS
CHASE MANHATTAN BANK NA THE	RCRA-NonGen, FINDS
ESSO STANDARD OIL CO - PR CO-020	RCRA-NonGen, FINDS
NAIMKO PLASTICS & TROPHY CENTER	RCRA-NonGen
A C T A HAZARDOUS WASTE SVCS	RCRA-NonGen, FINDS
HERA PRINTING CORP	RCRA-NonGen
VIADUCTO SHELL SERVICE STATION	RCRA-NonGen, FINDS
HOME DEPOT #HD6409	RCRA-CESQG
FARMACIA EL AMAL #5	RCRA-CESQG, FINDS
GARAGE ISLA VERDE INC	RCRA-CESQG, FINDS
LOS UNIDOS	RCRA-CESQG
BANCO POPULAR - POPULAR CENTER	RCRA-CESQG, FINDS
NEXT DAY SIGNS INC	RCRA-CESQG, FINDS
POLICIA DE PUERTO RICO	RCRA-CESQG, FINDS
ORGANIZATIONAL MAINT SHOP #6	RCRA-CESQG, FINDS
LABORATORIO DE FOTOGRAFIA CRIMINAL	RCRA-CESQG
LOS PRIMOS NISSAN	RCRA-CESQG, FINDS
ESSO STANDARD OIL CO - PR CO-042	RCRA-CESQG, FINDS
ESSO STANDARD OIL CO - PR 2P-341	RCRA-CESQG, FINDS
OFICINA CENTRAL FARMACIA EL AMAL	RCRA-CESQG, FINDS
VIDYS CAFE & RESTAURANT	RCRA-CESQG
MR MIRACLE	RCRA-CESQG
3M PUERTO RICO INC	RCRA-CESQG
JC PENNEY STORE - PLAZA LAS AMERIC	RCRA-CESQG, MANIFEST
ESSO STANDARD OIL CO - PR CO-027	RCRA-CESQG, FINDS
MARTIN PRINTING	FINDS
SOMASCAN, INC.	MLTS
INTERNATIONAL CYCLOTRON, INC.	MLTS
INTERNATIONAL CYCLOTRON, INC.	MLTS
HATO REY X-RAY & IMAGING CENTER	MLTS
RADIOLOGY INSTITUTE IMAGING CENTER	MLTS
BANCO DE SANGRE DE	MLTS
CENTRO DE RADIOTERAPIA/HOSP. AUXIL	MLTS
JURADO, M.D., JUAN A.	MLTS
FIRST CLINICAL LAB., INC.	MLTS
ESPINOLA, DANILO, M.D.	MLTS
SAN JUAN MUNICIPAL LANDFILL	ODI
PORTS AUTH OF PUERTO RICO	ICIS
PRASA - CAROLINA WWTP VISTAMAR DEV	ICIS
VILLA CAROLINA STP	ICIS
VILLA CAROLINA EJECTORS - CAROLINA	ICIS
LILLY DEL CARIBE INC	ICIS
PROFESSIONAL READY MIX, INC.	ICIS
CIA PETROLERA CARIBE STATION #1 FK	ICIS
ARECIBO SEWAGE TREATMENT PLT (PRAS	ICIS
IMPORTACIONES VIEL, INC	ICIS
COLISEO ROBERTO CLEMENTE	ICIS
CARIBBEAN PEDIATRICS AND SURGERY C	ICIS

EXECUTIVE SUMMARY

K/K/Z JOINT VENTURE	ICIS
GALERIA PASEO	ICIS
SAN JUAN CAPESTRANO HOSPITAL - UHS	ICIS
CHARNECO SERVICE STATION	ICIS
NIANI SERVICE STATION GULF	ICIS

OVERVIEW MAP - 2960202.2s



☆ Target Property

▲ Sites at elevations higher than or equal to the target property

◆ Sites at elevations lower than the target property

♟ Manufactured Gas Plants

▨ National Priority List Sites

▨ Dept. Defense Sites

▨ Indian Reservations BIA

╱╲ County Boundary

▨ 100-year flood zone

▨ 500-year flood zone

🟩 National Wetland Inventory

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Cano Martin Pena
ADDRESS: Cano Martin Pena
San Juan PR 00917
LAT/LONG: 18.4309 / 66.0495

CLIENT: PBS&J
CONTACT: Tamara Mayer
INQUIRY #: 2960202.2s
DATE: January 05, 2011 4:41 pm

DETAIL MAP - 2960202.2s

- ★ Target Property
- ▲ Sites at elevations higher than or equal to the target property
- ◆ Sites at elevations lower than the target property
- Manufactured Gas Plants
- Sensitive Receptors
- ▨ National Priority List Sites
- ▨ Dept. Defense Sites
- ▨ Indian Reservations BIA
- ▨ 100-year flood zone
- ▨ 500-year flood zone
- 🟩 National Wetland Inventory

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SITE NAME: Cano Martin Pena
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San Juan PR 00917
LAT/LONG: 18.4309 / 66.0495

CLIENT: PBS&J
CONTACT: Tamara Mayer
INQUIRY #: 2960202.2s
DATE: January 05, 2011 4:41 pm

MAP FINDINGS SUMMARY

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
STANDARD ENVIRONMENTAL RECORDS								
Federal NPL site list								
NPL		1.250	0	0	0	0	0	0
Proposed NPL		1.250	0	0	0	0	0	0
NPL LIENS		0.250	0	0	NR	NR	NR	0
Federal Delisted NPL site list								
Delisted NPL		1.250	0	0	0	0	0	0
Federal CERCLIS list								
CERCLIS		0.750	0	0	0	2	NR	2
FEDERAL FACILITY		1.250	0	0	0	0	0	0
Federal CERCLIS NFRAP site List								
CERC-NFRAP		0.750	0	0	0	0	NR	0
Federal RCRA CORRACTS facilities list								
CORRACTS		1.250	0	0	0	0	0	0
Federal RCRA non-CORRACTS TSD facilities list								
RCRA-TSDF		0.750	0	0	0	0	NR	0
Federal RCRA generators list								
RCRA-LQG		0.500	0	0	0	NR	NR	0
RCRA-SQG		0.500	0	0	0	NR	NR	0
RCRA-CESQG		0.500	0	0	0	NR	NR	0
Federal institutional controls / engineering controls registries								
US ENG CONTROLS		0.750	0	0	0	0	NR	0
US INST CONTROL		0.750	0	0	0	0	NR	0
Federal ERNS list								
ERNS		0.250	0	0	NR	NR	NR	0
State- and tribal - equivalent CERCLIS								
SHWS		N/A	N/A	N/A	N/A	N/A	N/A	N/A
State and tribal leaking storage tank lists								
LUST		0.750	0	0	0	1	NR	1
INDIAN LUST		0.750	0	0	0	0	NR	0
State and tribal registered storage tank lists								
UST		0.500	0	0	2	NR	NR	2
INDIAN UST		0.500	0	0	0	NR	NR	0
FEMA UST		0.500	0	0	0	NR	NR	0
State and tribal voluntary cleanup sites								
INDIAN VCP		0.750	0	0	0	0	NR	0

MAP FINDINGS SUMMARY

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
ADDITIONAL ENVIRONMENTAL RECORDS								
Local Brownfield lists								
US BROWNFIELDS		0.750	0	0	0	0	NR	0
Local Lists of Landfill / Solid Waste Disposal Sites								
DEBRIS REGION 9		0.750	0	0	0	0	NR	0
ODI		0.750	0	0	0	0	NR	0
INDIAN ODI		0.750	0	0	0	0	NR	0
Local Lists of Hazardous waste / Contaminated Sites								
US CDL		0.250	0	0	NR	NR	NR	0
US HIST CDL		0.250	0	0	NR	NR	NR	0
Local Land Records								
LIENS 2		0.250	0	0	NR	NR	NR	0
LUCIS		0.750	0	0	0	0	NR	0
Records of Emergency Release Reports								
HMIRS		0.250	0	0	NR	NR	NR	0
Other Ascertainable Records								
RCRA-NonGen		0.500	0	0	2	NR	NR	2
DOT OPS		0.250	0	0	NR	NR	NR	0
DOD		1.250	0	0	0	0	0	0
FUDS		1.250	0	0	0	0	0	0
CONSENT		1.250	0	0	0	0	0	0
ROD		1.250	0	0	0	0	0	0
UMTRA		0.750	0	0	0	0	NR	0
MINES		0.500	0	0	0	NR	NR	0
TRIS		0.250	0	0	NR	NR	NR	0
TSCA		0.250	0	0	NR	NR	NR	0
FTTS		0.250	0	0	NR	NR	NR	0
HIST FTTS		0.250	0	0	NR	NR	NR	0
SSTS		0.250	0	0	NR	NR	NR	0
ICIS		0.250	0	0	NR	NR	NR	0
PADS		0.250	0	0	NR	NR	NR	0
MLTS		0.250	0	0	NR	NR	NR	0
RADINFO		0.250	0	0	NR	NR	NR	0
FINDS		0.250	0	0	NR	NR	NR	0
RAATS		0.250	0	0	NR	NR	NR	0
INDIAN RESERV		1.250	0	0	0	0	0	0
SCRD DRYCLEANERS		0.750	0	0	0	0	NR	0
PCB TRANSFORMER		0.250	0	0	NR	NR	NR	0
COAL ASH EPA		0.750	0	0	0	0	NR	0
COAL ASH DOE		0.250	0	0	NR	NR	NR	0
EDR PROPRIETARY RECORDS								
EDR Proprietary Records								
Manufactured Gas Plants		1.250	0	0	0	0	0	0

MAP FINDINGS SUMMARY

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

N/A = This State does not maintain a SHWS list. See the Federal CERCLIS list.

1	**TEXACO PR INC - PINERO DEVELOPMENT SS**	**RCRA-NonGen**	**1004779176**
South	**MARGINAL #183 EXTENSION**	**FINDS**	**PRR000012906**
1/4-1/2	**HATO REY, PR 00918**		
0.366 mi.			
1934 ft.			

Relative:
Higher

Actual:
10 ft.

RCRA-NonGen:
Date form received by agency: 01/01/2008
Facility name: TEXACO PR INC - PINERO DEVELOPMENT SS
Facility address: MARGINAL #183 EXTENSION
ROOSEVELT AVE
HATO REY, PR 00918
EPA ID: PRR000012906
Mailing address: PO BOX 71315
SAN JUAN, PR 009368415
Contact: JOSE BETANCOURT
Contact address: PO BOX 71315
SAN JUAN, PR 009368415
Contact country: US
Contact telephone: (787) 749-5540
Contact email: Not reported
EPA Region: 02
Classification: Non-Generator
Description: Handler: Non-Generators do not presently generate hazardous waste

Owner/Operator Summary:
Owner/operator name: TEXACO PUERTO RICO INC
Owner/operator address: PO BOX 71315
SAN JUAN, PR 00936
Owner/operator country: US
Owner/operator telephone: (787) 783-6110
Legal status: Private
Owner/Operator Type: Operator
Owner/Op start date: 01/01/2001
Owner/Op end date: Not reported

Owner/operator name: TEXACO PUERTO RICO INC
Owner/operator address: PO BOX 71315
SAN JUAN, PR 00936
Owner/operator country: US
Owner/operator telephone: (787) 783-6110
Legal status: Private
Owner/Operator Type: Owner
Owner/Op start date: 01/01/2001
Owner/Op end date: Not reported

Handler Activities Summary:
U.S. importer of hazardous waste: Unknown
Mixed waste (haz. and radioactive): Unknown
Recycler of hazardous waste: No
Transporter of hazardous waste: Unknown
Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: Unknown
Furnace exemption: Unknown
Used oil fuel burner: No
Used oil processor: No
User oil refiner: No

TEXACO PR INC - PINERO DEVELOPMENT SS (Continued) **1004779176**

Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No
Off-site waste receiver: Commercial status unknown

Historical Generators:
Date form received by agency: 01/01/2006
Facility name: TEXACO PR INC - PINERO DEVELOPMENT SS
Classification: Not a generator, verified

Date form received by agency: 10/31/2000
Facility name: TEXACO PR INC - PINERO DEVELOPMENT SS
Classification: Conditionally Exempt Small Quantity Generator

Violation Status: No violations found

FINDS:

Registry ID: 110006434126

Environmental Interest/Information System

RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

2
SSE
1/4-1/2
0.375 mi.
1978 ft.

ROD-RODDER SERVICES INC
FRANKLIN ROOSEVELT
HATO REY, PR 00918

RCRA-NonGen
FINDS
UST

1000139586
PRD982187569

Relative:
Higher

Actual:
10 ft.

RCRA-NonGen:
Date form received by agency: 01/01/2008
Facility name: ROD-RODDER SERVICES INC
Facility address: FRANKLIN ROOSEVELT
HATO REY, PR 00918
EPA ID: PRD982187569
Mailing address: PO BOX 7173
HATO REY, PR 00918
Contact: BENJAMIN QUINTANA
Contact address: PO BOX 7173
HATO REY, PR 00918
Contact country: US
Contact telephone: (787) 753-8000
Contact email: Not reported
EPA Region: 02
Land type: Facility is not located on Indian land. Additional information is not known.
Classification: Non-Generator
Description: Handler: Non-Generators do not presently generate hazardous waste

Owner/Operator Summary:
Owner/operator name: UNKNOWN P

ROD-RODDER SERVICES INC (Continued) **1000139586**

Owner/operator address:	NOT REQUIRED NOT REQUIRED, WY 99999
Owner/operator country:	US
Owner/operator telephone:	(212) 555-1212
Legal status:	Private
Owner/Operator Type:	Owner
Owner/Op start date:	01/01/1600
Owner/Op end date:	Not reported
Owner/operator name:	UNKNOWN P
Owner/operator address:	NOT REQUIRED NOT REQUIRED, WY 99999
Owner/operator country:	US
Owner/operator telephone:	(212) 555-1212
Legal status:	Private
Owner/Operator Type:	Operator
Owner/Op start date:	01/01/1600
Owner/Op end date:	Not reported

Handler Activities Summary:

U.S. importer of hazardous waste:	Unknown
Mixed waste (haz. and radioactive):	Unknown
Recycler of hazardous waste:	No
Transporter of hazardous waste:	Unknown
Treater, storer or disposer of HW:	No
Underground injection activity:	No
On-site burner exemption:	Unknown
Furnace exemption:	Unknown
Used oil fuel burner:	No
Used oil processor:	No
User oil refiner:	No
Used oil fuel marketer to burner:	No
Used oil Specification marketer:	No
Used oil transfer facility:	No
Used oil transporter:	No
Off-site waste receiver:	Commercial status unknown

Historical Generators:

Date form received by agency:	01/01/2006
Facility name:	ROD-RODDER SERVICES INC
Classification:	Not a generator, verified
Date form received by agency:	05/18/1987
Facility name:	ROD-RODDER SERVICES INC
Classification:	Unverified
Violation Status:	No violations found

Evaluation Action Summary:

Evaluation date:	09/18/1992
Evaluation:	COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation:	Not reported
Date achieved compliance:	Not reported
Evaluation lead agency:	EPA Contractor/Grantee

FINDS:

ROD-RODDER SERVICES INC (Continued) **1000139586**

Registry ID: 110007809540

Environmental Interest/Information System
RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

UST:

Facility ID:	2-930034
Tank Status:	Permanently Out of Use
Substance Description:	Diesel
Facility ID:	2-930034
Tank Status:	Permanently Out of Use
Substance Description:	Gasoline

3
South
1/4-1/2
0.485 mi.
2562 ft.

ROSA ELENA JIMENEZ
CALLE PARIS #245
SAN JUAN, PR 00917

UST **U003432037**
N/A

Relative:
Higher

Actual:
10 ft.

UST:

Facility ID:	2-960022
Tank Status:	Permanently Out of Use
Substance Description:	Used Oil

4
SSE
1/2-1
0.540 mi.
2850 ft.

R. MALDONADO PESTICIDE WAREHOUSE
#2 JULIA STREET
HATO REY, PR 00917

CERCLIS **1009805593**
PRN000206024

Relative:
Higher

Actual:
10 ft.

CERCLIS:

Site ID:	0206024
Federal Facility:	Not a Federal Facility
NPL Status:	Not on the NPL
Non NPL Status:	Status Not Specified

Site Description: Site is active pesticide packaging facility. Site referred to EPA by the PR Department of Agriculture due to the condition of the facility during an inspection. OSC issued a field expedited notice letter and the conditions at the site were corrected under a voluntary cleanup without an order.

CERCLIS Assessment History:

Action:	NON-NATIONAL PRIORITIES LIST POTENTIALLY RESPONSIBLE PARTY SEARCH
Date Started:	08/23/06
Date Completed:	08/25/06
Priority Level:	Search Complete, Viable PRPs
Action:	POTENTIALLY RESPONSIBLE PARTY EMERGENCY REMOVAL
Date Started:	08/23/06

R. MALDONADO PESTICIDE WAREHOUSE (Continued) **1009805593**

Date Completed: 08/25/06
Priority Level: Not reported

A5
WSW
1/2-1
0.681 mi.
3594 ft.

Relative:
Higher

Actual:
10 ft.

CITIBANK N.A.- HATO REY
AVE. PONCE DE LEON #252
HATO REY, PR

Site 1 of 2 in cluster A

LUST **S104228796**
N/A

PR LUST:
Facility ID: 94-0089
Released: No
Released Date: Not reported
Owner Name: Citibank, N.A.

A6
WSW
1/2-1
0.689 mi.
3636 ft.

Relative:
Higher

Actual:
10 ft.

AMERICAN INTERNATIONAL PLAZA, ETHYLENE GLYCOL RELEASE
250 MUNOZ RIVERA AVENUE,
HATO REY, PR 00918

Site 2 of 2 in cluster A

CERCLIS **1011845450**
PRC200400208

CERCLIS:
Site ID: 0206293
Federal Facility: Not a Federal Facility
NPL Status: Not on the NPL
Non NPL Status: Removal Only Site (No Site Assessment Work Needed)

Site Description: Not reported

CERCLIS Assessment History:
Action: NON-NATIONAL PRIORITIES LIST POTENTIALLY RESPONSIBLE PARTY SEARCH
Date Started: 03/20/08
Date Completed: 03/20/08
Priority Level: Search Complete, Viable PRPs

Action: POTENTIALLY RESPONSIBLE PARTY EMERGENCY REMOVAL
Date Started: 03/20/08
Date Completed: 03/20/08
Priority Level: Stabilized

Count: 311 records.

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
CAGUAS	1000445073	NEWBRIDGE NETWORKS INTL CORP	HWY 1 KM 334	00925	RCRA-NonGen, FINDS
CAGUAS	1000481189	CARIBE PAINT CORP.	CONCEPTION RD	00923	CERCLIS, FINDS
CANOVANAS	1009526296	PHARMASOL CHEMICAL FACILITY	ROAD 188,LOT191-59 T-1002-0-70	00979	CERCLIS
CAROLINA	1010331650	HOME DEPOT #HD6409	65TH INFANTRY AVE KM 11.7	00979	RCRA-CESQG
CAROLINA	1004779274	FARMACIA EL AMAL #5	AVE CAMPO RICO ESQ CALLE 246	00979	RCRA-CESQG, FINDS
CAROLINA	1004778982	PEP BOYS 930	AVE CAMPO RICO ESQ CARR ESTATL	00979	RCRA-NonGen, FINDS
CAROLINA	1000801094	GARAGE ISLA VERDE INC	AVE BALDORIOTY DE CASTRO	00979	RCRA-CESQG, FINDS
CAROLINA	1001125575	ESSO STANDARD OIL CO - PR CO-184	AVE 65TH INFANTERIA KM 5.8	00979	RCRA-NonGen, FINDS
CAROLINA	1010567558	ESSO STANDARD OIL CO PR CO-178	AVE 65 INFANTERIA CARR PR #3	00979	RCRA-NonGen
CAROLINA	1010567577	LOS UNIDOS	AVE PONTOZUELA #2 EDF	00979	RCRA-CESQG
CAROLINA	1004590248	CORPORACION UNION DE INVERSIONES,	BALDORIOTY DE CASTRO AVE	00979	FTTS, HIST FTTS, FINDS
CAROLINA	1011621152	PORTS AUTH OF PUERTO RICO	BALDORIOTY DE CASTRO AVE TERM	00979	ICIS
CAROLINA	1001030516	DEPT OF ED - ANTONIO SARRIERA EGOZ	CALLE CARMEN HERNANDEZ KM 0.5	00979	RCRA-NonGen, FINDS
CAROLINA	U003430206	ESSO S/S CO-175	CALLE IGNACIO ARZUAGA #102 W V	00979	UST
CAROLINA	1012209770	LUIS MUNOZ MARIN INTERNATIONAL AIR	DEPARTURES B	00979	CERCLIS
CAROLINA	U003430974	CARIB INN HOTEL	GOBERNADORES AVE. BOCA DE CANG	00979	UST
CAROLINA	U003430538	LUIS MUNOZ MARIN INT AIRPORT	GOBERNADORES AVE. BALDORIOTY D	00979	UST
CAROLINA	1001081286	POPULAR LEASING	65 INFATRY AVE. KM.9.5 LOT #3	00979	RCRA-NonGen, FINDS, UST
CAROLINA	1003011388	TEXACO OF PR, INC	INTERNATIONAL AIRPORT BASE AER	00913	CERC-NFRAP
CAROLINA	1010331578	DELIZ PHARMACEUTICAL	INTURREY AVE	00979	RCRA-NonGen
CAROLINA	U003431562	CHARLIE CAR RENTAL INC	ISLA VERDE AVE, RD 187	00979	UST
CAROLINA	1004592380	SANDS HOTEL & CASINO	ISLA VARDE AVE	00913	FTTS, HIST FTTS, FINDS
CAROLINA	U003430106	SHELL S/S 0590	LAS ROSAS AVE. CORNER BALDORIO	00979	UST
CAROLINA	1011494616	PRASA - CAROLINA WWTP VISTAMAR DEV	LERIDA, GALICIA & GERONIA STRE	00979	ICIS
CAROLINA	1011598670	VILLA CAROLINA STP	ROBERTO CLEMENTE AVE CAROLI	00979	ICIS
CAROLINA	1011550251	VILLA CAROLINA EJECTORS - CAROLINA	ROBOERTO CLEMENTE AVE CAROL	00979	ICIS
CAROLINA	1004779231	ESSO STANDARD OIL CO PR HERTZ	SALVADORE CARO AVE	00909	RCRA-NonGen, FINDS
CAROLINA	1011623800	LILLY DEL CARIBE INC	STATE RD #3, KM 12.6 CAROLI	00979	ICIS
CAROLINA	1011626479	PROFESSIONAL READY MIX, INC.	STATE ROAD # 3, KM. 13.5, CANO	00979	ICIS
CAROLINA	1008218455	OGDEN AVIATION, INC	TONY SANTONA AVE, JUIZ MUNOZ M	00979	HIST FTTS, FINDS
HATO REY	1001203519	ESSO STANDARD OILCO - PR CO-199	AVE BARBOSA ESQ EMANUELLI 202	00917	RCRA-NonGen, FINDS
HATO REY	1000801071	INTEREXPORT & METALS CORP	AVE ARTERIAL HOSTOS CONDOMINIO	00917	RCRA-NonGen, FINDS
HATO REY	1001128252	ESSO STANDARD OIL CO - PR	AVE MUNOZ RIVERA 573	00918	RCRA-NonGen, FINDS
HATO REY	1001225405	CARIBBEAN PETROLEUM LP SS GULF 144	AVE CARR 27	00918	RCRA-NonGen, FINDS
HATO REY	1000891066	ASOCIACION HOSPITAL DE MAESTRO	AVE DOMENECH 400	00918	RCRA-NonGen, FINDS, UST
HATO REY	1000364350	STERLING PRODUCTS INT INC	AVE ROOSEVELT KM 14	00918	RCRA-NonGen, FINDS
HATO REY	1001030517	DEPT OF ED - TRINA PADILLA DE SANZ	AVENIDA JESUS T PINERO OESTE	00917	RCRA-NonGen, FINDS
HATO REY	1008892398	A L C AUTO REPAIR	250 BARBASA AVE LOCAL 1	00917	RCRA-NonGen
HATO REY	1000445072	METRO MOVIL	BARBOSA AVE 155	00917	RCRA-NonGen, FINDS
HATO REY	1004590235	PUBLIC BUILDING AUTHORITY (HOUSING	BARBOSA AVE 606	00917	FTTS, HIST FTTS, FINDS
HATO REY	1008892389	MINI MARKET	203 BARBOSA AVE	00917	RCRA-NonGen
HATO REY	1008892390	BARBOSA DIESEL	249 BARBOSA AVE	00917	RCRA-NonGen
HATO REY	1008892392	EL RAYO AUTO ELECTRIC	253 BARBOSA AVE	00917	RCRA-NonGen

City	EDR ID	Site Name	Site Address	Zip	Database(s)
HATO REY	1008892394	ARCO TRANSMISSIONS	195 BARBOSA AVE	00917	RCRA-NonGen
HATO REY	1008892396	TEXXAN GARAGE	312 BARBOSA AVE	00917	RCRA-NonGen
HATO REY	1009218446	SUPER FARMACIA	327 BARBOSA AVE	00917	RCRA-NonGen
HATO REY	1009218447	GULF STATION	624 BARBOSA AVE	00917	RCRA-NonGen
HATO REY	1001125515	R & R TRANSMISSION	BARBOSA AVE	00918	RCRA-NonGen, FINDS
HATO REY	1011494391	CIA PETROLERA CARIBE STATION #1 FK	1203 BARBOSA AVE HATO REY	00917	ICIS
HATO REY	1011620675	ARECIBO SEWAGE TREATMENT PLT (PRAS	604 BARBOSA AVE HATO REY P	00917	ICIS
HATO REY	1008892397	EDDIE TIRE CENTER INC	324 BARBOSA AVE	00917	RCRA-NonGen
HATO REY	1008892393	BARBOSA TIRES	277 BARBSOSA AVE	00917	RCRA-NonGen
HATO REY	1001233660	KMART #7783	525 CALLE CALAF ESQ BECERRA	00917	RCRA-NonGen, FINDS
HATO REY	1004592357	EDIFICIO ECHEGARRY	CALLE POREA #629	00917	FTTS, HIST FTTS, FINDS
HATO REY	1006458548	SOMASCAN, INC.	CALLE JOSE MARTI	00918	MLTS
HATO REY	1000347650	TROPICOLOR	CALLE CALAF ESQ FEDERICO ACOST	00918	RCRA-NonGen, FINDS
HATO REY	1000254385	ANTILLAS EXTERMINATING SERVICE INC	4 CALLE ONEIL G	00918	RCRA-NonGen, FINDS
HATO REY	1000254386	ANTILLAS EXTERMINATING SERVICE INC	4 CALLE ONEIL G	00918	RCRA-NonGen, FINDS
HATO REY	1011584289	IMPORTACIONES VIEL, INC	CALLE GUAYAMA 58 HATO REY	00917	ICIS
HATO REY	1012171369	INTERNATIONAL CYCLOTRON, INC.	CALLE JOSE MARTI #56	00918	MLTS
HATO REY	1012171370	INTERNATIONAL CYCLOTRON, INC.	CALLE JOSE MARTI #56	00918	MLTS
HATO REY	1010557883	MARTIN PRINTING	511 CAROLINA ST	00917	FINDS
HATO REY	1010567508	MARTIN PRINTING	511 CAROLINA ST	00917	RCRA-NonGen
HATO REY	1004592519	LOTERIA DE PUERTO RICO BUILDING	CHADON AVE	00918	FTTS, HIST FTTS, FINDS
HATO REY	1001030526	OLD MANTECADOS PAYCO BUILDING	CHARDON AVE #113	00917	RCRA-NonGen, FINDS
HATO REY	1000875265	PUBLIC BUILDINGS AUTH	CHARDON AVE	00918	RCRA-NonGen, FINDS
HATO REY	1004591670	PRAICO	7 CHARDON AVE	00918	FTTS, HIST FTTS, FINDS
HATO REY	1004592518	NEW SAN JUAN BUILDING	159 CHARDON AVE	00918	FTTS, HIST FTTS, FINDS
HATO REY	1010331674	MACYS - SAN JUAN #021	525 F D ROOSEVELT AVE	00918	RCRA-NonGen
HATO REY	1001128272	SHELL CO PR LTD SS 0787 REGIS SVC	DOMENECH AVE & HOSTOS ST	00917	RCRA-NonGen, FINDS
HATO REY	1010567522	SRVICIOS RADIOLOGIOS ASOCIADOS	390 DOMENECH AVE	00918	RCRA-NonGen
HATO REY	1011493984	COLISEO ROBERTO CLEMENTE	FRANKLIN DELANO ROOSEVELT AVE	00917	ICIS
HATO REY	1005418276	RADIOLOGY INST IMAGING CENTER	400 FRANKLIN D ROOSEVELT AVE	00918	RCRA-NonGen, FINDS
HATO REY	1009309192	HATO REY X-RAY & IMAGING CENTER	156 FRANKLIN D ROOSEVELT AVE	00918	MLTS
HATO REY	1000490357	RADIOLOGY INSTITUTE IMAGING CENTER	400 FRANKLIN D ROOSEVELT AVE	00918	MLTS
HATO REY	1004778972	GOVT OF PR HWY & TRANSPORTATION AU	398 JESUS T PINERO AVE	00918	RCRA-NonGen, FINDS
HATO REY	1008892391	ALCALDE AUTO PARTS	219 JUISQUEYA AVE	00917	RCRA-NonGen
HATO REY	1000108692	IBM CORP - HATO REY	654 MUNOZ RIVERA AVE	00918	RCRA-NonGen, FINDS
HATO REY	1001203514	B P P R POPULAR CENTER	208 MUNOZ RIVERA AVE	00917	RCRA-NonGen, FINDS
HATO REY	1000573803	SAN JUAN JUDICIAL CENTER	MUNOZ RIVERA AVE &	00917	RCRA-NonGen, FINDS
HATO REY	1001125582	BANCO POPULAR - POPULAR CENTER	209 MUNOZ RIVERA AVE	00918	RCRA-CESQG, FINDS
HATO REY	1004592515	DEPARTAMENTO DEL TRABAGOY RECURSOS	505 MUNOZ RIVERA AVE	00918	HIST FTTS, FINDS
HATO REY	1004778816	PR COMMUNICATION CORP	MUNOZ RIVERA AVE & COLL TOSTE	00918	RCRA-NonGen, FINDS
HATO REY	1001128376	SHELL CO PR LTD SS 804975 MARTIN P	PONCE DE LEON AVE	00918	RCRA-NonGen, FINDS
HATO REY	1004779033	TEXACO PR INC HATO REY SS	PONCE DE LEON AVE 73	00917	RCRA-NonGen, FINDS
HATO REY	1004779097	NEXT DAY SIGNS INC	551 PONCE DE LEON AVE	00917	RCRA-CESQG, FINDS
HATO REY	1004592259	BANCO CENTRAL	221 PONCE DE LEON AVE	00917	FTTS, HIST FTTS, FINDS
HATO REY	1004592260	BANCO NATIONAL PLAZA	431 PONCE DE LEON AVE	00917	FTTS, HIST FTTS, FINDS
HATO REY	1004592513	ELA RETIREMENT SYSTEM ADM	437 PONCE DE LEON AVE	00917	FTTS, HIST FTTS, FINDS
HATO REY	1006331088	BANCO DE SANGRE DE	662 PONCE DE LEON AVE	00918	MLTS

City	EDR ID	Site Name	Site Address	Zip	Database(s)
HATO REY	1007647507	CENTRO DE RADIOTERAPIA/HOSP. AUXIL	PONCE DE LEON AVE	00918	MLTS
HATO REY	1004779102	UNION ASSET MANAGEMENT	416 PONCE DE LEON AVE	00918	RCRA-NonGen, FINDS
HATO REY	1001203557	TROPICOLOR LBA	268 PONCE DE LEON AVE	00918	RCRA-NonGen, FINDS
HATO REY	1004590169	ASOCIACION DE EMPLEADOS DEL ELA DE	463 PONCE DE LEON AVE	00918	FTTS, HIST FTTS, FINDS
HATO REY	1004590234	SOCIEDAD ESPANOLA DE AUXILIO MUTUO	PONCE DE LEON AVE	00912	FTTS, HIST FTTS, FINDS
HATO REY	1004592308	ROYAL BANK BLDG	255 PONCE DE LEON AVE	00918	FTTS, HIST FTTS, FINDS
HATO REY	1004592516	CHASE 416	416 PONCE DE LEON AVE	00918	FTTS, HIST FTTS, FINDS
HATO REY	1000248612	ALLIED MANAGEMENT	255 PONCE DE LEON AVE	00918	RCRA-NonGen, FINDS
HATO REY	1001215977	AUTOMECANICA	615 PONCEDE LEON AVE	00918	RCRA-NonGen, FINDS
HATO REY	1004779200	FULL COLOR	209 QUISQUELLA AVE	00909	RCRA-NonGen, FINDS
HATO REY	1004778996	QUISQUEYA SERVICE STATION	155 QUISQUEYA AVE	00917	RCRA-NonGen, FINDS
HATO REY	1001030509	DEPT OF ED - NEMESIO R CANALES SCH	RES NEMESIO R CANALES	00917	RCRA-NonGen, FINDS
HATO REY	1000991850	POLICIA DE PUERTO RICO	ROOSEVELT AVE #101	00917	RCRA-CESQG, FINDS
HATO REY	1000140644	US POSTAL SERVICE	ROOSEVELT AVE	00917	RCRA-NonGen, FINDS
HATO REY	1000152665	ORGANIZATIONAL MAINT SHOP #6	ROOSEVELT AVE	00917	RCRA-CESQG, FINDS
HATO REY	1004779055	TEXACO PR INC ROOSEVELT & HOSTOS S	ROOSEVELT AVE	00918	RCRA-NonGen, FINDS
HATO REY	1008187702	PRIDCO CENTRAL OFFICE	FD ROOSEVELT AVE	00918	HIST FTTS
ISLA VERDE	1001208582	JURADO, M.D., JUAN A.	CALLE 5-180 VILLAMAR	00913	MLTS
PUERTO NUEVO	1006811223	LANUDRY ANDALUCIA	530 ANDALUCIA AVE	00912	RCRA-NonGen, FINDS
PUERTO NUEVO	1008375168	LABORATORIO DE FOTOGRAFIA CRIMINAL	601 ROOSEVELT AVE	00918	RCRA-CESQG
RIO PEDRAS	1004779011	TEXACO PR - VILLA GRANADA SVC STA	DE DIEGO AVE TRUJILLO ALTO	00923	RCRA-NonGen, FINDS
RIO PIEDRAS	1001030508	DEPT OF ED - VILLA CAPRI SCHOOL	KM 0.3 S 65TH AVE CALLE VERONA	00925	RCRA-NonGen, FINDS
RIO PIEDRAS	1001203433	TRIANGLE DEALERS	65TH INFANTERIA AVE	00918	RCRA-NonGen, FINDS
RIO PIEDRAS	1006817731	LOS PRIMOS NISSAN	AVE 65 INFANTERIA KM 5.6	00925	RCRA-CESQG, FINDS
RIO PIEDRAS	1001225390	ESSO STANDARD OIL CO - PR DO-200	AVE BARBOSA 621	00925	RCRA-NonGen, FINDS
RIO PIEDRAS	1004779160	WALGREENS - MUNOZ RIVERA	AVE MUNOZ RIVERA ESQ	00925	RCRA-NonGen, FINDS
RIO PIEDRAS	1001091270	ESSO STANDARD OIL CO - PR CO-042	AVE GLASSGOW ESQ GRENOBLE	00925	RCRA-CESQG, FINDS
RIO PIEDRAS	1001120721	ESSO STANDARD OIL CO - PR CO-183	AVE 65 DE INFANTERIA KM 12	00923	RCRA-NonGen, FINDS
RIO PIEDRAS	1001030558	ESSO STANDARD OIL CO - PR 2P-341	AVE BARBOSA 448	00917	RCRA-CESQG, FINDS
RIO PIEDRAS	1001969269	BUMPER ROYAL	AVE BARBOSA ESQ MAYAGUEZ	00923	RCRA-NonGen, FINDS
RIO PIEDRAS	1004592310	HOSPITAL SAN FRANCISCO	AVE DE DIEGO	00923	RCRA-NonGen, MLTS, FINDS
RIO PIEDRAS	1012314910	FIRST CLINICAL LAB., INC.	AVE. MUNOZ RIVERA 1007	00925	MLTS
RIO PIEDRAS	1011573820	CARIBBEAN PEDIATRICS AND SURGERY C	AVENIDA DE DIEGO #371	00923	ICIS
RIO PIEDRAS	1007146952	PONCE DE LEON SCHOOL	374 BARBOSA AVE	00923	FTTS, HIST FTTS, FINDS
RIO PIEDRAS	1004778799	PRASA PRINTING OFFICE	604 BARBOSA AVE	00923	RCRA-NonGen, FINDS
RIO PIEDRAS	1001030510	DEPT OF ED - RAFAEL HERNANDEZ SCHO	CALLE VALVERDE KM 1 E BARBOSA	00925	RCRA-NonGen, FINDS
RIO PIEDRAS	1001030514	DEPT OF ED - GASPAR VILA MAYANS SC	CALLE GENERAL VALERO URB LAS	00925	RCRA-NonGen, FINDS
RIO PIEDRAS	1000991860	DEPT OF ED - CARMEN SANABRIA SCHOO	CALLE ARKANSAS - ESQ ALABAMA	00925	RCRA-NonGen, FINDS
RIO PIEDRAS	1000991864	DEPT OF ED - EVARISTO R CHEVREMONT	CALLE 58 ESQ 17	00925	RCRA-NonGen, FINDS
RIO PIEDRAS	1000991869	DEPT OF ED - JOSE GUALBERTO PADILL	CALLE NEBLIN 500 4TA EXTENSION	00925	RCRA-NonGen, FINDS
RIO PIEDRAS	1000573497	COLEGIO SAN JOSE	CALLE AMEZQUITA ESQUINA PAZ	00925	RCRA-NonGen, FINDS
RIO PIEDRAS	1000982176	DEPT OF ED - ANTONIO SARRIERA	CALLE CARMEN HERNANDEZ & MARIA	00923	RCRA-NonGen, FINDS
RIO PIEDRAS	1011518401	K/K/Z JOINT VENTURE	CALLE GEORGETTI #14 RIO PIE	00925	ICIS
RIO PIEDRAS	1007281446	HOSPITAL SAN FRANCISCO, INC	371 DE DIEGO AVE	00923	FTTS, HIST FTTS
RIO PIEDRAS	1008188768	SAN FRANCISCO HOSPITAL	371 DE DIEGO AVE	00923	HIST FTTS
RIO PIEDRAS	1001215982	PAGAN AUTO REPAIR	605 DE DIEGO AVE	00923	RCRA-NonGen, FINDS
RIO PIEDRAS	1011557406	GALERIA PASEO	LAS PASEOS GRAND BLVD & LAS CU	00923	ICIS

