

An aerial photograph of a river channel, likely the Martín Peña Channel in San Juan, Puerto Rico. The image shows a large dam structure across the river, with a bridge crossing it. The surrounding area is densely built up with houses and buildings. The water in the channel is calm, and there are some structures along the banks. The overall scene is a mix of natural waterways and urban development.

Water & Sediment Quality

*1940s Aerial View of Eastern Martín Peña Channel.
Courtesy of Dr. Aníbal Sepúlveda.*

CHAPTER THREE: WATER AND SEDIMENT QUALITY ACTION PLAN

Improve the water and sediment quality of the San Juan Bay Estuary to ensure it is suitable for fishing and swimming and to promote other compatible recreational and commercial activities.

OBJECTIVE

1

Eliminate direct and indirect sewage discharges to the various canals and lagoons of the San Juan Bay Estuary to reduce nutrient and pathogen loadings and increase human uses of estuarine waters.



**Action
WS-1**

Design and construct a storm and sanitary sewer system for the communities fringing the eastern section of the Martín Peña Channel and other areas adjacent to the SJBE.

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**Action
WS-2**

Relocate families living adjacent to the Martín Peña Channel.

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**Action
WS-3**

Eliminate unauthorized raw sewage discharges (bypasses) from PRASA's collection system and pump stations into the SJBE.

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**Action
WS-4**

Eliminate illegal commercial and residential sewage discharges into the stormwater sewer system.

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OBJECTIVE

2

Improve water circulation in the San Juan Bay Estuary to enhance its flushing capacity resulting in an improvement of its waters and sediments.



**Action
WS-5**

Improve flow in the Martín Peña Channel.

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 **Action WS-6** Fill artificial depressions at the Suárez Canal and at the Los Corozos, San José, and La Torrecilla Lagoons. **Page 95**

Action WS-7 Improve the flow of water between La Esperanza Peninsula Cove and San Juan Bay. **Page 98**

Action WS-8 Assess the feasibility of opening the causeway to Isla de Cabras to increase water flow. **Page 101**

OBJECTIVE 3

Reduce nutrient and toxics loadings from nonpoint sources which result in an impairment of the estuary's habitats and uses.

Action WS-9 Minimize sediment loadings into the San Juan Bay Estuary system. **Page 103**

Action WS-10 Develop toxics criteria for sediment in the SJBE. **Page 106**

Action WS-11 Enforce the Used Motor Oil Management Law in the estuary's watershed (Law No. 172). **Page 109**

Action WS-12 Establish a policy to restore and protect riparian corridors along SJBE tributaries. **Page 111**

OBJECTIVE 4

Avoid the detrimental effects of oil and other contaminants on water and sediment quality, habitats, estuarine species, and socioeconomic activities.

Action WS-13 Develop a plan for creating a Board of Pilot Commissioners to focus exclusively on harbor safety issues. **Page 114**

Action WS-14 Create a task force to monitor docks and other watercraft facilities within the SJBE system and ensure regulatory and permit compliance. **Page 116**

Action WS-15 Assess the establishment of non-commercial watercraft special use areas in the SJBE. **Page 118**

OBJECTIVE 5

Reduce levels of oil and grease, nutrients, sediments, toxics, and other pollutants in municipal storm sewer point source discharges which result in the degradation of estuary habitats and uses.

Action WS-16 Develop and issue NPDES permits to regulate stormwater discharges in urbanized areas of the San Juan Bay Estuary watershed that contribute stormwater point source discharges to the system and its tributaries. **Page 120**

 WS-1

Design and Construct a Storm and Sanitary Sewer System for the Communities Fringing the Eastern Section of the Martín Peña Channel and Other Areas Adjacent to the SJBE.

BACKGROUND

Untreated wastewater is a major source of pollution in the SJBE. Illegal residential and commercial wastewater connections to the stormwater system, as well as overflows from PRASA's sanitary sewer system, discharge considerable quantities of nutrients and pathogens to the estuarine system. However, direct discharges from unsewered areas also contribute significant sources of raw sewage to the SJBE.

The communities of Cantera, Marina, Buena Vista, Israel, and Bitumul were established on the banks of the eastern half of the Martín Peña Channel by filling its waters and wetlands with debris and other types of refuse (Sepúlveda-Rivera and Carbonell, 1988). This housing was developed without the construction of basic utilities such as sanitary sewers and stormwater collection systems, leading to the discharge of untreated sewage into improvised gutters or directly into the Martín Peña Channel. Recurrent flooding in this low-lying area has been exacerbated by the lack of a stormwater collection system. During flood events, these communities are inundated with a combination of stormwater and sewage, causing public health problems. The flooding is compounded by the channel's width, which has been narrowed in some areas to 8 feet (2.4 m) and filled to less than 3 feet (0.9 m) in depth, limiting water flow and exacerbating water quality conditions. These conditions have led the SJBE Program to identify the Martín Peña Channel as a priority area for action since it is the estuary's water body most affected by sewage discharges.

Similar conditions can be found in other communities within the SJBE system. Approximately 4,000 families in these other communities, including Juana Matos, Cucharillas, and Puente Blanco in Cataño; Palo Seco in Toa Baja; Vietnam and Amelia in Guaynabo; Playita, El Checo, Sierra Maestra, Villa Clemente, and Plebiscito 1, 2 and 3 in San Juan; and La Torre and Piñones in Loíza, do not have proper sanitary sewer systems. In some areas, residents have built on-site septic systems to dispose of wastewater instead of discharging it directly into the estuary, its tributaries, or other related surface waters. However, the use of underground septic tanks is inappropriate in these low-lying areas, which are prone to flooding and seepage. Groundwater in these areas can be found just a few feet below the surface, which impairs the functioning of the septic systems and leads to overflows.

The discharge of raw sewage into the SJBE is a health risk to surrounding communities, estuary users, and living resources. Poor sanitary and water quality conditions also impair the potential for the development of recreational and economic activities. Efforts to solve this problem have been focused primarily on the Martín Peña Channel, since it has been identified as the estuary's water body most affected by sewage discharges. Lessons learned from the environmental rehabilitation of the Martín Peña Channel will be critical in implementing similar actions, such as the construction of a sanitary sewer, in other communities fringing the SJBE that currently lack these services.

STRATEGY

- 1.1** Complete an analysis of the infrastructure needs that will result as part of the improvements to the Martín Peña Channel sewage system, including an assessment of the existing stormwater system (storm sewer location and condition).
- Sanitary sewer**
 Implementing partners: PRWC, Municipality of San Juan (lead parties), DTPW – Based on DNER’s selected dimensions for Martín Peña Channel
 Schedule: Short-term. Preliminary analysis completed with evaluation of major infrastructure elements.
 Cost: \$165,000 (contracted study)
- Storm sewer**
 Implementing partners: Municipality of San Juan (lead), EQB, Community Groups, DOH (based on final sanitary and storm sewer design, some structures may have to be relocated or easements provided), PRWC (for sanitary sewer interconnections)
 Schedule: Ongoing
 Cost: \$10,000
- 1.2** Improve existing storm sewer system by implementing recommendations from step 1.1.
 Implementing partners: PRWC, Municipality of San Juan (lead parties), Community Groups
 Schedule: Long-term
 Cost: \$1,000,000
- 1.3** Relocate families near the Martín Peña Channel that will be affected by the infrastructure improvements, including those affected by the channel’s dredging.
 Implementing partners: PRWC, Municipality of San Juan (lead parties), DOH, Community Groups
 Schedule: Long-term
 Cost: Cost included under Action WS-2.
- 1.4** Verify that the Puerto Nuevo Wastewater Treatment Plant has the capacity to receive additional wastewaters from the eastern half of the Martín Peña Channel.
 Implementing partners: PRWC, Municipality of San Juan (lead parties), PRASA
 Schedule: Completed in 1999. Capacity will need to be reassessed at the time of action implementation.
 Cost: Administrative costs

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- 15** Design and construct a sanitary sewer system and stormwater sewer system for those communities that will be adjacent to the channel after the dredging is completed.

Sanitary sewer

Implementing partners: PRWC, Municipality of San Juan (lead parties), PRASA – Design sewage collection system and construct laterals.

Schedule: Short-term

Cost: \$10,000,000. In 1996, when this activity was included by PRASA and EQB in the Puerto Rico Project Priority List of the State Revolving Fund, the cost was estimated at \$6.4 million for 14,000 people. At this time, it is estimated that the cost of the project is \$10 million. Thus, it is critical that the Project Priority List be revised by PRASA and EQB. In addition, in order for the revised funds to be allocated, it is critical that PRASA and EQB reinstate the project in the Intended Use Plan.

The first-phase deadline to request funds is September 30, 2000, and the next deadline to request remaining State Revolving Funds from USEPA in the Intended Use Plan is September 30, 2001.

Storm sewer

Implementing partners: PRWC, Municipality of San Juan (lead parties), Community Groups

Schedule: Short-term

Cost: \$20,000,000

- 16** Develop and implement a storm sewer management plan for the Martín Peña Channel.

Implementing partners: PRWC, Municipality of San Juan (lead parties)

Schedule: Short- and Long-term

Cost: \$100,000 (Development and Implementation)

- 17** Identify those areas in other communities fringing the SJBE that have no sanitary sewer collection system and are prone to severe floods. This information will be used to identify structures eligible for future infrastructure improvements, such as connection to a sanitary sewer and storm sewer system.

Implementing partners: PRWC, Municipality of San Juan (lead parties), PRPB, FEMA, PRASA, Municipalities

Schedule: Mid-term

Cost: \$60,000

EXPECTED BENEFITS

Implementation of this action will significantly improve the living conditions for those communities adjacent to the SJBE, especially those along the eastern portion of the Martín Peña Channel that are the most affected by sewage discharges. Health risks associated with direct and indirect contact with raw sewage will be reduced. Those families that will be relocated will benefit from improved

living conditions in their new homes. A reduction in damage and loss of property due to flooding is expected, since the areas targeted for relocation will be available for the storage of flood waters. Ambient water quality conditions in the estuary will improve through the reduction of fecal coliforms and nutrient loadings, enhancing the value of these waterbodies for recreation, fish, and wildlife. Nutrient and turbidity reduction will result in healthier benthic communities.

MONITORING ENVIRONMENTAL RESPONSE/PROGRAMMATIC IMPLEMENTATION

Water quality monitoring stations will be established in surface waters receiving raw sewage to document the effectiveness of the infrastructure improvements and detect any future illegal sewage discharges.

REGULATORY NEEDS

Raw sewage discharges into surface waterbodies result in a violation of EQB's Water Quality Standards and the applicable provisions of the NPDES permits and their implementing regulations. A compliance plan must be developed and enforced. Municipal storm sewer discharges are regulated under the Federal Clean Water Act. Pursuant to this Act, USEPA issued regulations under the NPDES program which intend to minimize, reduce, control, and/or eliminate discharges of contaminated stormwater through storm sewers.

ACRONYMS

PRPB = PUERTO RICO PLANNING BOARD
 FEMA = FEDERAL EMERGENCY MANAGEMENT ADMINISTRATION
 PRIFA = PUERTO RICO INFRASTRUCTURE FINANCING AUTHORITY
 PRASA = PUERTO RICO AQUEDUCT AND SEWER AUTHORITY
 PRWC = PUERTO RICO WATER COMPANY
 USEPA = UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
 NPDES = NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
 EQB = ENVIRONMENTAL QUALITY BOARD
 DTPW = DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
 DOH = DEPARTMENT OF HOUSING

BACKGROUND

The Martín Peña Channel is located in the center of the SJBE system. This important hydrological link connects the San José Lagoon with San Juan Bay. Unfortunately, both its natural and hydrological functions are being severely affected by the overwhelming amount of human waste, debris, sediment, and fill material present in its waters.

From the 1930s to the early 1950s, many communities were established on the banks of the Martín Peña Channel by filling its waters and wetlands with debris and other types of refuse (Sepúlveda-Rivera and Carbonell, 1988). This housing was developed without the construction of basic utilities such as a sewage collection system, and, as a result, most of the structures discharge untreated sewage directly into the Martín Peña Channel or to the storm sewer system.

In the communities of Israel, Bitumul, Cantera, and Barrio Obrero, located adjacent to the Martín Peña Channel, flooding occurs during storm events and the sanitary wastes enter the stormwater system and the estuary. As a result, these areas become flooded with a combination of stormwater and sewage, causing public health problems.

The unhealthy living conditions along the Martín Peña Channel spurred a government relocation effort along the western part of the channel from the 1950s through the 1980s. This, in conjunction with the widening and deepening of this section of the Martín Peña Channel for the Acua Expreso Ferry System, helped to partially enhance both water quality conditions and hydrological flow. However, the eastern segment of the channel, from the Muñoz Rivera Bridge to its outlet at the San José Lagoon, continues to suffer from the same conditions experienced in the past on the western section (filling of wetlands, lack of sanitary sewers, etc.). At the present time, there are segments of the channel that have been narrowed to 8 feet (2.4 m) in width and filled to less than 3 feet (0.9 m) in depth. Channel waters from the Muñoz Rivera Bridge to the San José Lagoon are stagnant, and the flow between the ocean and the San José Lagoon through San Juan Bay is almost nonexistent.

Dredging of the Martín Peña Channel to increase the estuary's flushing capacity is recommended under Action WS-5 to solve some of these problems. A very dramatic impact of such a proposal will be the necessary relocation of some of the families that today live on both sides of the channel.

The Cantera Peninsula Project (CPP) has developed a plan for the relocation of those families living in housing units subject to frequent flooding or that have been constructed on unstable areas. The goal of this plan is to ensure the availability of safe, decent, and affordable housing for existing and future residents of the Cantera Peninsula. Many of the housing units identified in the project's plan are located in the north margin of the Martín Peña Channel. These contribute raw sewage and solid wastes to the channel.

Recently, concerned neighbors and community action groups, supported by a local church, formed "Corporación Desarrolladora de Viviendas de las Barriadas Israel y Bitumul." This group has presented a proposal to the local government to relocate most of the affected families to other areas within the community. A proposed housing complex was certified as a Community Housing Development Organization (CHDO) by the local government in 1993 and the state government in

1996. The project has been approved and is eligible for HOME federal funds. By the year 2000, construction of almost half of the new housing was completed.

These community initiatives will have a very positive impact on the estuarine environment and on the quality of life for many of the residents along the channel. Supporting these efforts not only will ensure an improvement in the water quality of the area, but will also facilitate the preliminary phases of the dredging of the channel.

The SJBE Program has fostered these community initiatives by providing information and soliciting the input of the affected communities. See Appendix J, pages 406 - 415, for a complete list of public involvement activities. This public involvement and outreach has helped ensure that families to be relocated as part of this action are treated fairly and consistently and not exposed to disproportionate injuries as a result of the relocation process.

Specifically, the SJBE Program has continuously updated affected communities on the relocation process, distributed flyers to inform the community of meetings, provided opportunities for the public to ask questions and express concerns, and brought representatives from the involved agencies to the meetings. The SJBE Program has encouraged community members to request additional informative meetings if needed. (See Appendix J for a complete list of public involvement activities.) The Environmental Justice Coordinator at USEPA's Office of Water reviewed the SJBE Program's outreach and involvement efforts related to this action and has found them to be satisfactory.

STRATEGY

2.1 Conduct a public poll in the communities to learn people's concerns about the relocation of families. Communities affected by the relocation may include sectors of Buena Vista, Las Monjas, Parada 27, Barrio Obrero, Israel, Bitumul, and Cantera.

Implementing partners: DOH (lead), Municipality of San Juan, CHDO, CPP, Community Groups
Schedule: Completed only for Las Monjas, Israel, Bitumul, and Cantera. This step was conducted by the CHDO and by the CPP.

Cost: \$50,000

2.2 Approach community residents to explain how the dredging project will affect their community, including the benefits of such a project on quality of life. Psychological and emotional support should be available from the Puerto Rico Family Department for those families affected by the relocation. In addition, environmental justice assessments may need to be performed as implementation proceeds.

Implementing partners: DOH (lead), CHDO, CPP, Municipality of San Juan, SJBE Program, Community Groups

Schedule: Short-term. (Some meetings have already taken place.)

Cost: \$15,000

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- 2.3** Identify those houses located next to the Martín Peña Channel that will be affected by the dredging of the channel. At this stage, a socioeconomic study will be conducted to assess residents' income and the conditions of the structures to be removed.
Implementing partners: DOH, USACE (lead parties), DNER, Community Groups
Schedule: Short-term
Cost: \$75,000 (provided by DOH)
- 2.4** Study the different alternatives and procedures for relocating families within the community.
Implementing partners: DOH (lead), Municipality of San Juan, CHDO, CPP, Community Groups
Schedule: Short-term. (This step completed only for Cantera, Israel, and Bitumul.)
Cost: \$50,000
- 2.5** Identify and/or acquire lands for the relocation of families. Efforts should focus on relocating displaced families within their community or in the nearest area available to reduce adverse impacts and disruption to the social composition of the community and its members.
Implementing partners: DOH (lead), Municipality of San Juan, CHDO, CPP, Community Groups
Schedule: Short-term. (Partially completed in Cantera, Israel, and Bitumul.)
Cost: \$2,000,000 (Costs will vary depending on the actual number of families to be relocated.)
- 2.6** Complete a land ownership subdivision study and purchase or expropriate (as applicable) private property next to the channel which is not public domain. It is also important that a land ownership-subdivision study be undertaken first.
Implementing partners: DOH (lead), Municipality of San Juan, CHDO, CPP, PRPB, Community Groups
Schedule: Short-term
Cost: \$30,400,000
- 2.7** Implement selected relocation alternatives from step 2.4.
Implementing partners: DOH (lead), Municipality of San Juan, PRPB, ARPE, CHDO, CPP, Community Groups
Schedule: Short-term
Cost: \$16,500,000

2.8 | Relocate families to the new facilities.

Implementing partners: DOH (lead), Municipality of San Juan, CHDO, CPP, Community Groups
 Schedule: Short-term. Steps have been initiated by “Corporación Desarrolladora de Viviendas de la Barriadas Israel y Bitumul,” and the first phase of the project was completed in Summer 2000. The CPP has already acquired most of the lands where the relocation will take place.

Cost: \$25,650,000

EXPECTED BENEFITS

The new housing will provide families with better quality housing and basic infrastructure like adequate sewage systems and garbage collection. Therefore, the relocated families will experience improvements in their quality of life and living conditions by moving to areas free from the environmental and health hazards associated with the polluted channel. The new location should also provide protection against recurrent street flooding and combined sewer over flows.

The relocation will have a positive impact on the water quality of the Martín Peña Channel. Raw sewage discharges from residential structures along the channel will be eliminated; filling activities and garbage disposal should cease.

The relocation will facilitate the preliminary phases of dredging the Martín Peña Channel. The dredging will be directed towards removing debris and restoring the flow between the San José Lagoon and San Juan Bay. This will improve the general water quality of the channel and most of the SJBE.

MS-2

MONITORING ENVIRONMENTAL RESPONSE/PROGRAMMATIC IMPLEMENTATION

Water quality assessments of the Martín Peña Channel and San Juan Bay will be performed regularly following relocation and dredging. Field inspections will be conducted regularly to detect illegal disposal of solid wastes or fill material by EQB and DNER.

REGULATORY NEEDS

A compliance plan should be developed to ensure enforcement of Clean Water Act section 404. Construction permits from ARPE should be obtained.

ACRONYMS

SJBE = SAN JUAN BAY ESTUARY

CHDO = COMMUNITY HOUSING DEVELOPMENT ORGANIZATION

USACE = UNITED STATES ARMY CORPS OF ENGINEERS

DNER = DEPARTMENT OF NATURAL AND ENVIRONMENTAL RESOURCES

PRPB = PUERTO RICO PLANNING BOARD

ARPE = PERMIT AND REGULATIONS ADMINISTRATION

EQB = ENVIRONMENTAL QUALITY BOARD

DOH = DEPARTMENT OF HOUSING

PRFD = PUERTO RICO FAMILY DEPARTMENT

CPP = CANTERA PENINSULA PROJECT



Eliminate Unauthorized Raw Sewage Discharges (bypasses) from PRASA's Collection System and Pump Stations into the SJBE.

BACKGROUND

The discharge of untreated wastewater is a major source of pollution to the estuarine system. Raw sewage discharges significantly impact wildlife and other living resources and could pose a serious health hazard to people who live near the estuarine system or use its waters for recreation and navigation.

Historical problems with the operation and maintenance of PRASA's sanitary sewer system include obstructions in sanitary sewer lines, leading to system back ups and overflows at manholes; infiltration of stormwater into the sanitary system, leading to overflows at manholes; the existence of combined or interconnected sewage and stormwater conveyances; and pumping station overflows. Among the most significant cases that have been reported are the overflows from PRASA's Los Corozos sewage pumping station into DNER's Baldorioty de Castro stormwater pumping station. The Baldorioty de Castro stormwater pumping station, with an approximate maximum capacity of 300,000 gallons per minute, should only discharge stormwater and only operate during wet weather conditions. However, it is discharging over one million gallons of raw sewage into Los Corozos Lagoon on a frequent basis, mostly as a result of bypasses from the Los Corozos sewage pumping station. Other, less significant, historical concerns were overflows from the Vistamar Marina and Villa Carolina sewage pumping stations in Carolina. Another source of sewage overflows is from the collection system of the Puerto Nuevo Sewage Treatment Plant. The discharge point from this sewage treatment plant was relocated from San Juan Bay to an ocean outfall in 1985, which ended all connections of the plant to the SJBE. Bypasses have occurred on an infrequent basis into the Puerto Nuevo River and, eventually, into San Juan Bay. Some of the historical problems associated with PRASA's collection system and pump stations have been addressed in recent years due to PRASA's and PRWC's focused efforts to resolve these issues. For example, the Vistamar Marina and Villa Carolina pumping stations are currently operating well, having zero and one overflow event reported since 1999, respectively.