City	EDR ID	Site Name	Site Address	Zip	Database(s)
RIO PIEDRAS	1001030563	CARIBBEAN DATA GROUP	1129 MUNOZ RIVERA AVE	00925	RCRA-NonGen, FINDS
RIO PIEDRAS	1001215985	DON DENNIS SERVICENTER	1007 MUNOZ RIVER AVE	00925	RCRA-NonGen, FINDS
RIO PIEDRAS	1001225283	AUTOCENTRO TOYOTA	MUNOZ RIVERA AVE	00925	RCRA-NonGen, FINDS
RIO PIEDRAS	1004779220	OFICINA CENTRAL FARMACIA EL AMAL	1086A MUNOZ RIVERA AVE	00925	RCRA-CESQG, FINDS
RIO PIEDRAS	1000297158	JAIME VICK INC	MUNOZ RIVERA AVE 867 E 302	00925	RCRA-NonGen, FINDS
RIO PIEDRAS	1011845428	RIO PIEDRAS CDT HOSPITAL MERCURY S	PINEIRO ST. INT. WITH VALLEJO	00925	CERCLIS
RIO PIEDRAS	1011619452	SAN JUAN CAPESTRANO HOSPITAL - UHS	RURAL ROUTE 2, BOX 11	00923	ICIS
RIO PIEDRAS	1006817753	VIDYS CAFE & RESTAURANT	104 UNIVERSIDAD AVE	00925	RCRA-CESQG
SAN JUAN	U003430546	EDUARDO VIERA S/S	RD #12, #517, BORINQUEN AVE. B	00915	UST
SAN JUAN	1008375163	AUT FINANCIAMIENTO INFRAESTRUCTURA	235 ARTERIAR HOSTOS AVE STE 16	00918	RCRA-NonGen
SAN JUAN	U003429499	GULF SERVICE STATION #148	AVE DOMENECH 403 ESQ CALLE NUE	00918	UST
SAN JUAN	S103934105	SHELL S/S #000515	AVE SIMON MADERA		LUST
SAN JUAN	S101442863	SHELL S/S #002828	AVE PRINCIPAL, ESQ. MONTECARLO		LUST
SAN JUAN	S103553930	ESSO S/S CO-023	AVE ROOSEVELT 1314 / PUERTO NU		LUST
SAN JUAN	S106917661	SHELL S/S #804797	AVE ROOSVELT ESQ. AVE. ESCORIA		LUST
SAN JUAN	S106917737	RAMON L. RODRIGUEZ S/S #311	AVE DE DIEGO ESQ.CALLE LOIZA		LUST
SAN JUAN	U003431429	SHELL S/S #804789	AVE. JESUS T PI EIRO ESQ DE DI	00918	UST
SAN JUAN	U003430322	ESSO S/S 2P-341	AVE. BARBOSA #448 ESQ. GUAYAMA	00917	UST
SAN JUAN	U003718311	UNION PLAZA	AVE. PONCE DE LEON #416	00918	UST
SAN JUAN	U003430450	ESSO- HOSP. DEL MAESTRO	AVE. DOMENECH	00918	UST
SAN JUAN	U003796787	EGIDA DEL ABOGADO	AVE. ARTERIAL B # 320	00918	UST
SAN JUAN	U004021937	ASOCIACION DE EMPLEADOS DEL ESTADO	AVE. PONCE DE LEON # 463	00917	UST
SAN JUAN	U003430311	SABANA LLANA S/S	AVE. DE DIEGO #475 SABANA LLAN	00923	UST
SAN JUAN	U003432044	L.S. QUILTING & TEXTILES INC.	AVE. JOSEOLIVER ESQ.MANUEL CAM	00918	UST
SAN JUAN	U003429705	SHELL S/S #004031	AVE. BARBOSA WARD #1846 CALLE	00917	UST
SAN JUAN	S106917657	HORACIO PASTRANA S/S	AVE. DE DIEGO ESQ PADRE CAPUCH		LUST
SAN JUAN	S106452763	ESSO S/S CO-042	AVE. GLASGOW		LUST
SAN JUAN	S104539989	GULF #119	AVE. CENTRAL 1039 PUERTO NUEVO		LUST
SAN JUAN	S104539998	SHELL S/S #000329	AVE. FERNANDEZ JUNCOS ESQ. HIP		LUST
SAN JUAN	S106917667	ABU-USBA PETROLEUM	AVE. DE DIEGO # 1155		LUST
SAN JUAN	S106917670	SHELL S/S # 002887	AVE. MUNOZ RIVERA		LUST
SAN JUAN	S106917689	ESSO S/S CO-015	AVE. ROOSEVELT 927 PUERTO NUEV		LUST
SAN JUAN	S106917691	ESSO S/S COB-025	AVE. MUNOZ RIVERA ESQ. ELEANOR		LUST
SAN JUAN	S105840992	FOOD & DRUG ADMINISTRATION	AVE. FERNANDEZ JUNCOS		LUST
SAN JUAN	S104539982	GULF #040	AVE. KENNEDY CARR. 2 KM. 2.5 P		LUST
SAN JUAN	S106917646	GULF S/ S #456	AVE. FERNANDEZ JUNCOS		LUST
SAN JUAN	S106676755	TEXACO # 320 PEDRO CABRERA S/S	AVE. BARBOSA ESQ. EMANUELLI		LUST
SAN JUAN	S105421734	ESSO- HOSP. DEL MAESTRO	AVE. DOMENECH		LUST
SAN JUAN	S106452774	TOTAL 1012	AVE. JESUS T PINERO NO 263 HAT		LUST
SAN JUAN	S105840978	CONGO GAS???	AVE. FERNANDEZ JUNCOS #1104		LUST
SAN JUAN	S105073590	ARAMCO GAS STATION	AVE. BARBOSA #710		LUST
SAN JUAN	S103554130	US ARMY CORPS OF ENGINEERS	AVE. FERNANDEZ JUNCOS #400		LUST
SAN JUAN	S104540029	ESSO S/S 2P-187	AVE. LOMAS VERDES PLAZA OLMEDO		LUST
SAN JUAN	S108917748	ANGELBERTO REYES S/S # 334	AVE.ESCORIAL/ROOSVELT		LUST
SAN JUAN	S103934118	OBRAS PUBLICAS MUNICIPAL	AVE.KENNEDY KM 1.7		LUST
SAN JUAN	S106917868	CHARNECO S/S	AVE.PONCE DE LEON		LUST
SAN JUAN	U003718286	TRIPLE-S	AVENIDA MATADERO	00917	UST

Count: 311 records.

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
SAN JUAN	S108917745	TRUCK STOP CARIBE	AVENIDA C ZONA PORTUARIA		LUST
SAN JUAN	1001125518	GARAGE MORE	BALDORIOTY AVE 205	00912	RCRA-NonGen, FINDS
SAN JUAN	U003430680	SAMMY MAIZ AND CO.	BALDORIOTY AVE. & POMARROSA	00912	UST
SAN JUAN	U003431425	ARAMCO GAS STATION	BARBOSA AVE. #710	00917	UST
SAN JUAN	U003431689	EDIFICIO JUAN C. CORDERO DAVILA	BARBOSA AVE. #606	00917	UST
SAN JUAN	U003430325	ESSO S/S 3P-198	BARBOSA AVE. CORNER DE DIEGO	00923	UST
SAN JUAN	U003430328	ESSO S/S COB-200	BARBOSA AVE. #621 ESQ CALLE NA	00918	UST
SAN JUAN	U003429424	AREA TRANSPORTE- HATO REY	BARBOSA AVE. #155 CORNER QUISQ	00917	UST
SAN JUAN	1001013303	ESSO S/S CO-027	BARBOSA AVE. 612 BARRIO CANTER	00917	UST
SAN JUAN	U003430977	TEXXAN OIL CO.	BARBOSA AVE. #312	00917	UST
SAN JUAN	U003430019	SHELL SERVICE STATION #001465	BARBOSA AVE. CORNER DUARTE	00917	UST
SAN JUAN	U003431554	GULF S/S #301	BARBOSA AVE. #620 AL LADO SUPE	00917	UST
SAN JUAN	U003796778	POLIDEPORTIVO DE SAN JUAN	CALLE MONTELLANOS FINAL ESQ. I	00925	UST
SAN JUAN	U003431954	CDT. DR.ENRIQUE KOPPISH	CALLE SICILIA ESQ. AVE. BARBOS	00923	UST
SAN JUAN	1010003681	EMILIO DEL TORO CUEVAS	CALLE CHILE, ESQ- QUISQUELLA H	0	FTTS
SAN JUAN	1010567600	MR MIRACLE	380 CALLE CALAF BUZON 4	00918	RCRA-CESQG
SAN JUAN	U003429480	VAQUERIA TRES MONJITAS-54295000	CALLE CHARDON	00918	UST
SAN JUAN	U003430222	ESSO S/S CO-011	CALLE PAZ GRANELA # 1421 URB S	00925	UST
SAN JUAN	U003430224	ESSO S/S CO-019	CALLE LO ZA ESQ. TAFT # 175	00911	UST
SAN JUAN	U003430232	ESSO S/S CO-186	CALLE LO ZA ESQ.TAPIA	00911	UST
SAN JUAN	U003430234	ESSO S/S CO-205	CALLE LO ZA # 2207 SANTA TERES	00911	UST
SAN JUAN	U003432067	CONDOMINIO SEGOVIA	CALLE SARGENTO LUIS MEDINA	00918	UST
SAN JUAN	U003730976	PRECINTO 182-HATO REY ESTE	CALLE SICILIA FINAL (CALLE 13)	00917	UST
SAN JUAN	U003761669	CDT DR. JAVIER JAVIER ANTON	CALLE PI EIRO ESQ. VALLEJO	00918	UST
SAN JUAN	1001182697	CHANTRES CLEANERS INC.	CALLE JOSE S. QUI ONES #524	00915	UST
SAN JUAN	U003430078	CITGO SERVICE STATION	CALLE BOLIVIA ESQ. CALLE QUISQ	00918	UST
SAN JUAN	S105840977	GULF S/S #176	CALLE AMATISTA BUCARE		LUST
SAN JUAN	S104904750	AMERICAN TRANSMISSION, INC.	CALLE GUAYAMA		LUST
SAN JUAN	S106452747	LA NUEVA PUERTA DE SANTURCE, INC.	CALLE RUIZ VELVIS 237		LUST
SAN JUAN	S104904764	GULF S/S#163	CALLE 31 INT. CALLE 38		LUST
SAN JUAN	S105840975	GULF S/S #436	CALLE TAPIA ESQ. EDUARDO CONDE		LUST
SAN JUAN	S104904818	GULF S/S #458	CALLE BALDORIOTY / DEGETAU		LUST
SAN JUAN	S104904835	QUISQUEYA S/S	CALLE QUISQUEYA # 55		LUST
SAN JUAN	S103553996	INDUSTRIA LECHERA DE P.R.	CALLE O'NEILL, HATO REY		LUST
SAN JUAN	S104540021	SANTA PAULA OIL	CALLE PALMA#1304		LUST
SAN JUAN	S103554081	GULF S/S #399	CALLE LOIZA ESQ.LOS BANOS		LUST
SAN JUAN	S105421749	HOSPITAL PEDIATRICO UNIVERSITARIO	CALLE PERIFERAL CENTRO MEDICO		LUST
SAN JUAN	S103554152	CENTERS FOR DISEAS. CONT.& PREV.	CALLE 2 CASIA		LUST
SAN JUAN	S105073594	PANADERIA RESTAURANTE LISBOA	CALLE PONCE DE LEON		LUST
SAN JUAN	U003429977	EL MUNDO, INC.	CARLOS CHARDON AVE. ROOSEVELT	00918	UST
SAN JUAN	S106917815	TOTAL PETROLEUM #3304	CARR 176 KM 8.1		LUST
SAN JUAN	S105073586	ISMAEL GONZALEZ CONST.	CARR 21 MONACILLOS		LUST
SAN JUAN	S103553822	BANCO POPULAR DE P.R.	CARR 176 KM 1.4 RIO PIEDRAS		LUST
SAN JUAN	S104539996	CITGO CAIMITO	CARR 842 KM 4.1 BO CAIMITO		LUST
SAN JUAN	S104228770	L.R. GAS STATION	CARR 176 KM 7.2 CUPEY		LUST
SAN JUAN	S105073593	RAMON ACOSTA DIAZ	CARR 65 DE INFANTERIA KM 6.1		LUST
SAN JUAN	S105421762	BONAIRE CLEANERS	CARR 177 AVE. LOMAS VERDES		LUST

City	EDR ID	Site Name	Site Address	Zip	Database(s)
SAN JUAN	S104904779	GULF #027	CARR. 176 KM. 1.5		LUST
SAN JUAN	U003796804	PLAZA LAS AMERICAS INC.	CARR.18 ESQ. AVE. FERNANDEZ RO	00917	UST
SAN JUAN	S105840973	HOSPITAL SIQUIATRIA RAMON FERNANDE	CENTRO MEDICO		LUST
SAN JUAN	1010331624	3M PUERTO RICO INC	350 CHARDON AVE SUITE 1010	00918	RCRA-CESQG
SAN JUAN	U003430468	ADMINISTRADOR TERRENOS	CHARDON AVE.	00918	UST
SAN JUAN	U003430656	EL MUNDO INC.	CHARDON AVE. TRES MONJITAS IND	00918	UST
SAN JUAN	S105421764	ASEM- MEDICAL CENTER-COCINA CENTRA	COCINA CENTRAL CENTRO MEDICO		LUST
SAN JUAN	U003429838	HORACIO PASTRANA S/S	DE DIEGO AVE. CORNER PADRES CA	00925	UST
SAN JUAN	1010567523	CLINICAL RESEARCH PR INC	359 DE DIEGO AVE SUITE 501	00909	RCRA-NonGen
SAN JUAN	U003430739	TEXACO VILLA GRANADA S/S #228	DE DIEGO AVE. & PR 181 VILLA G	00923	UST
SAN JUAN	U003430012	SHELL S/S # 000787	DOMENECH AVE. COR. HOSTOS HATO	00918	UST
SAN JUAN	U003429549	TOTAL PETROLEUM #3289	EDUARDO CONDE AVE./HAYDEE REXA	00915	UST
SAN JUAN	1009526295	PARDO RESIDENCE SITE	1466 ELIDA STREET, CAPARRA HEI		CERCLIS
SAN JUAN	S106917866	FEDERAL PACKING OF PUERTO RICO	ENRIQUE VAZQUEZ#4		LUST
SAN JUAN	U003430555	TEXACO- FERNANDEZ JUNCOS S/S # 203	FERNANDEZ JUNCOS AVE. & VICTOR	00909	UST
SAN JUAN	U003430900	HATO REY ARMORY	HATO REY ARMORY ELEONOR ROOSVE	00918	UST
SAN JUAN	U003430743	SUIZA DAIRY S/S # 205	ING. C. GONZALEZ AVE. #555 URB	00918	UST
SAN JUAN	1003864592	"NEW" ARMY AVIATION SUPPORT	ISLA GRANDE ROAD OFF HACIA FER		CERC-NFRAP
SAN JUAN	S106917628	GULF S/S #179	JDNES. METROPOLITANOS 32 / 2		LUST
SAN JUAN	1000706117	PRASA SAN JUAN CHEMICAL LABORATORY	KENNEDY AVE - OBRAS PUBLICAS	00909	RCRA-NonGen, FINDS
SAN JUAN	1010567599	LAUNDRY NEWAY	400 LAS AMERICAS AVE DOMENECH	00918	RCRA-NonGen
SAN JUAN	U003430008	GULF S/S #905	LUIS MU IZ SUFFRONT AVE. LOS M	00923	UST
SAN JUAN	U003431316	BANCO BILBAO VIZCAYA	MUNOZ RIVERA AVE. #254 HATO RE	00918	UST
SAN JUAN	1010149637	CENTRO EUGENIO MARIA DE HOSTOS, UR	NUEVO CALLE CONSTITUCION	0	FTTS
SAN JUAN	S103554121	VALINES INDUSTRIAL LAUNDRY	BO. OBRERO, SANTURCE		LUST
SAN JUAN	U003430187	GOMEZ HERMANOS, INC	MU OZ RIVERA AVE. #573	00918	UST
SAN JUAN	U003431478	AUT. DE COMUNICACIONES	MU OZ RIVERA AVE. & COLL ST.	00918	UST
SAN JUAN	U003430442	GOMEZ HNOS. INC	MU OZ RIVERA AVE. CORNER PI ER	00918	UST
SAN JUAN	U003429839	SHELL SERVICE STATION #804746	MU OZ RIVERA AVE. #761	00925	UST
SAN JUAN	U003431957	EL MONTE CLEANERS	MU OZ RIVERA AVE. EL MONTE SHO	00918	UST
SAN JUAN	U003431023	TREBOL MOTORS	MU OZ RIVERA AVE. #857 HATO RE	00925	UST
SAN JUAN	U003430738	MUNOZ RIVERA S/S #230	MU OZ RIVERA AVE. #560	00918	UST
SAN JUAN	S105758435	SHELL S/S #000019	PARADA 26 AVE PONCE DE LEON 19		LUST
SAN JUAN	S104540010	TEXACO STOP 6 1/2 S/S # 223	PARADA 6 1/2 PUERTA DE TIERRA		LUST
SAN JUAN	U003431805	CITIBANK N.A.- HATO REY	PONCE DE LEON AVE. #252	00918	UST
SAN JUAN	U003431131	HATO REY C.O.	PONCE DE LEON AVE. #562, PDA.3	00917	UST
SAN JUAN	U003431825	SANTIESTEBAN CLEMENTE	PONCE DE LEON AVE. #75 PDA. 26	00918	UST
SAN JUAN	U003430074	SHELL SERVICE STATION #001180	PONCE DE LEON AVE. ALHAMBRA ST	00917	UST
SAN JUAN	U003431701	SUCESION MARTI TORRES	PONCE DE LEON AVE. #555	00918	UST
SAN JUAN	U003430742	PONCE DE LEON S/S #219	PONCE DE LEON AVE. #510 HATO R	00918	UST
SAN JUAN	S104904832	SHELL S/S 804975	PONCE DE LEON PDA. 27		LUST
SAN JUAN	S105421738	TEXACO PUERTA DE TIERRA S/S	PUERTA DE TIERRA		LUST
SAN JUAN	1010149821	MONTE HATILLO	RES JARDINES DE MONTE HATILLO	0	FTTS
SAN JUAN	U003761672	RENOVADORA INC.	RIO PIEDRAS COMMERCIAL 1088 AV	00917	UST
SAN JUAN	1005904003	CHEMTEX CARIBBEAN INC.	ROAD 176, KM 9.5		CERCLIS, FINDS
SAN JUAN	1008196169	JC PENNEY STORE - PLAZA LAS AMERIC	525 ROOSEVELT AVE	00918	RCRA-CESQG, MANIFEST
SAN JUAN	1001181470	ESSO S/S CO-023	ROOSEVELT AVE. 1314 PUERTO NUE	00925	UST

City	EDR ID	Site Name	Site Address	Zip	Database(s)
SAN JUAN	U003431879	PLAZA LAS AMERICAS, INC.	ROOSEVELT AVE. INT. EXPRESO LA	00918	UST
SAN JUAN	U003432006	PANADERIA ANTIGUA LISBOA	ROOSEVELT AVE. #1316	00918	UST
SAN JUAN	U003430575	TEXACO- ROOSEVELT & HOSTOS S/S #22	ROOSEVELT AVE. #249 & HOSTOS A	00918	UST
SAN JUAN	U003430581	TEXACO- PI ERO DEVELOPMENT S/S #35	ROOSEVELT AVE. EXT. TRINIDAD U	00917	UST
SAN JUAN	S104904808	SHELL S/S #004031	ROOSEVELT / BARBOSA		LUST
SAN JUAN	S101442811	US POSTAL SERVICE-VMF FACILITY	585 ROOSEVELT BLVD		LUST
SAN JUAN	U003431688	SUPERINTENCIA DE LA POLICIA	ROOSVELT AVE. PUERTO NUEVO	00918	UST
SAN JUAN	1000381857	PEPSI COLA BOTTLING CO.-5423000	SIMON MADERA # 28		RCRA-NonGen, FINDS, LUST
SAN JUAN	1007445534	SAN JUAN MUNICIPAL LANDFILL	STATE ROAD P R - 2 KM 1 HM 4		ODI
SAN JUAN	1000215392	SUPERIOR PAINT MFG, INC	TRES MONJITAS IND PARK	00918	RCRA-TSDF, RCRA-NonGen, FINDS, UST
SAN JUAN	S104904831	SHELL SITE PR. MARINE MANAGEMENT #	ZONA PORTUARIA		LUST
SAN JUAN	S104904757	METRO WASTE DISPOSAL - 54215700	ZONA INDUSTRIAL JUANA MATOS		LUST
SANTURCE	1004779069	EDUARDO VIERA SS	ST 12 #517 COR BORINQUEN AVE	00915	RCRA-NonGen, FINDS
SANTURCE	1000991831	ESSO STANDARD OIL CO - PR CO-027	AVE BARBOSA 612 CANTERA	00915	RCRA-CESQG, FINDS
SANTURCE	1000991880	INTER-ISLAND RENTAL	AVE EDUARDO CONDE BLDG 15 137	00915	RCRA-NonGen, FINDS
SANTURCE	1000203737	ANGEL SUAREZ & HNOS INC	AVE BORINQUEN #2326	00915	RCRA-NonGen, FINDS
SANTURCE	1001125588	SHELL CO PR LTD SHELL SS 0019 ALVA	AVE PONCE DE LEON 1910	00909	RCRA-NonGen, FINDS
SANTURCE	1001216027	PR PUBLIC HOUSING ADMIN RES BALTOL	AVE BORINQUEN FINAL BO OBRERO	00917	RCRA-NonGen, FINDS
SANTURCE	1011551659	CHARNECO SERVICE STATION	AVE PONCE DELEON #1909	00909	ICIS
SANTURCE	1001207589	ESPINOLA, DANILO, M.D.	AVE. PONCE DE LEON 1822, PDA26	00909	MLTS
SANTURCE	1001485871	CARIBBEAN PETROLEUM LP - SS GULF 4	AVENIDA BALDORIDTY DE CASTRO	00915	RCRA-NonGen, FINDS
SANTURCE	1000982151	DEPT OF ED - ALBERT EINSTEIN SCHOO	CALLE HAYDE REXACH	00915	RCRA-NonGen, FINDS
SANTURCE	1001225296	NIANI SERVICE STATION GULF	CALLE TAPIA ESQ EDUARDO CONDE	00912	RCRA-NonGen, FINDS
SANTURCE	1011553304	NIANI SERVICE STATION GULF	CALLE TAPIA ESQ EDUARDO CONDE	00912	ICIS
SANTURCE	1000573438	SAN JUAN HEALTH CENTRE LAB	150 DE DIEGO AVE	00911	RCRA-NonGen, FINDS
SANTURCE	1012188197	TOTAL PETROLEUM PUERTO RICO CORP S	402 EDUARDO CONDE AVE	00915	RCRA-LQG
SANTURCE	1000801082	SCORPIO RECYCLING INC	705 PEDRO DE CASTRO ST	00909	CERC-NFRAP, RCRA-NonGen, FINDS
SANTURCE	1000106400	CHASE MANHATTAN BANK NA THE	1600 PONCE DELEON AVE	00909	RCRA-NonGen, FINDS
SANTURCE	1001203528	ESSO STANDARD OIL CO - PR CO-020	PONCE DE LEON & BORINQUEN AVE	00915	RCRA-NonGen, FINDS
SANTURCE	1008375154	NAIMKO PLASTICS & TROPHY CENTER	1810 PONCE DE LEON AVE	00909	RCRA-NonGen
SANTURCE	1000914180	A C T A HAZARDOUS WASTE SVCS	1603 PONCE DE LEON AVE	00909	RCRA-NonGen, FINDS
SANTURCE	1010331577	HERA PRINTING CORP	1671 PONECE DE LEON AVE	00909	RCRA-NonGen
SANTURCE	1001225307	VIADUCTO SHELL SERVICE STATION	906 ROBERTO H TODD AVE	00911	RCRA-NonGen, FINDS

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Number of Days to Update: Provides confirmation that EDR is reporting records that have been updated within 90 days from the date the government agency made the information available to the public.

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL: National Priority List

National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 07/02/2010
Date Data Arrived at EDR: 07/14/2010
Date Made Active in Reports: 10/04/2010
Number of Days to Update: 82

Source: EPA
Telephone: N/A
Last EDR Contact: 10/13/2010
Next Scheduled EDR Contact: 01/24/2011
Data Release Frequency: Quarterly

NPL Site Boundaries

Sources:

EPA's Environmental Photographic Interpretation Center (EPIC)
Telephone: 202-564-7333

EPA Region 1
Telephone 617-918-1143

EPA Region 3
Telephone 215-814-5418

EPA Region 4
Telephone 404-562-8033

EPA Region 5
Telephone 312-886-6686

EPA Region 10
Telephone 206-553-8665

EPA Region 6
Telephone: 214-655-6659

EPA Region 7
Telephone: 913-551-7247

EPA Region 8
Telephone: 303-312-6774

EPA Region 9
Telephone: 415-947-4246

Proposed NPL: Proposed National Priority List Sites

A site that has been proposed for listing on the National Priorities List through the issuance of a proposed rule in the Federal Register. EPA then accepts public comments on the site, responds to the comments, and places on the NPL those sites that continue to meet the requirements for listing.

Date of Government Version: 07/02/2010
Date Data Arrived at EDR: 07/14/2010
Date Made Active in Reports: 10/04/2010
Number of Days to Update: 82

Source: EPA
Telephone: N/A
Last EDR Contact: 10/13/2010
Next Scheduled EDR Contact: 01/24/2011
Data Release Frequency: Quarterly

NPL LIENS: Federal Superfund Liens

Federal Superfund Liens. Under the authority granted the USEPA by CERCLA of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner received notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/1991
Date Data Arrived at EDR: 02/02/1994
Date Made Active in Reports: 03/30/1994
Number of Days to Update: 56

Source: EPA
Telephone: 202-564-4267
Last EDR Contact: 11/22/2010
Next Scheduled EDR Contact: 02/28/2011
Data Release Frequency: No Update Planned

Federal Delisted NPL site list

DELISTED NPL: National Priority List Deletions

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 07/02/2010
Date Data Arrived at EDR: 07/14/2010
Date Made Active in Reports: 10/04/2010
Number of Days to Update: 82

Source: EPA
Telephone: N/A
Last EDR Contact: 10/13/2010
Next Scheduled EDR Contact: 01/24/2011
Data Release Frequency: Quarterly

Federal CERCLIS list

CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System

CERCLIS contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLIS contains sites which are either proposed to or on the National Priorities List (NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 01/29/2010
Date Data Arrived at EDR: 02/09/2010
Date Made Active in Reports: 04/12/2010
Number of Days to Update: 62

Source: EPA
Telephone: 703-412-9810
Last EDR Contact: 12/30/2010
Next Scheduled EDR Contact: 04/11/2011
Data Release Frequency: Quarterly

FEDERAL FACILITY: Federal Facility Site Information listing

A listing of National Priority List (NPL) and Base Realignment and Closure (BRAC) sites found in the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) Database where EPAa??s Federal Facilities Restoration and Reuse Office is involved in cleanup activities.

Date of Government Version: 06/23/2009
Date Data Arrived at EDR: 01/15/2010
Date Made Active in Reports: 02/10/2010
Number of Days to Update: 26

Source: Environmental Protection Agency
Telephone: 703-603-8704
Last EDR Contact: 10/13/2010
Next Scheduled EDR Contact: 01/24/2011
Data Release Frequency: Varies

Federal CERCLIS NFRAP site List

CERCLIS-NFRAP: CERCLIS No Further Remedial Action Planned

Archived sites are sites that have been removed and archived from the inventory of CERCLIS sites. Archived status indicates that, to the best of EPA’s knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list this site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. This decision does not necessarily mean that there is no hazard associated with a given site; it only means that, based upon available information, the location is not judged to be a potential NPL site.

Date of Government Version: 06/23/2009
Date Data Arrived at EDR: 09/02/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 19

Source: EPA
Telephone: 703-412-9810
Last EDR Contact: 12/01/2010
Next Scheduled EDR Contact: 03/14/2011
Data Release Frequency: Quarterly

Federal RCRA CORRACTS facilities list

CORRACTS: Corrective Action Report

CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 05/25/2010
Date Data Arrived at EDR: 06/02/2010
Date Made Active in Reports: 10/04/2010
Number of Days to Update: 124

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 11/22/2010
Next Scheduled EDR Contact: 02/28/2011
Data Release Frequency: Quarterly

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF: RCRA - Treatment, Storage and Disposal

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Transporters are individuals or entities that move hazardous waste from the generator offsite to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

Date of Government Version: 02/17/2010
Date Data Arrived at EDR: 02/19/2010
Date Made Active in Reports: 05/17/2010
Number of Days to Update: 87

Source: Environmental Protection Agency
Telephone: (212) 637-3660
Last EDR Contact: 10/07/2010
Next Scheduled EDR Contact: 01/17/2011
Data Release Frequency: Quarterly

Federal RCRA generators list

RCRA-LQG: RCRA - Large Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month.

Date of Government Version: 02/17/2010
Date Data Arrived at EDR: 02/19/2010
Date Made Active in Reports: 05/17/2010
Number of Days to Update: 87

Source: Environmental Protection Agency
Telephone: (212) 637-3660
Last EDR Contact: 10/07/2010
Next Scheduled EDR Contact: 01/17/2011
Data Release Frequency: Quarterly

RCRA-SQG: RCRA - Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

Date of Government Version: 02/17/2010
Date Data Arrived at EDR: 02/19/2010
Date Made Active in Reports: 05/17/2010
Number of Days to Update: 87

Source: Environmental Protection Agency
Telephone: (212) 637-3660
Last EDR Contact: 10/07/2010
Next Scheduled EDR Contact: 01/17/2011
Data Release Frequency: Quarterly

RCRA-CESQG: RCRA - Conditionally Exempt Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

Date of Government Version: 02/17/2010
Date Data Arrived at EDR: 02/19/2010
Date Made Active in Reports: 05/17/2010
Number of Days to Update: 87

Source: Environmental Protection Agency
Telephone: (212) 637-3660
Last EDR Contact: 10/07/2010
Next Scheduled EDR Contact: 01/17/2011
Data Release Frequency: Varies

Federal institutional controls / engineering controls registries

US ENG CONTROLS: Engineering Controls Sites List

A listing of sites with engineering controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.

Date of Government Version: 12/20/2009
Date Data Arrived at EDR: 01/20/2010
Date Made Active in Reports: 04/12/2010
Number of Days to Update: 82

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 12/10/2010
Next Scheduled EDR Contact: 03/28/2011
Data Release Frequency: Varies

US INST CONTROL: Sites with Institutional Controls

A listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

Date of Government Version: 12/20/2009
Date Data Arrived at EDR: 01/20/2010
Date Made Active in Reports: 04/12/2010
Number of Days to Update: 82

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 12/10/2010
Next Scheduled EDR Contact: 03/28/2011
Data Release Frequency: Varies

Federal ERNS list

ERNS: Emergency Response Notification System

Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 07/09/2010
Date Data Arrived at EDR: 07/09/2010
Date Made Active in Reports: 08/17/2010
Number of Days to Update: 39

Source: National Response Center, United States Coast Guard
Telephone: 202-267-2180
Last EDR Contact: 10/06/2010
Next Scheduled EDR Contact: 01/17/2011
Data Release Frequency: Annually

State- and tribal - equivalent CERCLIS

SHWS: This state does not maintain a SHWS list. See the Federal CERCLIS list and Federal NPL list.

State Hazardous Waste Sites. State hazardous waste site records are the states' equivalent to CERCLIS. These sites may or may not already be listed on the federal CERCLIS list. Priority sites planned for cleanup using state funds (state equivalent of Superfund) are identified along with sites where cleanup will be paid for by potentially responsible parties. Available information varies by state.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: Environmental Quality Board
Telephone: 787-767-8181
Last EDR Contact: 08/22/2005
Next Scheduled EDR Contact: 11/21/2005
Data Release Frequency: N/A

State and tribal leaking storage tank lists

LUST: Leaking Underground Storage Tanks

Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state.

Date of Government Version: 03/01/2008
Date Data Arrived at EDR: 04/22/2008
Date Made Active in Reports: 05/22/2008
Number of Days to Update: 30

Source: Environmental Quality Board
Telephone: 787-767-8056
Last EDR Contact: 11/09/2010
Next Scheduled EDR Contact: 02/14/2011
Data Release Frequency: Semi-Annually

INDIAN LUST R8: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming.

Date of Government Version: 05/24/2010
Date Data Arrived at EDR: 05/27/2010
Date Made Active in Reports: 08/09/2010
Number of Days to Update: 74

Source: EPA Region 8
Telephone: 303-312-6271
Last EDR Contact: 11/01/2010
Next Scheduled EDR Contact: 02/14/2011
Data Release Frequency: Quarterly

INDIAN LUST R7: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Iowa, Kansas, and Nebraska

Date of Government Version: 11/04/2009
Date Data Arrived at EDR: 05/04/2010
Date Made Active in Reports: 07/07/2010
Number of Days to Update: 64

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 12/03/2010
Next Scheduled EDR Contact: 02/14/2011
Data Release Frequency: Varies

INDIAN LUST R6: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in New Mexico and Oklahoma.

Date of Government Version: 08/05/2010
Date Data Arrived at EDR: 08/06/2010
Date Made Active in Reports: 10/04/2010
Number of Days to Update: 59

Source: EPA Region 6
Telephone: 214-665-6597
Last EDR Contact: 11/01/2010
Next Scheduled EDR Contact: 02/14/2011
Data Release Frequency: Varies

INDIAN LUST R1: Leaking Underground Storage Tanks on Indian Land
A listing of leaking underground storage tank locations on Indian Land.

Date of Government Version: 02/19/2009
Date Data Arrived at EDR: 02/19/2009
Date Made Active in Reports: 03/16/2009
Number of Days to Update: 25

Source: EPA Region 1
Telephone: 617-918-1313
Last EDR Contact: 11/02/2010
Next Scheduled EDR Contact: 02/14/2011
Data Release Frequency: Varies

INDIAN LUST R10: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Alaska, Idaho, Oregon and Washington.

Date of Government Version: 08/05/2010
Date Data Arrived at EDR: 08/06/2010
Date Made Active in Reports: 10/04/2010
Number of Days to Update: 59

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 11/01/2010
Next Scheduled EDR Contact: 02/14/2011
Data Release Frequency: Quarterly

INDIAN LUST R9: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Arizona, California, New Mexico and Nevada

Date of Government Version: 08/30/2010
Date Data Arrived at EDR: 08/30/2010
Date Made Active in Reports: 10/04/2010
Number of Days to Update: 35

Source: Environmental Protection Agency
Telephone: 415-972-3372
Last EDR Contact: 11/01/2010
Next Scheduled EDR Contact: 02/14/2011
Data Release Frequency: Quarterly

INDIAN LUST R4: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Florida, Mississippi and North Carolina.

Date of Government Version: 08/27/2010
Date Data Arrived at EDR: 08/30/2010
Date Made Active in Reports: 10/04/2010
Number of Days to Update: 35

Source: EPA Region 4
Telephone: 404-562-8677
Last EDR Contact: 11/01/2010
Next Scheduled EDR Contact: 02/14/2011
Data Release Frequency: Semi-Annually

State and tribal registered storage tank lists

UST: Underground Storage Tank Facilities
Underground storage tank site locations.

Date of Government Version: 01/01/2008	Source: Environmental Quality Board
Date Data Arrived at EDR: 03/26/2008	Telephone: 787-767-8056
Date Made Active in Reports: 04/23/2008	Last EDR Contact: 11/09/2010
Number of Days to Update: 28	Next Scheduled EDR Contact: 02/14/2011
	Data Release Frequency: Semi-Annually

INDIAN UST R7: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 7 (Iowa, Kansas, Missouri, Nebraska, and 9 Tribal Nations).

Date of Government Version: 04/01/2008	Source: EPA Region 7
Date Data Arrived at EDR: 12/30/2008	Telephone: 913-551-7003
Date Made Active in Reports: 03/16/2009	Last EDR Contact: 11/09/2010
Number of Days to Update: 76	Next Scheduled EDR Contact: 02/14/2011
	Data Release Frequency: Varies

INDIAN UST R9: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 9 (Arizona, California, Hawaii, Nevada, the Pacific Islands, and Tribal Nations).

Date of Government Version: 08/30/2010	Source: EPA Region 9
Date Data Arrived at EDR: 08/30/2010	Telephone: 415-972-3368
Date Made Active in Reports: 10/04/2010	Last EDR Contact: 11/01/2010
Number of Days to Update: 35	Next Scheduled EDR Contact: 02/14/2011
	Data Release Frequency: Quarterly

INDIAN UST R4: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee and Tribal Nations)

Date of Government Version: 08/27/2010	Source: EPA Region 4
Date Data Arrived at EDR: 08/30/2010	Telephone: 404-562-9424
Date Made Active in Reports: 10/04/2010	Last EDR Contact: 11/01/2010
Number of Days to Update: 35	Next Scheduled EDR Contact: 02/14/2011
	Data Release Frequency: Semi-Annually

INDIAN UST R5: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 5 (Michigan, Minnesota and Wisconsin and Tribal Nations).

Date of Government Version: 02/11/2010	Source: EPA Region 5
Date Data Arrived at EDR: 02/11/2010	Telephone: 312-886-6136
Date Made Active in Reports: 04/12/2010	Last EDR Contact: 11/01/2010
Number of Days to Update: 60	Next Scheduled EDR Contact: 02/14/2011
	Data Release Frequency: Varies

INDIAN UST R6: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 6 (Louisiana, Arkansas, Oklahoma, New Mexico, Texas and 65 Tribes).

Date of Government Version: 08/03/2010	Source: EPA Region 6
Date Data Arrived at EDR: 08/04/2010	Telephone: 214-665-7591
Date Made Active in Reports: 10/04/2010	Last EDR Contact: 11/01/2010
Number of Days to Update: 61	Next Scheduled EDR Contact: 02/14/2011
	Data Release Frequency: Semi-Annually

INDIAN UST R8: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming and 27 Tribal Nations).

Date of Government Version: 05/24/2010
Date Data Arrived at EDR: 05/27/2010
Date Made Active in Reports: 08/09/2010
Number of Days to Update: 74

Source: EPA Region 8
Telephone: 303-312-6137
Last EDR Contact: 11/01/2010
Next Scheduled EDR Contact: 02/14/2011
Data Release Frequency: Quarterly

INDIAN UST R10: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 10 (Alaska, Idaho, Oregon, Washington, and Tribal Nations).

Date of Government Version: 08/05/2010
Date Data Arrived at EDR: 08/06/2010
Date Made Active in Reports: 10/04/2010
Number of Days to Update: 59

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 11/01/2010
Next Scheduled EDR Contact: 02/14/2011
Data Release Frequency: Quarterly

INDIAN UST R1: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 1 (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont and ten Tribal Nations).

Date of Government Version: 02/19/2009
Date Data Arrived at EDR: 02/19/2009
Date Made Active in Reports: 03/16/2009
Number of Days to Update: 25

Source: EPA, Region 1
Telephone: 617-918-1313
Last EDR Contact: 11/02/2010
Next Scheduled EDR Contact: 02/14/2011
Data Release Frequency: Varies

FEMA UST: Underground Storage Tank Listing

A listing of all FEMA owned underground storage tanks.

Date of Government Version: 01/01/2010
Date Data Arrived at EDR: 02/16/2010
Date Made Active in Reports: 04/12/2010
Number of Days to Update: 55

Source: FEMA
Telephone: 202-646-5797
Last EDR Contact: 10/29/2010
Next Scheduled EDR Contact: 01/31/2011
Data Release Frequency: Varies

State and tribal voluntary cleanup sites

INDIAN VCP R1: Voluntary Cleanup Priority Listing

A listing of voluntary cleanup priority sites located on Indian Land located in Region 1.

Date of Government Version: 04/02/2008
Date Data Arrived at EDR: 04/22/2008
Date Made Active in Reports: 05/19/2008
Number of Days to Update: 27

Source: EPA, Region 1
Telephone: 617-918-1102
Last EDR Contact: 01/05/2010
Next Scheduled EDR Contact: 04/18/2011
Data Release Frequency: Varies

INDIAN VCP R7: Voluntary Cleanup Priority Lisitng

A listing of voluntary cleanup priority sites located on Indian Land located in Region 7.

Date of Government Version: 03/20/2008
Date Data Arrived at EDR: 04/22/2008
Date Made Active in Reports: 05/19/2008
Number of Days to Update: 27

Source: EPA, Region 7
Telephone: 913-551-7365
Last EDR Contact: 04/20/2009
Next Scheduled EDR Contact: 07/20/2009
Data Release Frequency: Varies

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS: A Listing of Brownfields Sites

Included in the listing are brownfields properties addresses by Cooperative Agreement Recipients and brownfields properties addressed by Targeted Brownfields Assessments. Targeted Brownfields Assessments-EPA’s Targeted Brownfields Assessments (TBA) program is designed to help states, tribes, and municipalities--especially those without EPA Brownfields Assessment Demonstration Pilots--minimize the uncertainties of contamination often associated with brownfields. Under the TBA program, EPA provides funding and/or technical assistance for environmental assessments at brownfields sites throughout the country. Targeted Brownfields Assessments supplement and work with other efforts under EPA’s Brownfields Initiative to promote cleanup and redevelopment of brownfields. Cooperative Agreement Recipients-States, political subdivisions, territories, and Indian tribes become Brownfields Cleanup Revolving Loan Fund (BCRLF) cooperative agreement recipients when they enter into BCRLF cooperative agreements with the U.S. EPA. EPA selects BCRLF cooperative agreement recipients based on a proposal and application process. BCRLF cooperative agreement recipients must use EPA funds provided through BCRLF cooperative agreement for specified brownfields-related cleanup activities.

Date of Government Version: 06/24/2010
Date Data Arrived at EDR: 06/25/2010
Date Made Active in Reports: 08/17/2010
Number of Days to Update: 53

Source: Environmental Protection Agency
Telephone: 202-566-2777
Last EDR Contact: 12/30/2010
Next Scheduled EDR Contact: 04/11/2011
Data Release Frequency: Semi-Annually

Local Lists of Landfill / Solid Waste Disposal Sites

ODI: Open Dump Inventory

An open dump is defined as a disposal facility that does not comply with one or more of the Part 257 or Part 258 Subtitle D Criteria.

Date of Government Version: 06/30/1985
Date Data Arrived at EDR: 08/09/2004
Date Made Active in Reports: 09/17/2004
Number of Days to Update: 39

Source: Environmental Protection Agency
Telephone: 800-424-9346
Last EDR Contact: 06/09/2004
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

DEBRIS REGION 9: Torres Martinez Reservation Illegal Dump Site Locations

A listing of illegal dump sites location on the Torres Martinez Indian Reservation located in eastern Riverside County and northern Imperial County, California.

Date of Government Version: 01/12/2009
Date Data Arrived at EDR: 05/07/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 137

Source: EPA, Region 9
Telephone: 415-947-4219
Last EDR Contact: 12/22/2010
Next Scheduled EDR Contact: 04/11/2011
Data Release Frequency: No Update Planned

INDIAN ODI: Report on the Status of Open Dumps on Indian Lands

Location of open dumps on Indian land.

Date of Government Version: 12/31/1998
Date Data Arrived at EDR: 12/03/2007
Date Made Active in Reports: 01/24/2008
Number of Days to Update: 52

Source: Environmental Protection Agency
Telephone: 703-308-8245
Last EDR Contact: 11/09/2010
Next Scheduled EDR Contact: 02/21/2011
Data Release Frequency: Varies

Local Lists of Hazardous waste / Contaminated Sites

US CDL: Clandestine Drug Labs

A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 05/07/2010	Source: Drug Enforcement Administration
Date Data Arrived at EDR: 06/18/2010	Telephone: 202-307-1000
Date Made Active in Reports: 08/17/2010	Last EDR Contact: 12/08/2010
Number of Days to Update: 60	Next Scheduled EDR Contact: 03/21/2011
	Data Release Frequency: Quarterly

US HIST CDL: National Clandestine Laboratory Register

A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 09/01/2007	Source: Drug Enforcement Administration
Date Data Arrived at EDR: 11/19/2008	Telephone: 202-307-1000
Date Made Active in Reports: 03/30/2009	Last EDR Contact: 03/23/2009
Number of Days to Update: 131	Next Scheduled EDR Contact: 06/22/2009
	Data Release Frequency: No Update Planned

Local Land Records

LIENS 2: CERCLA Lien Information

A Federal CERCLA ('Superfund') lien can exist by operation of law at any site or property at which EPA has spent Superfund monies. These monies are spent to investigate and address releases and threatened releases of contamination. CERCLIS provides information as to the identity of these sites and properties.

Date of Government Version: 05/06/2010	Source: Environmental Protection Agency
Date Data Arrived at EDR: 05/11/2010	Telephone: 202-564-6023
Date Made Active in Reports: 08/09/2010	Last EDR Contact: 11/01/2010
Number of Days to Update: 90	Next Scheduled EDR Contact: 02/14/2011
	Data Release Frequency: Varies

LUCIS: Land Use Control Information System

LUCIS contains records of land use control information pertaining to the former Navy Base Realignment and Closure properties.

Date of Government Version: 12/09/2005	Source: Department of the Navy
Date Data Arrived at EDR: 12/11/2006	Telephone: 843-820-7326
Date Made Active in Reports: 01/11/2007	Last EDR Contact: 11/22/2010
Number of Days to Update: 31	Next Scheduled EDR Contact: 03/07/2011
	Data Release Frequency: Varies

Records of Emergency Release Reports

HMIRS: Hazardous Materials Information Reporting System

Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 04/06/2010	Source: U.S. Department of Transportation
Date Data Arrived at EDR: 04/07/2010	Telephone: 202-366-4555
Date Made Active in Reports: 05/27/2010	Last EDR Contact: 01/05/2011
Number of Days to Update: 50	Next Scheduled EDR Contact: 04/18/2011
	Data Release Frequency: Annually

Other Ascertainable Records

RCRA-NonGen: RCRA - Non Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

Date of Government Version: 02/17/2010
Date Data Arrived at EDR: 02/19/2010
Date Made Active in Reports: 05/17/2010
Number of Days to Update: 87

Source: Environmental Protection Agency
Telephone: (212) 637-3660
Last EDR Contact: 10/07/2010
Next Scheduled EDR Contact: 01/17/2011
Data Release Frequency: Varies

DOT OPS: Incident and Accident Data

Department of Transporation, Office of Pipeline Safety Incident and Accident data.

Date of Government Version: 01/12/2010
Date Data Arrived at EDR: 02/09/2010
Date Made Active in Reports: 04/12/2010
Number of Days to Update: 62

Source: Department of Transporation, Office of Pipeline Safety
Telephone: 202-366-4595
Last EDR Contact: 11/09/2010
Next Scheduled EDR Contact: 02/21/2011
Data Release Frequency: Varies

DOD: Department of Defense Sites

This data set consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 11/10/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 62

Source: USGS
Telephone: 703-692-8801
Last EDR Contact: 10/28/2010
Next Scheduled EDR Contact: 01/31/2011
Data Release Frequency: Semi-Annually

FUDS: Formerly Used Defense Sites

The listing includes locations of Formerly Used Defense Sites properties where the US Army Corps of Engineers is actively working or will take necessary cleanup actions.

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 08/12/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 112

Source: U.S. Army Corps of Engineers
Telephone: 202-528-4285
Last EDR Contact: 12/13/2010
Next Scheduled EDR Contact: 03/28/2011
Data Release Frequency: Varies

CONSENT: Superfund (CERCLA) Consent Decrees

Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: 07/01/2010
Date Data Arrived at EDR: 08/11/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 113

Source: Department of Justice, Consent Decree Library
Telephone: Varies
Last EDR Contact: 01/03/2011
Next Scheduled EDR Contact: 04/18/2011
Data Release Frequency: Varies

ROD: Records Of Decision

Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 06/01/2010
Date Data Arrived at EDR: 06/16/2010
Date Made Active in Reports: 08/17/2010
Number of Days to Update: 62

Source: EPA
Telephone: 703-416-0223
Last EDR Contact: 12/10/2010
Next Scheduled EDR Contact: 03/28/2011
Data Release Frequency: Annually

UMTRA: Uranium Mill Tailings Sites

Uranium ore was mined by private companies for federal government use in national defense programs. When the mills shut down, large piles of the sand-like material (mill tailings) remain after uranium has been extracted from the ore. Levels of human exposure to radioactive materials from the piles are low; however, in some cases tailings were used as construction materials before the potential health hazards of the tailings were recognized.

Date of Government Version: 12/14/2009	Source: Department of Energy
Date Data Arrived at EDR: 09/29/2010	Telephone: 505-845-0011
Date Made Active in Reports: 10/04/2010	Last EDR Contact: 11/29/2010
Number of Days to Update: 5	Next Scheduled EDR Contact: 03/14/2011
	Data Release Frequency: Varies

MINES: Mines Master Index File

Contains all mine identification numbers issued for mines active or opened since 1971. The data also includes violation information.

Date of Government Version: 08/04/2010	Source: Department of Labor, Mine Safety and Health Administration
Date Data Arrived at EDR: 09/09/2010	Telephone: 303-231-5959
Date Made Active in Reports: 12/02/2010	Last EDR Contact: 09/09/2010
Number of Days to Update: 84	Next Scheduled EDR Contact: 03/21/2011
	Data Release Frequency: Semi-Annually

TRIS: Toxic Chemical Release Inventory System

Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/2008	Source: EPA
Date Data Arrived at EDR: 01/13/2010	Telephone: 202-566-0250
Date Made Active in Reports: 02/18/2010	Last EDR Contact: 12/17/2010
Number of Days to Update: 36	Next Scheduled EDR Contact: 03/14/2011
	Data Release Frequency: Annually

TSCA: Toxic Substances Control Act

Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/2006	Source: EPA
Date Data Arrived at EDR: 09/29/2010	Telephone: 202-260-5521
Date Made Active in Reports: 12/02/2010	Last EDR Contact: 12/29/2010
Number of Days to Update: 64	Next Scheduled EDR Contact: 04/11/2011
	Data Release Frequency: Every 4 Years

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 04/09/2009	Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Date Data Arrived at EDR: 04/16/2009	Telephone: 202-566-1667
Date Made Active in Reports: 05/11/2009	Last EDR Contact: 11/29/2010
Number of Days to Update: 25	Next Scheduled EDR Contact: 03/14/2011
	Data Release Frequency: Quarterly

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

A listing of FIFRA/TSCA Tracking System (FTTS) inspections and enforcements.

Date of Government Version: 04/09/2009	Source: EPA
Date Data Arrived at EDR: 04/16/2009	Telephone: 202-566-1667
Date Made Active in Reports: 05/11/2009	Last EDR Contact: 11/29/2010
Number of Days to Update: 25	Next Scheduled EDR Contact: 03/14/2011
	Data Release Frequency: Quarterly

HIST FTTS: FIFRA/TSCA Tracking System Administrative Case Listing

A complete administrative case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2007
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

HIST FTTS INSP: FIFRA/TSCA Tracking System Inspection & Enforcement Case Listing

A complete inspection and enforcement case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2008
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

SSTS: Section 7 Tracking Systems

Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 12/31/2008
Date Data Arrived at EDR: 01/06/2010
Date Made Active in Reports: 02/10/2010
Number of Days to Update: 35

Source: EPA
Telephone: 202-564-4203
Last EDR Contact: 11/01/2010
Next Scheduled EDR Contact: 02/14/2011
Data Release Frequency: Annually

ICIS: Integrated Compliance Information System

The Integrated Compliance Information System (ICIS) supports the information needs of the national enforcement and compliance program as well as the unique needs of the National Pollutant Discharge Elimination System (NPDES) program.

Date of Government Version: 04/24/2010
Date Data Arrived at EDR: 04/29/2010
Date Made Active in Reports: 05/17/2010
Number of Days to Update: 18

Source: Environmental Protection Agency
Telephone: 202-564-5088
Last EDR Contact: 12/23/2010
Next Scheduled EDR Contact: 04/11/2011
Data Release Frequency: Quarterly

PADS: PCB Activity Database System

PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 02/01/2010
Date Data Arrived at EDR: 04/22/2010
Date Made Active in Reports: 08/09/2010
Number of Days to Update: 109

Source: EPA
Telephone: 202-566-0500
Last EDR Contact: 11/10/2010
Next Scheduled EDR Contact: 01/31/2011
Data Release Frequency: Annually

MLTS: Material Licensing Tracking System

MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 03/18/2010
Date Data Arrived at EDR: 04/06/2010
Date Made Active in Reports: 05/27/2010
Number of Days to Update: 51

Source: Nuclear Regulatory Commission
Telephone: 301-415-7169
Last EDR Contact: 12/13/2010
Next Scheduled EDR Contact: 03/28/2011
Data Release Frequency: Quarterly

RADINFO: Radiation Information Database

The Radiation Information Database (RADINFO) contains information about facilities that are regulated by U.S. Environmental Protection Agency (EPA) regulations for radiation and radioactivity.

Date of Government Version: 07/13/2010
Date Data Arrived at EDR: 07/14/2010
Date Made Active in Reports: 08/09/2010
Number of Days to Update: 26

Source: Environmental Protection Agency
Telephone: 202-343-9775
Last EDR Contact: 10/14/2010
Next Scheduled EDR Contact: 01/24/2011
Data Release Frequency: Quarterly

FINDS: Facility Index System/Facility Registry System

Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 04/14/2010
Date Data Arrived at EDR: 04/16/2010
Date Made Active in Reports: 05/27/2010
Number of Days to Update: 41

Source: EPA
Telephone: (212) 637-3000
Last EDR Contact: 12/10/2010
Next Scheduled EDR Contact: 03/28/2011
Data Release Frequency: Quarterly

RAATS: RCRA Administrative Action Tracking System

RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/1995
Date Data Arrived at EDR: 07/03/1995
Date Made Active in Reports: 08/07/1995
Number of Days to Update: 35

Source: EPA
Telephone: 202-564-4104
Last EDR Contact: 06/02/2008
Next Scheduled EDR Contact: 09/01/2008
Data Release Frequency: No Update Planned

BRS: Biennial Reporting System

The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/2007
Date Data Arrived at EDR: 02/25/2010
Date Made Active in Reports: 05/12/2010
Number of Days to Update: 76

Source: EPA/NTIS
Telephone: 800-424-9346
Last EDR Contact: 11/30/2010
Next Scheduled EDR Contact: 03/07/2011
Data Release Frequency: Biennially

INDIAN RESERV: Indian Reservations

This map layer portrays Indian administered lands of the United States that have any area equal to or greater than 640 acres.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 12/08/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 34

Source: USGS
Telephone: 202-208-3710
Last EDR Contact: 10/28/2010
Next Scheduled EDR Contact: 01/31/2011
Data Release Frequency: Semi-Annually

SCRD DRYCLEANERS: State Coalition for Remediation of Drycleaners Listing

The State Coalition for Remediation of Drycleaners was established in 1998, with support from the U.S. EPA Office of Superfund Remediation and Technology Innovation. It is comprised of representatives of states with established drycleaner remediation programs. Currently the member states are Alabama, Connecticut, Florida, Illinois, Kansas, Minnesota, Missouri, North Carolina, Oregon, South Carolina, Tennessee, Texas, and Wisconsin.

Date of Government Version: 08/31/2010
Date Data Arrived at EDR: 09/01/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 92

Source: Environmental Protection Agency
Telephone: 615-532-8599
Last EDR Contact: 12/13/2010
Next Scheduled EDR Contact: 02/07/2011
Data Release Frequency: Varies

FEDLAND: Federal and Indian Lands

Federally and Indian administrated lands of the United States. Lands included are administrated by: Army Corps of Engineers, Bureau of Reclamation, National Wild and Scenic River, National Wildlife Refuge, Public Domain Land, Wilderness, Wilderness Study Area, Wildlife Management Area, Bureau of Indian Affairs, Bureau of Land Management, Department of Justice, Forest Service, Fish and Wildlife Service, National Park Service.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 02/06/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 339

Source: U.S. Geological Survey
Telephone: 888-275-8747
Last EDR Contact: 10/28/2010
Next Scheduled EDR Contact: 01/31/2011
Data Release Frequency: N/A

PCB TRANSFORMER: PCB Transformer Registration Database

The database of PCB transformer registrations that includes all PCB registration submittals.

Date of Government Version: 01/01/2008
Date Data Arrived at EDR: 02/18/2009
Date Made Active in Reports: 05/29/2009
Number of Days to Update: 100

Source: Environmental Protection Agency
Telephone: 202-566-0517
Last EDR Contact: 11/10/2010
Next Scheduled EDR Contact: 02/14/2011
Data Release Frequency: Varies

COAL ASH EPA: Coal Combustion Residues Surface Impoundments List

A listing of coal combustion residues surface impoundments with high hazard potential ratings.

Date of Government Version: 11/09/2009
Date Data Arrived at EDR: 12/18/2009
Date Made Active in Reports: 02/10/2010
Number of Days to Update: 54

Source: Environmental Protection Agency
Telephone: N/A
Last EDR Contact: 12/21/2010
Next Scheduled EDR Contact: 03/28/2011
Data Release Frequency: Varies

COAL ASH DOE: Sleam-Electric Plan Operation Data

A listing of power plants that store ash in surface ponds.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 08/07/2009
Date Made Active in Reports: 10/22/2009
Number of Days to Update: 76

Source: Department of Energy
Telephone: 202-586-8719
Last EDR Contact: 10/28/2010
Next Scheduled EDR Contact: 01/31/2011
Data Release Frequency: Varies

EDR PROPRIETARY RECORDS

EDR Proprietary Records

Manufactured Gas Plants: EDR Proprietary Manufactured Gas Plants

The EDR Proprietary Manufactured Gas Plant Database includes records of coal gas plants (manufactured gas plants) compiled by EDR’s researchers. Manufactured gas sites were used in the United States from the 1800’s to 1950’s to produce a gas that could be distributed and used as fuel. These plants used whale oil, rosin, coal, or a mixture of coal, oil, and water that also produced a significant amount of waste. Many of the byproducts of the gas production, such as coal tar (oily waste containing volatile and non-volatile chemicals), sludges, oils and other compounds are potentially hazardous to human health and the environment. The byproduct from this process was frequently disposed of directly at the plant site and can remain or spread slowly, serving as a continuous source of soil and groundwater contamination.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

OTHER DATABASE(S)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

NJ MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2009	Source: Department of Environmental Protection
Date Data Arrived at EDR: 07/22/2010	Telephone: N/A
Date Made Active in Reports: 08/26/2010	Last EDR Contact: 10/19/2010
Number of Days to Update: 35	Next Scheduled EDR Contact: 01/31/2011
	Data Release Frequency: Annually

RI MANIFEST: Manifest information
Hazardous waste manifest information

Date of Government Version: 12/31/2009	Source: Department of Environmental Management
Date Data Arrived at EDR: 07/19/2010	Telephone: 401-222-2797
Date Made Active in Reports: 08/26/2010	Last EDR Contact: 11/29/2010
Number of Days to Update: 38	Next Scheduled EDR Contact: 03/14/2011
	Data Release Frequency: Annually

Oil/Gas Pipelines: This data was obtained by EDR from the USGS in 1994. It is referred to by USGS as GeoData Digital Line Graphs from 1:100,000-Scale Maps. It was extracted from the transportation category including some oil, but primarily gas pipelines.

Electric Power Transmission Line Data
Source: Rextag Strategies Corp.
Telephone: (281) 769-2247
U.S. Electric Transmission and Power Plants Systems Digital GIS Data

Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

AHA Hospitals:
Source: American Hospital Association, Inc.
Telephone: 312-280-5991
The database includes a listing of hospitals based on the American Hospital Association’s annual survey of hospitals.
Medical Centers: Provider of Services Listing
Source: Centers for Medicare & Medicaid Services
Telephone: 410-786-3000
A listing of hospitals with Medicare provider number, produced by Centers of Medicare & Medicaid Services, a federal agency within the U.S. Department of Health and Human Services.
Nursing Homes
Source: National Institutes of Health
Telephone: 301-594-6248
Information on Medicare and Medicaid certified nursing homes in the United States.
Public Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics’ primary database on elementary and secondary public education in the United States. It is a comprehensive, annual, national statistical database of all public elementary and secondary schools and school districts, which contains data that are comparable across all states.
Private Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics’ primary database on private school locations in the United States.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 2003 & 2009 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002 and 2005 from the U.S. Fish and Wildlife Service.

Scanned Digital USGS 7.5' Topographic Map (DRG)
Source: United States Geologic Survey
A digital raster graphic (DRG) is a scanned image of a U.S. Geological Survey topographic map. The map images are made by scanning published paper maps on high-resolution scanners. The raster image is georeferenced and fit to the Universal Transverse Mercator (UTM) projection.

STREET AND ADDRESS INFORMATION

GEOCHECK ®- PHYSICAL SETTING SOURCE ADDENDUM

TARGET PROPERTY ADDRESS

CANO MARTIN PENA
CANO MARTIN PENA
SAN JUAN, PR 00917

TARGET PROPERTY COORDINATES

Latitude (North):	18.43090 - 18˚ 25' 51.2''
Longitude (West):	66.0495 - 66˚ 2' 58.2''
Universal Tranverse Mercator:	Zone 19
UTM X (Meters):	811695.8
UTM Y (Meters):	2040276.1
Elevation:	0 ft. above sea level

USGS TOPOGRAPHIC MAP

Target Property:	N/A
Source:	USGS 7.5 min quad index

EDR's GeoCheck Physical Setting Source Addendum is provided to assist the environmental professional in forming an opinion about the impact of potential contaminant migration.

Assessment of the impact of contaminant migration generally has two principle investigative components:

1. Groundwater flow direction, and
2. Groundwater flow velocity.

Groundwater flow direction may be impacted by surface topography, hydrology, hydrogeology, characteristics of the soil, and nearby wells. Groundwater flow velocity is generally impacted by the nature of the geologic strata.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW DIRECTION INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, such as surface topographic information, hydrologic information, hydrogeologic data collected on nearby properties, and regional groundwater flow information (from deep aquifers).

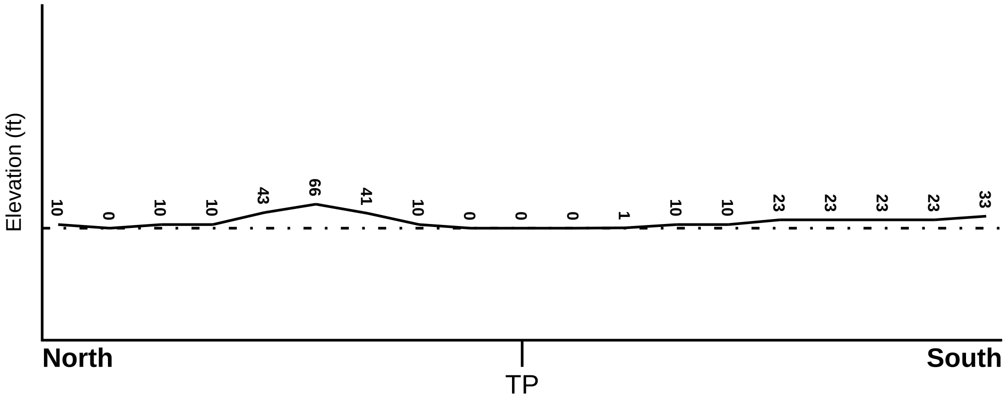
TOPOGRAPHIC INFORMATION

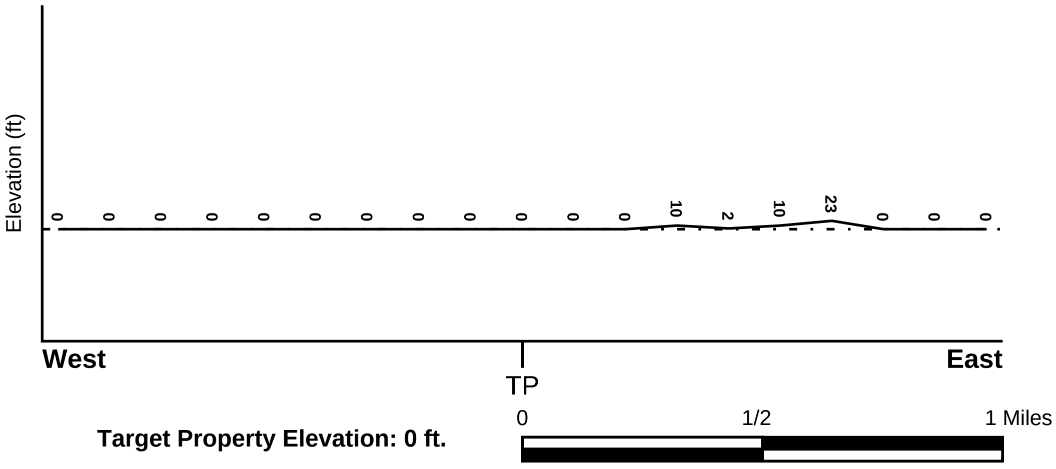
Surface topography may be indicative of the direction of surficial groundwater flow. This information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

TARGET PROPERTY TOPOGRAPHY

General Topographic Gradient: General South

SURROUNDING TOPOGRAPHY: ELEVATION PROFILES





Target Property Elevation: 0 ft.

Source: Topography has been determined from the USGS 7.5’ Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

HYDROLOGIC INFORMATION

Surface water can act as a hydrologic barrier to groundwater flow. Such hydrologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Refer to the Physical Setting Source Map following this summary for hydrologic information (major waterways and bodies of water).

FEMA FLOOD ZONE

Target Property County	FEMA Flood Electronic Data
SAN JUAN, PR	YES - refer to the Overview Map and Detail Map

Flood Plain Panel at Target Property: 72000C - FEMA DFIRM Flood data

Additional Panels in search area: Not Reported

NATIONAL WETLAND INVENTORY

NWI Quad at Target Property	NWI Electronic Data Coverage
NOT AVAILABLE	YES - refer to the Overview Map and Detail Map

HYDROGEOLOGIC INFORMATION

Hydrogeologic information obtained by installation of wells on a specific site can often be an indicator of groundwater flow direction in the immediate area. Such hydrogeologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

AQUIFLOW®

Search Radius: 1.000 Mile.

EDR has developed the AQUIFLOW Information System to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted by environmental professionals to regulatory authorities at select sites and has extracted the date of the report, groundwater flow direction as determined hydrogeologically, and the depth to water table.

MAP ID	LOCATION FROM TP	GENERAL DIRECTION GROUNDWATER FLOW
Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW VELOCITY INFORMATION

Groundwater flow velocity information for a particular site is best determined by a qualified environmental professional using site specific geologic and soil strata data. If such data are not reasonably ascertainable, it may be necessary to rely on other sources of information, including geologic age identification, rock stratigraphic unit and soil characteristics data collected on nearby properties and regional soil information. In general, contaminant plumes move more quickly through sandy-gravelly types of soils than silty-clayey types of soils.

GEOLOGIC INFORMATION IN GENERAL AREA OF TARGET PROPERTY

Geologic information can be used by the environmental professional in forming an opinion about the relative speed at which contaminant migration may be occurring.

ROCK STRATIGRAPHIC UNIT

Era: -
System: -
Series: -
Code: N/A *(decoded above as Era, System & Series)*

GEOLOGIC AGE IDENTIFICATION

Category: -

Geologic Age and Rock Stratigraphic Unit Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - a digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

DOMINANT SOIL COMPOSITION IN GENERAL AREA OF TARGET PROPERTY

The U.S. Department of Agriculture’s (USDA) Soil Conservation Service (SCS) leads the National Cooperative Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps. The following information is based on Soil Conservation Service STATSGO data.

Soil Component Name:	URBAN LAND
Soil Surface Texture:	variable
Hydrologic Group:	Not reported
Soil Drainage Class:	Not reported

Hydric Status: Soil does not meet the requirements for a hydric soil.

Corrosion Potential - Uncoated Steel:	Not Reported
Depth to Bedrock Min:	> 10 inches
Depth to Bedrock Max:	> 10 inches

Soil Layer Information

	Boundary			Classification			
Layer	**Upper**	**Lower**	**Soil Texture Class**	**AASHTO Group**	**Unified Soil**	**Permeability Rate (in/hr)**	**Soil Reaction (pH)**
1	0 inches	6 inches	variable	Not reported	Not reported	Max: 0.00 Min: 0.00	Max: 0.00 Min: 0.00

OTHER SOIL TYPES IN AREA

Based on Soil Conservation Service STATSGO data, the following additional subordinant soil types may appear within the general area of target property.

Soil Surface Textures:	clay loam loamy sand
Surficial Soil Types:	clay loam loamy sand
Shallow Soil Types:	No Other Soil Types
Deeper Soil Types:	unweathered bedrock

LOCAL / REGIONAL WATER AGENCY RECORDS

EDR Local/Regional Water Agency records provide water well information to assist the environmental professional in assessing sources that may impact ground water flow direction, and in forming an opinion about the impact of contaminant migration on nearby drinking water wells.

WELL SEARCH DISTANCE INFORMATION

DATABASE	SEARCH DISTANCE (miles)
Federal USGS	1.000
Federal FRDS PWS	Nearest PWS within 1 mile

FEDERAL USGS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
A1	USGS2018430	1/4 - 1/2 Mile SSE
A2	USGS2018424	1/4 - 1/2 Mile SSE
3	USGS2018402	1/4 - 1/2 Mile South
4	USGS2018268	1/2 - 1 Mile North
5	USGS2018560	1/2 - 1 Mile SSW
6	USGS2018538	1/2 - 1 Mile South
7	USGS2018546	1/2 - 1 Mile SSE

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

FEDERAL USGS WELL INFORMATION

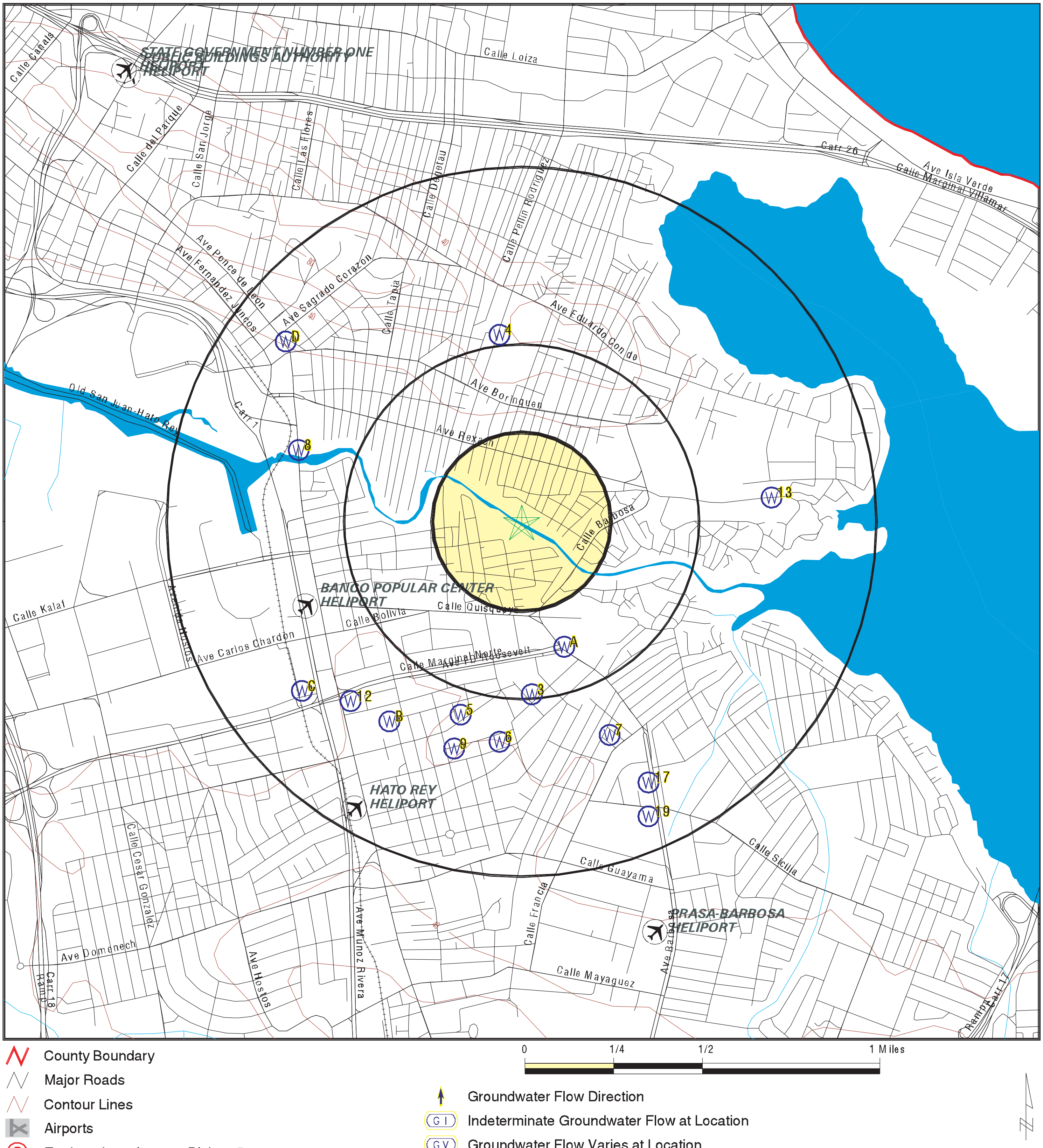
MAP ID	WELL ID	LOCATION FROM TP
8	USGS2018213	1/2 - 1 Mile WNW
9	USGS2018535	1/2 - 1 Mile SSW
B10	USGS2018554	1/2 - 1 Mile SSW
B11	USGS2018553	1/2 - 1 Mile SSW
12	USGS2018397	1/2 - 1 Mile SW
13	USGS2018368	1/2 - 1 Mile East
C14	USGS2018398	1/2 - 1 Mile SW
C15	USGS2018407	1/2 - 1 Mile SW
D16	USGS2018262	1/2 - 1 Mile NW
17	USGS2018522	1/2 - 1 Mile SSE
D18	USGS2018269	1/2 - 1 Mile NW
19	USGS2018497	1/2 - 1 Mile SSE

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No PWS System Found		

Note: PWS System location is not always the same as well location.