These historical problems may occur again as a result of the demands of the growing population in the SJBE watershed on PRASA's aging infrastructure. Unless remediation actions are initiated, this situation will lead to increases in the number of illegal interconnections and discharges of untreated wastes to both the storm sewer system and estuary waters during both dry and wet weather conditions.

Unauthorized raw sewage discharges and bypasses into surface waterbodies result in a violation of EQB's Water Quality Standards and the applicable provisions of the Clean Water Act and its implementing regulations. The USEPA is committed to bringing all unauthorized discharges from PRASA into compliance with NPDES permit requirements, the applicable statute (Clean Water Act), and its implementing regulations.

STRATEGY

- 3.1** Conduct a preliminary engineering evaluation of the sewer lines and approximately sixty (60) pump stations in the SJBE watershed prior to any major action or investment from PRASA to eliminate unauthorized discharges. USEPA will incorporate compliance schedules into consent administrative orders based upon the engineering evaluation document recommendations. The engineering evaluation also will be a useful tool for PRASA to determine connection capabilities of new or proposed projects. This strategy follows PRASA's private administrator (Puerto Rico Water Company [PRWC]) policies.
- Implementing partners: PRASA, PRWC (lead parties), EQB, Municipality of San Juan, USEPA
 Schedule: Ongoing. Steps to reduce the number of unauthorized discharges have been undertaken by USEPA through Consent Order Agreements. By the year 2000, the goal is to significantly reduce the number of bypasses reaching estuarine waters.
 Cost: \$800,000
- 3.2** Eliminate overflows and bypasses through adequate operation and maintenance of the pumping stations and collection systems leading to the Puerto Nuevo Sewage Treatment Plant.
- Implementing partners: PRASA, PRWC (lead parties)
 Schedule: Ongoing
 Cost: \$10,000,000
- 3.3** Determine the origin of the sanitary wastes from PRASA's system reaching storm sewers by cleaning (flushing) sewer and storm drain segments. In the past, EQB has requested the cleaning of sewer and storm line segments with limited response from PRASA and the Municipality of San Juan. Regarding the connection between the Los Corozos pumping station and the Baldorioty stormwater station, PRASA, PRWC, and DNER are attempting to identify, isolate, and resolve the problem in coordination with EQB and USEPA.
- Implementing partners: PRASA, PRWC (lead parties), EQB, Municipalities
 Schedule: Mid-term
 Cost: \$40,000
- 3.4** Verify compliance of auxiliary or backup equipment, i.e. alternate power units for pumping stations, as necessary. USEPA and EQB will report on compliance during periodic follow-up inspections of PRASA's facilities.
- Implementing partners: PRASA, PRWC (lead parties), USEPA
 Schedule: Ongoing
 Cost: \$30,000

- 3.5** Increase surveillance and decrease the response time at locations where sewer and manhole spills are frequent occurrences. At the present time, the discharge of sanitary wastes into surface water bodies due to sewage overflows or bypasses are reported to PRASA either when employees observe the overflow condition or when a citizen files a complaint. PRASA is required by regulations to report the existence of overflows or bypasses within 24 hours of their occurrence. When an overflow or bypass occurs, PRASA must initiate appropriate actions to correct the condition. Monitoring improvements in the PRASA system, including the implementation of a new telemetry system, will help to improve the surveillance and decrease the response times to resolve the overflow and bypass conditions.

Implementing partners: PRASA, PRWC (lead parties), USEPA, EQB
 Schedule: Ongoing
 Cost: \$20,000

- 3.6** Use the frequency of reported overflows and bypasses as a tool for targeting sewer line problems and manhole overflows for corrective action. A master plan study has been proposed by the PRWC to review the Condado, Hato Rey, and Old San Juan collection systems.

Implementing partners: PRASA, PRWC (lead parties), USEPA, EQB
 Schedule: Mid-term
 Cost: \$2,500 per manhole (proposed master plan study cost is \$250,000)

- 3.7** Address reported and non-reported discharges via administrative orders with corresponding compliance schedules. This is currently performed on an "as-needed basis". Schedules are completed by and coordinated with regulatory agencies.

Implementing partners: PRASA, PRWC (lead parties), USEPA, EQB
 Schedule: Mid-term
 Cost: \$20,000

EXPECTED BENEFITS

The reduction and eventual elimination of unauthorized raw sewage discharges into the SJBE will immediately enhance the quality of the waters in the estuary for recreational activities and for marine organisms. Reduction in the amount of organic matter will reduce BOD. Increased DO will benefit fish and wildlife. It will also contribute to a reduction in algal blooms, increased light penetration, and, consequently, healthier benthic communities. The living resources and aesthetics of the estuary will be enhanced, improving the scenery in areas heavily frequented by tourists, such as the cruise ship terminals and the Old San Juan Waterfront. Boating and sport fishing activities will be improved.

MONITORING ENVIRONMENTAL RESPONSE/PROGRAMMATIC IMPLEMENTATION

Quantitative measures: PRASA's bypass reports will serve as the basis for determining progress in reducing the number of bypasses. Accordingly, and upon examination of the available records, USEPA will measure the degree of compliance and should study the effectiveness of the procedures.

Qualitative Measures: Periodic water quality sampling will be used by EQB as the qualitative measure to quantify changes in water quality due to a reduction in sewage discharges. The sampling will include measurements of bacteriological contamination and nutrients.

Monitoring will be performed and enforced by EQB in accordance with a pre-established schedule that considers tidal movements and climatological conditions.

REGULATORY NEEDS

The treatment and discharge of wastewater are regulated by the NPDES permit program and the Clean Water Act and its applicable regulations. A compliance plan should be developed and enforced.

ACRONYMS

DNER = DEPARTMENT OF NATURAL AND ENVIRONMENTAL RESOURCES

PRASA = PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

PRWC = PUERTO RICO WATER COMPANY

BOD = BIOCHEMICAL OXYGEN DEMAND

DO = DISSOLVED OXYGEN

EQB = ENVIRONMENTAL QUALITY BOARD

USEPA = UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

NPDES = NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM



Eliminate Illegal Commercial and Residential Sewage Discharges into the Stormwater Sewer System.

BACKGROUND

Untreated wastewater from sewage overflows and illegal commercial and residential raw sewage discharges is a major source of pollution in the SJBE. A substantial volume of the raw sewage entering these stormwater sewers from residential and commercial interconnections is discharged into the estuary by stormwater pumping stations. The DNER and the San Juan and Carolina municipalities manage a total of fourteen (14) stormwater pumping stations. These stations were designed to discharge stormwater only during wet weather conditions. However, some of these pumping stations need to be operated on a daily basis, partly due to incoming sewage from illegal connections. For example, the Stop 18 stormwater pumping station in Santurce, with a pumping capacity of 175,000 gallons per minute, discharges raw sewage into the western half of the Martín Peña Channel.

The discharge of raw sewage significantly impacts wildlife and other living resources in the estuary, posing a serious health hazard to people who live near the estuarine system or use its waters for recreation and navigation. In addition, the operation of stormwater pumps during dry weather increases maintenance costs and shortens the service life of the pumping stations.

Commercial and residential sanitary sewer interconnections to the storm sewers are illegal and, as such, are required to be removed through interagency coordination, short-term compliance notifications, or administrative enforcement orders.

STRATEGY

4.1 Conduct a field survey to identify all residential, commercial, and industrial sanitary connections to the storm sewer system that lead to stormwater pumping stations and eventually discharge into the SJBE.

Implementing partners: DNER, Municipality of San Juan, Municipality of Carolina, EQB (lead parties)

Schedule: Short-term

Cost: Baldorioty de Castro service area:	\$15,000
Stop 18 service area:	\$25,000
Malaria Canal:	\$20,000
Bay View:	\$15,000
Juana Matos:	\$15,000
San Fernando:	\$15,000
Sabana:	\$15,000
Puerto Nuevo North East:	\$10,000
Puerto Nuevo North West:	\$10,000
Bechara:	\$15,000

Barrio Obrero:	\$20,000
Villamar:	\$5,000
El Palmar:	\$5,000
Vistamar:	\$5,000

4.2 Issue short-term compliance notifications to violators.

Implementing partners: DNER, Municipality of San Juan, Municipality of Carolina, EQB (lead parties)

Schedule: Short-term

Cost: \$40,000 - 60,000 per year

4.3 Connect violators to the existing sanitary sewer system.

Implementing partners: PRASA (lead), Municipality of San Juan, Municipality of Carolina

Schedule: Short-term

Cost: Baldorioty de Castro service area: \$1,000,000

Stop 18 service area: \$1,500,000

Malaria Canal: \$600,000

Bay View: \$500,000

Juana Matos: \$400,000

San Fernando: \$600,000

Sabana: \$600,000

Puerto Nuevo North East: \$300,000

Puerto Nuevo North West: \$300,000

Bechara: \$400,000

Barrio Obrero: \$600,000

Villamar: \$200,000

El Palmar: \$200,000

Vistamar: \$200,000

4.4 Provide follow-up to force those parties illegally connected to the storm sewer to cease their discharges and connect their wastewater discharges to the sanitary system. EQB must periodically monitor the area to require compliance with applicable environmental regulations.

Implementing partners: EQB, USEPA (lead parties), DNER, Municipality of San Juan, Municipality of Carolina

Schedule: Short-term

Cost: \$75,000 per year

EXPECTED BENEFITS

This action will reduce the amount of raw sewage entering the SJBE and its tributaries, including the Los Corozos Lagoon, San Juan Bay, and the Puerto Nuevo River. Reductions in raw sewage will reduce total organic matter entering these waterbodies, reducing BOD. Increased DO will benefit fish and wildlife. It will also contribute to a reduction in algal blooms, increased light penetration, and,

WS-4

consequently, healthier benthic communities. Increased DO will reduce or eliminate fish kills. Reduced fecal coliform levels will enhance the recreational value of the lagoons, making them fishable and swimmable.

MONITORING ENVIRONMENTAL RESPONSE/PROGRAMMATIC IMPLEMENTATION

A long-term monitoring network will be established for the stormwater pumping stations and, in the SJBE, to sample for water and sediment quality as well as bacteria.

REGULATORY NEEDS

Unauthorized raw sewage discharges and bypasses into surface waterbodies result in a violation of EQB's Water Quality Standards as well as the applicable provisions of the NPDES permits and their implementing regulations. A compliance plan must be developed and enforced.

ACRONYMS

DNER = DEPARTMENT OF NATURAL AND ENVIRONMENTAL RESOURCES

EQB = ENVIRONMENTAL QUALITY BOARD

PRASA = PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

NPDES = NATION POLLUTANT DISCHARGE ELIMINATION SYSTEM

DO = DISSOLVED OXYGEN

BOD = BIOCHEMICAL OXYGEN DEMAND

SJBE = SAN JUAN BAY ESTUARY

USEPA = UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

WS-4
SM

 **WS-5****Improve Flow in the Martín Peña Channel.****BACKGROUND**

The Martín Peña Channel is located in the center of the SJBE system. This important hydrological link connects the San José Lagoon with San Juan Bay. Unfortunately, both its natural and hydrological functions are being severely affected by the overwhelming amount of human waste, debris, sediment, and fill material present in its waters.

From the 1930s to the early 1950s, many communities were established on the banks of the Martín Peña Channel by filling its waters and wetlands with debris and other types of refuse (Sepúlveda-Rivera and Carbonell, 1988). The construction of structures on fill material significantly reduced the flow of water through this part of the estuary and reduced its capacity to store floodwaters. The housing was developed without the construction of basic utilities such as a sewage collection system, and, as a result, most of the structures discharge untreated sewage directly into the Martín Peña Channel or to the storm sewer system. In addition, these communities were built without proper planning, and the streets are so narrow that garbage trucks cannot enter the area. Residents dispose of their garbage in the channel or use it as fill material to extend their properties.

The unhealthy living conditions along the Martín Peña Channel spurred a government relocation effort along the western part of the channel from the 1950s through the 1980s. This, in conjunction with the widening and deepening of this section of the Martín Peña Channel for the Acua Expreso Ferry System, helped to partially restore both water quality conditions and hydrological flow. However, the eastern segment of the channel, from the Martín Peña Channel Bridge to its outlet at the San José Lagoon, continues to suffer from the same conditions experienced in the past on the western section (filling of wetlands, lack of sanitary sewers, etc.).

The western half of the Martín Peña Channel was described in 1899 as being between 30 feet (9.1 m) and 150 feet (45.7 m) in width and between 2 feet (0.61 m) and 10 feet (3.1 m) in depth (Warren-Evermann, 1900). The eastern half was originally around 200 feet (61.0 m) wide, based on a 1892 map depicting the channel and an aerial photograph from 1936 (Sepúlveda-Rivera and Carbonell, 1988; Eng. Tous, J., USACE, personal communication, 1999). At the present time, there are segments of the channel that have been narrowed to 8 feet (2.4 m) in width and filled to less than 3 feet (0.9 m) in depth. Channel waters from the Muñoz Rivera Bridge to the San José Lagoon are stagnant, and the flow between the ocean and the San José Lagoon through San Juan Bay is almost nonexistent.

Dredging of the Martín Peña Channel to increase the estuary's flushing capacity is recommended to solve some of these problems. A very dramatic impact of such a proposal will be the necessary relocation of some of the families that today live on both sides of the channel. This relocation effort is discussed under Action WS-2.

Please see map for this action in Appendix A.

STRATEGY

- 5.1** Conduct alternatives analysis. Concerned agencies have evaluated various channel dimensions in terms of their overall cost, including, but not limited to, real estate, construction, operation and maintenance, as well as flushing capacity and overall environmental impact. The USACE, as part of the hydrodynamics/water quality model developed for the SJBE Program, evaluated channel dimensions which would provide the most environmental benefits. Based on both efforts, a channel of 150 to 230 feet (45.7 to 70.1 m) in width, dredged to 10 feet (3.0 m) in depth was selected as the alternative to be constructed for restoring the Martín Peña Channel.

Implementing partners: DNER (lead), USACE, SJBE Program, PRPB, DTPW

Schedule: Completed

Cost: Completed under hydrological model at an approximate cost of \$750,000.

- 5.2** Prepare a Design Memorandum and Environmental Impact Statement for the selected channel alternative. Detailed design plans for the construction of the selected channel alternative will be developed, including information identifying those residences, buildings, and other infrastructure that will need to be relocated. Other information that will be provided includes sampling and laboratory analysis of dredged materials, selection of a disposal site for the dredged material, and the costs for replacing the bridges at Muñoz Rivera Avenue, Ponce de León Avenue, and Barbosa Avenue.

Implementing partners: DNER (lead), USACE

Schedule: Ongoing

Cost: \$600,000

- 5.3** Relocate affected families. Begin construction of housing and relocation of those families located in the selected channel pathway. Several community organizations such as the Cantera Peninsula Project (CPP) and the Israel-Bitumul Community Housing Development Organization (IBCHDO) have already started the process of relocating those families along the banks of the Martín Peña Channel that will be directly impacted by the dredging. Acquisition of lands for new housing has already started.

Implementing partners: DOH (lead), DNER, Municipality of San Juan, CPP, IBCHDO

Schedule: Short-term

Cost: \$50,000,000

- 5.4** Construct sewage laterals and other infrastructure improvements. Many of the structures that will not be affected by the channel pathway and that will remain in the area lack adequate utilities such as storm and sanitary sewers and proper solid waste disposal facilities. The bridges that cross the Martín Peña Channel will have to be raised or reconstructed to allow the passage of the machinery involved in the dredging. Construction of utility improvements will have to begin prior to initiating the dredging of the new channel. See related Action WS-1.

Implementing partners: PRASA (lead), DNER, DTPW, Municipality of San Juan
 Schedule: Short-term
 Cost: \$12,000,000 (for bridge replacement only)

55 | Dredge the Martín Peña Channel.

Implementing partners: DNER (lead), SWMA, EQB, Municipality of San Juan, USFWS, NMFS, PRPB, USACE, USEPA
 Schedule: Short-term
 Cost: \$50,000,000

EXPECTED BENEFITS

Restoring flow between the Martín Peña Channel and San Juan Bay will improve water circulation and water quality in the channel and in the San José Lagoon. Raw sewage discharges from residential structures along the channel will be eliminated; filling activities and garbage disposal should cease. The dredging will create a buffer zone with adequate grading and hydrology between the new channel and the adjacent upland areas which should result in natural colonization of mangroves. Improvements in environmental conditions should increase fish and wildlife in the area, and the movement or dispersion of species across the Martín Peña Channel from other waterbodies within the estuary is expected due to continuity in the natural landscape. New opportunities will be available for recreational activities. The use of Martín Peña Channel as a transportation route will become possible.

Relocated families will experience improved quality of life and living conditions by moving to areas free from the environmental and health hazards associated with the polluted channel. The new location should provide protection against recurrent street flooding and combined sewer overflows. Also, families will have access to better housing facilities and basic infrastructure like sewage systems and garbage collection.

WS-5

MONITORING ENVIRONMENTAL RESPONSE/PROGRAMMATIC IMPLEMENTATION

Monitoring will be conducted to determine whether the system responds as predicted by modeling.

REGULATORY NEEDS

Permits should be obtained in accordance with the Rivers and Harbors Act Section 10 and the Clean Water Act Section 404. Associated water quality and coastal zone certifications should be obtained.

ACRONYMS

CHDO = COMMUNITY HOUSING DEVELOPMENT ORGANIZATION
 CPP = CANTERA PENINSULA PROJECT
 DNER = DEPARTMENT OF NATURAL AND ENVIRONMENTAL RESOURCES
 DOH = DEPARTMENT OF HOUSING
 DTPW = DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
 EQB = ENVIRONMENTAL QUALITY BOARD
 IBCHDO = ISRAEL-BITUMUL COMMUNITY HOUSING DEVELOPMENT ORGANIZATION
 NMFS = NATIONAL MARINE FISHERIES SERVICE
 PRASA = PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

PRHD = PUERTO RICO HEALTH DEPARTMENT
PRPB = PUERTO RICO PLANNING BOARD
SJBE = SAN JUAN BAY ESTUARY
SWMA = SOLID WASTE MANAGEMENT AUTHORITY
USACE = UNITED STATES ARMY CORPS OF ENGINEERS
USEPA = UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
USFWS = UNITED STATES FISH & WILDLIFE SERVICE

WS-5

WS-6**Fill Artificial Depressions at the Suárez Canal and at the Los Corozos, San José, and La Torrecilla Lagoons.****BACKGROUND**

Dredging, channelization, the mining of fill material, the placement of fill material, and sedimentation have significantly modified the SJBE. In particular, these activities have degraded the water quality of Los Corozos, San José, and La Torrecilla Lagoons, as well as the Suárez Canal. This problem has been exacerbated by the natural, limited water exchange that the lagoons and the canal have with the ocean.

The San José Lagoon, the SJBE's water body least affected by tidal flow, has approximately 1,344 acres (544 ha) of surface area (Conde-Costas, 1987). Originally it had a natural average depth of 6 feet (1.8 m) and did not exceed 8.2 feet (2.5 m) in depth (Ellis, 1976; Conde-Costas, 1987).

Modifications to the shape of the San José Lagoon began with dredging for fill material in the 1950s and 1960s (Ellis, 1976). During the 1960s, the eastern part of the lagoon was dredged to as much as 35 feet (10.7 m) in depth (Conde-Costas, 1987) to obtain fill material for the area north of the San Antón Creek and for the Laguna Gardens Condominiums construction site (Ellis, 1976).

The area north of the Cantera Peninsula, located in Los Corozos Lagoon, was also dredged for fill material to depths that ranged from 20 to 25 feet (6.1 - 7.6 m) (Conde-Costas, 1987). The dredged material was used to fill the construction site for Las Margaritas Public Housing Development (Ellis, 1976).

Dredging has occurred in about 17 percent of the San José and Los Corozos Lagoons, increasing their combined original volume by about 30 percent (Ellis, 1976). The increased volume reduces the capacity of these two lagoons to exchange water with the ocean, since the Suárez Canal only provides limited water exchange with the sea.

The area occupied today by the Suárez Canal was originally an extensive swamp associated with the San José and La Torrecilla Lagoons (Sepúlveda-Rivera, 1989). From the 1820s to 1830s, the Suárez Canal, then called Canal de la Pasa, was dug between the San José and La Torrecilla Lagoons. The canal provided a safe, non-ocean route alternative for the landowners of the Río Grande de Loíza flood plain who sold their products at the market of the San Juan Islet (Giusti-Cordero, 1994).

As originally constructed, the canal was very narrow and shallow, providing only limited flow between the San José and La Torrecilla Lagoons (Ellis, 1976). During the mid-1960s, the Suárez Canal was deepened and widened and a yacht harbor basin was dug west of the Baldorioty de Castro Expressway Bridge (Ellis, 1976). This section of the canal was dredged to a maximum depth of 30 feet (9.1 m) for the construction of the yacht harbor (USACE, 2000).

La Torrecilla Lagoon covers an area of approximately 1 square mile (2.46 km²) and contains one of the three ocean outlets of the estuary, Boca de Cangrejos. The lagoon originally had an average depth of 3.2 feet (1 m). The shallowest area, found at the Boca de Cangrejos outlet, was originally reported to be approximately 3.2 feet (1 m) in depth (Ledrú, 1971).