PHYSICAL SETTING SOURCE MAP - 2960202.2s



County Boundary

Major Roads

Contour Lines

Airports

Earthquake epicenter, Richter 5 or greater

Water Wells

Public Water Supply Wells

Cluster of Multiple Icons

Groundwater Flow Direction

GI Indeterminate Groundwater Flow at Location

GV Groundwater Flow Varies at Location

SITE NAME:	Cano Martin Pena
ADDRESS:	Cano Martin Pena San Juan PR 00917
LAT/LONG:	18.4309 / 66.0495

CLIENT:	PBS&J
CONTACT:	Tamara Mayer
INQUIRY #:	2960202.2s
DATE:	January 05, 2011 4:41 pm

Map ID Direction Distance Elevation	Database	EDR ID Number
A1 **SSE** **1/4 - 1/2 Mile** **Higher**	**FED USGS**	**USGS2018430**

Agency cd:	USGS	Site no:	182541066025200
Site name:	TRANSPORTACION WELL, SAN JUAN, PR		
Latitude:	182541	EDR Site id:	USGS2018430
Longitude:	0660252	Dec lat:	18.42605778
Dec lon:	-66.04738778	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	72
State:	72	County:	127
Country:	US	Land net:	Not Reported
Location map:	SAN JUAN	Map scale:	20000
Altitude:	16.0		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	3		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Eastern Puerto Rico. Puerto Rico. Area = 1067 sq.mi.		
Topographic:	Not Reported		
Site type:	Ground-water other than Spring	Date construction:	19450906
Date inventoried:	19610407	Mean greenwich time offset:	AST
Local standard time flag:	N		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	93.0	Hole depth:	101.0
Source of depth data:	driller		
Project number:	PR454300200		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00
Peak flow data count:	0	Water quality data begin date:	0000-00-00
Water quality data end date:	0000-00-00	Water quality data count:	0
Ground water data begin date:	1945-09-06	Ground water data end date:	1989-06-28
Ground water data count:	5		

Ground-water levels, Number of Measurements: 5

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
1989-06-28	3.50		1987-06-02	4.36	
1985-05-30	4.46		1985-01-22	4.56	
1945-09-06	4.83				

A2 **SSE** **1/4 - 1/2 Mile** **Higher**	**FED USGS**	**USGS2018424**

Agency cd:	USGS	Site no:	182539066025400
Site name:	AQUALUX WELL, SAN JUAN, PR		
Latitude:	182539	EDR Site id:	USGS2018424
Longitude:	0660254	Dec lat:	18.42550222
Dec lon:	-66.0479433	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	72
State:	72	County:	127
Country:	US	Land net:	Not Reported
Location map:	SAN JUAN	Map scale:	20000
Altitude:	13.0		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	2.5		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Eastern Puerto Rico. Puerto Rico. Area = 1067 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	19410101
Date inventoried:	19610407	Mean greenwich time offset:	AST
Local standard time flag:	N		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	Not Reported	Hole depth:	99.0
Source of depth data:	driller		
Project number:	PR454300200		
Real time data flag:	Not Reported	Daily flow data begin date:	Not Reported
Daily flow data end date:	Not Reported	Daily flow data count:	Not Reported
Peak flow data begin date:	Not Reported	Peak flow data end date:	Not Reported
Peak flow data count:	Not Reported	Water quality data begin date:	Not Reported
Water quality data end date:	Not Reported	Water quality data count:	Not Reported
Ground water data begin date:	Not Reported	Ground water data end date:	Not Reported
Ground water data count:	Not Reported		

Ground-water levels, Number of Measurements: 0

3
South
1/4 - 1/2 Mile
Higher

FED USGS **USGS2018402**

Agency cd:	USGS	Site no:	182533066025800
Site name:	GREEN SPOT WELL, SAN JUAN, PR		
Latitude:	182533	EDR Site id:	USGS2018402
Longitude:	0660258	Dec lat:	18.42383556
Dec lon:	-66.0490547	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	72
State:	72	County:	127
Country:	US	Land net:	Not Reported
Location map:	SAN JUAN	Map scale:	20000
Altitude:	13.0		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	3		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Eastern Puerto Rico. Puerto Rico. Area = 1067 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	19480101
Date inventoried:	19620403	Mean greenwich time offset:	AST

Local standard time flag:	N		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	80.0	Hole depth:	90.0
Source of depth data:	driller		
Project number:	PR454300200		
Real time data flag:	Not Reported	Daily flow data begin date:	Not Reported
Daily flow data end date:	Not Reported	Daily flow data count:	Not Reported
Peak flow data begin date:	Not Reported	Peak flow data end date:	Not Reported
Peak flow data count:	Not Reported	Water quality data begin date:	Not Reported
Water quality data end date:	Not Reported	Water quality data count:	Not Reported
Ground water data begin date:	Not Reported	Ground water data end date:	Not Reported
Ground water data count:	Not Reported		

Ground-water levels, Number of Measurements: 0

4
North
1/2 - 1 Mile
Higher

FED USGS **USGS2018268**

Agency cd:	USGS	Site no:	182626066030300
Site name:	LAUNDRY WELL, SAN JUAN, PR		
Latitude:	182626	EDR Site id:	USGS2018268
Longitude:	0660303	Dec lat:	18.43855694
Dec lon:	-66.0504433	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	72
State:	72	County:	127
Country:	US	Land net:	Not Reported
Location map:	SAN JUAN	Map scale:	20000
Altitude:	49.0		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	3		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Eastern Puerto Rico. Puerto Rico. Area = 1067 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	19470425
Date inventoried:	19610313	Mean greenwich time offset:	AST
Local standard time flag:	N		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	150.0	Hole depth:	150.0
Source of depth data:	driller		
Project number:	PR454300200		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00
Peak flow data count:	0	Water quality data begin date:	0000-00-00
Water quality data end date:	0000-00-00	Water quality data count:	0
Ground water data begin date:	1947-04-25	Ground water data end date:	1947-04-25
Ground water data count:	1		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1947-04-25	32.0	

5
SSW
1/2 - 1 Mile
Higher

FED USGS **USGS2018560**

Agency cd:	USGS	Site no:	182530066030900
Site name:	ASOCIACION DEL MAESTRO WELL, SAN JUAN, PR		
Latitude:	182530	EDR Site id:	USGS2018560
Longitude:	0660309	Dec lat:	18.42300222
Dec lon:	-66.05211028	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	72
State:	72	County:	127
Country:	US	Land net:	Not Reported
Location map:	SAN JUAN	Map scale:	20000
Altitude:	33.0		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	3		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Eastern Puerto Rico. Puerto Rico. Area = 1067 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	Not Reported
Date inventoried:	19610313	Mean greenwich time offset:	AST
Local standard time flag:	N		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	85.66	Hole depth:	127.0
Source of depth data:	driller		
Project number:	PR454300200		
Real time data flag:	Not Reported	Daily flow data begin date:	Not Reported
Daily flow data end date:	Not Reported	Daily flow data count:	Not Reported
Peak flow data begin date:	Not Reported	Peak flow data end date:	Not Reported
Peak flow data count:	Not Reported	Water quality data begin date:	Not Reported
Water quality data end date:	Not Reported	Water quality data count:	Not Reported
Ground water data begin date:	Not Reported	Ground water data end date:	Not Reported
Ground water data count:	Not Reported		

Ground-water levels, Number of Measurements: 0

6
South
1/2 - 1 Mile
Higher

FED USGS **USGS2018538**

Agency cd:	USGS	Site no:	182526066030300
Site name:	BARRERA WELL, SAN JUAN, PR		
Latitude:	182526	EDR Site id:	USGS2018538
Longitude:	0660303	Dec lat:	18.4218911
Dec lon:	-66.0504436	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	72
State:	72	County:	127
Country:	US	Land net:	Not Reported
Location map:	SAN JUAN	Map scale:	20000
Altitude:	25.0		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	2.5		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Eastern Puerto Rico. Puerto Rico. Area = 1067 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	19500101
Date inventoried:	19620403	Mean greenwich time offset:	AST
Local standard time flag:	N		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	80.0	Hole depth:	80.0
Source of depth data:	driller		
Project number:	PR454300200		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00
Peak flow data count:	0	Water quality data begin date:	0000-00-00
Water quality data end date:	0000-00-00	Water quality data count:	0
Ground water data begin date:	1962-04-04	Ground water data end date:	1985-01-23
Ground water data count:	2		

Ground-water levels, Number of Measurements: 2

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
1985-01-23	18.05		1962-04-04	18.20	

7
SSE
1/2 - 1 Mile
Higher

FED USGS **USGS2018546**

Agency cd:	USGS	Site no:	182527066024600
Site name:	VICENT WELL, SAN JUAN, PR		
Latitude:	182527	EDR Site id:	USGS2018546
Longitude:	0660246	Dec lat:	18.42216889
Dec lon:	-66.0457211	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	72
State:	72	County:	127
Country:	US	Land net:	Not Reported
Location map:	SAN JUAN	Map scale:	20000
Altitude:	13.0		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	2.5		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Eastern Puerto Rico. Puerto Rico. Area = 1067 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	19540101
Date inventoried:	19610410	Mean greenwich time offset:	AST

Local standard time flag: N
Type of ground water site: Single well, other than collector or Ranney type
Aquifer Type: Not Reported
Aquifer: Not Reported
Well depth: 100.0 Hole depth: 100.0
Source of depth data: driller
Project number: PR454300200
Real time data flag: Not Reported Daily flow data begin date: Not Reported
Daily flow data end date: Not Reported Daily flow data count: Not Reported
Peak flow data begin date: Not Reported Peak flow data end date: Not Reported
Peak flow data count: Not Reported Water quality data begin date: Not Reported
Water quality data end date: Not Reported Water quality data count: Not Reported
Ground water data begin date: Not Reported Ground water data end date: Not Reported
Ground water data count: Not Reported

Ground-water levels, Number of Measurements: 0

8
WNW
1/2 - 1 Mile
Higher

FED USGS USGS2018213

Agency cd: USGS Site no: 182609066033400
Site name: OBRAS PUBLICAS WELL, SAN JUAN, PR
Latitude: 182609 EDR Site id: USGS2018213
Longitude: 0660334 Dec lat: 18.43383528
Dec lon: -66.0590547 Coor meth: M
Coor accr: S Latlong datum: NAD27
Dec latlong datum: NAD83 District: 72
State: 72 County: 127
Country: US Land net: Not Reported
Location map: SAN JUAN Map scale: 20000
Altitude: 3.0
Altitude method: Interpolated from topographic map
Altitude accuracy: 3
Altitude datum: National Geodetic Vertical Datum of 1929
Hydrologic: Eastern Puerto Rico. Puerto Rico. Area = 1067 sq.mi.
Topographic: Flat surface
Site type: Ground-water other than Spring Date construction: Not Reported
Date inventoried: 19610412 Mean greenwich time offset: AST
Local standard time flag: N
Type of ground water site: Single well, other than collector or Ranney type
Aquifer Type: Not Reported
Aquifer: Not Reported
Well depth: 100.0 Hole depth: 100.0
Source of depth data: reporting agency (generally USGS)
Project number: PR454300200
Real time data flag: Not Reported Daily flow data begin date: Not Reported
Daily flow data end date: Not Reported Daily flow data count: Not Reported
Peak flow data begin date: Not Reported Peak flow data end date: Not Reported
Peak flow data count: Not Reported Water quality data begin date: Not Reported
Water quality data end date: Not Reported Water quality data count: Not Reported
Ground water data begin date: Not Reported Ground water data end date: Not Reported
Ground water data count: Not Reported

Ground-water levels, Number of Measurements: 0

Map ID Direction Distance Elevation	Database	EDR ID Number
9 **SSW** **1/2 - 1 Mile** **Higher**	**FED USGS**	**USGS2018535**

Agency cd:	USGS	Site no:	182525066031000
Site name:	INDULAC WELL, SAN JUAN, PR		
Latitude:	182525	EDR Site id:	USGS2018535
Longitude:	0660310	Dec lat:	18.4216136
Dec lon:	-66.052388	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	72
State:	72	County:	127
Country:	US	Land net:	Not Reported
Location map:	SAN JUAN	Map scale:	20000
Altitude:	10.0		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	2.5		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Eastern Puerto Rico. Puerto Rico. Area = 1067 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	19540422
Date inventoried:	19610411	Mean greenwich time offset:	AST
Local standard time flag:	N		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	78.0	Hole depth:	80.0
Source of depth data:	driller		
Project number:	PR454300200		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00
Peak flow data count:	0	Water quality data begin date:	0000-00-00
Water quality data end date:	0000-00-00	Water quality data count:	0
Ground water data begin date:	1954-04-22	Ground water data end date:	1954-04-22
Ground water data count:	1		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1954-04-22	13.50	

B10 **SSW** **1/2 - 1 Mile** **Higher**	**FED USGS**	**USGS2018554**

Agency cd:	USGS	Site no:	182529066032001
Site name:	JULIA 1 WELL, SAN JUAN, PR		
Latitude:	182529	EDR Site id:	USGS2018554
Longitude:	0660320	Dec lat:	18.42272444
Dec lon:	-66.0551658	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	72
State:	72	County:	127
Country:	US	Land net:	Not Reported
Location map:	SAN JUAN	Map scale:	20000
Altitude:	25.0		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	2.5		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Eastern Puerto Rico. Puerto Rico. Area = 1067 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	19450712
Date inventoried:	19610410	Mean greenwich time offset:	AST
Local standard time flag:	N		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	70.42	Hole depth:	73.0
Source of depth data:	driller		
Project number:	PR454300200		
Real time data flag:	Not Reported	Daily flow data begin date:	Not Reported
Daily flow data end date:	Not Reported	Daily flow data count:	Not Reported
Peak flow data begin date:	Not Reported	Peak flow data end date:	Not Reported
Peak flow data count:	Not Reported	Water quality data begin date:	Not Reported
Water quality data end date:	Not Reported	Water quality data count:	Not Reported
Ground water data begin date:	Not Reported	Ground water data end date:	Not Reported
Ground water data count:	Not Reported		

Ground-water levels, Number of Measurements: 0

B11
SSW
1/2 - 1 Mile
Higher

FED USGS **USGS2018553**

Agency cd:	USGS	Site no:	182529066032000
Site name:	JULIA 2 WELL, SAN JUAN, PR		
Latitude:	182529	EDR Site id:	USGS2018553
Longitude:	0660320	Dec lat:	18.42272444
Dec lon:	-66.0551658	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	72
State:	72	County:	127
Country:	US	Land net:	Not Reported
Location map:	SAN JUAN	Map scale:	20000
Altitude:	25.0		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	2.5		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Eastern Puerto Rico. Puerto Rico. Area = 1067 sq.mi.		
Topographic:	Not Reported		
Site type:	Ground-water other than Spring	Date construction:	19450811
Date inventoried:	19610410	Mean greenwich time offset:	AST

Local standard time flag:	N		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	70.0	Hole depth:	73.0
Source of depth data:	driller		
Project number:	PR454300200		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00
Peak flow data count:	0	Water quality data begin date:	0000-00-00
Water quality data end date:	0000-00-00	Water quality data count:	0
Ground water data begin date:	1961-04-10	Ground water data end date:	1961-04-10
Ground water data count:	1		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1961-04-10	20.0	

12
SW
1/2 - 1 Mile
Higher

FED USGS USGS2018397

Agency cd:	USGS	Site no:	182532066032600
Site name:	GAS STATION WELL, SAN JUAN, PR		
Latitude:	182532	EDR Site id:	USGS2018397
Longitude:	0660326	Dec lat:	18.42355778
Dec lon:	-66.0568325	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	72
State:	72	County:	127
Country:	US	Land net:	Not Reported
Location map:	SAN JUAN	Map scale:	20000
Altitude:	16.0		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	2.5		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Eastern Puerto Rico. Puerto Rico. Area = 1067 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	19480101
Date inventoried:	19610410	Mean greenwich time offset:	AST
Local standard time flag:	N		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	Not Reported	Hole depth:	125.0
Source of depth data:	other reported		
Project number:	PR454300200		
Real time data flag:	Not Reported	Daily flow data begin date:	Not Reported
Daily flow data end date:	Not Reported	Daily flow data count:	Not Reported
Peak flow data begin date:	Not Reported	Peak flow data end date:	Not Reported
Peak flow data count:	Not Reported	Water quality data begin date:	Not Reported
Water quality data end date:	Not Reported	Water quality data count:	Not Reported
Ground water data begin date:	Not Reported	Ground water data end date:	Not Reported
Ground water data count:	Not Reported		

Ground-water levels, Number of Measurements: 0

Map ID Direction Distance Elevation	Database	EDR ID Number
13 **East** **1/2 - 1 Mile** **Higher**	**FED USGS**	**USGS2018368**

Agency cd:	USGS	Site no:	182602066022100
Site name:	READY MIX WELL, SAN JUAN, PR		
Latitude:	182602	EDR Site id:	USGS2018368
Longitude:	0660221	Dec lat:	18.43189083
Dec lon:	-66.03877667	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	72
State:	72	County:	127
Country:	US	Land net:	Not Reported
Location map:	SAN JUAN	Map scale:	20000
Altitude:	7.0		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	3		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Eastern Puerto Rico. Puerto Rico. Area = 1067 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	19450101
Date inventoried:	19610412	Mean greenwich time offset:	AST
Local standard time flag:	N		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	Not Reported	Hole depth:	86.0
Source of depth data:	other reported		
Project number:	PR454300200		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00
Peak flow data count:	0	Water quality data begin date:	0000-00-00
Water quality data end date:	0000-00-00	Water quality data count:	0
Ground water data begin date:	1945-01-01	Ground water data end date:	1945-01-01
Ground water data count:	1		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1945-01-01	4.0	

C14 **SW** **1/2 - 1 Mile** **Higher**	**FED USGS**	**USGS2018398**

Agency cd:	USGS	Site no:	182532066033200
Site name:	BANCO DE PONCE WELL, SAN JUAN, PR		
Latitude:	182532	EDR Site id:	USGS2018398
Longitude:	0660332	Dec lat:	18.42355778
Dec lon:	-66.05849917	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	72
State:	72	County:	127
Country:	US	Land net:	Not Reported
Location map:	SAN JUAN	Map scale:	20000
Altitude:	9.84		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	0		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Eastern Puerto Rico. Puerto Rico. Area = 1067 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	198611
Date inventoried:	19891107	Mean greenwich time offset:	AST
Local standard time flag:	N		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	73.0	Hole depth:	110.0
Source of depth data:	driller		
Project number:	PR454300200		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00
Peak flow data count:	0	Water quality data begin date:	0000-00-00
Water quality data end date:	0000-00-00	Water quality data count:	0
Ground water data begin date:	1989-11-09	Ground water data end date:	1989-11-09
Ground water data count:	1		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1989-11-09	14.57	

C15
SW
1/2 - 1 Mile
Higher

FED USGS **USGS2018407**

Agency cd:	USGS	Site no:	182535066033500
Site name:	COCA-COLA WELL, SAN JUAN, PR		
Latitude:	182535	EDR Site id:	USGS2018407
Longitude:	0660335	Dec lat:	18.4243911
Dec lon:	-66.0593325	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	72
State:	72	County:	127
Country:	US	Land net:	Not Reported
Location map:	SAN JUAN	Map scale:	20000
Altitude:	10.0		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	2.5		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Eastern Puerto Rico. Puerto Rico. Area = 1067 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	19461011
Date inventoried:	19610411	Mean greenwich time offset:	AST

Local standard time flag: N
Type of ground water site: Single well, other than collector or Ranney type
Aquifer Type: Not Reported
Aquifer: Not Reported
Well depth: 168.75 Hole depth: 170.0
Source of depth data: driller
Project number: PR454300200
Real time data flag: 0 Daily flow data begin date: 0000-00-00
Daily flow data end date: 0000-00-00 Daily flow data count: 0
Peak flow data begin date: 0000-00-00 Peak flow data end date: 0000-00-00
Peak flow data count: 0 Water quality data begin date: 0000-00-00
Water quality data end date:0000-00-00 Water quality data count: 0
Ground water data begin date: 1961-04-11 Ground water data end date: 1961-04-11
Ground water data count: 1

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1961-04-11	7.63	

D16
NW
1/2 - 1 Mile
Higher

FED USGS **USGS2018262**

Agency cd: USGS Site no: 182624066033400
Site name: MACHINE SHOP WELL, SAN JUAN, PR
Latitude: 182624 EDR Site id: USGS2018262
Longitude: 0660334 Dec lat: 18.43800167
Dec lon: -66.0590547 Coor meth: M
Coor accr: S Latlong datum: NAD27
Dec latlong datum: NAD83 District: 72
State: 72 County: 127
Country: US Land net: Not Reported
Location map: SAN JUAN Map scale: 20000
Altitude: 16.0
Altitude method: Interpolated from topographic map
Altitude accuracy: 3
Altitude datum: National Geodetic Vertical Datum of 1929
Hydrologic: Eastern Puerto Rico. Puerto Rico. Area = 1067 sq.mi.
Topographic: Not Reported
Site type: Ground-water other than Spring Date construction: 19420114
Date inventoried: 19451128 Mean greenwich time offset: AST
Local standard time flag: N
Type of ground water site: Single well, other than collector or Ranney type
Aquifer Type: Not Reported
Aquifer: Not Reported
Well depth: 121.91 Hole depth: 150.0
Source of depth data: driller
Project number: PR454300200
Real time data flag: 0 Daily flow data begin date: 0000-00-00
Daily flow data end date: 0000-00-00 Daily flow data count: 0
Peak flow data begin date: 0000-00-00 Peak flow data end date: 0000-00-00
Peak flow data count: 0 Water quality data begin date: 0000-00-00
Water quality data end date:0000-00-00 Water quality data count: 0
Ground water data begin date: 1942-01-26 Ground water data end date: 1942-01-26
Ground water data count: 1

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1942-01-26	12.0	

17
SSE
1/2 - 1 Mile
Higher

FED USGS **USGS2018522**

Agency cd:	USGS	Site no:	182520066024000
Site name:	MASTER WELL, SAN JUAN, PR		
Latitude:	182520	EDR Site id:	USGS2018522
Longitude:	0660240	Dec lat:	18.42022472
Dec lon:	-66.0440544	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	72
State:	72	County:	127
Country:	US	Land net:	Not Reported
Location map:	SAN JUAN	Map scale:	20000
Altitude:	7.0		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	2.5		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Eastern Puerto Rico. Puerto Rico. Area = 1067 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	19540101
Date inventoried:	19610407	Mean greenwich time offset:	AST
Local standard time flag:	N		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	70.0	Hole depth:	90.0
Source of depth data:	driller		
Project number:	PR454300200		
Real time data flag:	Not Reported	Daily flow data begin date:	Not Reported
Daily flow data end date:	Not Reported	Daily flow data count:	Not Reported
Peak flow data begin date:	Not Reported	Peak flow data end date:	Not Reported
Peak flow data count:	Not Reported	Water quality data begin date:	Not Reported
Water quality data end date:	Not Reported	Water quality data count:	Not Reported
Ground water data begin date:	Not Reported	Ground water data end date:	Not Reported
Ground water data count:	Not Reported		

Ground-water levels, Number of Measurements: 0

D18
NW
1/2 - 1 Mile
Higher

FED USGS **USGS2018269**

Agency cd:	USGS	Site no:	182626066033800
Site name:	CUADRADO WELL, SAN JUAN, PR		
Latitude:	182626	EDR Site id:	USGS2018269
Longitude:	0660338	Dec lat:	18.43855722
Dec lon:	-66.0601658	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	72
State:	72	County:	127
Country:	US	Land net:	Not Reported
Location map:	SAN JUAN	Map scale:	20000
Altitude:	25.0		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	5		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Eastern Puerto Rico. Puerto Rico. Area = 1067 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	19610101
Date inventoried:	19620303	Mean greenwich time offset:	AST
Local standard time flag:	N		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	165.0	Hole depth:	165.0
Source of depth data:	driller		
Project number:	PR454300200		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00
Peak flow data count:	0	Water quality data begin date:	0000-00-00
Water quality data end date:	0000-00-00	Water quality data count:	0
Ground water data begin date:	1962-04-03	Ground water data end date:	1962-04-03
Ground water data count:	1		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1962-04-03	5.0	

19
SSE
1/2 - 1 Mile
Higher

FED USGS USGS2018497

Agency cd:	USGS	Site no:	182515066024000
Site name:	BYRON WELL, SAN JUAN, PR		
Latitude:	182515	EDR Site id:	USGS2018497
Longitude:	0660240	Dec lat:	18.41883583
Dec lon:	-66.0440544	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	72
State:	72	County:	127
Country:	US	Land net:	Not Reported
Location map:	SAN JUAN	Map scale:	20000
Altitude:	7.0		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	2.5		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Eastern Puerto Rico. Puerto Rico. Area = 1067 sq.mi.		
Topographic:	Hillside (slope)		
Site type:	Ground-water other than Spring	Date construction:	19480101
Date inventoried:	19620404	Mean greenwich time offset:	AST

Local standard time flag:	N		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	60.0	Hole depth:	90.0
Source of depth data:	driller		
Project number:	PR454300200		
Real time data flag:	Not Reported	Daily flow data begin date:	Not Reported
Daily flow data end date:	Not Reported	Daily flow data count:	Not Reported
Peak flow data begin date:	Not Reported	Peak flow data end date:	Not Reported
Peak flow data count:	Not Reported	Water quality data begin date:	Not Reported
Water quality data end date:	Not Reported	Water quality data count:	Not Reported
Ground water data begin date:	Not Reported	Ground water data end date:	Not Reported
Ground water data count:	Not Reported		

Ground-water levels, Number of Measurements: 0

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS
RADON

AREA RADON INFORMATION

Not Reported

PHYSICAL SETTING SOURCE RECORDS SEARCHED

TOPOGRAPHIC INFORMATION

USGS 7.5’ Digital Elevation Model (DEM)
Source: United States Geologic Survey
EDR acquired the USGS 7.5’ Digital Elevation Model in 2002 and updated it in 2006. The 7.5 minute DEM corresponds to the USGS 1:24,000- and 1:25,000-scale topographic quadrangle maps. The DEM provides elevation data with consistent elevation units and projection.

Scanned Digital USGS 7.5’ Topographic Map (DRG)
Source: United States Geologic Survey
A digital raster graphic (DRG) is a scanned image of a U.S. Geological Survey topographic map. The map images are made by scanning published paper maps on high-resolution scanners. The raster image is georeferenced and fit to the Universal Transverse Mercator (UTM) projection.

HYDROLOGIC INFORMATION

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 2003 & 2009 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002 and 2005 from the U.S. Fish and Wildlife Service.

HYDROGEOLOGIC INFORMATION

AQUIFLOW^R Information System
Source: EDR proprietary database of groundwater flow information
EDR has developed the AQUIFLOW Information System (AIS) to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted to regulatory authorities at select sites and has extracted the date of the report, hydrogeologically determined groundwater flow direction and depth to water table information.

GEOLOGIC INFORMATION

Geologic Age and Rock Stratigraphic Unit
Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

STATSGO: State Soil Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Services
The U.S. Department of Agriculture’s (USDA) Natural Resources Conservation Service (NRCS) leads the national Conservation Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps.

SSURGO: Soil Survey Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Services (NRCS)
Telephone: 800-672-5559
SSURGO is the most detailed level of mapping done by the Natural Resources Conservation Services, mapping scales generally range from 1:12,000 to 1:63,360. Field mapping methods using national standards are used to construct the soil maps in the Soil Survey Geographic (SSURGO) database. SSURGO digitizing duplicates the original soil survey maps. This level of mapping is designed for use by landowners, townships and county natural resource planning and management.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

LOCAL / REGIONAL WATER AGENCY RECORDS

FEDERAL WATER WELLS

PWS: Public Water Systems
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PWS ENF: Public Water Systems Violation and Enforcement Data
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SDWIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

USGS Water Wells: USGS National Water Inventory System (NWIS)
This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on wells, springs, and other sources of groundwater.

OTHER STATE DATABASE INFORMATION

RADON

Area Radon Information
Source: USGS
Telephone: 703-356-4020
The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

EPA Radon Zones
Source: EPA
Telephone: 703-356-4020
Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

OTHER

Airport Landing Facilities: Private and public use landing facilities
Source: Federal Aviation Administration, 800-457-6656

Epicenters: World earthquake epicenters, Richter 5 or greater
Source: Department of Commerce, National Oceanic and Atmospheric Administration

STREET AND ADDRESS INFORMATION

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Appendix H6.b

Suelos, Inc., Laboratory Tests and Boring Logs

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SAN JOSE LAGOON
SAN JUAN, PUERTO RICO
(Laboratory Tests & Boring Logs)
(Reference No. 4216)

Suelos, Inc.
Calle Chile 258, San Juan, P.R. 00917-2103 Tel. (787)753-0147 Fax. (787)753-8387

Suelos, Inc.
Soil & Construction Materials Laboratory and Environmental Drilling Services

13 de junio de 2011

ATKINS CARIBE
Westernbank World Plaza
268 Muñoz Rivera Ave., Suite 1602
San Juan, P.R. 00918-1918

Atención : **Ing. Carlos J. Arboleda Osorio**

Referente: **Proyecto Laguna San José**
(Núm. de Ref. 4216)

Estimado ingeniero Arboleda:

Junto con esta carta encontrará los resultados de los laboratorios especializados. Los mismos fueron realizados en muestras no-perturbadas tomadas de los barrenos LSJ23B y LSJ24B. La muestra no-perturbada del barreno LLC-205 resultó ser demasiada arenosa para realizar los laboratorios, es por esta razón que no encontrará resultados de laboratorios para la muestra LLC-205.

En el caso de las muestras LSJ23B y LSJ24B, pudimos realizar dos pruebas de consolidación, una prueba de compresión no consolidada/no drenada (UU) y un set de triaxiales consolidados/no drenados (CIU).

Debido a su suave consistencia y contenido orgánico, no todas las muestras sobrevivieron a la extracción de los tubos shelby, por lo que notará que algunas de las pruebas originalmente contempladas, no pudieron realizarse.

Por último, la factura #25610 adjunta, solo incluye los trabajos y laboratorios que pudieron llevarse a cabo.

Cordialmente,

IVAN JACKSON MADURO, P.E., MSCE
Chief Geotechnical Engineer & Partner

mgn

APPENDIX

SPECIALIZED LABORATORY TESTS
BORING LSJ-24B (UU AND CONSOLIDATION)
BORING LSJ-23B (CIU AND CONSOLIDATION)

Suelos
San Jose Lagoon
LABORATORY TESTING DATA SUMMARY

BORING NO.	SAMPLE NO.	DEPTH (ft)	IDENTIFICATION TESTS				STRENGTH			CONSOLIDATION			REMARKS
			WATER CONTENT (%)	USCS SYMB. (1)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	Type Test @ STRESS (psi)	PEAK SHEAR STRESS (psi)	AXIAL STRAIN @ PEAK STRESS (%)	Method	INITIAL CONDITIONS VOID RATIO (-)	INITIAL CONDITIONS SATURATION (%)	
LSJ-23B		14-16			88.0								
LSJ-23B	A	14.7	167.7	CH-OH	81.9	30.6					Specimen collapsed, no test		
LSJ-23B	B	15.1	172.0	CH-OH	80.8	29.7	CIU@2	0.7	1.2				T3132
LSJ-23B	C	15.5	113.0	CH-OH	88.1	41.4	CIU@4	2.1	4.5				T3133
LSJ-23B	D	15.8	51.1	CH	108.3	98.0				D2435	1.508	98	C11019
LSJ-24B					89.3								
LSJ-24B	A		37.8	CL	115.0	83.5	UC	1.8	15.0				UC143a
LSJ-24B	B		33.7	CL	117.5	87.9				D2435	0.974	96	C11020

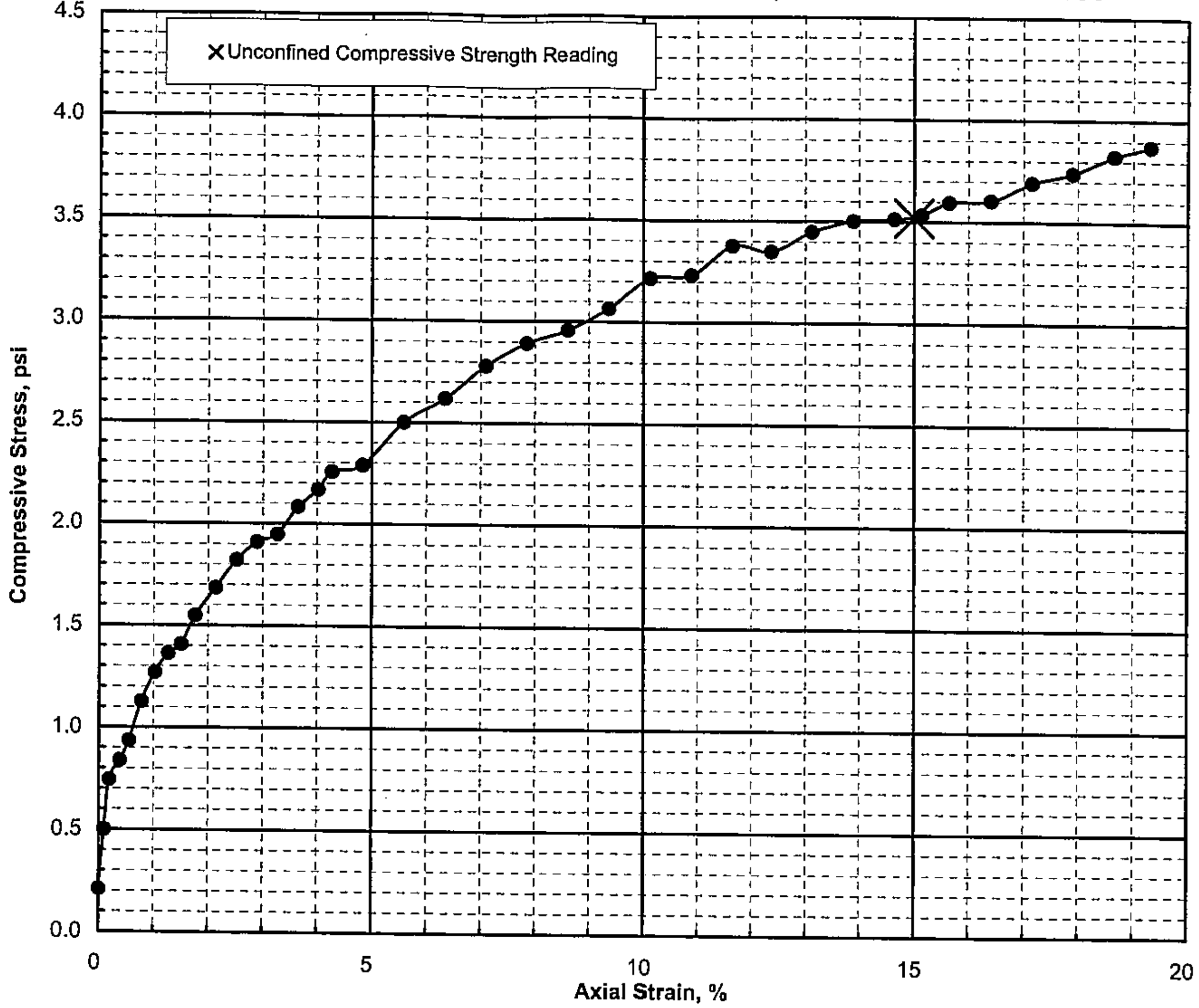
Note: (1) USCS symbol based on visual observation.

Prepared by: JR
Reviewed by: GET
Date: 6/10/2011

TerraSense, LLC
45H Commerce Way
Totowa, NJ 07512

Project No.: 7845-11006
File: Indx1.xls

UNCONFINED COMPRESSIVE STRENGTH TEST, ASTM METHOD D2166



Specimen and Material Property Information

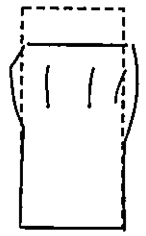
Sample Type: Intact

Description and/or Classification: CL, light gray lean clay

	Water (1) Content (%)	Wet Unit Weight (pcf)	Dry Unit (1) Weight (pcf)	Void(2) Ratio (-)	Saturation(2) (%)	Length (inch)	Diameter (inch)	L/D (-)	LL (-)	PI (-)	Specific (2) Gravity (-)
Initial	37.8	115.0	83.48	1.03	100.0	6.001	2.842	2.1			2.71

Failure Summary

UC Compressive Strength, q_u (psi)	UC Shear Strength, s_u (psi)	Strain to to Peak (%)	Strain Rate (%/min)
3.52	1.76	15.0	0.73



FAILURE SKETCH

Remarks and Notes:

(1) Water Content determined after shear from partial specimen.