Modifications to La Torrecilla Lagoon began with the filling and possibly some dredging of the western banks as part of the construction of the Luis Muñoz Marín International Airport and for the

construction of a bridge at Boca de Cangrejos in the early 1950s. The Boca de Cangrejos outlet was dredged to 7 feet (2.2 m) in depth and 60 feet (18.8 m) in width during the early 1960s (USACE, 1992; Ellis, 1976). Further dredging for the construction of a marina for the Boca de Cangrejos Yacht Club, a navigational channel with a boat basin for the Vistamar Marina housing development, and the building of two drainage channels for the Luis Muñoz Marín International Airport also occurred during the 1960s (Ellis, 1976). During this time, several sites around Punta Mosquito, a mangrove island found at the southeastern end of the lagoon, were intensively dredged. An area north of Punta Mosquito was dredged to a depth of 39.3 feet (12 m) (Ellis, 1976). Thereafter, the area southeast of Punta Mosquito was dredged to a depth of 52 feet (16 m) and an area at the outlet of the Blasina Creek north of the Piñones Channel was dredged to 23 feet (7 m) in depth. Another area east of Punta Mosquito was deepened to approximately 59 feet (18 m) (Ellis, 1976).

Dredging and filling activities performed from the early 1960s to 1971 increased the volume of La Torrecilla Lagoon by 110 percent and reduced its area by about 10 percent (Ellis, 1976). Although the deepening and widening of the Boca de Cangrejos outlet increased the flushing rate of the lagoon, this may not have been enough to counteract the effects of the extensive dredging and deepening.

The deep dredging of the lagoons and the Suárez Canal has negatively impacted water quality. Dense salt or brackish water entering the lagoons flows underneath the fresh water discharged by streams and stormwater pumping stations. In deep areas of the lagoons, 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 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 lagoons to sustain life.

Please see map for this action in Appendix A.

STRATEGY

6.1 Conduct a detailed survey of the present extension and depth of the depressions to determine the volume of fill material needed. The USACE, as part of the hydrodynamics/water quality model project for the SJBE Program, developed a bathymetric map of the estuary. If this map has enough detail, no further survey will be required.

Implementing partners: USACE, SJBE Program (lead parties), DNER

Schedule: Completed

Cost: Completed under hydrological model developed by the USACE for the SJBE Program.

6.2 Identify source(s) for suitable fill material. Perform sampling and laboratory analysis of fill material to assess contaminant concentrations and toxicity. Potential sources of fill include dredged material from the construction of the Río Puerto Nuevo Flood Control Project, the material to be dredged from the Martín Peña Channel, and the dredged material from San Juan Bay's Navigational Channel Project.

Implementing partners: DNER (lead), USACE, USEPA, EQB
 Schedule: Short-term
 Cost: \$270,000

6.3 | Initiate filling of dredged depressions up to the historical average depth once the necessary permits have been obtained.

Implementing partners: DNER (lead), PRPB, USACE, USEPA, EQB
 Schedule: Short-term (San Jose and Los Corozos Lagoons) and Mid-term (La Torrecilla Lagoon and Suárez Canal)

Cost: San Jose and Los Corozos Lagoons: \$3,300,000; La Torrecilla Lagoon and Suárez Canal: \$2,250,000

EXPECTED BENEFITS

Water quality within the San José, Los Corozos, and La Torrecilla Lagoons and in the Suárez Canal will improve from increased water circulation and a reduction in the time needed for flushing or exchange of their waters. The storage and production of nutrients in the depressions will be eliminated. Oxygen-depleted areas and water stratification will be significantly reduced or eliminated. As water stratification is eliminated and oxygen levels and water transparency are increased, benthic communities such as shellfish or seagrass beds could extend or be established in other areas within the estuarine system. Fisheries and wildlife will be enhanced, especially birds that prey on fish. Waters currently entering the Piñones Lagoon through the Piñones Channel will be of better quality.

WS-6

MONITORING ENVIRONMENTAL RESPONSE/PROGRAMMATIC IMPLEMENTATION

The USACE hydrodynamics/water quality model was used to analyze the effectiveness of this action in terms of enhanced water flow and circulation in the estuary. In terms of species diversity, bird census and creel surveys as well as habitat studies will be performed.

REGULATORY NEEDS

A Clean Water Act Section 404 permit and associated coastal zone and water quality certifications should be obtained.

ACRONYMS

USACE = UNITED STATES ARMY CORPS OF ENGINEERS
 DNER = DEPARTMENT OF NATURAL AND ENVIRONMENTAL RESOURCES
 PRPB = PUERTO RICO PLANNING BOARD
 EQB = ENVIRONMENTAL QUALITY BOARD
 USEPA = UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
 SJBE = SAN JUAN BAY ESTUARY

BACKGROUND

From 1962 to 1965, the federal San Juan Navigation Project was developed in San Juan Bay. This project included, among other works, the construction of the Puerto Nuevo Port facilities and the deepening and widening of the bay's entrance channel, as well as the dredging of a new navigation channel, known today as the Puerto Nuevo Channel. A substantial amount of the dredged material from the development of these two 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 what is known today as La Esperanza Peninsula. Slightly after their creation, both islands were connected by the deposition of littoral material forming a sand spit. At the same time, the deposition connected the island to the Bacardí property, forming a peninsula, and the entire island also migrated southwestward. By the mid-1970s, the western edge of the hook came close to Cataño's coastline, forming the peninsula (Seguino-Barbosa, 1983). Over the past 30 years, La Esperanza Peninsula has been migrating and changing in shape due to prevailing winds, tides, wave action, and annual swells produced by northern cold fronts.

In the early 1980s, the Municipality of Cataño purchased part of the peninsula from the Puerto Rico Ports Authority and created a park. Park lands (the western half of the peninsula) were protected on the northern shoreline by the placement of riprap, while the lower, eastern end continued migrating. The eastern end of Peninsula La Esperanza curved around to the southwest as it continued to move, forming a hook shape pointing to the southwest of Bay View. This long hook now significantly impairs water circulation inside a shallow embayment by trapping and concentrating nutrients and sediment-laden water discharged by the Malaria Canal (USACE, 2000). There is also evidence that the long hook traps contaminant-laden waters drifting westward from inner San Juan Bay into La Esperanza Peninsula's cove (USACE, 2000). These conditions have increased the time required for the dispersal of contaminants reaching San Juan Bay, adversely affecting the water quality in this segment of the estuary and significantly degrading those resources already affected by the discharge of the Malaria Canal.

Please see map for this action in Appendix A.

STRATEGY

- 7.1** Conduct an environmental study to evaluate and recommend alternatives that will improve the flow of water in La Esperanza Peninsula Cove. This study should present information about the cost estimates of the proposed alternatives as well as their effectiveness in enhancing water circulation. It also needs to address the concerns of various government agencies and the general public.

Implementing partners: DNER (lead), USACE, Municipality of Cataño, USFWS, NMFS, Community Groups, SJB Program

Schedule: Draft report completed in June 1999.

Cost: \$100,000. The funds for this step were provided entirely as federal matching funds through Section 1135 of the Federal Water Resources Development Act. State matching funds for this effort will be provided as part of the expenses related to the construction of the selected alternative.

7.2 Select the most environmentally-sound alternative that will be implemented based on the report completed under step 7.1. Concurrence and comments from regulatory and resource agencies will be sought during public circulation of the report and as part of the alternative selection process.

Implementing partners: DNER (lead), Municipality of Cataño, USACE, EQB, PRPB, PRPA, USFWS, NMFS, Community Groups, SJB Program

Schedule: Ongoing

Cost: None

7.3 Commence the project after authorization and funding has been received. This would include developing plans and specifications, issuing a contract for completion of related works, and initiating construction.

Implementing partners: DNER (lead), USACE

Schedule: Mid-term

Cost: \$1,300,000. The federal share of the project's cost would be 75 percent; the Government of Puerto Rico's share would be 25 percent.

MS-7

EXPECTED BENEFITS

Water quality within La Esperanza Peninsula Cove should improve as a result of frequent and more complete dispersal of nutrients and other loadings to the outer part of San Juan Bay and eventually to the ocean. Isolation of the outer peninsula segment should make it more attractive to wildlife. The island to be formed in the cove with the dredged material will provide additional mangrove and mudflat habitat. The bait fishery should improve due to an improvement in water quality.

MONITORING ENVIRONMENTAL RESPONSE/PROGRAMMATIC IMPLEMENTATION

Water quality monitoring will be implemented to monitor changes in water quality. Volunteers could be used to conduct monitoring

REGULATORY NEEDS

None.

ACRONYMS

SJBE = SAN JUAN BAY ESTUARY

USACE = UNITED STATES ARMY CORPS OF ENGINEERS

DNER = DEPARTMENT OF NATURAL AND ENVIRONMENTAL RESOURCES

PRPB = PUERTO RICO PLANNING BOARD

EQB = ENVIRONMENTAL QUALITY BOARD

USFWS = UNITED STATES FISH & WILDLIFE SERVICE

NMFS = NATIONAL MARINE FISHERIES SERVICE

PRPA = PUERTO RICO PORTS AUTHORITY

WS-7

WS-8**Assess the Feasibility of Opening the Causeway to Isla de Cabras to Increase Water Flow.****BACKGROUND**

The area known today as Isla de Cabras originally consisted of two islands united by a reef with a depth that did not exceed 5 feet (1.5 m) (U.S. Department of Commerce, 1976). These two islands, named Islote del Cañuelo and Isla de Cabras, were positioned almost parallel to the entrance channel at the western side of outer San Juan Bay. The Islote del Cañuelo, presumably a rock outcrop, was located south of Isla de Cabras. Besides the main entrance channel to the bay, a second channel existed between the Islote del Cañuelo and the Palo Seco headland. This channel, named El Cañuelo, was narrower and shallower than the entrance channel to San Juan Bay. (Seguinot-Barbosa, 1983).

Although modifications to the Islote del Cañuelo began just before 1595, permanent alterations began in 1662 with the construction of the San Juan de la Cruz Fort. In constructing the fort, a small section of the Islote was filled with rocks to strengthen its base (Ramos-Vélez, 1995). Other changes to the area included the dredging of the Cañuelo Channel during the 1890s and the building of a bridge before 1939 that connected the Palo Seco with the Islote del Cañuelo and Isla de Cabras (Ramos-Vélez, 1995; Seguinot-Barbosa, 1983).

During the 1940s, the shallow reef area between Isla de Cabras and the Islote del Cañuelo was filled for the construction of military installation facilities. The fill material transformed the two islands into one. A causeway was constructed with rubble and other materials to connect this area with the mainland (Seguinot-Barbosa, 1983). This action reduced almost by half the width of San Juan Bay's outlet and significantly reduced the exchange of water between the bay and the ocean.

Please see map for this action in Appendix A.

STRATEGY

8.1 Evaluate the need to increase the flow of water between San Juan Bay and Ensenada Boca Vieja. The USACE hydrodynamic/water quality model should be used to assess the benefits of performing this action. A discussion of the potential impact of this action on marine resources will form part of this step.

Implementing partners: DNER (lead), USACE, SJBE Program

Schedule: Long-term

Cost: \$12,000

WS-8

8.2 | Select the location and size of the new opening. Alternatives for evaluation include placing culverts across the causeway or building a bridge on piles.