(2) Assumed specific gravity

Tested by: DT

Test Date: 5/23/2011

Reviewed by: GET

Review Date: 6/10/2011

Suelos

TerraSense, LLC

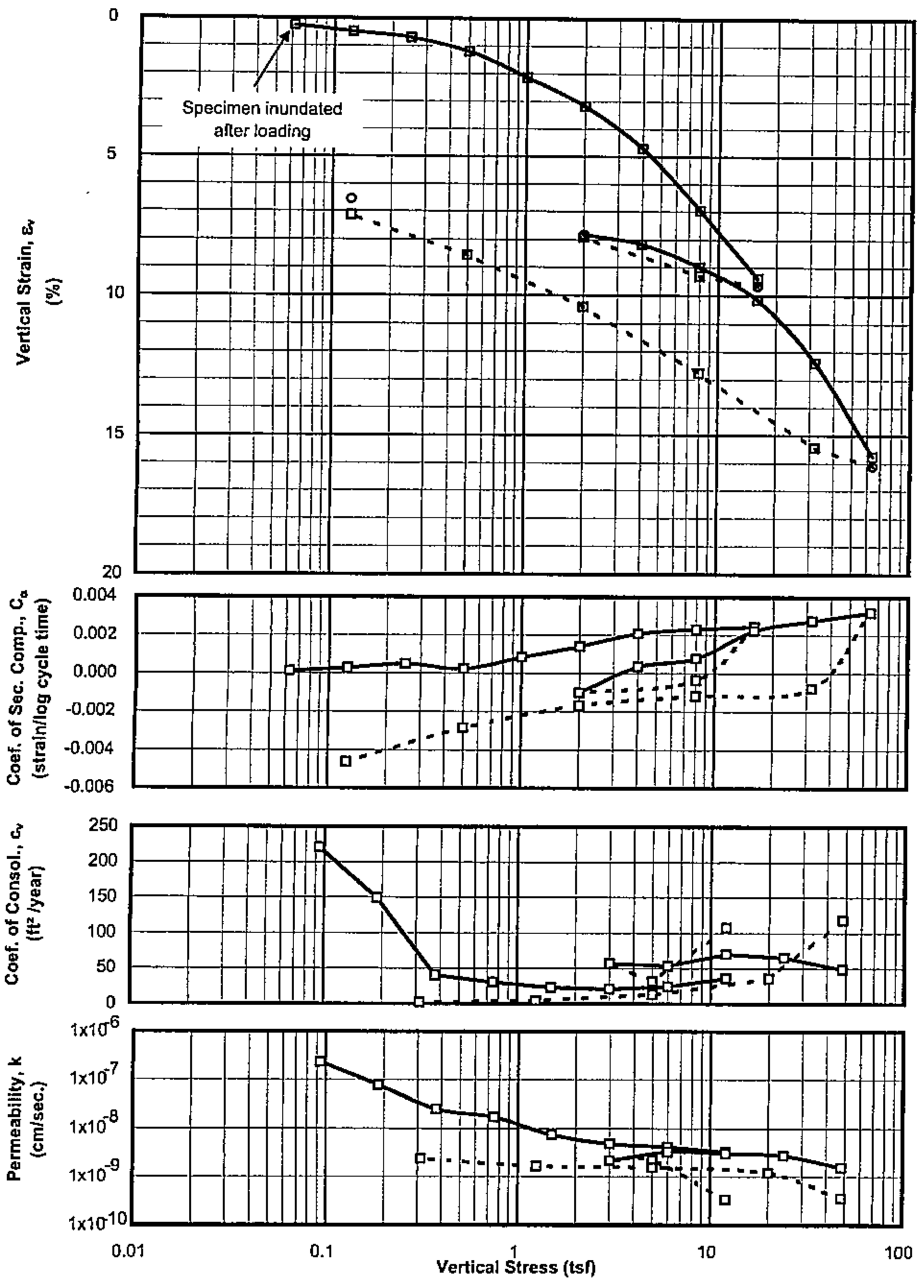
Project # 7845-11006

San Jose Lagoon

UNCONFINED COMPRESSION TEST

Boring: LSJ-24B

Section: A



SAMPLE INFORMATION

Boring:	LSJ-24B
Sample:	B
Depth:	
Elevation:	
Type:	3-inch thin wall tube
Description:	CL, gray lean clay

SPECIMEN INFORMATION

(NOTE: Initial and final states refer to beginning and end of test)

Initial height:	0.62	inch
Diameter:	2.50	inch
Initial water content:	33.7	%
Initial total unit weight:	117.5	pcf
Initial dry unit weight:	87.9	pcf
Initial void ratio:	0.974	
Initial degree of saturation:	96	%
Final water content:	32.0	%
Final total unit weight:	121.0	pcf
Final dry unit weight:	91.6	pcf
Final void ratio:	0.894	
Final degree of saturation:	100	%

(assumed specific gravity = 2.78)

TEST SUMMARY

Construction Method:	Casagrande (Log)
Estimated preconsolidation stress (tsf):	6.4 (Range: 5.2 to 7.9)
Estimated in situ effective overburden stress (tsf):	
Compression Ratio (strain per log cycle stress):	0.106
Compression Index (void ratio per log cycle stress):	0.209
Swell Ratio (strain per log cycle stress):	0.023
Swell Index (void ratio per log cycle stress):	0.045
Recompression Ratio (strain per log cycle stress):	0.025
Recompression Index (void ratio per log cycle stress):	0.049
Remarks:	

LEGEND: ☐ End of primary ○ End of Stage ——— Loading ------- Unloading

Test Date: 5/23/11 Tested By: CMJ Checked By: GET

Suelos	San Jose Lagoon	ONE DIMENSIONAL CONSOLIDATION TEST Boring: LSJ-24B
TerraSense, LLC	Project No. 7845-11006	June 2011

PROJECT: San Jose Lagoon
PROJECT NO.: 7845-11006
BORING: LSJ-24B
SAMPLE: B
TEST: C11020
DEPTH, feet: '
BY: CMJ
TEST DATE: 5/23/2011

Initial height: 0.616 inch
Initial water content: 33.7 %
Initial dry density: 87.9 pcf
Initial total density: 117.5 pcf
Initial saturation: 96 %
Initial void ratio: 0.974

Final height: 0.592 inch
Final water content: 32.0 %
Final dry density: 91.6 pcf
Final total density: 121.0 pcf
Final saturation: 100 %
Final void ratio: 0.894
Final strain: 4.0 %

EQUIPMENT:
Load Frame No.: 2
Ring Diameter: 2.5 inch

SPECIMEN DESCRIPTION: CL, gray lean clay

G	LL	PL	PI
2.78			

Load No.	Load (tsf)	d_{100} (inch)	t_{100} Strain (%)	t_{100} Void Ratio (-)	Final Strain (%)	Final Void Ratio (-)	c_v (ft²/year)	C_α (strain/logt)	Constrained Modulus (tsf)	Permeability (cm/sec)
1	0.063	0.0016	0.264	0.968	0.264	0.968	53.77	0.0001	23.66	6.86E-08
2	0.125	0.0030	0.480	0.964	0.552	0.963	220.57	0.0003	28.91	2.30E-07
3	0.250	0.0043	0.698	0.960	0.771	0.958	149.22	0.0005	57.40	7.84E-08
4	0.500	0.0075	1.209	0.950	1.231	0.949	39.99	0.0002	48.95	2.46E-08
5	1.00	0.0132	2.137	0.931	2.222	0.930	30.19	0.0008	53.88	1.69E-08
6	2.00	0.0196	3.186	0.911	3.401	0.906	23.14	0.0014	95.33	7.32E-09
7	4.00	0.0290	4.711	0.881	4.943	0.876	20.94	0.0021	131.16	4.82E-09
8	8.00	0.0429	6.963	0.836	7.359	0.828	24.57	0.0023	177.63	4.17E-09
9	16.0	0.0579	9.394	0.788	9.667	0.783	35.89	0.0025	329.04	3.29E-09
10	8.00	0.0574	9.313	0.790	9.265	0.791	107.52	-0.0004	9863.57	3.29E-10
11	2.00	0.0488	7.922	0.817	7.818	0.819	31.56	-0.0010	431.31	2.21E-09
12	4.00	0.0504	8.177	0.812	8.240	0.811	56.59	0.0003	783.84	2.18E-09
13	8.00	0.0554	8.993	0.796	9.028	0.795	53.58	0.0008	490.12	3.30E-09
14	16.0	0.0626	10.155	0.773	10.408	0.768	69.82	0.0022	688.38	3.06E-09
15	32.0	0.0764	12.397	0.729	12.686	0.723	65.05	0.0028	713.76	2.75E-09
16	64.0	0.0971	15.753	0.663	16.112	0.656	48.49	0.0032	953.51	1.53E-09
17	32.0	0.0952	15.440	0.669	15.388	0.670	118.58	-0.0008	10236.19	3.49E-10
18	8.00	0.0787	12.767	0.722	12.543	0.726	35.64	-0.0012	897.87	1.20E-09
19	2.00	0.0642	10.419	0.768	10.131	0.774	12.93	-0.0017	255.47	1.53E-09
20	0.500	0.0529	8.575	0.804	8.214	0.812	4.44	-0.0028	81.37	1.65E-09
21	0.125	0.0440	7.143	0.833	6.574	0.844	2.06	-0.0046	26.18	2.38E-09

SUMMARY FOR STATIC CIU' TRIAXIAL TESTS SPECIMENS

Test No	Boring No	Sample Section No	Depth	USCS Group Symbol	w_o	$\gamma_{t,o}$	$\gamma_{d,o}$	$\sigma'_{c,max}$ (psi)	$\sigma'_{v,c}$ (psi)	$\varepsilon_{a,c}$	B factor (%)	at Peak Deviator Stress					
												at Peak Obliquity					
			Elev (ft)	Gs	w_c (%)	$\gamma_{t,c}$ (pcf)	$\gamma_{d,c}$ (pcf)	OCR	$K_c = \frac{\sigma'_{v,c}}{\sigma'_{h,c}}$	$\varepsilon_{v,c}$ (%)	ε_{rate} (%/hr)	ε_a (%)	$\frac{\sigma_1 - \sigma_3}{2}$ (psi)	$\frac{\sigma'_1 + \sigma'_3}{2}$ (psi)	σ'_1 / σ'_3	A factor	ϕ' for c'=0
T3132	LSJ-23B	B	15.1	CH-OH	172.0	80.8	29.7	2.00	2.00	5.0		1.2	0.69	1.93	2.11	0.551	20.8
				(2.65)	133.5	85.1	36.5	1.0	1.00	18.5	1.3	6.9	0.52	1.24	2.43	1.228	24.7
T3133	LSJ-23B	C	15.5	CH-OH	113.0	88.1	41.4	4.00	4.00	9.1		4.5	2.08	4.35	2.83	0.416	28.5
				(2.65)	94.9	91.7	47.1	1.0	1.00	12.1	1.3	7.3	1.96	3.98	2.93	0.505	29.5

Test No	Description of Material Tested and Remarks
T3132	CH-OH, gray organic clay, shell fragments noted
T3133	CH-OH, gray organic clay, shell fragments noted

Strength Envelope Summary

Test Series	Failure Criteria	ϕ' (deg)	c' (psi)	α' (deg)	a' (psi)	Correlation Coefficient
1	1	27.2	0.000	24.6	0.000	--
	2	29.0	0.000	25.9	0.000	--

Failure Criteria: 1 - Peak Deviator Stress
2 - Peak Obliquity

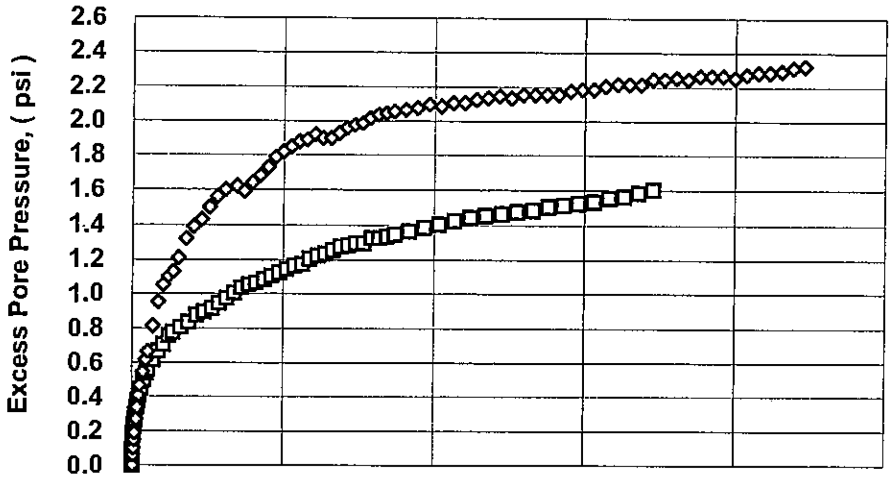
Project No.
7845-11006

San Jose Lagoon
Suelos

TerraSense, LLC

CONSOLIDATED UNDRAINED
TRIAXIAL COMPRESSION
with Pore Pressure Measurements
LSJ-23B SUMMARY

May 2011

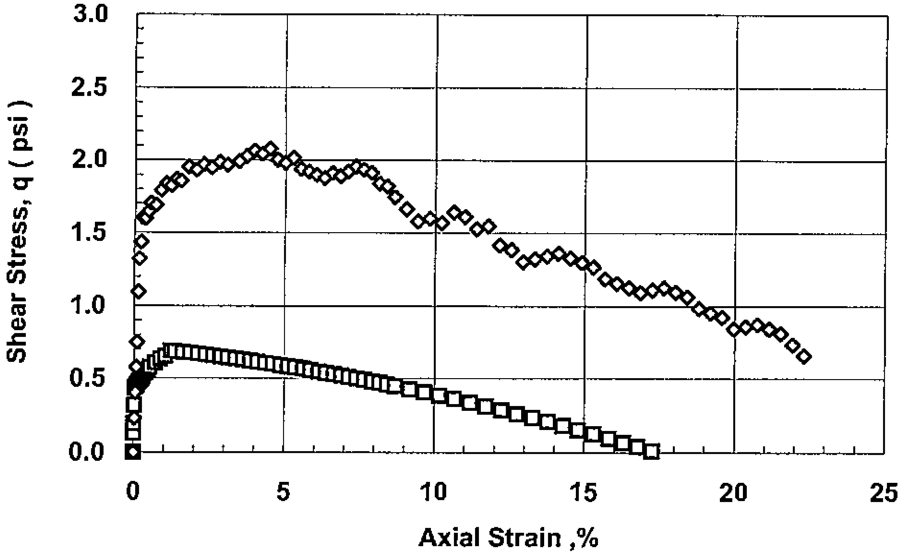


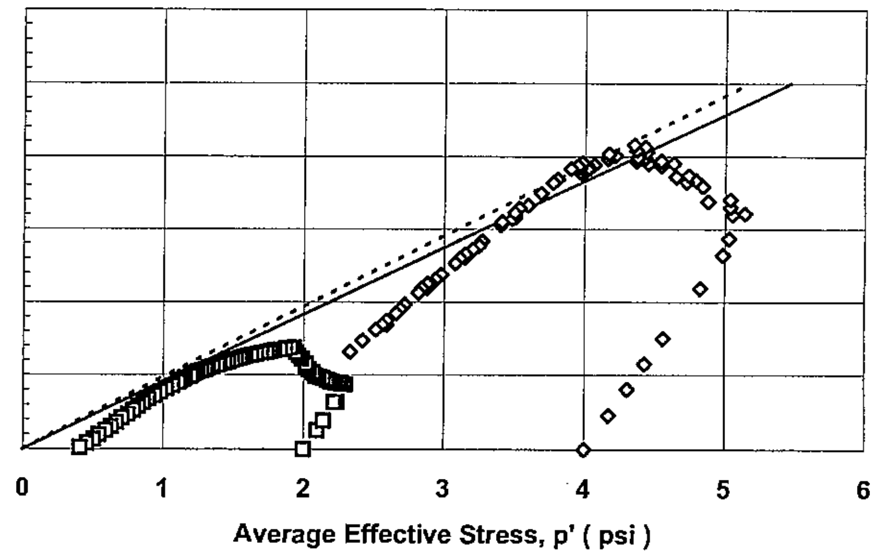
LEGEND AND SUMMARY INFORMATION

Symbol	Test	Boring	Sample	Depth (ft)	w_o (%)	γ_{to} (pcf)	σ'_c (psi)
□	T3132	LSJ-23B	B	15.1	172.0	80.8	2.00
◊	T3133	LSJ-23B	C	15.5	113.0	88.1	4.00

SERIES SUMMARY

Notation	Failure Criteria	c' (psi)	Φ' (degrees)
—	Peak Deviator Stress	0.00	27.2
—	Peak Obliquity	0.00	29.0





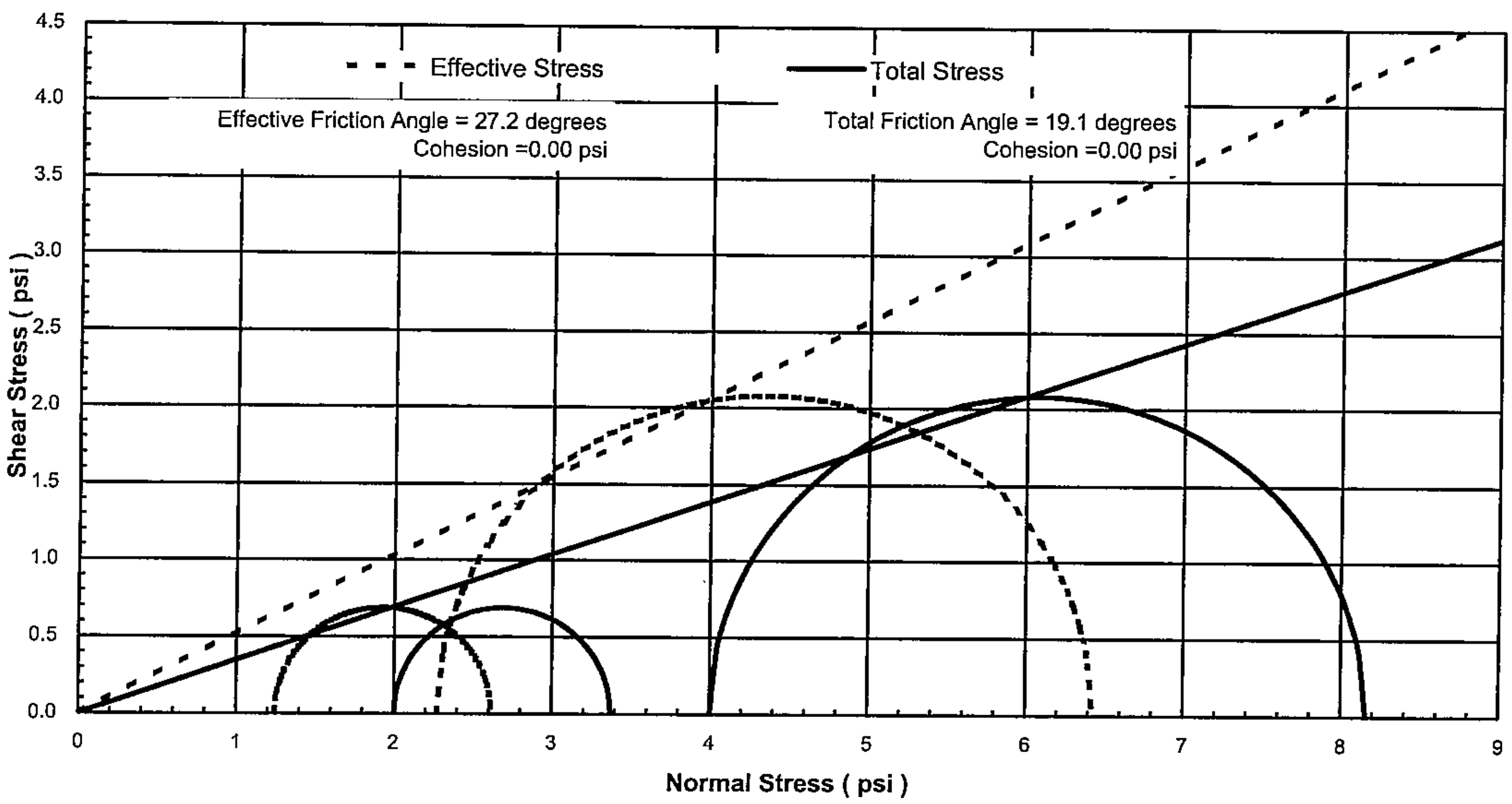
Project No. 7845-11006	**San Jose Lagoon** **Suelos**	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements LSJ-23B SUMMARY	Figure 1
TerraSense, LLC			May 2011

Prepared by: CMJ

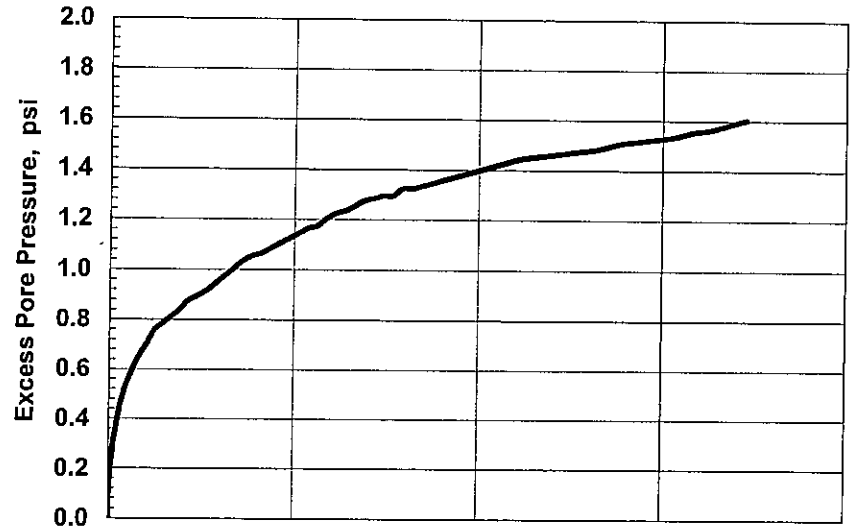
Checked by: G. Thomas

GSI Analysis File: Cu'sum2v4

6/10/2011 Test: Ciusum1.xls



Project No. **7845-11006**	**San Jose Lagoon** **Suelos**	**Mohr Circles of Total and Effective Stresses at Peak** **CIU' Triaxial Test**	**Figure** **2**
TerraSense, LLC		**LSJ-23B SUMMARY**	**May 2011**



SAMPLE INFORMATION

Boring: LSJ-23B Sample: B Depth: 15.1ft

Type: Undisturbed

Description: CH-OH, gray organic clay, shell fragments noted

SPECIMEN INFORMATION (Initial)

Height: 3.96 inch Diameter: 1.94 inch Area: 2.95 in²

Water Content: 172.0 % Total Unit Weight: 80.8 pcf

TEST SUMMARY

Consolidation Stresses: 2.00 psi vertical, 2.00 psi lateral

Water Content: 133.5 % Total Unit Weight: 85.1 pcf

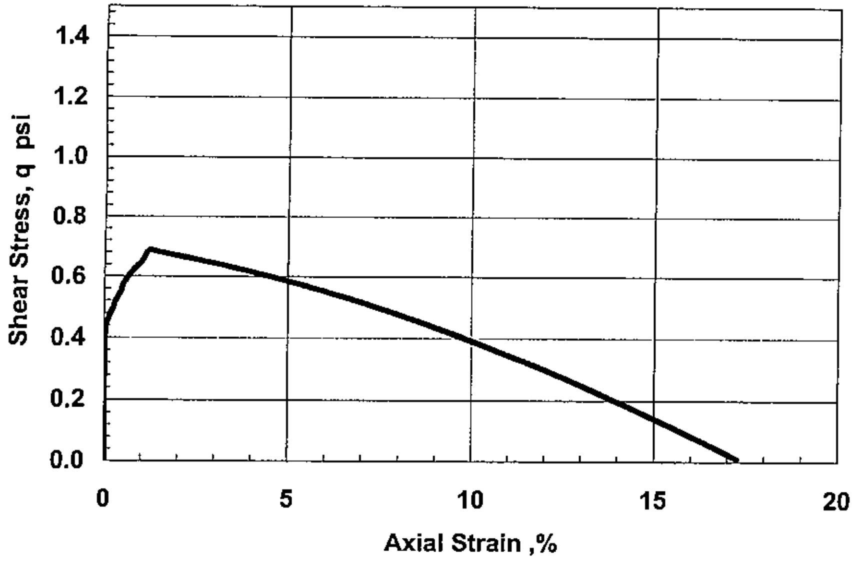
B Coefficient: Strain Rate: 0.021 %/min

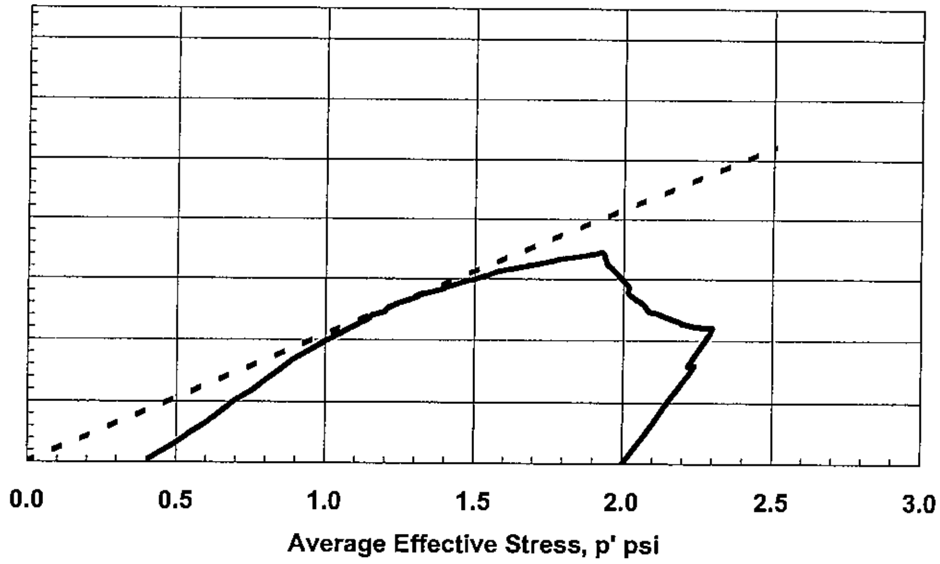
Peak Shear Strength: 0.69 psi @ 1.2 % Strain

Peak Effective Friction Angle: 24.7°

Failure Sketch

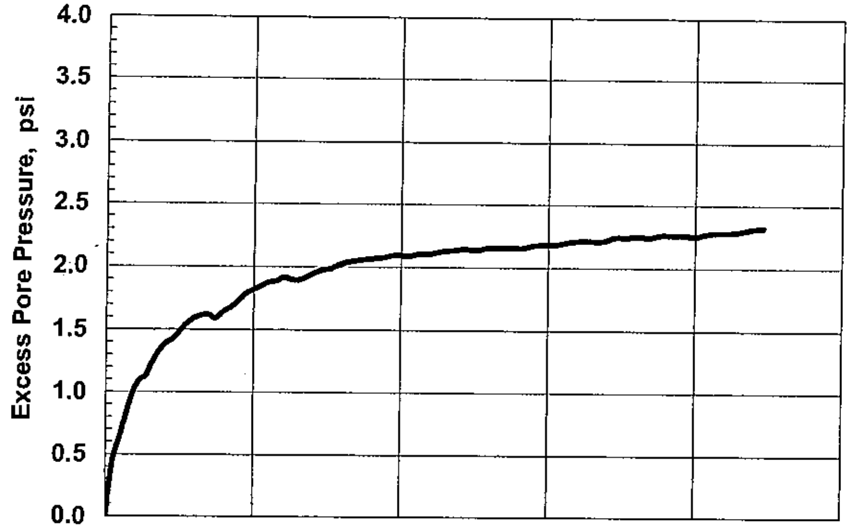
REMARKS:





Test by: DT	Project No. 7845-11006	Suelos San Jose Lagoon	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements Boring: LSJ-23B Sample: B	
Checked by: GET	**TerraSense, LLC**			June-11

Analysis File: CU'v5.xls (2/11) T3132.xls 6/10/2011 Page 1 of 1



SAMPLE INFORMATION

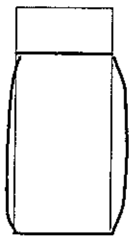
Boring: LSJ-23B Sample: C Depth: 15.5ft
Type: Undisturbed
Description: CH-OH, gray organic clay, shell fragments noted

SPECIMEN INFORMATION (Initial)

Height: 4.02 inch Diameter: 1.91 inch Area: 2.87 in²
Water Content: 113.0 % Total Unit Weight: 88.1 pcf

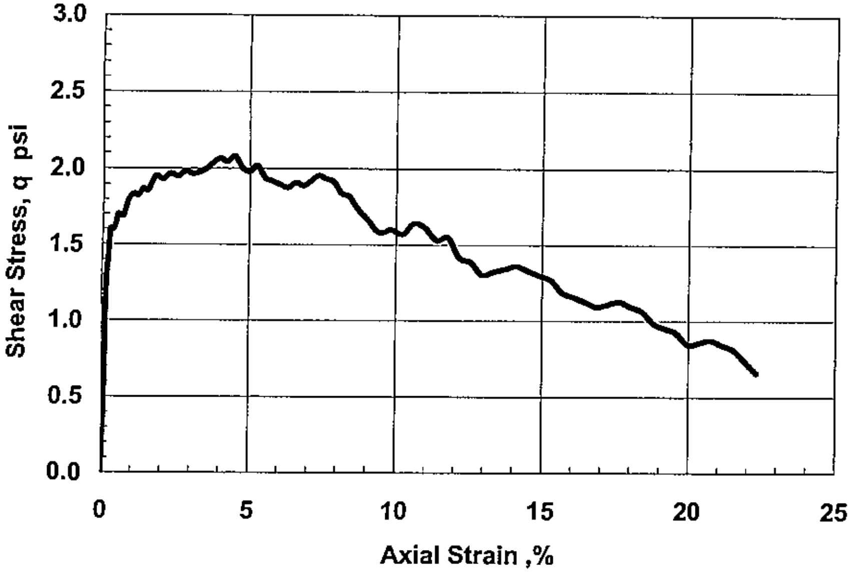
TEST SUMMARY

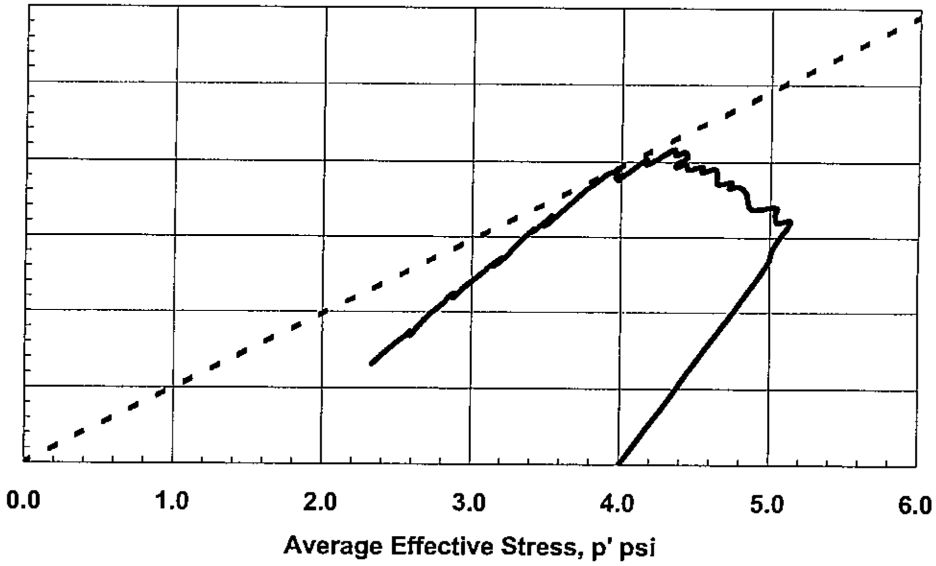
Consolidation Stresses: 4.00 psi vertical, 4.00 psi lateral
Water Content: 94.9 % Total Unit Weight: 91.7 pcf
B Coefficient: Strain Rate: 0.022 %/min
Peak Shear Strength: 2.08 psi @ 4.5 % Strain
Peak Effective Friction Angle: 29.5°



Failure Sketch

REMARKS:





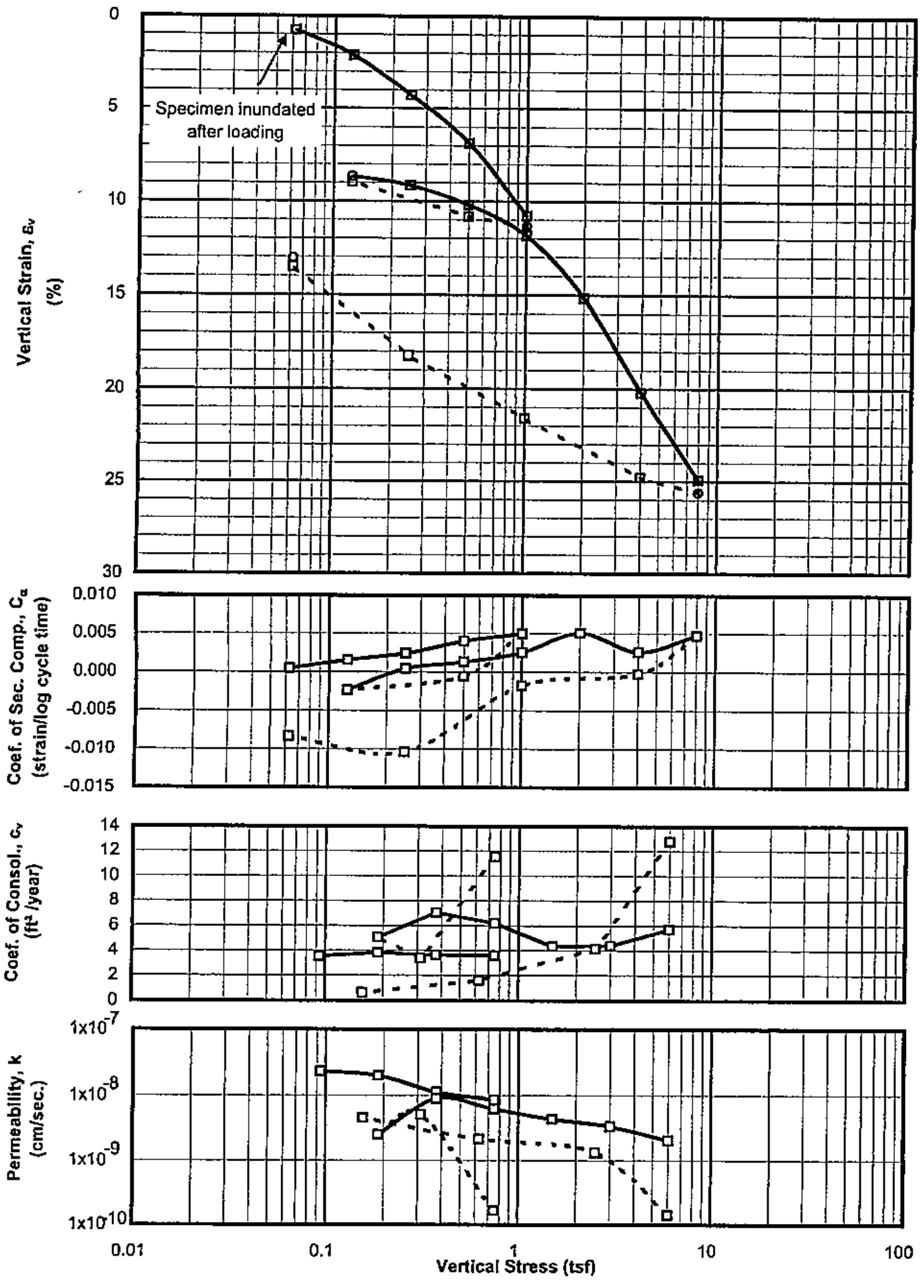
Test by: DT

Checked by: GET

Project No. 7845-11006	Suelos San Jose Lagoon
	TerraSense, LLC

CONSOLIDATED UNDRAINED
TRIAXIAL COMPRESSION
with Pore Pressure Measurements
Boring: LSJ-23B Sample: C

June-11



SAMPLE INFORMATION

Boring: LSJ-23B
Sample: D
Depth: 15.80 feet
Elevation:
Type: 3-inch thin wall tube
Description: CH, light gray fat clay; slightly organic

SPECIMEN INFORMATION

(NOTE: Initial and final states refer to beginning and end of test)

Initial height: 0.61 inch
Diameter: 2.50 inch

Initial water content: 51.1 %
Initial total unit weight: 108.3 pcf
Initial dry unit weight: 71.7 pcf
Initial void ratio: 1.508
Initial degree of saturation: 98 %

Final water content: 44.5 %
Final total unit weight: 113.9 pcf
Final dry unit weight: 78.8 pcf
Final void ratio: 1.281
Final degree of saturation: 100 % (assumed specific gravity = 2.88)

TEST SUMMARY

Construction Method: Casagrande (Log)
Estimated preconsolidation stress (tsf): 0.8 (Range: 0.5 to 0.9)
Estimated in situ effective overburden stress (tsf):
Compression Ratio (strain per log cycle stress): 0.162
Compression Index (void ratio per log cycle stress): 0.406
Swell Ratio (strain per log cycle stress): 0.031
Swell Index (void ratio per log cycle stress): 0.078
Recompression Ratio (strain per log cycle stress): 0.033
Recompression Index (void ratio per log cycle stress): 0.083
Remarks:

LEGEND: ☐ End of primary ○ End of Stage ———— Loading -------- Unloading

Test Date: 5/23/11 Tested By: CMJ Checked By: GET

Suelos	San Jose Lagoon	ONE DIMENSIONAL CONSOLIDATION TEST Boring: LSJ-23B Depth: 15.80 feet
TerraSense, LLC	Project No. 7845-11006	June 2011

PROJECT: San Jose Lagoon
PROJECT NO.: 7845-11006
BORING: LSJ-23B
SAMPLE: D
TEST: C11019
DEPTH, feet: 15.8
BY: CMJ
TEST DATE: 5/23/2011

Initial height: 0.608 inch
Initial water content: 51.1 %
Initial dry density: 71.7 pcf
Initial total density: 108.3 pcf
Initial saturation: 98 %
Initial void ratio: 1.508

Final height: 0.553 inch
Final water content: 44.5 %
Final dry density: 78.8 pcf
Final total density: 113.9 pcf
Final saturation: 100 %
Final void ratio: 1.281
Final strain: 9.1 %

EQUIPMENT:
Load Frame No.: 3
Ring Diameter: 2.5 inch

SPECIMEN DESCRIPTION: CH, light gray fat clay; slightly organic

G	LL	PL	PI
2.88			

Load No.	Load (tsf)	d_{100} (inch)	t_{100} Strain (%)	t_{100} Void Ratio (-)	Final Strain (%)	Final Void Ratio (-)	c_v (ft^2/year)	C_α (strain/logt)	Constrained Modulus (tsf)	Permeability (cm/sec)
1	0.063	0.0047	0.767	1.489	0.814	1.487	14.51	0.0004	8.14	5.37E-08
2	0.125	0.0130	2.135	1.454	2.281	1.451	3.51	0.0015	4.57	2.32E-08
3	0.250	0.0262	4.309	1.400	4.543	1.394	3.82	0.0024	5.75	2.00E-08
4	0.500	0.0418	6.870	1.336	7.333	1.324	3.63	0.0040	9.76	1.12E-08
5	1.00	0.0657	10.805	1.237	11.362	1.223	3.60	0.0050	12.71	8.54E-09
6	0.500	0.0658	10.829	1.236	10.726	1.239	11.54	-0.0006	2109.58	1.65E-10
7	0.125	0.0544	8.949	1.283	8.675	1.290	3.37	-0.0024	19.95	5.10E-09
8	0.250	0.0557	9.153	1.278	9.196	1.277	5.08	0.0004	61.07	2.51E-09
9	0.500	0.0620	10.202	1.252	10.395	1.247	7.05	0.0013	23.84	8.92E-09
10	1.00	0.0721	11.861	1.210	12.219	1.201	6.19	0.0025	30.14	6.20E-09
11	2.00	0.0922	15.163	1.128	15.526	1.118	4.35	0.0050	30.29	4.33E-09
12	4.00	0.1229	20.221	1.001	20.483	0.994	4.39	0.0026	39.54	3.35E-09
13	8.00	0.1517	24.944	0.882	25.632	0.865	5.71	0.0047	84.69	2.03E-09
14	4.00	0.1508	24.798	0.886	24.751	0.887	12.79	-0.0003	2739.03	1.41E-10
15	1.00	0.1314	21.611	0.966	21.393	0.971	4.14	-0.0018	94.12	1.33E-09
16	0.250	0.1108	18.224	1.051	17.793	1.062	1.57	-0.0104	22.14	2.14E-09
17	0.063	0.0823	13.532	1.168	13.078	1.180	0.60185	-0.0083	4.00	4.54E-09

APPENDIX

BORING LOGS LSJ-23B, LLC-205, LSJ-24B

Soil and Construction Materials Laboratory

SUBSURFACE EXPLORATION LOG

PROJECT: SAN JOSE LAGOON, SAN JUAN, P.R.

BORING NO.: LSJ23B
Job No. 4216
Sheet 1 of 1

Spoon : 1.375"I.D. Hammer: 140# Drop : 30"	Driller : M. ALVAREZ Method : AUGER Drill Type: CME-45	Date Started : 05/18/11 Date Completed: 05/18/11 Total Depth : 16	WATER LEVEL: Date : 05/18/11 Depth: 12'	N < 100 = 16 N > 100 = CORE =

Depth ft	Samp No.	Recov %	S.P.T. values	RQD %	Description of material		SPT-N values	Qu TSF	Moist Cont%	Moist Cont - × PL ├──┤ LL N-Values - ○ 25 50 75
5					WATER					
10										
					MUDLINE					▽
					DRILLING WITHOUT SAMPLING	▤				
15					SHELBY TUBE (CH-OH)	▤				
					END OF TEST HOLE - 16 FT					
20										
25										
30										
35										
40										

"N" values are the number of blows required to drive the sampling spoon a distance of twelve inches with a 140 lbs hammer falling 30 inches. Natural Moisture Content (2) is expressed in percentage of its dry weight. Unconfined Compressive Strength (Qu) values are expressed in tons per square foot. *Pocket penetrometer values are marked with an asterisk.

Suelos Inc.

Soil and Construction Materials Laboratory

SUBSURFACE EXPLORATION LOG

PROJECT: SAN JOSE LAGOON, SAN JUAN, P.R.

BORING NO.: LLC205

Job No. 4216

Sheet 1 of 1

Spoon : 1.375"I.D. Hammer: 140# Drop : 30"	Driller : M. ALVAREZ Method : AUGER Drill Type: CME-45	Date Started : 05/17/11 Date Completed: 05/17/11 Total Depth : 22	WATER LEVEL: Date : 05/17/11 Depth: 15'	N < 100 = 22 N > 100 = CORE =

Depth ft	Samp No.	Recov %	S.P.T. values	RQD %	Description of material		SPT-N values	Qu TSF	Moist Cont%	Moist Cont - X PL ├──┤ LL N-Values - O 25 50 75
0–15					WATER					▽ 15
15.5					MUDLINE					
15.5–22					DRILLING WITHOUT SAMPLING SHELBY TUBE SAND	▤				

END OF TEST HOLE - 22 FT

Depth scale: 5, 10, 15, 20, 25, 30, 35, 40

"N" values are the number of blows required to drive the sampling spoon a distance of twelve inches with a 140 lbs hammer falling 30 inches. Natural Moisture Content (2) is expressed in percentage of its dry weight. Unconfined Compressive Strength (Qu) values are expressed in tons per square foot. *Pocket penetrometer values are marked with an asterisk.

Soil and Construction Materials Laboratory

SUBSURFACE EXPLORATION LOG

PROJECT: SAN JOSE LAGOON, SAN JUAN, P.R.