Implementing partners: DNER (lead), USACE, PRPA, USFWS, NMFS, Municipality of Toa Baja, SJBE Program

Schedule: Long-term

Cost: \$5,000

8.3 | Begin construction once necessary permits have been granted.

Implementing partners: DNER (lead), USACE, PRPB, PRPA, DTPW

Schedule: Long-term

Cost: \$74 per square foot (\$800/m²) of construction

EXPECTED BENEFITS

The feasibility study will be used to determine the expected benefits. It is anticipated that water exchange between San Juan Bay and Ensenada Boca Vieja will increase. A possible impact that will need to be evaluated is the movement of aquatic debris from Isla de Cabra's shoreline into Boca Vieja Bay and the spread of contaminants from San Juan Bay into Boca Vieja Bay.

MONITORING ENVIRONMENTAL RESPONSE/PROGRAMMATIC IMPLEMENTATION

Water flow meters or gauges will be used to assess changes in water flow if the opening is completed.

REGULATORY NEEDS

A Clean Water Act Section 404 permit and associated coastal zone and water quality certifications should be obtained.

ACRONYMS

SJBE = SAN JUAN BAY ESTUARY

USACE = UNITED STATES ARMY CORPS OF ENGINEERS

DNER = DEPARTMENT OF NATURAL AND ENVIRONMENTAL RESOURCES

PRPB = PUERTO RICO PLANNING BOARD

USFWS = UNITED STATES FISH & WILDLIFE SERVICE

NMFS = NATIONAL MARINE FISHERIES SERVICE

PRPA = PUERTO RICO PORTS AUTHORITY

DTPW = DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS

WS-9

Minimize Sediment Loadings into the San Juan Bay Estuary System.

BACKGROUND

Rivers, streams, surface runoff, and point source discharges contribute sediments to the SJBE. When excessive sedimentation occurs in a waterbody, the functional values of the system may become impaired. Sediments are capable of modifying the water column in such ways as to inhibit important biological functions (photosynthesis, nitrogen fixation, migration). It is therefore important to evaluate the role that sediments play in determining the productivity and diversity of the system.

Sediments suspended in the water column attenuate light transmission while reducing or inhibiting the primary productivity of the system. When excessive sediment loads enter estuary waters, corals, seagrasses, and algae become buried and killed. An example of this effect is the destruction of the submarine Gardens of Boca de Cangrejos, which were totally destroyed in part by sediments discharged by the opening of the Boca de Cangrejos outlet.

Sediment criteria need to be developed in order to protect the ecological resources of the SJBE. There is an existing standard of 10 NTU (nephelometric units) for SC waters such as San Juan Bay. However, the basis, justification, usefulness, and benefits of this standard have been questioned.

This action calls for a research study to determine the relative effects of sediments on overall water quality, water transparency, primary productivity of the water column, and primary productivity of benthic habitats (e.g., algal beds, seagrass beds, coral reefs). The relative contribution of sediments to the extinction of light (the primary source of energy for the estuary) and to the distribution of autotrophic systems in the estuary will be determined. The study will include both field and in vitro studies following standard methods modified for particular conditions.

In addition, this action supports implementation of the EQB's Regulation for Control of Erosion and Sedimentation (CES) and its Technical Manual, included in the Puerto Rico Coastal Non-Point Pollution Control Plan (PRCNPC). The PRCNPC is a 15-year plan, with a goal "to achieve full island-wide implementation of all applicable mandatory management measures" of various categories, including erosion and sediment control. The Governor of Puerto Rico has established the PRCNPC Committee (Composed of 16 agencies) as part of the Coastal Zone Management Program with the responsibility to submit progress reports at three- and five-year intervals to monitor compliance. The SJBE system was identified as a special priority watershed in the PRCNPC.

STRATEGY

- 9.1** Define the spatial and temporal scale of the study.
 Implementing partners: EQB (lead), DNER, USEPA
 Schedule: Long-term
 Cost: \$30,000 (Meetings).

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- 9.2** | Contract personnel and purchase equipment and materials.
 Implementing partners: EQB (lead), DNER, USEPA
 Schedule: Long-term
 Cost: \$60,000 (Student grants, basic equipment).
- 9.3** | Implement sampling and testing periodically.
 Implementing partners: EQB (lead), DNER, USEPA
 Schedule: Long-term
 Cost: \$25,000 (Literature review, analysis).
- 9.4** | Determine the relative contribution of sediments to overall water quality and light extinction curves.
 Implementing partners: USEPA, EQB (lead parties), DNER
 Schedule: Long-term
 Cost: \$25,000 (statistical analysis and interpretation of results)
- 9.5** | Require implementation of erosion and sediment control best management practices through NPDES construction and Control of Erosion and Sedimentation (CES) Plan permits.
 Implementing partners: USEPA, EQB (lead parties), DNER, PRPB, ARPE
 Schedule: Short-term
 Cost: Administrative
- 9.6** | Implement management actions.
 Implementing partners: USEPA, EQB (lead parties), PRPB, ARPE, DNER
 Schedule: Long-term
 Cost: None
- 9.7** | Periodically monitor and evaluate results of management strategy.
 Implementing partners: USEPA, EQB (lead parties), PRPB, ARPE, DNER
 Schedule: Long-term
 Cost: \$60,000 (graduate student thesis research, publications)

NOTE: Steps 9.5 - 9.7 are part of the PRCNPC, which covers many categories of nonpoint source pollution.

EXPECTED BENEFITS

The development of sediment control best management practices will result in a reduction of the relative contribution of sediments to water quality in the estuary, the effects of sediments on

the productivity and biodiversity of the estuary, and the impacts of sediments on the recreational values, fisheries, and aesthetics of the system. This action will also result in the development of a management control strategy for reducing sediment loadings into the SJBE.

MONITORING ENVIRONMENTAL RESPONSE/PROGRAMMATIC IMPLEMENTATION

Periodic monitoring of the results of the management control strategies will be conducted. Monitoring is also part of the PRCNPC.

REGULATORY NEEDS

None.

ACRONYMS

SJBE = SAN JUAN BAY ESTUARY

EQB = ENVIRONMENTAL QUALITY BOARD

NTU = NEFELOMETRIC UNITS

PRPB = PUERTO RICO PLANNING BOARD

DNER = DEPARTMENT OF NATURAL AND ENVIRONMENTAL RESOURCES

USEPA = UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

NPDES = NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

ARPE = PERMIT AND REGULATIONS ADMINISTRATION

PRCNPC = PUERTO RICO COASTAL NON-POINT POLLUTION CONTROL PLAN

BACKGROUND

Toxic contaminants include human-caused and naturally occurring substances that, when found in certain concentrations, can cause adverse ecosystem or human health effects. Toxic contaminants can enter the estuary system through stormwater runoff from urban areas, agricultural land, marinas, and industrial sites. If present in the estuary system, toxic substances may be found in the water, attached to sediments, and in plants and animals. Contaminants in marine sediments are known to impair estuarine functions. For example, toxic compounds may cause lethal (e.g., massive kills) or sublethal (e.g., decreased reproduction) impairments on the biological components of the estuary. Furthermore, contaminants in sediments may imperil human lives when they become biologically available in the food chain where humans are a secondary consumer (e.g., mercury and the Minamata disease; cadmium and lead and the Itai Itai disease).

Under this action, information gathered on the nature of contaminants (some are more toxic than others), the concentration of contaminants, the frequency at which contaminants are found, the biological availability of contaminants, and the location of contaminants will be used to develop toxics sediment quality criteria.

STRATEGY

10.1 Analyze historical information on sediment quality in the SJBE. A literature study should be conducted which includes an annotated review of existing documents pertaining to sediment quality, loadings, and land use studies in the SJBE.

Implementing partners: USEPA, EQB (lead parties), SJBE Program, USGS

Schedule: Completed.

Cost: Completed as part of the SJBE Program water and sediment quality studies.

10.2 Perform a general screening of sediment samples to identify contaminants in the following categories in accordance with the National Status and Trends Program and use impairments (sediment toxicity, fish advisories, etc.) specific to San Juan Bay:

- 1) DDT and its metabolites (e.g., 2,4'-ddd)
- 2) Chlorinated pesticides other than DDT (e.g., Aldrin, cis-Chlordane)
- 3) Polychlorinated biphenyls (e.g., PCB congeners)
- 4) Toxaphene (at some sites)
- 5) Polycyclic aromatic hydrocarbons (e.g., Biphenyl, Naphtalene)
- 6) Major elements (e.g., aluminum, iron, silicon)

- 7) Trace elements (e.g., arsenic, cadmium, mercury, copper)
- 8) Related Parameters (e.g., grain size, Total Organic Carbon)

Implementing partners: USEPA, EQB (lead parties), SJBE Program
 Schedule: Long-term
 Cost: \$560 to \$800 per sample

10.3 Perform sediment toxicity and bioaccumulation tests, benthic community structure, microtox, and other assays/tests as necessary.

Implementing partners: USEPA, EQB (lead parties), SJBE Program
 Schedule: Long-term
 Costs: Data are insufficient to determine costs at this time.

10.4 Select the parameters of interest. The basis for the selection of the parameters of interest will include one or more of the following: the nature of the contaminant (some are more toxic than others), the concentration of the contaminant, the frequency at which the contaminant is found, the biological availability of the contaminant, and the location where the contaminant is found.

Implementing partners: USEPA, EQB (lead parties), SJBE Program
 Schedule: Long-term
 Cost: \$560 to \$800 per sample

10.5 Develop sediment quality criteria for each of the parameters of interest. The development of sediment quality criteria will be conducted jointly with NOAA's Office of Ocean Resources Conservation and Assessment (ORCA) and USEPA. Since USEPA has been developing sediment quality criteria, it is identified as the lead agency. New approaches developed by USEPA include developing equilibrium-based sediment quality guidelines for screening problem sediments.

Implementing partners: USEPA, EQB (lead parties), NOAA
 Schedule: Long-term
 Cost: \$250,000 per year

EXPECTED BENEFITS

Understanding the locations, origins, concentrations, and toxicity of estuarine contaminants is critical in the development of management plans oriented towards the restoration/enhancement of the functional values of the ecosystem. Examining the historical levels of contaminants in SJBE may help develop benchmark values. Identifying contaminants in the sediments of the estuary will help managers develop the necessary and practical corrective actions needed to restore or enhance specific uses of the bay.

WS-10

MONITORING ENVIRONMENTAL RESPONSE/PROGRAMMATIC IMPLEMENTATION

An annual survey of sediment discharges to SJBE will be conducted to determine any improvement in the quality of sediments.

REGULATORY NEEDS

Amendments to EQB's Regulation for the Control of Erosion and Sedimentation (CES) (approved and implemented since March 1998) may be needed based on the results of the study.

ACRONYMS

SJBE = SAN JUAN BAY ESTUARY

EQB = ENVIRONMENTAL QUALITY BOARD

NOAA = NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

ORCA = OCEAN RESOURCES CONSERVATION AND ASSESSMENT

DDT = DICHLORO-DIPHENYL-TRICHLOROETHANE

PCB = POLYCHLORINATED BIPHENYLS

USEPA = UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

USGS = UNITED STATES GEOLOGICAL SOCIETY

WS-10

WS-11 Enforce the Used Motor Oil Management Law in the Estuary's Watershed (Law No. 172).