BORING NO.: LSJ24B

Job No. 4216
Sheet 1 of 1

Spoon : 1.375"I.D. Hammer: 140# Drop : 30"	Driller : M. ALVAREZ Method : AUGER Drill Type: CME-45	Date Started : 05/18/11 Date Completed: 05/18/11 Total Depth : 17	WATER LEVEL: Date : 05/18/11 Depth: 10'	N < 100 = 17 N > 100 = CORE =

Depth ft	Samp No.	Recov %	S.P.T. values	RQD %	Description of material		SPT-N values	Qu TSF	Moist Cont%	Moist Cont - X PL ├──┤ LL N-Values - O 25 50 75
5					WATER					
10					MUDLINE					▽
					DRILLING WITHOUT SAMPLING	▤				
15						▤				
					SHELBY TUBE (CL)	▤				
					END OF TEST HOLE - 17 FT					
20										
25										
30										
35										
40										

"N" values are the number of blows required to drive the sampling spoon a distance of twelve inches with a 140 lbs hammer falling 30 inches. Natural Moisture Content (2) is expressed in percentage of its dry weight. Unconfined Compressive Strength (Qu) values are expressed in tons per square foot. *Pocket penetrometer values are marked with an asterisk.

Appendix H6.c

Site Photographs from Field Visits

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Appendix H7

Pertinent Correspondence and Public Involvement

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APPENDIX H-7

H-7 PERTINENT CORRESPONDENC AND PUBLIC INVOLVEMENT

APPENDIX H7.a

NOTICE OF INTENT

with annual renewals; however, no member, unless authorized, by the Secretary of Defense, may serve more than two consecutive terms of service.

The Department, when necessary, and consistent with the Committee's mission and DoD policies/procedures, may establish subcommittees to support the Committee. Establishment of subcommittees will be based upon a written determination, to include terms of reference, by the Secretary of Defense, or the Committee's sponsor.

These Subcommittees shall not work independently of the chartered Committee, and shall report all their recommendations and advice to the Committee for full deliberation and discussion. Subcommittees have no authority to make decisions on behalf of the chartered Committee; nor can any subcommittee or its members update or report directly to the DoD or any Federal officers or employees.

All subcommittee members shall be appointed in the same manner as the Committee members; that is, the Secretary of Defense shall appoint subcommittee members even if the member in question is already a Committee member. Subcommittee members, with the approval of the Secretary of Defense, may serve a term of service on the Subcommittee of one to four years; however, no member shall serve more than two consecutive terms of service on the Subcommittee, unless authorized by the Secretary of Defense.

Subcommittee members, if not full-time or part-time government employees, shall be appointed to serve as experts and consultants under the authority of 5 U.S.C. § 3109, and shall serve as special government employees, whose appointments must be renewed by the Secretary of Defense on an annual basis. With the exception of travel and per diem for official Committee-related travel, Subcommittee members shall serve without compensation.

All subcommittees operate under the provisions of FACA, the Government in the Sunshine Act, governing Federal statutes and regulations, and governing DoD policies/procedures.

FOR FURTHER INFORMATION CONTACT: Jim Freeman, Advisory Committee Management Officer for the Department of Defense, 703–692–5952.

SUPPLEMENTARY INFORMATION: The Committee shall meet at the call of the Committee's Designated Federal Officer, in consultation with Committee's Chairperson. The estimated number of Committee meetings is twenty-six per year.

In addition, the Designated Federal Officer is required to be in attendance at all Committee and subcommittee meetings for the entire duration of each and every meeting; however, in the absence of the Designated Federal Officer, a properly approved Alternate Designated Federal Officer shall attend the entire duration of the Committee or subcommittee meeting.

The Designated Federal Officer, or the Alternate Designated Federal Officer, shall call all of the Committee's and Subcommittee's meetings; prepare and approve all meeting agendas; adjourn any meeting when the Designated Federal Officer, or the Alternate Designated Federal Officer, determines adjournment to be in the public interest or required by governing regulations or DoD policies/procedures; and chair meetings when directed to do so by the official to whom the Committee reports.

Pursuant to 41 CFR §§ 102–3.105(j) and 102–3.140, the public or interested organizations may submit written statements to Department of Defense Wage Committee membership about the Committee's mission and functions. Written statements may be submitted at any time or in response to the stated agenda of planned meeting of Department of Defense Wage Committee.

All written statements shall be submitted to the Designated Federal Officer for the Department of Defense Wage Committee, and this individual will ensure that the written statements are provided to the membership for their consideration. Contact information for the Department of Defense Wage Committee's Designated Federal Officer can be obtained from the GSA's FACA Database—*https://www.fido.gov/facadatabase/public.asp.*

The Designated Federal Officer, pursuant to 41 CFR § 102–3.150, will announce planned meetings of the Department of Defense Wage Committee. The Designated Federal Officer, at that time, may provide additional guidance on the submission of written statements that are in response to the stated agenda for the planned meeting in question.

Dated: November 13, 2012.

Aaron Siegel,

Alternate OSD Federal Register Liaison Officer, Department of Defense.

[FR Doc. 2012–27923 Filed 11–15–12; 8:45 am]

BILLING CODE 5001–06–P

DEPARTMENT OF DEFENSE

Department of the Army, Corps of Engineers

Intent To Prepare a Draft Environmental Impact Statement and Feasibility Report for the Caño Martín Peña Ecosystem Restoration, San Juan, PR

AGENCY: Department of the Army, U.S. Army Corps of Engineers, DoD.

ACTION: Notice of Intent.

SUMMARY: The Jacksonville District, U.S. Army Corps of Engineers (Corps) intends to prepare a Draft Environmental Impact Statement (DEIS) and Feasibility Report (FR) for the ecosystem restoration of the Caño Martín Peña (CMP) within the San Juan Bay National Estuary (SJBE), San Juan, Puerto Rico. The CMP Ecosystem Restoration Project consists of (a) dredging approximately 825,200 cubic yards of sediments and debris in 2.2 miles of the eastern segment of the CMP, from the San José Lagoon westbound to the Enrique Martí Coll Linal Park pedestrian bridge; and, (b) installing sheet piles along north and south of the CMP. Additional features include, among others, a mangrove restoration project along the CMP, formal public spaces for recreation and interaction between the communities, visitors and the CMP identified as water plazas, and a mangrove restoration project at the Suárez Canal. The project is a cooperative effort between the Corps and the non-Federal sponsor Corporación del Proyecto ENLACE del Caño Martín Peña (ENLACE).

ADDRESSES: U.S. Army Corps of Engineers, Jacksonville District, Planning Division, Environmental Branch, P.O. Box 4970, Jacksonville, FL 32232–0019.

FOR FURTHER INFORMATION CONTACT: Wilberto Cubero by email at *martinpena@usace.army.mil* or by telephone at (904) 232–2050.

SUPPLEMENTARY INFORMATION: These DEIS and FR will be prepared under the provisions of the Memorandum for Commander, South Atlantic Division (CESAD–PM) Implementation Guidance for Section 5127 of the Water Resources Development Act of 2007 (WRDA 2007)—Caño Martín Peña, San Juan, Puerto Rico dated October 27, 2008. A Reconnaissance Report completed in June 2004 by the Corps, concluded that there is justification to continue into more detailed investigation and that there was strong Federal interest in proceeding to the feasibility phase.

Background: The CMP is a tidal channel 3.75 miles long in metropolitan San Juan, Puerto Rico and one of eight interconnected bodies of water within the SJBE, the only tropical estuary in the U.S. Environmental Protection Agency (EPA) National Estuary Program (NEP). The SJBE interior coastal lagoons and tidal channels are connected to the Atlantic Ocean at both ends. Extending from east to west through eight densely populated impoverished communities in San Juan, the CMP connects the San Juan Bay with the San José and Los Corozos Lagoons, which are further connected by the Suárez Canal to La Torrecilla Lagoon and the Atlantic Ocean. The drainage area of the CMP comprises about 2,500 acres. Historically, the CMP had an average width of approximately 200 feet and a depth between 6 to 8 feet and provided tidal exchange between San Juan Bay and San José Lagoon. The CMP's ability to convey flows has been almost completely blocked as a result of siltation, accumulation of household and construction debris, and encroachment of housing and other structures, thus affecting the habitat functional value and water quality in both the CMP and San José Lagoon. Water quality has been affected by the lack of sewer systems and proper trash collection in neighboring areas. The study area is the SJBE and the detailed project area is the eastern half of the CMP from the Enrique Martí Coll pedestrian bridge eastward, the San José and Los Corozos Lagoons, and the western half of the Suárez Canal.

Purpose: The purpose of this project is to restore the hydraulic connection and tidal exchange between the San José Lagoon and the San Juan Bay, and thus, in the SJBE. The dredging of 2.2 miles of the CMP will restore and improve habitat functional value and water quality in both the CMP and San José Lagoon, and significantly enhance the fish and wildlife habitats and water quality of the entire SJBE, thus achieving ecological uplift. The tidal restoration will achieve viable, healthy, diverse, and sustainable conditions that are necessary to support life. The project will also improve the quality of life of approximately 26,000 residents along the CMP, addressing health and safety concerns. As ancillary benefits, the project will reduce the risk of flooding, and promote recreation and tourism, with minimal temporary negative impact on the ecosystem and the adjacent communities. It will create new economic development opportunities for the San Juan Metropolitan Area and Puerto Rico, while contributing to the protection of crucial port and airport facilities. The Project responds to one of the most significant ecosystem restoration and environmental justice efforts in Puerto Rico.

Alternatives: The restoration of the CMP will occur within the Public Domain lands associated with the CMP Maritime Terrestrial Zone, as per Commonwealth Law 489 of September 24, 2004. The alternative interventions within the restoration area include no action, rectangular section 100 feet wide x 10 feet deep channel width with earth bottom and sheet piles; hybrid section 100 feet x 10 feet channel width with earth bottom and sheet piles in some areas and slopes in others; rectangular section 75 feet wide x 10 feet deep channel with articulated cement bottom and sheet piles; and hybrid section 75 feet wide x 10 feet deep canal with articulated cement bottom and sheet piles in some areas and slopes in others.

All the alternatives may restore open water resources and improve the wetland and benthic habitat functional value. The Corps will consider other project measures such as in-bay sediment disposal and the relocation of infrastructure.

Issues: The DEIS will consider impacts on benthic communities, protected species, public health and safety, water quality, aesthetics and recreation, fish and wildlife resources, cultural resources, conservation resources, environmental justice, and other impacts identified through scoping, public involvement and interagency coordination.

Scoping: Scoping has been conducted by ENLACE, the non-Federal sponsor and leading local expert, over the past 10 years. ENLACE conducted a scoping meeting and interagency review in 2003, and created varied mechanisms to ensure continued participation of all concerned parties. The scoping process has involved federal, state, and municipal agencies, residents along the CMP, as well as other interested persons and organizations.

Public Involvement: We invite the participation of affected federal, state and local agencies, and other interested private organizations and individuals. There will be a public meeting on the DEIS following its preparation. The exact location, date, and time of the public meeting will be announced in a public notice and local newspapers.

Coordination: The proposed action is being coordinated with the U.S. Fish and Wildlife Service (FWS) [under Section 7 of the Endangered Species Act and the Fish and Wildlife Coordination Act] and with the National Marine Fisheries Service [under Magnuson-Stevens Fishery Conservation and Management Act (on Essential Fish Habitat)] and Section 7 of the Endangered Species Act. The proposed action is also being coordinated with the Puerto Rico State Historic Preservation Office and the U.S. Environmental Protection Agency.

Other Environmental Review and Consultation: The proposed action would involve evaluation for compliance with guidelines pursuant to Section 404(b)(1) of the Clean Water Act, water quality certification (application to the Puerto Rico Environmental Quality Board) pursuant to Section 401 of the Clean Water Act, certification of state lands, easements, and rights-of-way, and determination of Coastal Zone Management Act Consistency.

Agency Role: As the cooperating agency, non-Federal sponsor and leading local expert, ENLACE will provide information and assistance on the resources to be impacted and construction mitigation measures and alternatives. Additionally, other agencies with either regulatory authority or special expertise have been incorporated and are participating in an interagency Technical Dredge Committee coordinated by ENLACE. These agencies may be called upon in preparation of the DEIS.

DEIS Preparation: It is anticipated that the DEIS will be available for public review in the 3rd quarter of 2013.

Dated: November 2, 2012.

Eric P. Summa,

Chief, Environmental Branch.

[FR Doc. 2012–27752 Filed 11–15–12; 8:45 am]

BILLING CODE 3720–58–P

DEPARTMENT OF DEFENSE

Department of the Army, Corps of Engineers

Notice of Intent To Prepare a Draft Environment Impact Statement for the Proposed Prado Basin, California Feasibility Study, City of Corona, Riverside County, CA

AGENCY: Department of the Army, U.S. Army Corps of Engineers, DoD.

ACTION: Notice of Intent.

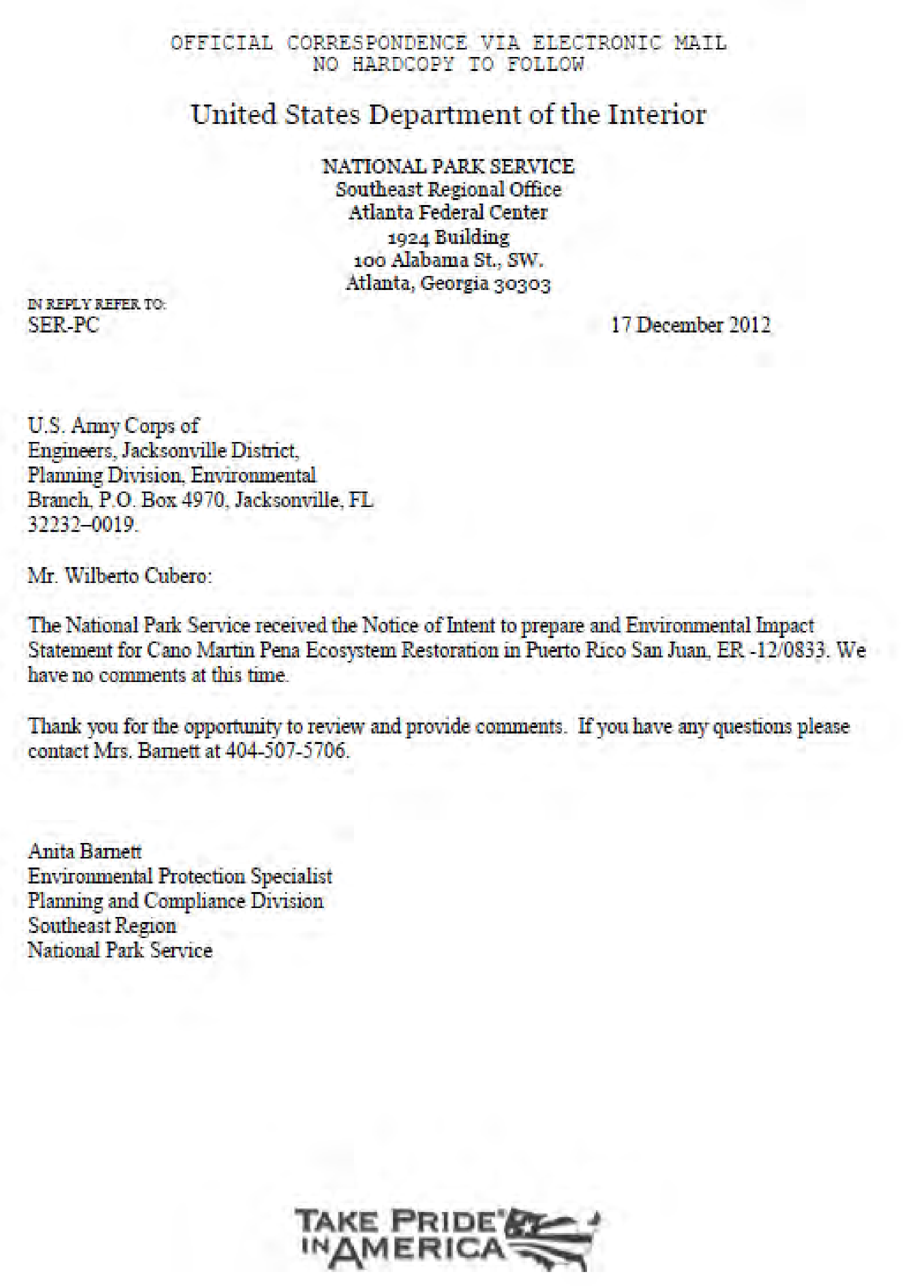
SUMMARY: The Los Angeles District of the U.S. Army Corps of Engineers (Corps) and Orange County Water District (OCWD), the non-Federal sponsor for the project, intend to jointly prepare an Environmental Impact Statement/Environmental Impact Report (EIS/EIR) to study, plan, and implement a multifaceted project to restore

APPENDIX H7.b

NOTICE OF INTENT COMMENTS

NOTICE OF INTENT COMMENTS

NPS



OFFICIAL CORRESPONDENCE VIA ELECTRONIC MAIL
NO HARDCOPY TO FOLLOW

United States Department of the Interior

NATIONAL PARK SERVICE
Southeast Regional Office
Atlanta Federal Center
1924 Building
100 Alabama St., SW.
Atlanta, Georgia 30303

IN REPLY REFER TO:
SER-PC

17 December 2012

U.S. Army Corps of
Engineers, Jacksonville District,
Planning Division, Environmental
Branch, P.O. Box 4970, Jacksonville, FL
32232–0019.

Mr. Wilberto Cubero:

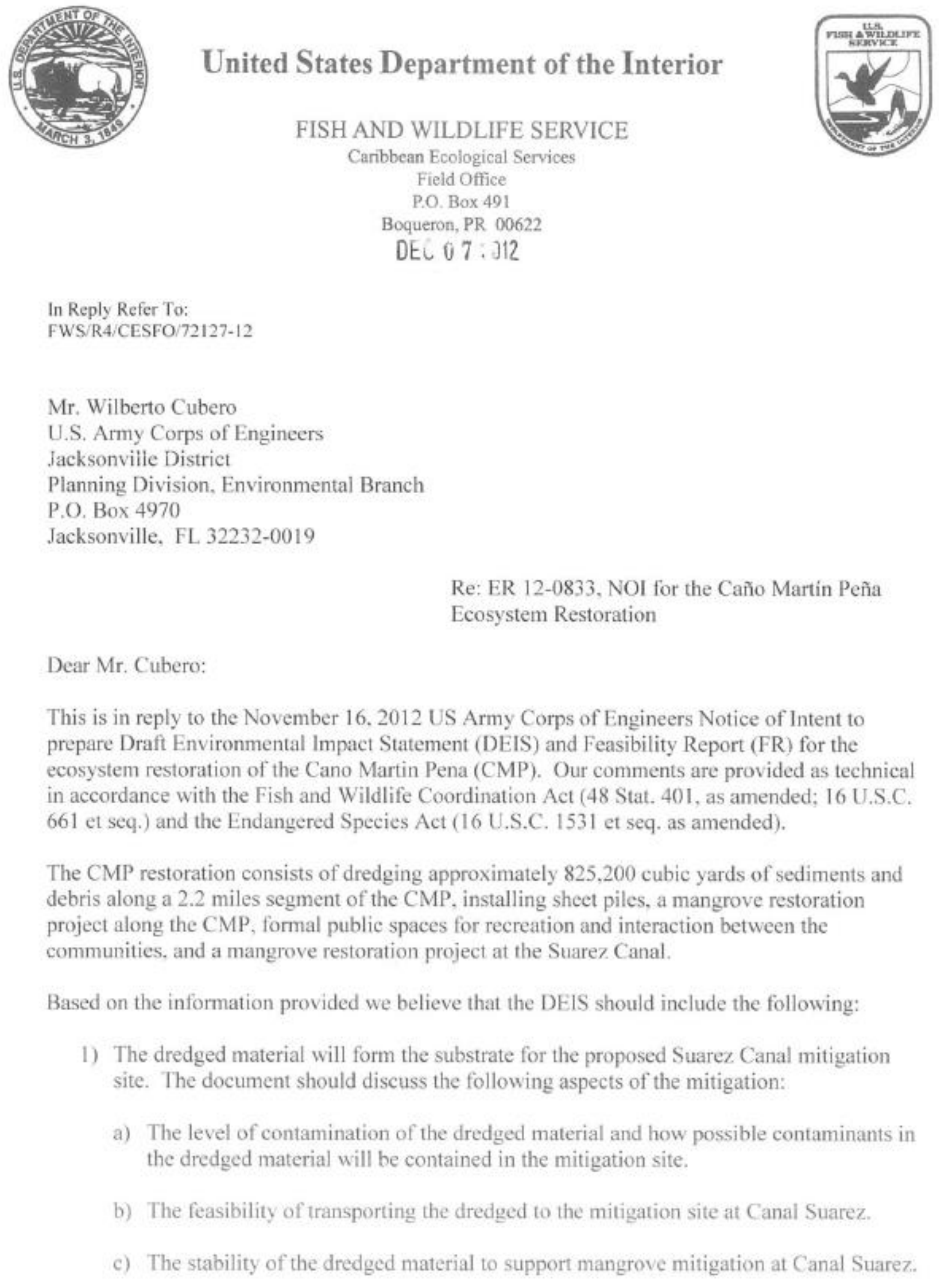
The National Park Service received the Notice of Intent to prepare and Environmental Impact Statement for Cano Martin Pena Ecosystem Restoration in Puerto Rico San Juan, ER -12/0833. We have no comments at this time.

Thank you for the opportunity to review and provide comments. If you have any questions please contact Mrs. Barnett at 404-507-5706.

Anita Barnett
Environmental Protection Specialist
Planning and Compliance Division
Southeast Region
National Park Service

TAKE PRIDE IN AMERICA

FWS



United States Department of the Interior

FISH AND WILDLIFE SERVICE
Caribbean Ecological Services
Field Office
P.O. Box 491
Boqueron, PR 00622

DEC 0 7 2012

In Reply Refer To:
FWS/R4/CESFO/72127-12

Mr. Wilberto Cubero
U.S. Army Corps of Engineers
Jacksonville District
Planning Division, Environmental Branch
P.O. Box 4970
Jacksonville, FL 32232-0019

Re: ER 12-0833, NOI for the Caño Martín Peña
Ecosystem Restoration

Dear Mr. Cubero:

This is in reply to the November 16, 2012 US Army Corps of Engineers Notice of Intent to prepare Draft Environmental Impact Statement (DEIS) and Feasibility Report (FR) for the ecosystem restoration of the Cano Martin Pena (CMP). Our comments are provided as technical in accordance with the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) and the Endangered Species Act (16 U.S.C. 1531 et seq. as amended).

The CMP restoration consists of dredging approximately 825,200 cubic yards of sediments and debris along a 2.2 miles segment of the CMP, installing sheet piles, a mangrove restoration project along the CMP, formal public spaces for recreation and interaction between the communities, and a mangrove restoration project at the Suarez Canal.

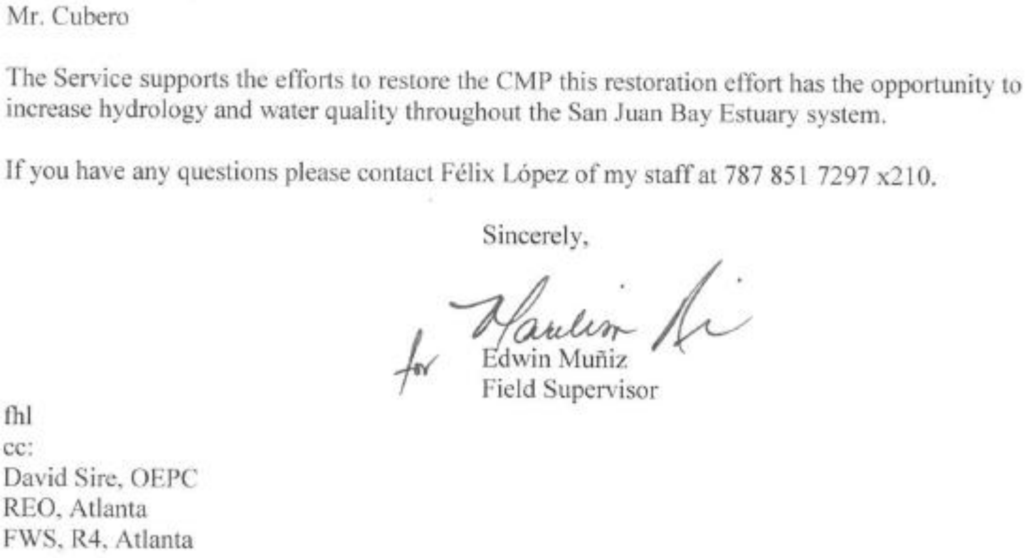
Based on the information provided we believe that the DEIS should include the following:

1) The dredged material will form the substrate for the proposed Suarez Canal mitigation site. The document should discuss the following aspects of the mitigation:

   a) The level of contamination of the dredged material and how possible contaminants in the dredged material will be contained in the mitigation site.

   b) The feasibility of transporting the dredged to the mitigation site at Canal Suarez.

   c) The stability of the dredged material to support mangrove mitigation at Canal Suarez.



Mr. Cubero

The Service supports the efforts to restore the CMP this restoration effort has the opportunity to increase hydrology and water quality throughout the San Juan Bay Estuary system.

If you have any questions please contact Félix López of my staff at 787 851 7297 x210.

Sincerely,

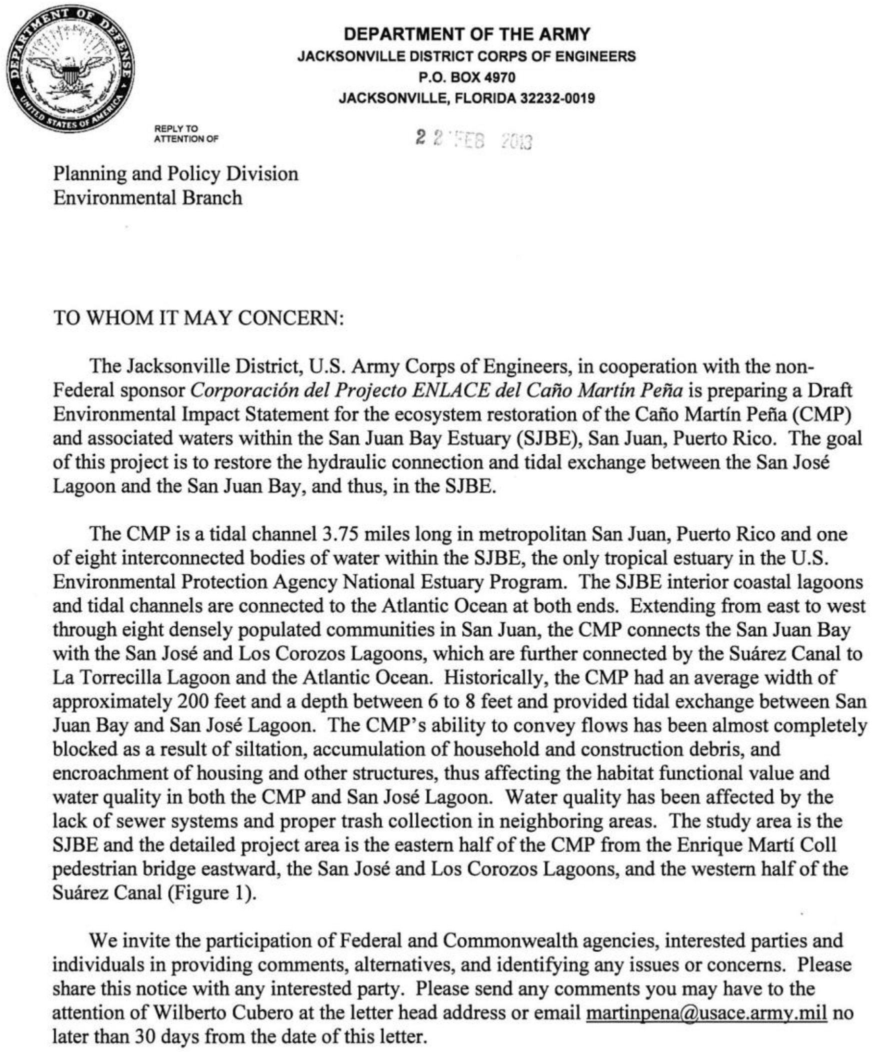
for

Edwin Muñiz
Field Supervisor

fhl
cc:
David Sire, OEPC
REO, Atlanta
FWS, R4, Atlanta

APPENDIX H7.c

SCOPING LETTER AND DISTRIBUTION LIST



DEPARTMENT OF DEFENSE
UNITED STATES OF AMERICA

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P.O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019

REPLY TO
ATTENTION OF

Planning and Policy Division
Environmental Branch

22 FEB 2013

TO WHOM IT MAY CONCERN:

The Jacksonville District, U.S. Army Corps of Engineers, in cooperation with the non-Federal sponsor *Corporación del Projecto ENLACE del Caño Martín Peña* is preparing a Draft Environmental Impact Statement for the ecosystem restoration of the Caño Martín Peña (CMP) and associated waters within the San Juan Bay Estuary (SJBE), San Juan, Puerto Rico. The goal of this project is to restore the hydraulic connection and tidal exchange between the San José Lagoon and the San Juan Bay, and thus, in the SJBE.

The CMP is a tidal channel 3.75 miles long in metropolitan San Juan, Puerto Rico and one of eight interconnected bodies of water within the SJBE, the only tropical estuary in the U.S. Environmental Protection Agency National Estuary Program. The SJBE interior coastal lagoons and tidal channels are connected to the Atlantic Ocean at both ends. Extending from east to west through eight densely populated communities in San Juan, the CMP connects the San Juan Bay with the San José and Los Corozos Lagoons, which are further connected by the Suárez Canal to La Torrecilla Lagoon and the Atlantic Ocean. Historically, the CMP had an average width of approximately 200 feet and a depth between 6 to 8 feet and provided tidal exchange between San Juan Bay and San José Lagoon. The CMP's ability to convey flows has been almost completely blocked as a result of siltation, accumulation of household and construction debris, and encroachment of housing and other structures, thus affecting the habitat functional value and water quality in both the CMP and San José Lagoon. Water quality has been affected by the lack of sewer systems and proper trash collection in neighboring areas. The study area is the SJBE and the detailed project area is the eastern half of the CMP from the Enrique Martí Coll pedestrian bridge eastward, the San José and Los Corozos Lagoons, and the western half of the Suárez Canal (Figure 1).

We invite the participation of Federal and Commonwealth agencies, interested parties and individuals in providing comments, alternatives, and identifying any issues or concerns. Please share this notice with any interested party. Please send any comments you may have to the attention of Wilberto Cubero at the letter head address or email martinpena@usace.army.mil no later than 30 days from the date of this letter.

All individuals providing comments will be included in future mailings. Others may be added to the mailing list by making a written request (postcard) to the same address or email.

Sincerely,

Eric L. Bush
Chief, Planning and Policy Division

Enclosure

Figure 1. Project Location

Caño Martín Peña Ecosystem Restoration Project, San Juan, Puerto Rico
Mailing List

Honorable Alejandro García Padilla
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Resident Commissioner of Puerto Rico
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San Juan, Puerto Rico 00940-2001

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Puerto Rico Federal Affairs Administration
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Mr. Miles Croom
Assistant Regional Administrator
Habitat Conservation Division
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Caribbean Water Science Center
651 Federal Drive, Suite 400-15
Guaynabo, Puerto Rico 00965

Caribbean Fishery Management Council
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CESAJ-DS-RD
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Mr. Jose Rivera
Habitat Conservation Division
National Marine Fisheries Service
Habitat Conservation Division
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Mr. Edwin Almodóvar
State Director
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U.S. Environmental Protection Agency
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Compañía para el Desarrollo de la
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Samuel E.Suleiman
Sociedad Ambiente Marino

Gabriel Lugo
Presidente
Sociedad Ornitológica Puertorriqueña, Inc.

Alberto E. Martí Ruiz
Presidente
Scuba Dogs Society

Francisco (Paco) López
Arrecife Pro Ciudad, Inc.

Luis Jorge Rivera Herrera
Planificador Ambiental
Iniciativa para un Desarrollo Sustentable

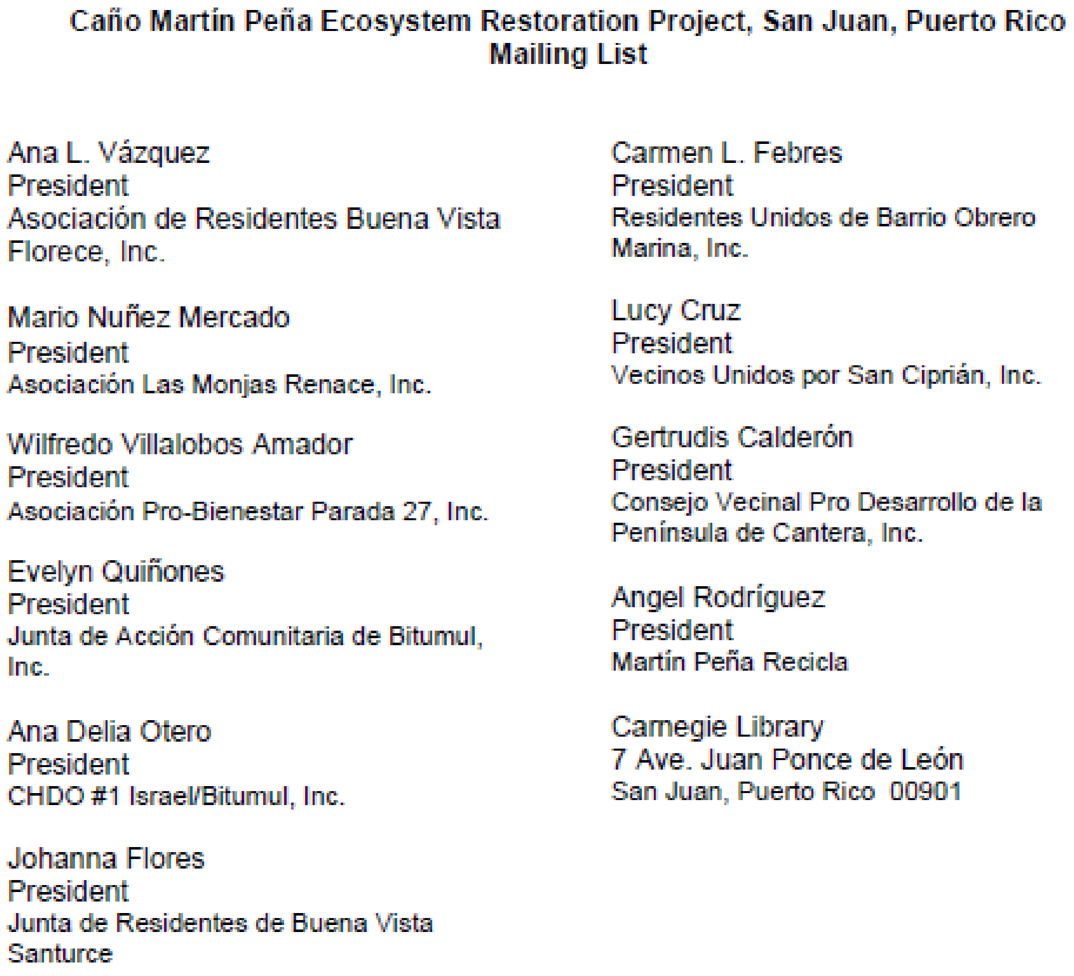
Pablo Calero
Corredor Ecológico de San Juan

Abel Vale
Ciudadanos del Karso

Camilla Feibelman
Sierra Club de Puerto Rico

Orlando L. Negrón
Presidente 2011, Comité Ejecutivo
Sierra Club de Puerto Rico

José L. Alsina
Director de Conservación
Sierra Club de Puerto Rico



Caño Martín Peña Ecosystem Restoration Project, San Juan, Puerto Rico
Mailing List

Ana L. Vázquez
President
Asociación de Residentes Buena Vista
Florece, Inc.

Mario Nuñez Mercado
President
Asociación Las Monjas Renace, Inc.

Wilfredo Villalobos Amador
President
Asociación Pro-Bienestar Parada 27, Inc.

Evelyn Quiñones
President
Junta de Acción Comunitaria de Bitumul,
Inc.

Ana Delia Otero
President
CHDO #1 Israel/Bitumul, Inc.

Johanna Flores
President
Junta de Residentes de Buena Vista
Santurce

Carmen L. Febres
President
Residentes Unidos de Barrio Obrero
Marina, Inc.

Lucy Cruz
President
Vecinos Unidos por San Ciprián, Inc.

Gertrudis Calderón
President
Consejo Vecinal Pro Desarrollo de la
Península de Cantera, Inc.