BACKGROUND

Inadequate disposal of used motor oil contaminates the estuary's waterbodies. It is estimated that one-quarter teaspoon of car oil will form a film over about 2,000 square feet of water; one quart of motor oil will contaminate 250,000 gallons of water; and the oil from one engine (4-6 quarts) can produce an 8-acre (3 ha) oil slick.

Until August 1996, there were no laws or regulations requiring businesses which sold motor oil to establish used oil collection centers. There were also no requirements for consumers related to the disposal of used oil. On March 1, 1997, Law No. 172 came into effect. This law requires all businesses which sell motor oil to:

- Establish a used oil collection center;
- Charge a \$0.50 deposit for every quart that is sold; and
- Install a sign that reads, "we accept, free of charge, used oil that has not been mixed with any other substance, to be reused or recycled."

All collection centers are required to:

- Obtain the permit and ID number required by the EQB;
- Accept up to five (5) gallons of used oil free of charge; and
- Use the services of an EQB-authorized transporter for disposal of used oil.

Under Law No. 172, the management and disposal costs associated with all used motor oil generated after March 1, 1997, will be reimbursed by the Used Oil Management and Collection Fund.

According to the law, all consumers who change their own oil are required to take the used oil to any collection center within 30 days after purchasing the new motor oil. The collection center will issue a certificate of proper oil disposal that the consumer can use to request a \$0.50/gallon reimbursement at the store where the oil was bought. The certificate must be presented within 90 days of the purchase.

Although this law has been in place since 1997, more enforcement is necessary to achieve the objectives of the law.

STRATEGY

11.1 Evaluate the possibility of increasing the enforcement of Law No. 172 by using existing human resources of EQB and DNER, as well as state and municipal police.

Implementing partners: EQB (lead), DNER Rangers, DNER, SWMA, State and Municipal Police

Schedule: Short-term

Cost: \$7,000

11.2 Develop additional enforcement mechanisms.

Implementing partners: EQB (lead), DNER Rangers, DNER, SWMA, State and Municipal Police

Schedule: Short-term

Cost: \$85,000

11.3 Modify existing regulations, if necessary.

Implementing partners: EQB (lead), DNER Rangers, DNER, SWMA, State and Municipal Police

Schedule: Short-term

Cost: Administrative costs

EXPECTED BENEFITS

Increased enforcement of Law No. 172 should improve the quality of stormwater flowing into the estuary by reducing the amount of oil entering the system.

MONITORING ENVIRONMENTAL RESPONSE/PROGRAMMATIC IMPLEMENTATION

Storm sewer water quality will be monitored.

REGULATORY NEEDS

Amendments to the present regulation should be considered.

ACRONYMS

EQB = ENVIRONMENTAL QUALITY BOARD

DNER = DEPARTMENT OF NATURAL AND ENVIRONMENTAL RESOURCES

SWMA = SOLID WASTE MANAGEMENT AUTHORITY

WS-12

Establish a Policy to Restore and Protect Riparian Corridors Along SJBE Tributaries.

BACKGROUND

Riparian corridors are lands adjoining and immediately upgradient from rivers and streams that are vegetated with a combination of trees, shrubs, and herbaceous plants. Until recently, the value of riparian corridors has not been widely recognized for improving the water quality of associated streams and down-current receiving waters, such as estuaries. These forested areas function, often simultaneously, as filters, transformers, and sinks for nutrients, sediments, organic materials, pesticides, and other detrimental substances normally carried by runoff into surface waters and ground water recharge areas. Riparian corridors provide stream bank stability and space for the natural adaptation and evolution of stream courses, which typically migrate slowly with time. These vegetated areas mitigate flood impacts by preserving part of the natural floodplain to accommodate high-water events. This in turn reduces the prevalence of nuisance drainage problems that frequently occur when development encroaches into the floodplain of a stream or river. In addition, riparian corridors have vegetation and soil characteristics distinctly different from surrounding uplands and support higher levels of species diversity, species density, and rates of biological productivity than most other landscape elements. When continuous, riparian corridors provide an area for wildlife movement between distant and otherwise isolated forest patches. The extent of all of these benefits depends on the width of the buffer or corridor and the type, arrangement, and species of plants (CSA Architects and Engineers/Weston, Inc., 1999[b]); Federal Interagency Stream Restoration Working Group, 1998; Departamento de Recursos Naturales y Ambientales, 1997; NRCS, 1997, 1996; USEPA, 1993, 1990; USDA, 1991).

Since the late 1980s, the upper parts of the SJBE watershed have experienced a dramatic increase in the development of housing. As a result of this and related land development, an average loss of 10 cm of soil per year in this area has been reported (Webb and Gómez-Gómez, 1998). Suspended sediment yield rates in the Río Piedras River have been documented as significantly higher than those from other rivers located in watersheds where agriculture is the principal land use (Guevara-González, 1996; Lugo, *et al.*, 1980). Agriculture and mining activities are usually considered the largest contributors of sediments into a river.

In the SJBE watershed, many streams have been or are proposed for channelization due to recurring flooding caused by the wide extent of developed upland areas. Replacing riparian corridors with flood control structures (i.e., concrete channels) eliminates most of the benefits that these natural systems provide. For those streams that have not been confined to a concrete channel or culvert, regular removal of sediments and the vegetation found within the natural channels and their banks is a common practice employed to improve water flow; one that has significantly degraded or eliminated the functions provided by these forested areas. As a result, several areas in the SJBE have been dramatically affected, especially by sedimentation. For example, at the confluence of the Martín Peña Channel and the Puerto Nuevo River, approximately 6 feet (1.8 meters) of silt accumulated from 1986 to 1995 (Eng. Antonio Rivera, USACE, personal communication, 1998). The accumulated sediments had to be dredged to allow for the continuation of the Acua-Expreso Ferry System service,

at a cost of over \$940,000 to the PRPA. This same situation could well be occurring in San Juan Bay and the Puerto Nuevo River, reducing the service life of the bay's recent navigational enhancement project and the first two phases of the river's flood control project, projects performed at an approximate cost of \$35 million and \$73 million, respectively (Eng. Jaime Acosta, USACE, personal communication, 1999).

Law No. 47, the Law for the Protection of Watersheds and the Prevention of Floods (12 L.P.R.A. 252-254) authorizes the government to acquire those properties that are necessary or convenient for developing watershed protection and flood prevention projects. The Regulation for Subdivision and Urbanization (Planning Board Regulation No. 3) requires that 16.4 feet (5 m) of land adjacent to streams be dedicated for public use. Regulation No. 5754, which provides for erosion control and the prevention of sedimentation, requires various measures to prevent and control the pollution of waterbodies from those projects involving land movement. Although most of these and other statutes have existed for many years, they have not been effective in protecting and conserving the beneficial riparian corridors of the SJBE (Aponte, 1996).

STRATEGY

12.1 Convene a legal/technical task force to review existing statutes and guidelines related to the creation and protection of riparian corridors, their suitability, financing sources, and any management measures needed to properly attend to current needs. Using the SJBE watershed as a demonstration project area, identify those sites subject to these statutes where the protection and enhancement of riparian functions could be immediately enforced and implemented. This would serve as an interim measure until the task force completes a riparian corridor public policy.

Implementing partners: DNER (lead), EQB, PRPB, Municipalities, USACE, USFS, NRCS, Community Groups, SJBE Program

Schedule: Short-term

Cost: \$15,000

12.2 Develop an educational program that highlights the social benefits of riparian corridors. This program would attempt to change the common public misconception that riparian corridors are dangerous and unkempt public areas that encourage the dumping of trash and litter.

Implementing partners: DNER (lead), EQB, Municipalities

Schedule: Short-term

Cost: \$30,000

12.3 Define setback or riparian corridor widths. Although several widths have been proposed in the literature, a final definition applicable to Puerto Rico should be established to achieve specific and desirable water quality and habitat protection and enhancement objectives.

Implementing partners: DNER (lead), Legal/Technical Task Force established in Step 1, EQB, PRPB, Municipalities, USACE, USFS, NRCS, Community Groups, SJBE Program

Schedule: Short-term

Cost: \$25,000

12.4 | Adopt the new riparian corridor public policy developed by the task force. Incorporate the policy into the Objectives and Public Policies section of the Land Use Plan for Puerto Rico and into any applicable laws and regulations, including municipal territorial plans.

Implementing partners: DNER (lead), PRPB, EQB, USACE, Municipalities

Schedule: Short-term

Cost: None

12.5 | Implement the new riparian corridor public policy within the SJBE watershed.

Implementing partners: DNER (lead), PRPB, EQB, Municipalities

Schedule: Short-term

Cost: \$80,000 per year

12.6 | Develop enhancement and restoration measures, such as instream practices, streambank treatments, or channel reconstruction, if needed, based on the condition of selected riparian corridors.

Responsible parties: DNER (lead), EQB, USFS, NRCS, Municipalities

Schedule: Short-term

Cost: Dependant on the condition and extent of stream reach

MS-12

EXPECTED BENEFITS

In addition to reducing nonpoint source pollution inputs to the SJBE system, development, preservation, and enhancement of riparian corridors could be used to increase recreational opportunities within the SJBE. For example, pedestrian and bicycle trails could be built along the riparian corridors, where information about the importance of these areas could be posted. As a result, these trails would also provide an accessible educational, passive, nature-oriented experience that would also serve as an alternative transportation system.

MONITORING ENVIRONMENTAL RESPONSE/PROGRAMMATIC IMPLEMENTATION

Changes in sediment/habitats as a result of establishing riparian corridors will be measured.

REGULATORY NEEDS

None.

ACRONYMS

SJBE = SAN JUAN BAY ESTUARY

PRPA = PUERTO RICO PORTS AUTHORITY

DNER = DEPARTMENT OF NATURAL AND ENVIRONMENTAL RESOURCES

EQB = ENVIRONMENTAL QUALITY BOARD

PRPB = PUERTO RICO PLANNING BOARD

USACE = UNITED STATES ARMY CORPS OF ENGINEERS

USFS = UNITED STATES FOREST SERVICE

NRCS = NATURAL RESOURCES CONSERVATION SERVICE

WS-13

Develop a Plan for Creating a Board of Pilot Commissioners to Focus Exclusively on Harbor Safety Issues.

BACKGROUND

San Juan Harbor is the fourth busiest container port in the Western Hemisphere. It is the Island's primary port of entry for industrial and domestic materials. In addition to cargo, the port regularly receives hundreds of tourists from cruise ships. Proper pilotage and harbor safety are extremely important for minimizing the risk of marine disasters. Collisions can hamper both the functioning of the port and the health of the bay waters, especially if spills occur.

After the Port Authority made a request to the Puerto Rico House of Representatives for legislation regarding a Board of Pilot Commissioners, a draft bill was prepared and presented to the Puerto Rico Senate. The bill was signed into law in October 1999. The bill establishes a body or board to focus exclusively on pilotage and harbor safety issues. Members would be appointed by the Governor, with the advice and consent of the Puerto Rico legislature. More than 50 percent of the Board members must possess recognized maritime expertise. Specific representation should include: the Puerto Rico Shipping Association, local pilots, and the general public, including persons involved in environmental issues and tourism. The Board should also include at least one member with legal expertise. Board members should be appointed for a term not to coincide with the term of the political administration. The USCG Captain of the Port shall be given official observer status. The Board would be given the authority, and an adequate budget, to hire, fire, discipline, and enforce harbor traffic management rules. The Board must have the power to act autonomously even if placed within the context of a Commonwealth agency.

STRATEGY

B.1 Introduce the bill and vote the bill into law before the end of the next legislative session.

Implementing partners: USCG (lead), PRPA

Schedule: Completed. (Bill signed into law in October 1999.)

Cost: Legislature and concerned agency administrative costs.

B.2 Appoint members to the Board of Pilot Commissioners.

Implementing partners: USCG (lead), Governor of Puerto Rico, PRPA

Schedule: Short-term

Cost: Administrative costs

B.3 | Activate the Board. The Board's primary purpose will be to oversee Pilot training appointments and action. The Board will also oversee operation of Port Control and harmonize its operations with local pilotage so that the processes and decision-making criteria used to bring vessels into and out of port are designed to minimize the risk of marine disasters.

Implementing partners: USCG (lead), PRPA

Schedule: Short-term

Cost: Administrative costs

B.4 | Evaluate and refine procedures at Port Control.

Implementing partners: PRPA (lead), USCG, Board of Pilot Commissioners

Schedule: Short-term

Cost: Administrative

EXPECTED BENEFITS

The actions of the Board of Pilot Commissioners will help to prevent a major marine disaster, including grounding or a collision, and the subsequent pollution of the harbor and interruption of commerce.

MONITORING ENVIRONMENTAL RESPONSE/PROGRAMMATIC IMPLEMENTATION

The SJBE Program tracking system will be used to monitor implementation of this action (programmatic in nature). Please see Volume II for details.

REGULATORY NEEDS

None.

ACRONYMS

USCG = UNITED STATES COAST GUARD

PRPA = PUERTO RICO PORTS AUTHORITY

WS-14

Create A Task Force to Monitor Docks and Other Watercraft Facilities within the SJBE System and Ensure Regulatory and Permit Compliance.

BACKGROUND

The high density of people living within the geographic limits of the SJBE has contributed to an increase in the number of docks, boating activities, and related infrastructure (marinas, fishing associations, etc.). Docks provide important and needed access to the water, but their use and operation represents a potential source of pollution to the SJBE system. Because these facilities are located on the waterfront, they have a high potential to adversely impact natural resources, especially as their number increases. These impacts can be associated with the siting, construction, or operation of such facilities. Some potential impacts include shadowing of submerged aquatic vegetation, alterations to natural coastlines, and pollutant loading associated with fueling, motorboat repair, boat cleaning detergents, and leaching chemicals and paints from wooden structures. Additional information on the impacts resulting from boating activities is presented in Action WS-15.

The impact to any given area is, in general, proportional to the type and size of a particular structure; however, the cumulative impact to an area also should be considered, since a significant number of small-scale docks could have an effect similar to an entire marina.

The impacts of docks, marinas, and other watercraft facilities have been documented in detail in the Water and Sediment Quality section of the State of the Estuary chapter of this document. The SJBE system is particularly vulnerable to these impacts due to the shallow depth of the majority of its waterbodies.

STRATEGY

14.1 Create a task force to 1) conduct an inventory of all docks, marinas, and associated structures within the SJBE system and establish trends and 2) determine the legal status of existing structures. Make recommendations to the DNER regarding necessary measures to control the proliferation of docks and other watercraft facilities within the SJBE system.

Implementing partners: DNER Coastal Zone Management Program (lead), DNER Navigation Commissioner, DNER Rangers Office, DNER Marine Resources Division, USACE, USFWS, NMFS, USCG, Recreational Users, DSR, Municipalities, SJBE Program

Schedule: Short-term

Cost: \$15,000

14.2 | Recommend enforcement action against illegal structures.
Implementing partners: DNER, PRPB, USACE (lead parties)
Schedule: Short-term
Cost: \$25,000

14.3 | Recommend the development of public docks and other facilities in areas where the natural resources will not be adversely impacted.
Implementing partners: DNER (lead)
Schedule: Short-term
Cost: \$25,000

14.4 | Coordinate with the DNER Rangers Office to continue enforcing illegal dock sitings.
Implementing partners: DNER (lead)
Schedule: Short-term
Cost: \$15,000

EXPECTED BENEFITS

The implementation of these measures will help in the overall enhancement of the SJBE system by reducing all impacts associated with dock infrastructure and boating activity. This will improve the water and habitat quality of the system, increase the diversity and relative abundance of fish and wildlife, and provide better quality recreational activities for users.

MONITORING ENVIRONMENTAL RESPONSE/PROGRAMMATIC IMPLEMENTATION

Inventories on the number and location of docks and other watercraft-related structures will be completed once per year.

REGULATORY NEEDS

To be determined as a result of this action.

ACRONYMS

DNER = DEPARTMENT OF NATURAL AND ENVIRONMENTAL RESOURCES
USFWS = UNITED STATES FISH AND WILDLIFE SERVICE
NMFS = NATIONAL MARINE FISHERIES SERVICE
USCG = UNITED STATES COAST GUARD
SJBE = SAN JUAN BAY ESTUARY
USACE = UNITED STATES ARMY CORPS OF ENGINEERS
DSR = DEPARTMENT OF SPORTS AND RECREATION
PRPB = PUERTO RICO PLANNING BOARD

WS-15

Assess the Establishment of Non-Commercial Watercraft Special Use Areas in the SJBE.

BACKGROUND

The SJBE is located within the most densely populated area of Puerto Rico. The waters of the SJBE are widely used for boating activities of all kinds. While continued use of the estuary's waters for boating activities is necessary and important, it is also necessary and important to minimize adverse impacts to the SJBE system associated with these activities. The use of watercraft in shallow waters is of particular concern. Therefore, the intent of this action is to minimize impacts and protect existing resources from further degradation.

The main impacts of boating activities include sediment and contaminant resuspension and resultant turbidity, increased turbulence, laceration of aquatic vegetation with loss of faunal habitat and substrate stability, chemical emissions from boat engines, and physical and physiological damage to aquatic organisms.

The impacts of watercraft have been documented in detail in the Water and Sediment Quality section of the State of the Estuary chapter of this document. The SJBE system is particularly vulnerable to these impacts due to the shallow depth of the majority of its waterbodies.

STRATEGY

15.1 Create a task force and convene a series of meetings to establish regulations concerning appropriate areas for the use of non-commercial watercraft within the SJBE system.

Implementing partners: DNER Navigation Commissioner, DNER Rangers (lead parties), USFWS, NMFS, USCG, Recreational Users, DSR, Municipalities, SJBE Program

Schedule: Short-term

Cost: \$15,000

15.2 Conduct public hearings on draft regulations. Modify regulations as a result of public comments.

Implementing partners: DNER (lead)

Schedule: Short-term

Cost: \$20,000

15.3 Adopt and implement regulations.

Implementing partners: DNER (lead)

Schedule: Short-term

Cost: \$35,000 per year

EXPECTED BENEFITS

The approval and implementation of these regulations will reduce the impact of watercraft on passive users and the natural resources of the SJBE system. It will also contribute to the enhancement of the diverse natural resources within the SJBE and Puerto Rico.

MONITORING ENVIRONMENTAL RESPONSE/PROGRAMMATIC IMPLEMENTATION

Surveys will be conducted periodically to establish watercraft usage in regulated areas.

REGULATORY NEEDS

To be determined as a result of this action.

ACRONYMS

DNER = DEPARTMENT OF NATURAL AND ENVIRONMENTAL RESOURCES

USFWS = UNITED STATES FISH AND WILDLIFE SERVICE

NMFS = NATIONAL MARINE FISHERIES SERVICE

USCG = UNITED STATES COAST GUARD

SJBE = SAN JUAN BAY ESTUARY PROGRAM

DSR = DEPARTMENT OF SPORTS AND RECREATION

WS-16

Develop and Issue NPDES Permits to Regulate Stormwater Discharges in Urbanized Areas of the San Juan Bay Estuary Watershed that Contribute Stormwater Point Source Discharges to the System and its Tributaries.

BACKGROUND

Studies have shown that storm sewer discharges carry significant amounts of pollutants during dry and wet weather. Illicit connections of sanitary, commercial, and industrial discharges to storm sewer systems have been found to significantly degrade surface waters. In addition, the improper disposal of materials such as motor oil, household toxic materials, radiator fluids, and litter (e.g., disposable cups, cans, and fast food packages) into storm sewer systems contributes to water impairments.

Uncontrolled stormwater discharges from areas with urban development and construction activity negatively impact receiving waters by changing the physical, chemical, and biological composition of the water, resulting in an unhealthy environment for aquatic organisms, wildlife, and humans.

Municipal stormwater management plans and programs that have been developed to reduce illicit discharges to municipal storm sewers have led to significant improvements in water quality.

In 1987, the US Congress recognized the negative impacts of storm sewer discharges on the nation's waters and amended the Clean Water Act, which, among other things, required USEPA to establish a national program to control storm sewer discharges. In December 1999, USEPA issued Phase II regulations that will require NPDES permits for certain urbanized areas in Puerto Rico. The regulations will become effective on August 7, 2001.

STRATEGY

16.1 Prepare and issue NPDES permits for urbanized areas in the San Juan Metropolitan area.

Implementing partners: USEPA (lead), EQB, PRPB, USFWS

Schedule: Short-term

Cost: Administrative cost

16.2 Evaluate and implement municipal storm water management plans based on NPDES permit requirements.

Implementing partners: USEPA (lead), EQB, Municipalities

Schedule: Short-term

Cost: Evaluation: administrative; Implementation: unknown

EXPECTED BENEFITS

Implementation of this action will result in greater citizen awareness of stormwater discharge pollution as well as a significant reduction in sediment and other pollutant loadings. Through this action, illicit connections to storm sewers will be identified and eliminated. Municipal plans will be tailored to deal with stormwater management. Sediment and nutrient loadings from uncontrolled small construction and agricultural discharges will be reduced.

MONITORING ENVIRONMENTAL RESPONSE/PROGRAMMATIC IMPLEMENTATION

Areas with NPDES stormwater permits will be mapped. Following implementation of this action, water quality improvements will be monitored as part of the *Monitoring Plan*.

REGULATORY NEEDS

None.

ACRONYMS

USEPA = UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

EQB = ENVIRONMENTAL QUALITY BOARD

NPDES = NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

PRPB = PUERTO RICO PLANNING BOARD

USFWS = UNITED STATES FISH AND WILDLIFE SERVICE