Angel Rodríguez
President
Martín Peña Recicla

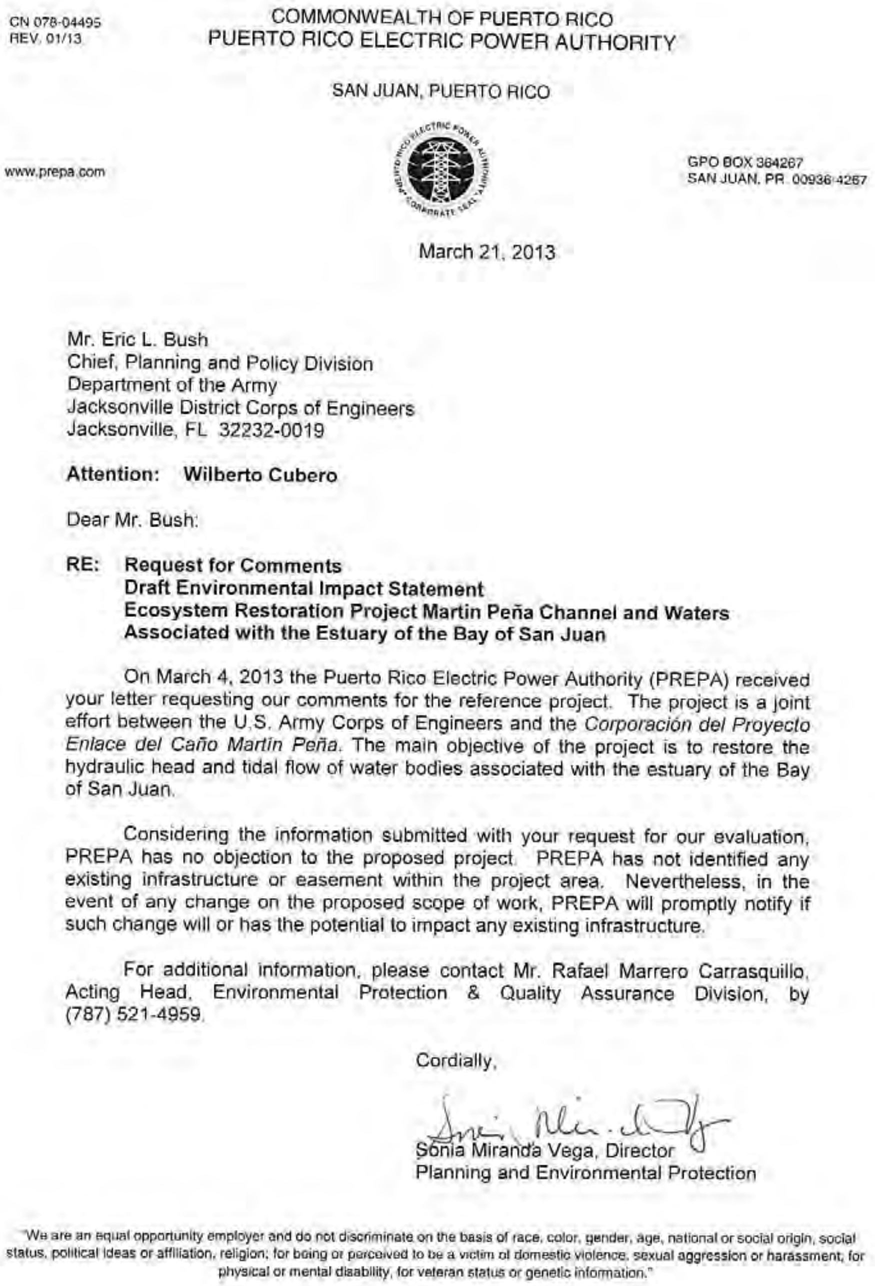
Carnegie Library
7 Ave. Juan Ponce de León
San Juan, Puerto Rico 00901

APPENDIX H7.d

SCOPING COMMENTS

COMMONWEALTH GOVERNMENT

PREPA-1



CN 078-04495
REV. 01/13

COMMONWEALTH OF PUERTO RICO
PUERTO RICO ELECTRIC POWER AUTHORITY

SAN JUAN, PUERTO RICO

www.prepa.com

GPO BOX 364267
SAN JUAN, PR 00936-4267

March 21, 2013

Mr. Eric L. Bush
Chief, Planning and Policy Division
Department of the Army
Jacksonville District Corps of Engineers
Jacksonville, FL 32232-0019

Attention: Wilberto Cubero

Dear Mr. Bush:

RE: Request for Comments
Draft Environmental Impact Statement
Ecosystem Restoration Project Martin Peña Channel and Waters
Associated with the Estuary of the Bay of San Juan

On March 4, 2013 the Puerto Rico Electric Power Authority (PREPA) received your letter requesting our comments for the reference project. The project is a joint effort between the U.S. Army Corps of Engineers and the *Corporación del Proyecto Enlace del Caño Martin Peña*. The main objective of the project is to restore the hydraulic head and tidal flow of water bodies associated with the estuary of the Bay of San Juan.

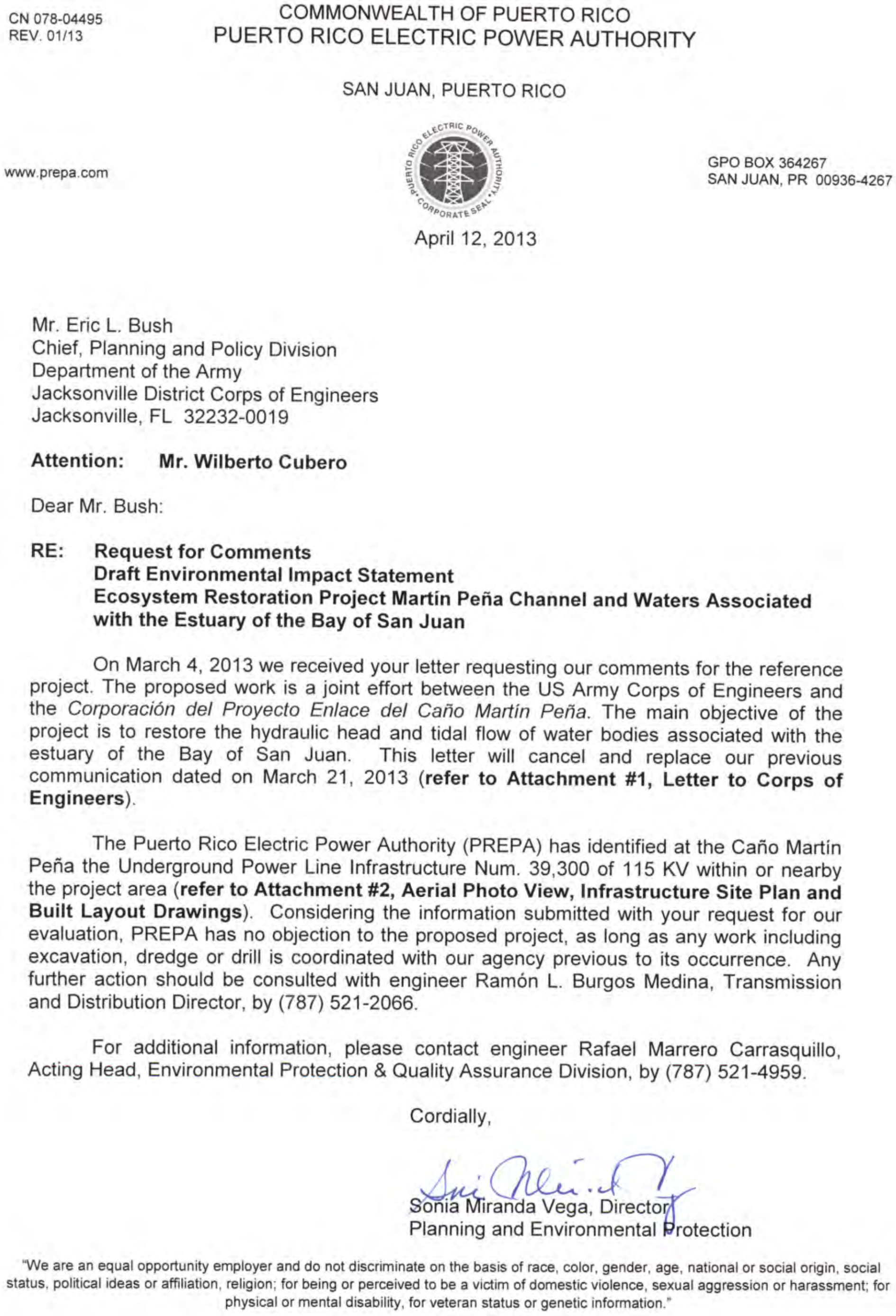
Considering the information submitted with your request for our evaluation, PREPA has no objection to the proposed project. PREPA has not identified any existing infrastructure or easement within the project area. Nevertheless, in the event of any change on the proposed scope of work, PREPA will promptly notify if such change will or has the potential to impact any existing infrastructure.

For additional information, please contact Mr. Rafael Marrero Carrasquillo, Acting Head, Environmental Protection & Quality Assurance Division, by (787) 521-4959.

Cordially,

Sonia Miranda Vega, Director
Planning and Environmental Protection

PREPA-2



CN 078-04495
REV. 01/13

COMMONWEALTH OF PUERTO RICO
PUERTO RICO ELECTRIC POWER AUTHORITY

SAN JUAN, PUERTO RICO

www.prepa.com

GPO BOX 364267
SAN JUAN, PR 00936-4267

April 12, 2013

Mr. Eric L. Bush
Chief, Planning and Policy Division
Department of the Army
Jacksonville District Corps of Engineers
Jacksonville, FL 32232-0019

Attention: Mr. Wilberto Cubero

Dear Mr. Bush:

RE: Request for Comments
Draft Environmental Impact Statement
Ecosystem Restoration Project Martín Peña Channel and Waters Associated with the Estuary of the Bay of San Juan

On March 4, 2013 we received your letter requesting our comments for the reference project. The proposed work is a joint effort between the US Army Corps of Engineers and the *Corporación del Proyecto Enlace del Caño Martín Peña*. The main objective of the project is to restore the hydraulic head and tidal flow of water bodies associated with the estuary of the Bay of San Juan. This letter will cancel and replace our previous communication dated on March 21, 2013 (**refer to Attachment #1, Letter to Corps of Engineers**).

The Puerto Rico Electric Power Authority (PREPA) has identified at the Caño Martín Peña the Underground Power Line Infrastructure Num. 39,300 of 115 KV within or nearby the project area (**refer to Attachment #2, Aerial Photo View, Infrastructure Site Plan and Built Layout Drawings**). Considering the information submitted with your request for our evaluation, PREPA has no objection to the proposed project, as long as any work including excavation, dredge or drill is coordinated with our agency previous to its occurrence. Any further action should be consulted with engineer Ramón L. Burgos Medina, Transmission and Distribution Director, by (787) 521-2066.

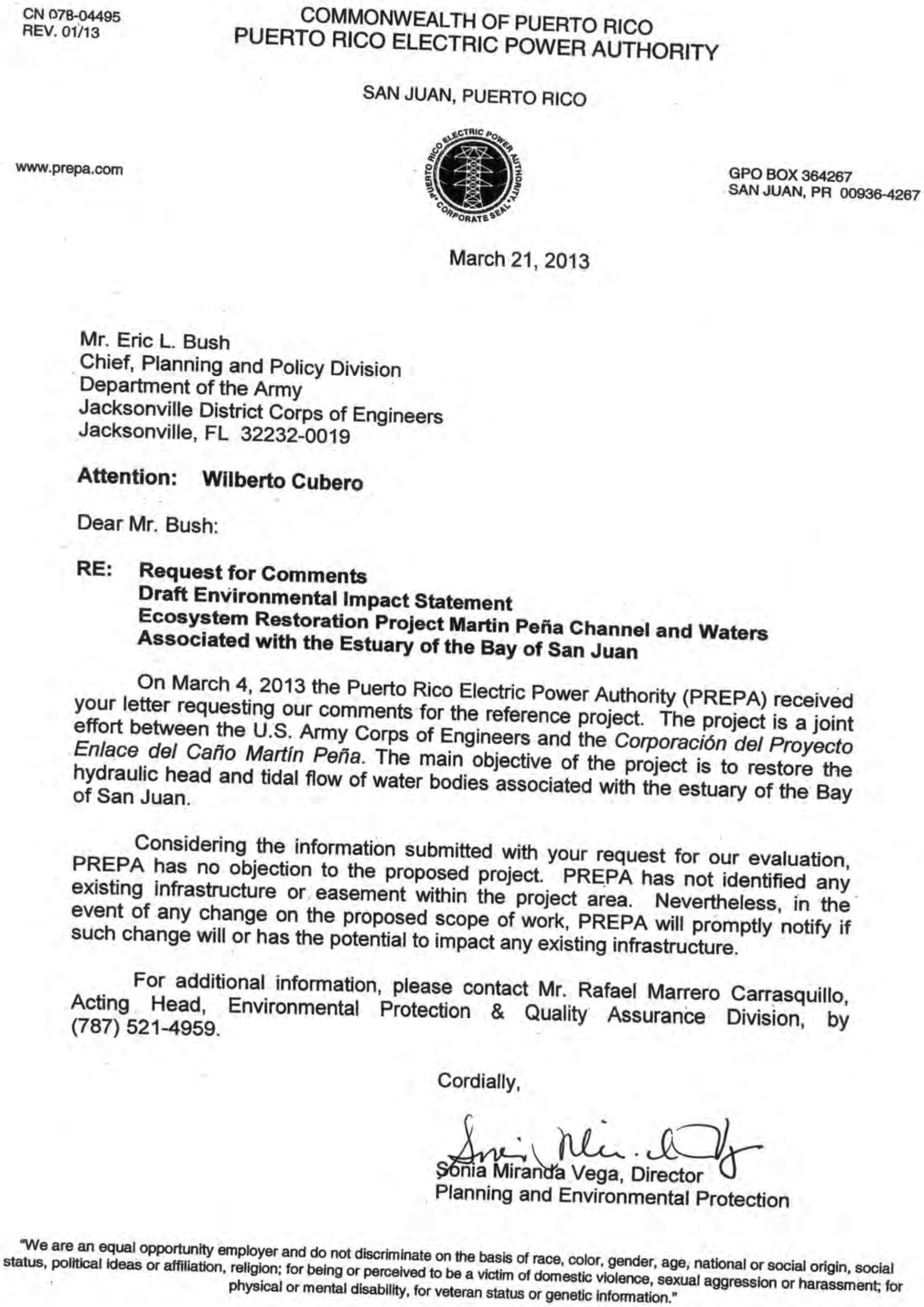
For additional information, please contact engineer Rafael Marrero Carrasquillo, Acting Head, Environmental Protection & Quality Assurance Division, by (787) 521-4959.

Cordially,

Sonia Miranda Vega, Director
Planning and Environmental Protection

Attachment #1

Letter to Corps of Engineers



CN 078-04495
REV. 01/13

COMMONWEALTH OF PUERTO RICO
PUERTO RICO ELECTRIC POWER AUTHORITY

SAN JUAN, PUERTO RICO

www.prepa.com

GPO BOX 364267
SAN JUAN, PR 00936-4267

March 21, 2013

Mr. Eric L. Bush
Chief, Planning and Policy Division
Department of the Army
Jacksonville District Corps of Engineers
Jacksonville, FL 32232-0019

Attention: Wilberto Cubero

Dear Mr. Bush:

RE: Request for Comments
Draft Environmental Impact Statement
Ecosystem Restoration Project Martin Peña Channel and Waters Associated with the Estuary of the Bay of San Juan

On March 4, 2013 the Puerto Rico Electric Power Authority (PREPA) received your letter requesting our comments for the reference project. The project is a joint effort between the U.S. Army Corps of Engineers and the *Corporación del Proyecto Enlace del Caño Martín Peña*. The main objective of the project is to restore the hydraulic head and tidal flow of water bodies associated with the estuary of the Bay of San Juan.

Considering the information submitted with your request for our evaluation, PREPA has no objection to the proposed project. PREPA has not identified any existing infrastructure or easement within the project area. Nevertheless, in the event of any change on the proposed scope of work, PREPA will promptly notify if such change will or has the potential to impact any existing infrastructure.

For additional information, please contact Mr. Rafael Marrero Carrasquillo, Acting Head, Environmental Protection & Quality Assurance Division, by (787) 521-4959.

Cordially,

Sonia Miranda Vega, Director
Planning and Environmental Protection

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Attachment #2

Aerial Photo View, Infrastructure Site Plan & Built Layout Drawing

TODOS LOS ALIMENTADORES (13 KV, 4 KV) Y LINEAS DE TRANSMISION 38 KV
VAN EN TUBERIAS POR LOS DOS PUENTES.
LINEA 39300 A 115 KV PASA POR EL CAÑO EN DIRECTIONAL DRILL, ADJUNTO PLANO EN PDF.

Alimentadores
1111-01,02 a 13KV
1113-02 a 4KV

Linea 39300
115 KV

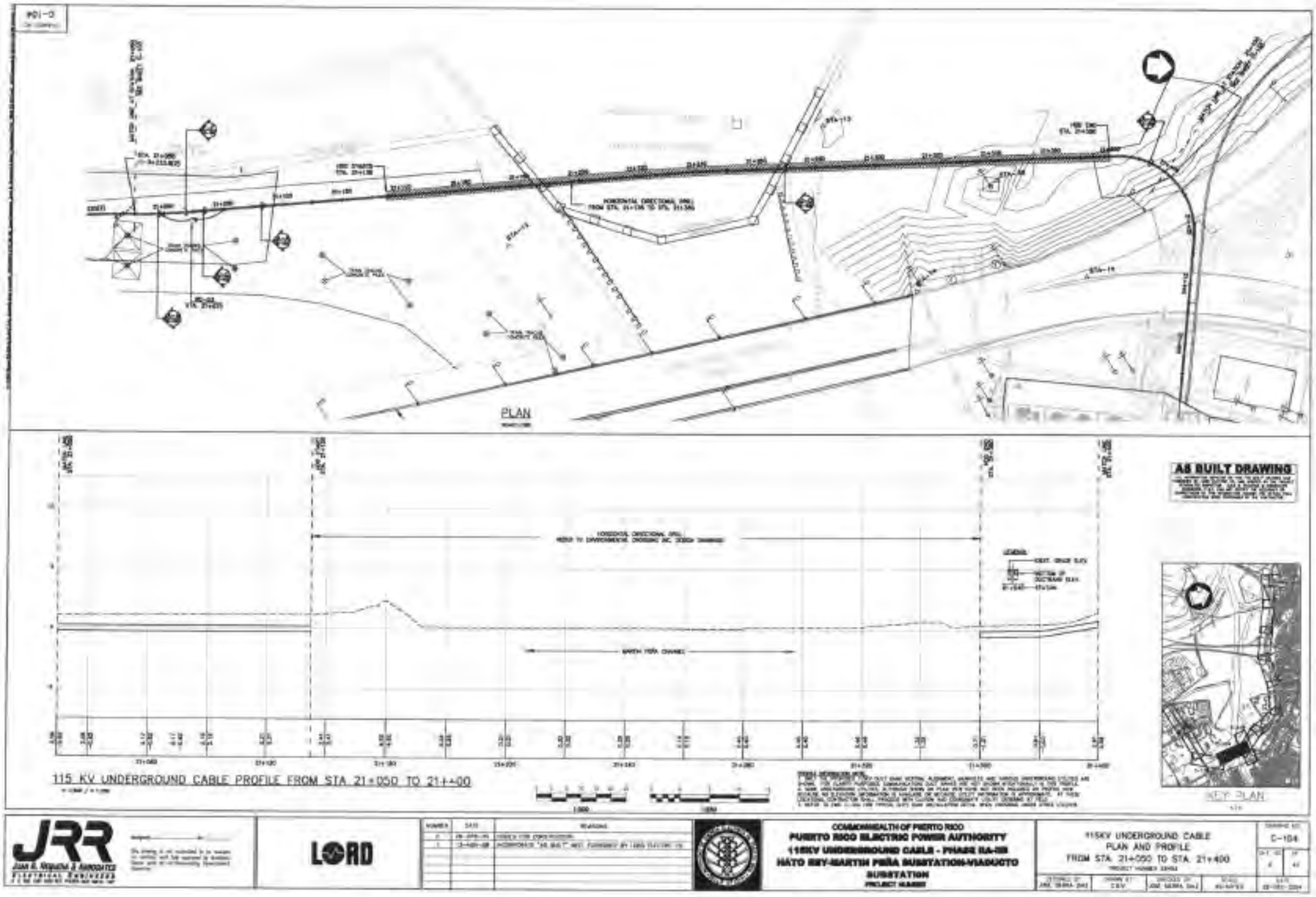
Lineas a 38KV
3300, 17100

Alimentador
1112-04 a 13KV

Linea 3600
a 38KV

Alimentador
1404-07 a 13KV

TODOS LOS ALIMENTADORES (13 KV, 4 KV) Y LINEAS DE TRANSMISION 38 KV
VAN EN TUBERIAS POR LOS DOS PUENTES.
LINEA 39300 A 115 KV PASA POR EL CAÑO EN DIRECTIONAL DRILL, ADJUNTO PLANO EN PDF.


PLAN
AS BUILT DRAWING
HORIZONTAL DIRECTIONAL DRILL
MARTIN PEÑA CHANNEL
115 KV UNDERGROUND CABLE PROFILE FROM STA 21+050 TO 21++00
KEY PLAN
LORD
COMMONWEALTH OF PUERTO RICO
PUERTO RICO ELECTRIC POWER AUTHORITY
115KV UNDERGROUND CABLE - PHASE IIA-IIB
HATO REY-MARTIN PEÑA SUBSTATION-VIADUCTO
SUBSTATION
PROJECT NUMBER
115KV UNDERGROUND CABLE
PLAN AND PROFILE
FROM STA. 21+050 TO STA. 21+400
C-104

State Historic Preservation Office (SHPO)

OFICINA ESTATAL DE
CONSERVACIÓN HISTÓRICA

STATE HISTORIC
PRESERVATION OFFICE

SHPO
OECH

March 27, 2013

Eric L. Bush
Planning and Policy Division
Environmental Branch
U. S. Army Corps of Engineers
P.O. Box 4970
Jacksonville, FL 32232-0019

SHPO 03-01-13-02 ECOSYSTEM RESTORATION OF THE CAÑO MARTIN PEÑA AND ASSOCIATED WATERS WITHIN THE SAN JUAN BAY ESTUARY, SAN JUAN, PUERTO RICO

Dear Mr. Bush:

We acknowledge receipt of your request for comments, alternatives, issues or concerns in the preparation of a draft Environmental Impact Statement for the ecosystem restoration of the Caño Martin Peña and associated waters. Within the past twenty years, several reconnaissance level surveys have been carried out to identify potential historic properties within the Caño Martin Peña area. Considering the passage of time since these surveys were undertaken, as well as possible changes that may occur on how to implement the restoration of the tidal channel, previous studies should be reevaluated within the context of the current restoration strategy. The accumulation of household and construction debris within the channel, starting in the early twentieth may be considered an archaeological site. Also, in 2008, the Martin Peña Bridge was listed in the National Register of Historic Places.

If you have any questions, please contact Miguel Bonini at (787) 721-3737 or mbonini@prshpo.gobierno.pr.

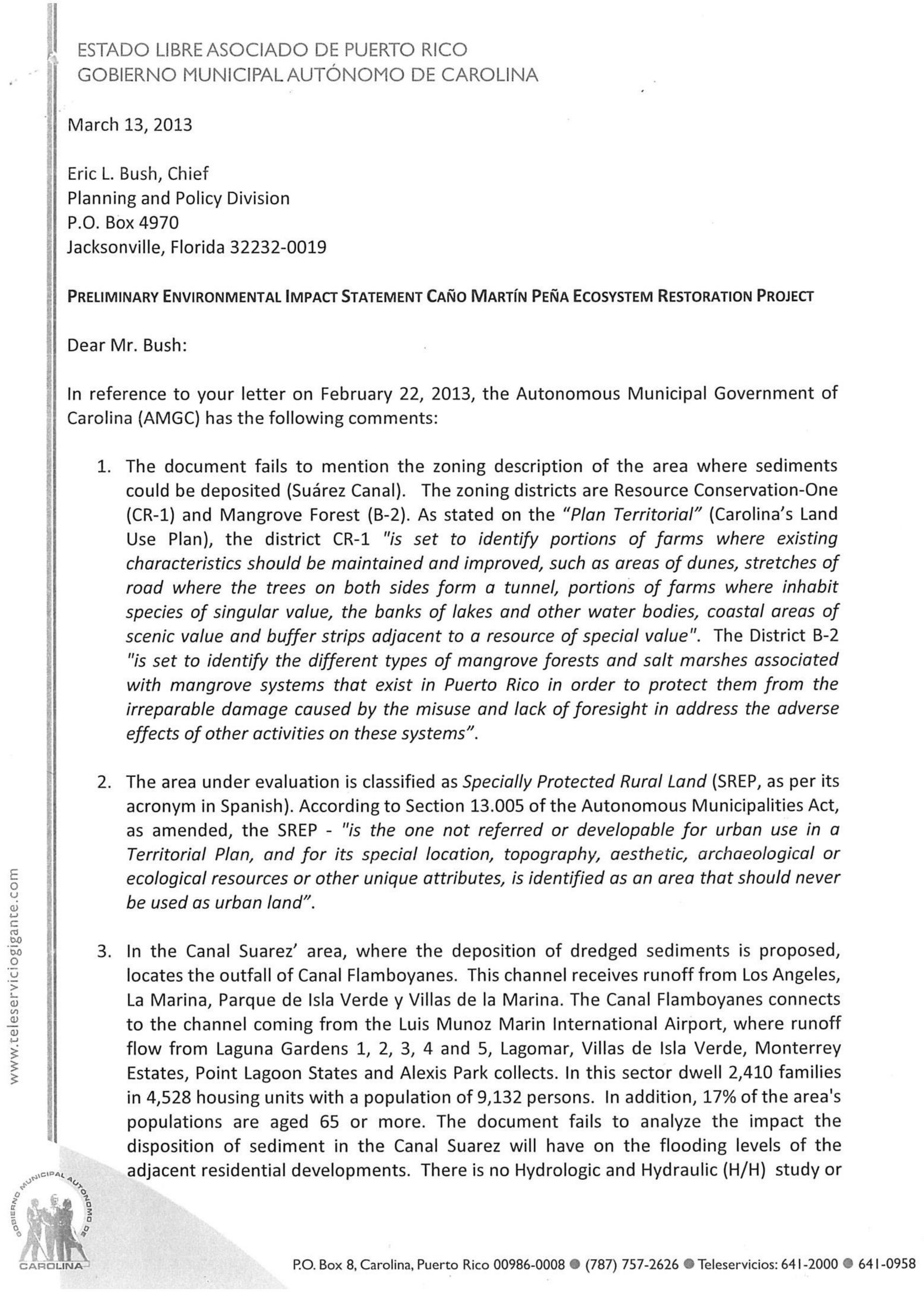
Sincerely,

Arch. Berenice Sueiro, AIT
Acting State Historic Preservation Officer

BRS/MB

WWW.OECH.GOBIERNO.PR

Municipality of Carolina



ESTADO LIBRE ASOCIADO DE PUERTO RICO
GOBIERNO MUNICIPAL AUTÓNOMO DE CAROLINA

March 13, 2013

Eric L. Bush, Chief
Planning and Policy Division
P.O. Box 4970
Jacksonville, Florida 32232-0019

PRELIMINARY ENVIRONMENTAL IMPACT STATEMENT CAÑO MARTÍN PEÑA ECOSYSTEM RESTORATION PROJECT

Dear Mr. Bush:

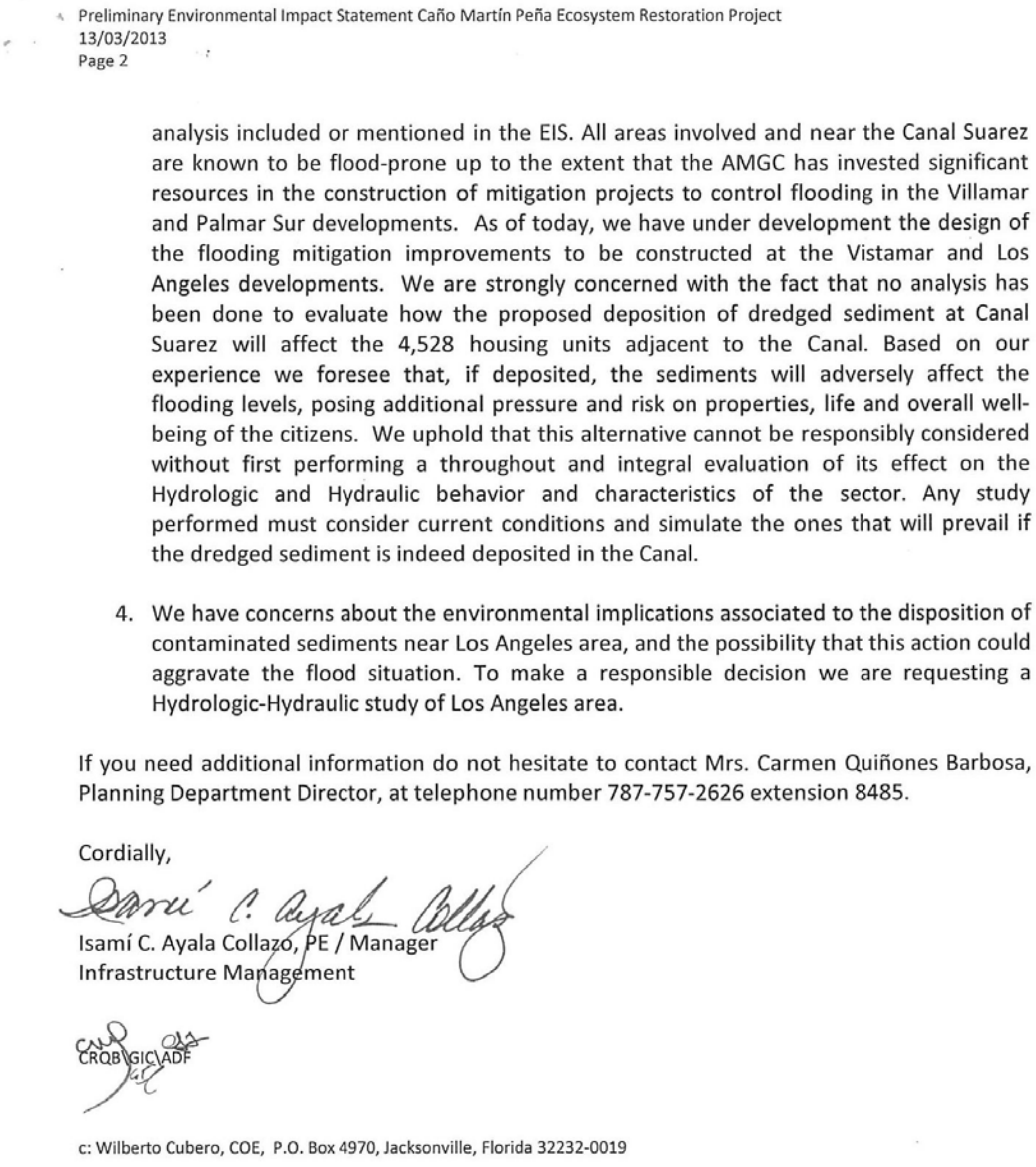
In reference to your letter on February 22, 2013, the Autonomous Municipal Government of Carolina (AMGC) has the following comments:

1. The document fails to mention the zoning description of the area where sediments could be deposited (Suárez Canal). The zoning districts are Resource Conservation-One (CR-1) and Mangrove Forest (B-2). As stated on the *"Plan Territorial"* (Carolina's Land Use Plan), the district CR-1 *"is set to identify portions of farms where existing characteristics should be maintained and improved, such as areas of dunes, stretches of road where the trees on both sides form a tunnel, portions of farms where inhabit species of singular value, the banks of lakes and other water bodies, coastal areas of scenic value and buffer strips adjacent to a resource of special value"*. The District B-2 *"is set to identify the different types of mangrove forests and salt marshes associated with mangrove systems that exist in Puerto Rico in order to protect them from the irreparable damage caused by the misuse and lack of foresight in address the adverse effects of other activities on these systems"*.

2. The area under evaluation is classified as *Specially Protected Rural Land* (SREP, as per its acronym in Spanish). According to Section 13.005 of the Autonomous Municipalities Act, as amended, the SREP - *"is the one not referred or developable for urban use in a Territorial Plan, and for its special location, topography, aesthetic, archaeological or ecological resources or other unique attributes, is identified as an area that should never be used as urban land"*.

3. In the Canal Suarez' area, where the deposition of dredged sediments is proposed, locates the outfall of Canal Flamboyanes. This channel receives runoff from Los Angeles, La Marina, Parque de Isla Verde y Villas de la Marina. The Canal Flamboyanes connects to the channel coming from the Luis Munoz Marin International Airport, where runoff flow from Laguna Gardens 1, 2, 3, 4 and 5, Lagomar, Villas de Isla Verde, Monterrey Estates, Point Lagoon States and Alexis Park collects. In this sector dwell 2,410 families in 4,528 housing units with a population of 9,132 persons. In addition, 17% of the area's populations are aged 65 or more. The document fails to analyze the impact the disposition of sediment in the Canal Suarez will have on the flooding levels of the adjacent residential developments. There is no Hydrologic and Hydraulic (H/H) study or

P.O. Box 8, Carolina, Puerto Rico 00986-0008 ● (787) 757-2626 ● Teleservicios: 641-2000 ● 641-0958



analysis included or mentioned in the EIS. All areas involved and near the Canal Suarez are known to be flood-prone up to the extent that the AMGC has invested significant resources in the construction of mitigation projects to control flooding in the Villamar and Palmar Sur developments. As of today, we have under development the design of the flooding mitigation improvements to be constructed at the Vistamar and Los Angeles developments. We are strongly concerned with the fact that no analysis has been done to evaluate how the proposed deposition of dredged sediment at Canal Suarez will affect the 4,528 housing units adjacent to the Canal. Based on our experience we foresee that, if deposited, the sediments will adversely affect the flooding levels, posing additional pressure and risk on properties, life and overall well-being of the citizens. We uphold that this alternative cannot be responsibly considered without first performing a throughout and integral evaluation of its effect on the Hydrologic and Hydraulic behavior and characteristics of the sector. Any study performed must consider current conditions and simulate the ones that will prevail if the dredged sediment is indeed deposited in the Canal.

4. We have concerns about the environmental implications associated to the disposition of contaminated sediments near Los Angeles area, and the possibility that this action could aggravate the flood situation. To make a responsible decision we are requesting a Hydrologic-Hydraulic study of Los Angeles area.

If you need additional information do not hesitate to contact Mrs. Carmen Quiñones Barbosa, Planning Department Director, at telephone number 787-757-2626 extension 8485.

Cordially,

Isamí C. Ayala Collazo

Isamí C. Ayala Collazo, PE / Manager
Infrastructure Management

CRQB\GIC\ADF

c: Wilberto Cubero, COE, P.O. Box 4970, Jacksonville, Florida 32232-0019

FEDERAL GOVERNMENT

NOAA- NMFS

-----Original Message-----

From: Lisamarie Carrubba - NOAA Federal [mailto:lisamarie.carrubba@noaa.gov]

Sent: Monday, March 18, 2013 2:34 PM

To: martinpena

Cc: Cubero-Deltoro, Wilberto SAJ; Anabel Padilla; Jose Rivera; Pace Wilber

Subject: Draft Environmental Impact Statement for the Ecosystem Restoration of the Caño Martín Peña and Associated Waters within the San Juan Bay Estuary System, San Juan, PR

This is in response to the February 22, 2013, letter from the U.S. Army Corps of Engineers (USACE) requesting comments, alternatives, and issues or concerns related to the preparation of a Draft Environmental Impact Statement (DEIS) for the proposed ecosystem restoration project in the eastern half of the Caño Martín Peña (CMP), which is part of the San Juan Bay Estuary System.

The National Marine Fisheries Service (NMFS) has reviewed several iterations of the CMP project. In this most recent iteration, NMFS Protected Resources Division (PRD) has provided comments and participated in several technical meetings with the Corporacion del Proyecto ENLACE del Caño Martín Peña, the non-federal sponsor for the project. Our comments are based on the information from these meetings as your letter did not contain details of the proposed project.

1. The DEIS should contain a detailed analysis of alternatives related to the dredging method, including access to the channel and any disposal sites for dredging material; proposed size of the channel (width, depth, and side slopes) under each of the alternatives; and proposed dredged material disposal sites.

2. The reasons for the selection of the preferred alternative should include a thorough analysis of the environmental benefits of the preferred alternative versus other proposed alternatives, in particular related to the final channel size and flushing of the channel. It is our understanding that the preferred channel width can be kept to a smaller size rather than one of the larger size alternatives and still achieve similar results (compared with the larger channel widths) related to flushing and interchange within the larger estuary system, which will also reduce the amount of dredging material requiring disposal, as well as reduce impacts to mangrove wetlands.

3. We are concerned regarding some of the dredging material disposal alternatives in terms of the potential for transport of contaminated sediments and potential fish kills from dispersal of anoxic waters during the proposed disposal of dredged materials in former dredge pits in the San José Lagoon. As we have recommended previously for this and other projects that proposed the filling of these and

other pits in some of the lagoons within the San Juan Bay Estuary System and because of the level of contamination of sediments to be dredged from the CMP, dredged material should be contained with geotubes, for example, and flocculating agents should be added as needed to ensure containment of materials. Disposal methods should include appropriate containment and treatment of dredged sediments themselves, as well as waters from dewatering, and containment of the area where spoil will be disposed, whether in-water or on-land. Note that some terrestrial sites have been proposed as either staging or temporary dredge disposal areas that are wetlands. These sites should be removed from further consideration for temporary or permanent disposal of dredged material and upland sites selected. Details of the use of capping material if the dredge pits are selected as the disposal site for dredged material, including the source of capping material should also be included in the DEIS.

4. The DEIS should contain information regarding the overall master plan for the area and not focus only on the CMP dredging. ENLACE has presented several projects during USACE Regulatory meetings related to the master plan for the CMP area, many of which include impacts to mangrove wetlands. These projects would not be proposed if it were not for the CMP master plan to redevelop the area and restore the channel. The DEIS should quantify all anticipated benthic habitat and mangrove wetland impacts in order to analyze the total impact of the project on these resources.

5. The DEIS should include information regarding the presence or absence of species and habitat under the purview of NMFS PRD both in the project area and in other portions of the estuary that will be affected by the project. For instance, the project contemplates an increased hydrologic connection between Laguna San José and Laguna Torrecillas and between Laguna San José and the San Juan Bay. Endangered Species Act (ESA)-listed sea turtles are known to occur in Torrecillas and San Juan Bay. Therefore, the DEIS should contain information regarding how the proposed dredging and disposal of dredge spoil, as well as the proposed increases in connectivity between various water bodies in the estuary system will affect ESA-listed species and their habitat because the project may require consultation pursuant to the requirements of Section 7 of the ESA. Therefore, the DEIS should include the same information as would be included in a Biological Evaluation (BE) so that the document could serve as the BE. I am attaching the BA/BE guide to this message.

In summary, the DEIS should detail all of the methodology associated with the preferred alternative in terms of access routes to dredge the canal, reach all temporary staging areas, including in-water and terrestrial staging areas for equipment and materials, and access disposal sites; dredging methods, including the number and size of barges and any support vessels to be used and where they will anchor both during operations and when not in use; habitat characterizations for areas where dredged material disposal is proposed, whether on land or in-water; a quantification of all potential impacts of the dredging and other projects contemplated in the master plan to benthic habitat and mangrove wetlands, as well as ESA resources, including the overall time frame of the dredging and associated projects; and avoidance and minimization measures to be incorporated in the project to protect ESA resources.

The project area also contains habitats designated as essential fish habitat (EFH) by the Caribbean Fishery Management Council pursuant to the requirements of the Magnuson-Stevens Fishery Conservation and Management Act. Therefore, we refer you to Mr. José Rivera of NMFS Habitat Conservation Division, who was included in the distribution list for your February 22, 2013, letter, to provide guidance as to any information related to EFH resources and conservation measures that should be included in the DEIS and project design, as well as EFH consultation requirements for the project. Mr. Rivera may be reached via e-mail at Jose.A.Rivera@noaa.gov or by telephone at 787-405-3605.

Please let me know if you have any questions regarding these comments.

Thank you,

Lee

--

Dr. Lisamarie Carrubba

NOAA Fisheries

Caribbean Field Office, PRD

P.O. Box 1310

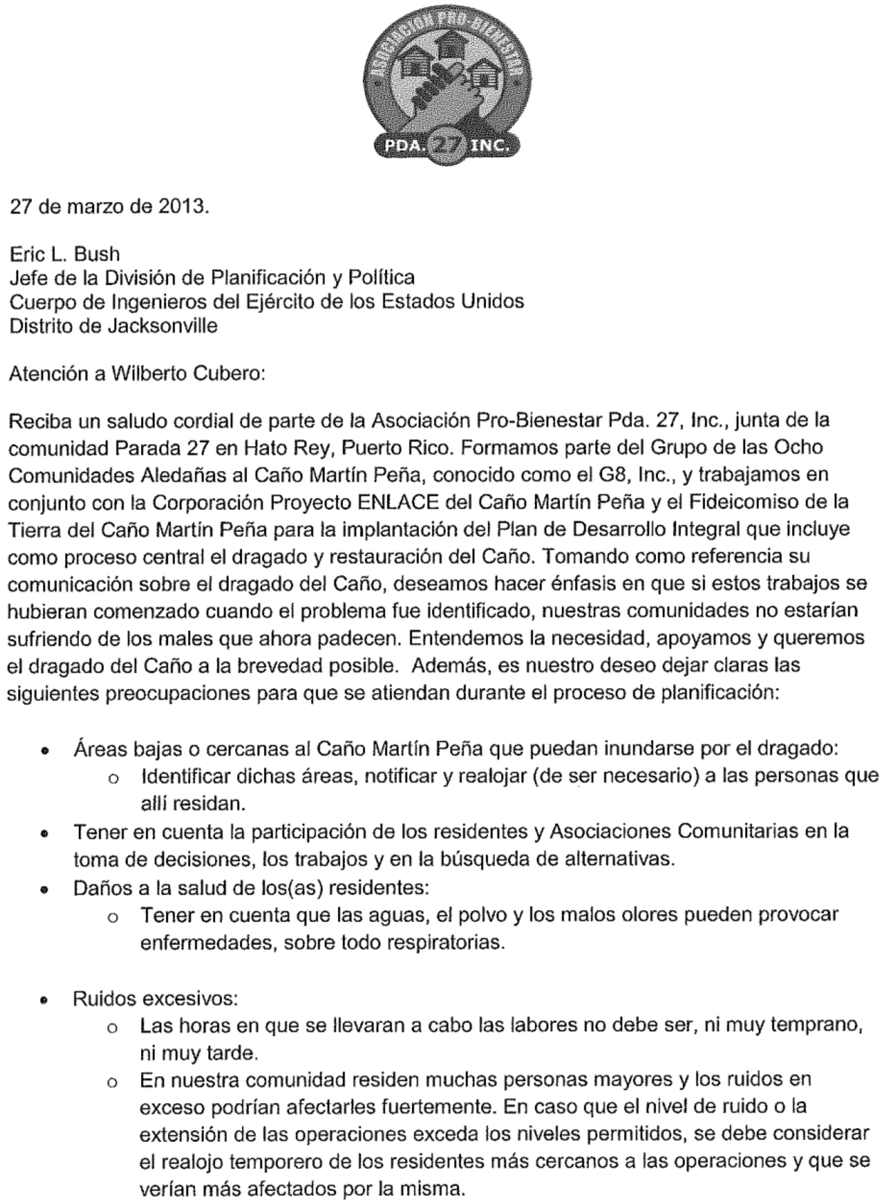
Boquerón, PR 00622

787-851-3700

787-851-5588 (fax)

COMMUNITY ORGANIZATIONS

Asociación Pro-Bienestar Parada 27, Inc.



27 de marzo de 2013.

Eric L. Bush
Jefe de la División de Planificación y Política
Cuerpo de Ingenieros del Ejército de los Estados Unidos
Distrito de Jacksonville

Atención a Wilberto Cubero:

Reciba un saludo cordial de parte de la Asociación Pro-Bienestar Pda. 27, Inc., junta de la comunidad Parada 27 en Hato Rey, Puerto Rico. Formamos parte del Grupo de las Ocho Comunidades Aledañas al Caño Martín Peña, conocido como el G8, Inc., y trabajamos en conjunto con la Corporación Proyecto ENLACE del Caño Martín Peña y el Fideicomiso de la Tierra del Caño Martín Peña para la implantación del Plan de Desarrollo Integral que incluye como proceso central el dragado y restauración del Caño. Tomando como referencia su comunicación sobre el dragado del Caño, deseamos hacer énfasis en que si estos trabajos se hubieran comenzado cuando el problema fue identificado, nuestras comunidades no estarían sufriendo de los males que ahora padecen. Entendemos la necesidad, apoyamos y queremos el dragado del Caño a la brevedad posible. Además, es nuestro deseo dejar claras las siguientes preocupaciones para que se atiendan durante el proceso de planificación:

- Áreas bajas o cercanas al Caño Martín Peña que puedan inundarse por el dragado:
  - Identificar dichas áreas, notificar y realojar (de ser necesario) a las personas que allí residan.
- Tener en cuenta la participación de los residentes y Asociaciones Comunitarias en la toma de decisiones, los trabajos y en la búsqueda de alternativas.
- Daños a la salud de los(as) residentes:
  - Tener en cuenta que las aguas, el polvo y los malos olores pueden provocar enfermedades, sobre todo respiratorias.
- Ruidos excesivos:
  - Las horas en que se llevaran a cabo las labores no debe ser, ni muy temprano, ni muy tarde.
  - En nuestra comunidad residen muchas personas mayores y los ruidos en exceso podrían afectarles fuertemente. En caso que el nivel de ruido o la extensión de las operaciones exceda los niveles permitidos, se debe considerar el realojo temporero de los residentes más cercanos a las operaciones y que se verían más afectados por la misma.

- Animales que habitan en el Caño:
  - Nos preocupa el cómo se verá afectada la vida silvestre durante la restauración del Caño.
  - En el Caño residen animales que pueden considerarse como plagas o peligrosos (ratas, iguanas, caimanes, etc.). Deben asegurarse, de una forma u otra, que se evite que estos animales, huyendo de la operación, invadan las comunidades, o aún peor los hogares de los residentes y nuestras escuelas más cercanas al Caño.
- Áreas de trabajo seguras:
  - Es importante para nosotros(as) el prevenir cualquier tipo de accidentes con las maquinarias o áreas cercanas a los trabajos. Deben tomarse todas las medidas de precaución para evitar exponer a nuestros niños a maquinarias o áreas peligrosas durante la operación.

Agradecemos sinceramente su atención y esperamos que estas preocupaciones y sugerencias sean tomadas en cuenta para lograr que las labores sean eficientes. Recuerde que el dragado no solo beneficia a las ocho comunidades aledañas a éste, sino que también beneficia a todo el país.

Cordialmente,

Asociación Pro-Bienestar Pda. 27, Inc.

Cynthia Román

Cynthia Román
Presidenta
(787) 362-9884

Residentes Unidos de Barrio Obrero Marina, Inc.

RUBOMI
Residentes Unidos de Barrio Obrero Marina, Inc.

25 de marzo de 2013.

Eric L. Bush
Jefe de la División de Planificación y Política
Cuerpo de Ingenieros del Ejército de los Estados Unidos
Distrito de Jacksonville

ATENCIÓN A: Wilberto Cubero

De parte de la junta directiva de la comunidad Barrio Obrero Marina reciba un cordial saludo. En respuesta a su comunicación sobre el dragado del Caño Martín Peña, hemos identificado las siguientes preocupaciones y deseamos se atiendan en el proceso de construcción:

1. Los horarios en que se vayan a llevar a cabo las labores del dragado:
    a. Producción de ruido en horarios muy tempranos o tardes
    b. Interferencia con el acceso y salida de las calles en horario laborable de la mayoría de los residentes.
2. Los malos olores cuando comience el dragado:
    a. Al estar revolcando las aguas y removiendo sedimentos que levantan malos olores. Estos se quedan en el aire y pueden causar enfermedades en las vías respiratorias y en la piel.
3. La vibración de las máquinas que se utilicen:
    a. Posibles daños que estas puedan causar a las viviendas.
4. La seguridad en el área de construcción y áreas aledañas:
    a. En las comunidades hay muchos niños corriendo por el área y queremos evitar una desgracia.
    b. Exposición del equipo y la maquinaria luego de las horas de trabajo.
5. La disposición del material que se remueva del Caño:
    a. Lugar de almacenamiento y método de disposición del mismo.
    b. Que la comunidad no este expuesta al mismo.
6. La comunicación que se establezca y mantenga con los residentes y líderes comunitarios para facilitar los trabajos.

Entendemos que el dragado del Caño Martín Peña es vital para el bienestar físico y la salud de nuestra comunidad y el país en general:

1. Levanta el autoestima de nuestros residentes y nos motiva a mantener nuestra comunidad limpia y bonita.
2. Se nos hace justicia al cumplir con las promesas que por años han quedado sin cumplir.
3. Se le hace justicia al ambiente, ya que su estado actual ha reducido la diversidad de flora y fauna.
4. Al dragar el Caño se re-establecería la conexión hidráulica entre los cuerpos de agua y reduciría las inundaciones en nuestras comunidades.
    a. Estos eventos ocasionan daños a la propiedad de los residentes
    b. Obligan a los niños y jóvenes a ausentarse de la escuela y a otros residentes a faltar al trabajo.
    c. El estancamiento de las aguas por mucho tiempo provoca malos olores, mosquitos, entre otros, que pueden provocar enfermedades y epidemias.

Esperamos que se tomen en cuenta todas nuestras preocupaciones y recomendaciones para garantizar que el trabajo se lleve a cabo efectivamente.

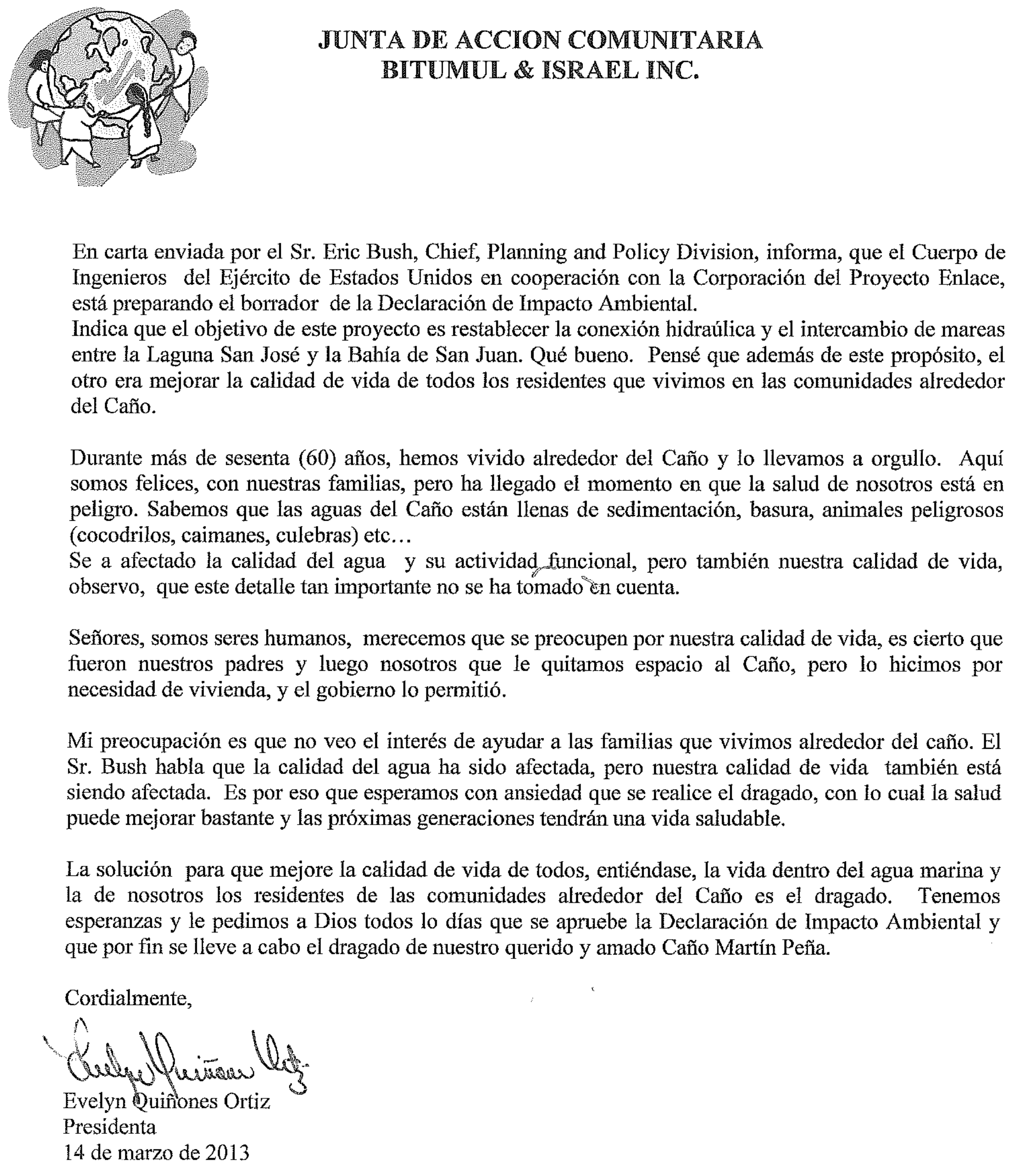
Atentamente,

Junta directiva
Residentes Unidos de Barrio Obrero Marina, Inc.

Carmen L. Febres Alméstica

Carmen L. Febres Alméstica
Presidenta RUBOMI
(787) 594-2814

Junta de Acción Comunitaria Israel & Bitumul, Inc.



JUNTA DE ACCION COMUNITARIA
BITUMUL & ISRAEL INC.

En carta enviada por el Sr. Eric Bush, Chief, Planning and Policy Division, informa, que el Cuerpo de Ingenieros del Ejército de Estados Unidos en cooperación con la Corporación del Proyecto Enlace, está preparando el borrador de la Declaración de Impacto Ambiental.
Indica que el objetivo de este proyecto es restablecer la conexión hidraúlica y el intercambio de mareas entre la Laguna San José y la Bahía de San Juan. Qué bueno. Pensé que además de este propósito, el otro era mejorar la calidad de vida de todos los residentes que vivimos en las comunidades alrededor del Caño.

Durante más de sesenta (60) años, hemos vivido alrededor del Caño y lo llevamos a orgullo. Aquí somos felices, con nuestras familias, pero ha llegado el momento en que la salud de nosotros está en peligro. Sabemos que las aguas del Caño están llenas de sedimentación, basura, animales peligrosos (cocodrilos, caimanes, culebras) etc…
Se a afectado la calidad del agua y su actividad funcional, pero también nuestra calidad de vida, observo, que este detalle tan importante no se ha tomado en cuenta.

Señores, somos seres humanos, merecemos que se preocupen por nuestra calidad de vida, es cierto que fueron nuestros padres y luego nosotros que le quitamos espacio al Caño, pero lo hicimos por necesidad de vivienda, y el gobierno lo permitió.

Mi preocupación es que no veo el interés de ayudar a las familias que vivimos alrededor del caño. El Sr. Bush habla que la calidad del agua ha sido afectada, pero nuestra calidad de vida también está siendo afectada. Es por eso que esperamos con ansiedad que se realice el dragado, con lo cual la salud puede mejorar bastante y las próximas generaciones tendrán una vida saludable.

La solución para que mejore la calidad de vida de todos, entiéndase, la vida dentro del agua marina y la de nosotros los residentes de las comunidades alrededor del Caño es el dragado. Tenemos esperanzas y le pedimos a Dios todos lo días que se apruebe la Declaración de Impacto Ambiental y que por fin se lleve a cabo el dragado de nuestro querido y amado Caño Martín Peña.

Cordialmente,

Evelyn Quiñones Ortiz
Presidenta
14 de marzo de 2013

APPENDIX H7.e

COMMENT RESPONSE MATRIX

COMMENTS RESPONSE MATRIX

COMMENTS TO THE NOTICE OF INTENT		
	Public/Agency Comment	USACE/Sponsor Response
FEDERAL AGENCIES		
NPS **Written comment by letter** **2012-12-17**	No comments to the Notice of Intent to prepare an EIS for Caño Martín Peña Ecosystem Restoration in Puerto Rico San Juan, ER -12/0833.	
FWS **Written comment by letter** **2012-12-7**	Comments to the Notice of Intent to prepare an EIS for Caño Martín Peña Ecosystem Restoration. The FWS believes that the EIS should consider that the dredge material will form the substrate for the proposed Suárez Canal mitigation site. The document should discuss the following aspects of the mitigation:	Dredged sediments would be disposed at the San José Lagoon dredged pits. It was selected as the preferred dredged sediments disposal method because it is the disposal option that most contribute to the ecosystem restoration goal and will allow a beneficial use of the sediments. See Section 2.2.5. In addition, mangrove habitat along the Suárez Canal is expected to improve as a result of the CMP-ERP. See Sections 4.5.2 and 4.9.2.
	a) The level of contamination of the dredged material and how possible contaminants in the dredged material will be contained in the mitigation site.	Dredged sediments would be disposed at the San José Lagoon dredged pits. They would be contained in geotextiles and covered with 2ft. of clean sand. Section 404 testing would be conducted in the Planning, Engineering and Design (PED) phase. Although risk has been reduced by utilizing the existing sampling data and coordinating with the USEPA and the PREQB, there is a possibility that Section 404 testing could indicate unsuitable material within the CMP, potentially leading to a requirement for reformulation. If material were found unsuitable for aquatic disposal, the sediment/solid waste would need to be disposed of in an upland landfill or other approved location.

COMMENTS TO THE NOTICE OF INTENT		
	Public/Agency Comment	**USACE/Sponsor Response**
FEDERAL AGENCIES		
	b) The feasibility of transporting the dredged to the mitigation site at Canal Suárez.	Suarez Canal was eliminated due to insufficient capacity at the location. In addition, it would require containment of the material behind a sheet pile bulkhead that would be exposed to currents and possible wave action during storms and tropical events.
	c) The stability of the dredged material to support mangrove mitigation at Canal Suárez.	See previous response.
	Supports the efforts to restore the CMP and the hydrology and water quality throughout the San Juan Bay Estuary System.	

COMMENTS TO THE SCOPING PROCESS		
	Public/Agency Comment	**USACE/Sponsor Response**
COMMONWEALTH GOVERNMENT		
PREPA-1 **Written comment by letter** **2013-03-21**	No objection to the proposed project	
	No existing PREPA's infrastructure or easement was identified within the project area	
PREPA-2 **Written comment by letter** **2013-04-12**	Cancel and replace previous communication from 2013-03-21	
	Underground Power Infrastructure Num. 39,300 of 115-kV was identified within or nearby the project area.	This power line is an aerial power line that crosses the Caño east of the Barbosa Bridge. No impacts are expected in this infrastructure since The 115-kilovolt (kV) overhead transmission line has been relocated as a component of the CMP-ERP. Works included raising the height of the line sixty feet in the section crossing the CMP close to the San José lagoon, to allow the passage of the dredging machinery. Its former height was not sufficient, posing a hazard to equipment needed for construction/dredging associated to the CMP-ERP. See Sections 3.12.2.3 and 4.12 of DEIS.

COMMENTS TO THE SCOPING PROCESS		
	Public/Agency Comment	**USACE/Sponsor Response**
	No objection to the project, as long as any work including excavation, dredge or drill is coordinated with them before its occurrence.	See previous response.
SHPO **Written comment by letter** **2013-03-27**	Within the past 20 years, several reconnaissance level surveys have been carried out to identify potential historic properties within the Caño Martin Peña's area. Considering the passage of time since these surveys were undertaken, as well as possible changes that may occur on how to implement the restoration of the tidal channel, previous studies should be reevaluated within the context of the current restoration strategy. The accumulation of household and construction debris within the channel, starting in the early twentieth may be considered an archeological site. Also in 2008, Martin Peña Bridge was listed in the National Register of Historic Places.	No significant impacts to cultural resources are expected. Permanent sheet pile walls, weirs, and other structures during construction would protect the Martin Peña Bridge; photo-documentation would be recorded for this historic bridge. A field archeologist (full-time), aided by a supervising archeologist (part-time), would be employed to monitor construction activities near the bridge, as well as to monitor for cultural resources as each clamshell bucket of dredged material is laid onto the screen during the construction (dredging) process. In the event that material of interest is observed by the archeologist during dredging and sorting operations, lifting of sediment would halt until the archeologist could determine whether the material is historic. Evaluation of three to four areas from the deepest sediments in the Eastern CMP to identify debris that may be considered of historical value is also recommended (Vélez, 2001; Vega 2002). A Phase IA Cultural Resources Assessment for the proposed temporary disposal site at the CDRC staging area found a very low potential for cultural resources due to extensive impacts and modifications in the area. No additional archeological investigations were recommended for this site. See sections 3.15 and 4.16 of DEIS.
Municipality of Carolina **Written comment by letter** **2013-03-13**	The document fails to mention the zoning description of the area where sediments could be deposited (Suárez Canal). The zoning districts are Resource Conservation-One (CR-1) and Mangrove Forest (B-2). As stated on the Municipal Land Use	This comment refers to the original intention of using Suárez Canal as the preferred disposal site, which is no longer the case. The preferred disposal option is the San Jose Lagoon CAD site.

COMMENTS TO THE SCOPING PROCESS		
	Public/Agency Comment	**USACE/Sponsor Response**
	Plan, this districts were adopted to protect the natural characteristics of these areas (a more detailed description of these districts was included in the letter).	See sections 2.2.5 for a more thorough description of the dredged sediments disposal methods.
	In the Canal Suárez' area, where the deposition of dredged sediments is proposed, locates the outfall of Canal Flamboyanes. This channel receives runoff from the urbanizations Los Angeles, La Marina, Parque de Isla Verde y Villas de la Marina. The Canal Flamboyanes connects to the channel coming from the LMM International Airport, where runoff flow from urbanizations Laguna Gardens 1, 2, 3, 4 and 5, Lagomar, Villas de Isla Verde, Monterrey Estates, Point Lagoon States, and Alexis Park collects. In this sector dwell 2,410 families in 4,528 housing units with a population of 9,132 persons. In addition, 17% of the area's populations are aged 65 or more. The document fails to analyze the impact the disposition of sediment in the Canal Suárez will have on the flooding levels of the adjacent residential developments. There is no hydrologic and hydraulic (H/H) study or analysis included or mentioned in the EIS. All areas involved and near the Canal Suárez are known to be flood-prone up to the extent that the Municipality of Carolina has invested significant resources in the construction of mitigation projects to control flooding in the Villamar and Palma Sur developments. As of the day of the letter, the Municipality has under development the design of the flooding mitigation improvements to be constructed at the Vistamar and Los Angeles developments. The Municipality is strongly concerned with the fact that no analysis has been done to evaluate how the proposed deposition of dredge sediments at Canal Suárez will affect the 4,528 housing units adjacent to the Canal. Based on their experience, the Municipality foresees that, if deposited, the sediments will adversely affect the flooding levels, posing additional pressure and risk on properties, life and overall well-being of citizens. The Municipality uphold that this alternative cannot be responsibly considered without first performing a throughout	Potential flood risk increase to adjacent residents of the Suárez Canal was one of the reasons as to why this site was no longer the preferred disposal alternative. See sections 2.2.5 of DEIS.

COMMENTS TO THE SCOPING PROCESS		
	Public/Agency Comment	**USACE/Sponsor Response**
	and integral evaluation of its effects on the hydrologic and hydraulic behavior and characteristics of the sector. Any study performed must consider current conditions and simulate the ones that will prevail if the dredge sediment is indeed deposited in the Canal.	
	Concerns about the environmental implications associated to the disposition of contaminated sediments near Los Angeles area, and the possibility that this action could aggravate the flood situation. To make a responsible decision we are requesting a Hydrologic-Hydraulic study of Los Angeles area.	See previous response.
FEDERAL GOVERNMENT		
NOAA- NMFS **Written comment by email** **2013-03-27**	The DEIS should contain a detailed analysis of alternatives related to the dredging method, including access to the channel and any disposal sites for dredging material; proposed size of the channel (width, depth, and side slopes) under each of the alternatives; and proposed dredged material disposal sites.	Chapter 2 details the analysis and criteria for selection of the channel configuration and dredged material disposal site. The Engineering Appendix contains a more detailed analysis of these aspects.
	The reasons for the selection of the preferred alternative should include a thorough analysis of the environmental benefits of the preferred alternative versus other proposed alternatives, in particular related to the final channel size and flushing of the channel. It is our understanding that the preferred channel width can be kept to a smaller size rather than one of the larger size alternatives and still achieve similar results (compared with the larger channel widths) related to flushing and interchange within the larger estuary system, which will also reduce the amount of dredging material requiring disposal, as well as reduce impacts to mangrove wetlands.	The environmental benefits were one of the main criteria behind the selection of the Tentatively Selected Plan (TSP). See Section 2.4. Beneficial impacts of the TSP are explained in detailed in Chapter 4 of the DEIS.
	Concerns regarding some of the dredging material disposal alternatives, in terms of the potential for transport of contaminated sediments and potential fish kill from dispersal of anoxic waters during the proposed disposal of dredged materials in former dredge pits in the San José Lagoon. As we have recommended previously for this and other projects that	The preferred dredged sediments disposal site is the San José Lagoon dredged pits (SJ1 and 2). Sediments would be placed into geotextiles. The subaqueous artificial dredged pits would be surrounded by a temporary sheet pile and turbidity curtains to control sediment dispersion

COMMENTS TO THE SCOPING PROCESS		
	Public/Agency Comment	**USACE/Sponsor Response**
	proposed the filling of these and other pits in some of the lagoons within the San Juan Bay Estuary System and because of the level of contamination of sediments to be dredged from the CMP, dredged material should be contained with geotubes, for example, and flocculating agents should be added as needed to ensure containment of materials. Disposal methods should include appropriate containment and treatment of dredged sediments themselves, as well as waters from dewatering, and containment of the area where spoil will be disposed, whether in-water or on-land. Note that some terrestrial sites have been proposed as either staging or temporary dredge disposal areas that are wetlands. These sites should be removed from further consideration for temporary or permanent disposal of dredged material and upland sites selected. Details of the use of capping material if the dredge pits are selected as the disposal site for dredged material, including the source of capping material should also be included in the DEIS.	into other areas of the San José Lagoon while construction activity is taking place. Once all sediments are disposed of into the CAD, these would be capped with a 2 ft. layer of sand to confine any possible contaminants and avoid their dispersion into the water column. The proposed layer of sand capping would also help reduce benthic burrowing organisms from reaching and disturbing the sediments. See section 2.2.5 The source of capping material is quarry sand. However ENLACE is evaluating additional acceptable alternative sources for the sand cap, such as recycled glass. See section 2.2.5.2.1 No dewatering would occur. Dewatering of the solid waste is not considered necessary for the disposal process in light of the planning assumption that the solid waste would air dry during transportation from the CMP to the landfill. See Section 2.2.5. Suggested temporary staging area is a five acre parcel of artificially created upland to the southeast of the San José Lagoon. See Section 2.2.5.1.
NOAA- NMFS **Written comment by email** **2013-03-27 (Cont.)**	Provide information regarding the overall master plan for the area and not focus only on the CMP dredging. ENLACE has presented several projects during USACE Regulatory meetings related to the master plan for the CMP area, many of which include impacts to mangrove wetlands. These projects would not be proposed if it were not for the CMP master plan to redevelop the area and restore the channel.	Background on the ENLACE Master Plan is provided in Sections 1.5.2. Cumulative impacts of the CMP Special District Plan are discussed in Section 4.18.3 of the DEIS.

COMMENTS TO THE SCOPING PROCESS		
	Public/Agency Comment	**USACE/Sponsor Response**
	The DEIS should quantify all anticipated benthic habitat and mangrove wetland impacts in order to analyze the total impact of the project on these resources.	Benthic habitat and mangrove impacts are thoroughly detailed in Sections 4.9 of the Draft-EIS. An Assessment of the Ecological Uplift Associated with the Restoration of the Caño Martín Peña, Focusing on Benefits to the Study Area was developed to guide the selection of the TSP.
	Include information regarding the presence or absence of species and habitat under the purview of NMFS PRD both in the project area and in other portions of the estuary that will be affected by the project. For instance, the project contemplates an increased hydrologic connection between Laguna San José and Laguna Torrecillas and between Laguna San José and the San Juan Bay. Endangered Species Act (ESA)-listed sea turtles are known to occur in Torrecillas and San Juan Bay. Therefore, the DEIS should contain information regarding how the proposed dredging and disposal of dredge spoil, as well as the proposed increases in connectivity between various water bodies in the estuary system will affect ESA-listed species and their habitat because the project may require consultation pursuant to the requirements of Section 7 of the ESA. Therefore, the DEIS should include the same information as would be included in a Biological Evaluation (BE) so that the document could serve as the BE. A BA/BE guide was attached to this message.	Sections 3.10, 4.9, 4.10 and 4.11 of the DEIS detail expected habitat and fish and wildlife species resources impacts throughout the San Juan Bay Estuary (SJBE). Overall, the CMP-ERP should improve connectivity and flow through the CMP in order to have an overall positive impact on habitat, fish, and wildlife resources, including endangered species, in the SJBE. A Biological Assessment has been prepared and included as Appendix H-2 of the DEIS.
	In summary, the DEIS should detail all of the methodology associated with the preferred alternative in terms of access routes to dredge the canal, reach all temporary staging areas, including in-water and terrestrial staging areas for equipment and materials, and access disposal sites; dredging methods, including the number and size of barges and any support vessels to be used and where they will anchor both during operations and when not in use; habitat characterizations for areas where dredged material disposal is proposed, whether on land or in-water; a quantification of all potential impacts of	Chapter 2 of the DEIS details Projects components, Chapter 3 thoroughly describes species and habitats and Chapter 4 details all expected environmental consequences from dredging, dredged material disposal, and long-term impacts from the channelization. Additional specificity on design criteria and operational details is provided in the Engineering Appendix.

COMMENTS TO THE SCOPING PROCESS

	Public/Agency Comment	USACE/Sponsor Response
	the dredging and other projects contemplated in the master plan to benthic habitat and mangrove wetlands, as well as ESA resources, including the overall time frame of the dredging and associated projects; and avoidance and minimization measures to be incorporated in the project to protect ESA resources.	
	The project area also contains habitats designated as essential fish habitat (EFH) by the CFMC pursuant to the requirements of the Magnuson-Stevens Fishery Conservation and Management Act. Therefore, we refer you to Mr. José Rivera of NMFS Habitat Conservation Division, who was included in the distribution list for your February 22, 2013, letter, to provide guidance as to any information related to EFH resources and conservation measures that should be included in the DEIS and project design, as well as EFH consultation requirements for the project.	An Essential Fish Habitat (EFH) Assessment for the CMP-ERP has been prepared and the package will be submitted to the NMFS. Significant beneficial impacts to EFH are anticipated as a result of the CMP-ERP. These would result from the increase of tidal exchange in San José Lagoon via conveyance through the CMP. Various ecological benefits to fish and invertebrates are anticipated within the eastern CMP and the San José Lagoon after construction is completed through reconnecting the water bodies within the SJBE system. Mr. José Rivera would continue to be consulted regarding EFH.
COMMUNITY ORGANIZATIONS		
Asociación Pro-Bienestar Parada 27, Inc. **Written comment by letter** **2013-03-27**	Requesting the identification of areas that could be flooded by the CMP dredging, the notification of the residents that could be affected and their relocation, if needed.	Section 4.14 and 4.14 of the DEIS addresses this issue. During construction, the channel flow would be temporarily plugged with a sheet pile wall. Storms lower than 25-years in return interval had virtually the same surface elevation for the existing and plugged condition. Storms 25 years or greater experienced maximum increases of 0.5 ft. for the existing condition and 0.86 ft. for the plugged condition. Storm events without storm surge are the ones most affected by the blocking of channel flow with the 100-year event increasing the water surface from 1.28 ft. for the existing condition and 3.94 ft. for the plugged condition, a change of 2.66 ft.

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		The temporary sheet pile wall would be placed at an elevation that allows flood waters to overtop and flow west, but still high enough to limit or impede tidal flow into the Project Area. After construction of the channel, tidal amplitude within the CMP and the San José Lagoon would increase. The Lagoon's tide range is expected to increase 1.28 ft., from 0.33 ft. preconstruction to 1.61 ft. after construction. This represents a 0.64-ft. increase to the high spring tide. Furthermore, tidal amplitude decreases from west to east. That is, increases are expected to be higher at the weir than at the San José Lagoon. The 0.64-ft. increase is representative of conditions where the channel meets the lagoon. Surface elevations across the lagoon are expected to be somewhat lower. During PED, a "sequence of events" based upon performance standards, must be established and incorporated into the construction contract documents. In addition, there would be close coordination with the adjacent communities to establish local emergency management strategies.
	Consider the participation of residents and community associations in the decision making process, works, and in the search for alternatives.	Section 6 of the DEIS discusses how ENLACE has incorporated the affected communities throughout the planning process. Between 2002 and 2004, ENLACE hosted over 700 community meetings to select the community alternative for the CMP-ERP, which was incorporated as part of the Comprehensive Development Plan. Also, kick-off community assemblies for the preparation of this DRAFT EIS were held during October 2010 at each community to inform residents on the status of the ERP and document their concerns and suggestions.

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	Consider the residents' health impacts, especially respiratory problems, which may be caused by the waters, dust, and odors.	Sections 4.6 and 4.14 of the DEIS detail expected impacts to nearby residents due to the release of H_2S from dredging the CMP. In order to reduce or eliminate possible temporary impacts to air quality from H_2S concentrations that may result a hazard to human health would include, depending on the severity and under the three project alternatives: the installation of water sprays near the source to reduce concentrations; in situ chemical treatment of the sediments to sequester the hydrogen sulfide or convert it into a less harmful substance; collection of the air at the site of sediment disturbances followed by air scrubbing to sequester hydrogen sulfide; collection of the air at the site of sediment disturbances and transmission to a safe zone (e.g. high above the ground or to the middle of the San José Lagoon) where dilution/dispersal can occur safely. Temporary relocation (evacuation) of individuals located in the areas anticipated to be impacted by unsafe levels of hydrogen sulfide may also be considered during construction.
	Avoid excessive noises by maintaining a work schedule neither too early nor too late.	Noise from construction activities is recognized as a temporary unavoidable impact of the CMR-ERP, however, the heavier activities would take place during daytime and would be at levels that would not cause hearing impairment. See Section 4.7 of the DEIS.
	In the case of excessive noises, people living too close to the impacted area, should be temporarily relocated.	Relocation due to excessive noise is not considered in the EIS, although other temporary measures would be considered during construction. It should be noted that presently, there are approximately 158 structures facing the project footprint and approximately 20% (32) of these structures may be impacted due to

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		vibrations. A vibration and noise mitigation plan would be prepared to include pre-construction surveys of adjacent structures and, if appropriate, distant structures with sensitive equipment (i.e., hospitals or businesses with precision instruments). In the event that damage is reported, the pre-construction survey becomes the baseline for comparing the pre and post-construction conditions. Noise mitigation may include installation of temporary sound barriers in critical areas, mandating the use of heavy equipment less likely to create noise and vibration issues. Establishing vibration monitoring equipment is recommended every 500 ft. See Section 4.7 of the DEIS.
	Concerns on how wildlife will be affected during the CMP restoration.	There would be 33.46 acres of mangrove wetland that would be disturbed during construction. However, under the TSP, replacement of the mangroves would result in 34.48 acres of mangrove wetland, and 25.57 acres of open water habitat. Under the TSP, the aerial extent of open water is substantially increased, and uplands are substantially reduced in extent, from 27.61 acres, current, to 3.42. See Section 4.9 of the DEIS.
	Requesting controls to avoid the invasion of plagues or dangerous animals (i.e. rats, lizards, alligators) fleeing from the operation sites into homes or schools.	Three invasive fauna and one flora invasive species have been identified in the eastern CMP and will be controlled via integrated pest management. The proposed action would not promote the introduction or spread of invasive species, in fact, for some of these such as the mongoose and the water hyacinth, the resulting habitat conditions should discourage their dispersal. See Section 4.10.
	Prevent any accidents with the machinery or in the places closer to the working sites.	Safety measures, as regulated by OSHA, would be implemented at the construction site.

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	Requesting precautionary measures to avoid exposing children to the machinery and/or to hazardous areas.	Safety measures, as regulated by OSHA, would be implemented at the construction site.
Residentes Unidos de Barrio Obrero Marina, Inc. **Written comment by letter** **2013-03-25**	Concerns that must be addressed during the construction process:	
	Construction works' schedule should not be neither too early nor too late.	Noise from construction activities is recognized as an unavoidable impact of the CMR-ERP, however, the heavier activities would take place during daytime and would be at levels that would not cause hearing impairment. See Section 4.7.
	Blockage of main access roads during residents' work schedule	Construction-related traffic will occur in the water. Impacts to roads, particularly the transportation of 73,000 cy of trash and debris to the Humacao landfill, would not use community streets, and would cease after construction. No irretrievable or irreversible impacts are anticipated to transportation resources. See Section 4.20
	Health concerns due to odors caused by the dredging and other works.	Sections 4.6 and 4.14 of the DEIS detail expected impacts to nearby residents due to the release of H_2S from dredging the CMP. In order to reduce or eliminate possible temporary impacts to air quality from H_2S concentrations that may result a hazard to human health would include, depending on the severity and under the three project alternatives: the installation of water sprays near the source to reduce concentrations; in situ chemical treatment of the sediments to sequester the hydrogen sulfide or convert it into a less harmful substance; collection of the air at the site of sediment disturbances followed by air scrubbing to sequester hydrogen sulfide; collection of the air at the site of sediment disturbances and transmission to a safe zone (e.g. high above the ground or to the middle of the San José Lagoon) where dilution/dispersal can occur safely. Temporary relocation (evacuation) of

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		individuals located in the areas anticipated to be impacted by unsafe levels of hydrogen sulfide may also be considered during construction.
	Damages that may be caused to the houses due to the machineries' vibrations.	There are approximately 158 structures facing the project footprint and approximately 20% (32) of these structures may be impacted due to vibrations. A vibration and noise mitigation plan would be prepared to include pre-construction surveys of adjacent structures and, if appropriate, distant structures with sensitive equipment (i.e., hospitals or businesses with precision instruments). In the event that damage is reported, the pre-construction survey becomes the baseline for comparing the pre and post-construction conditions. Noise mitigation may include installation of temporary sound barriers in critical areas, mandating the use of heavy equipment less likely to create noise and vibration issues. Establishing vibration monitoring equipment is recommended every 500 ft. See Section 4.7 of the DEIS.
	Security on the construction site and surrounding areas to avoid situations with kids playing with the machinery and any other equipment.	Safety measures, as regulated by OSHA, would be implemented at the construction site.
	Reach consensus with the communities on how and where the dredging material will be disposed.	Section 6 discusses how ENLACE has incorporated the affected communities throughout the planning process.
	Maintain communication with residents and community leaders to facilitate the work.	Close communication with residents and community leaders has been and will be maintained.
Junta de Acción Comunitaria Israel & Bitumul, Inc. **Written comment by letter** **2013-03-14**	Concerns on how the life quality of the families living next to the project will be helped.	The CMP-ERP would enhance environmental conditions and the quality of life in all of the communities. Restoring conveyance flows to the CMP would reduce flood risk and improve water quality. In addition, the CMP-ERP would provide

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		communities more outdoor recreation opportunities and would increase community's adaptive capacity to cope with climate change impacts.