



# ESTUARIO

San Juan Bay National Estuary Program

EPA Work Plan & Budget  
October 1, 2019 - September 30, 2020

Prepared by the Corporation for the Conservation  
of the San Juan Bay Estuary

[estuario.org](http://estuario.org)

Approved: March 27, 2019

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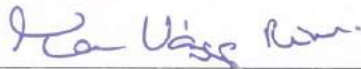
MEMBERS OF THE SAN JUAN BAY ESTUARY PROGRAM MANAGEMENT CONFERENCE: We, the members of the San Juan Bay Estuary Program Management Conference, have reviewed the contents of the 26<sup>th</sup> Year Work Plan for the fiscal year 2019-2020. We hereby approve the document and endorse the activities, products, and schedules set forth herein as appropriate and necessary for the implementation of the Comprehensive Conservation and Management Plan of the San Juan Bay Estuary.



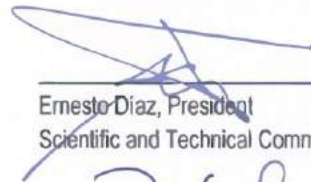
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## EXECUTIVE SUMMARY

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The San Juan Bay Estuary Program (Estuario) responded to the aftermath of Hurricane María with direct actions that resulted in providing direct support to over 10,000 people during the Natural Year 2018 and becoming a model for other estuaries and organizations in Puerto Rico and beyond. The Estuario focused the amended Work Plan 24 and Work Plan 25 on recovery and reconstruction of the metropolitan area. During the process, Work Plan 25 shifted from immediate relief to sustained long-term community-based recovery. The fiscal year 2019 funds allowed Estuario to begin the first phase of the Mitigation Plan, through the Vulnerability and Risk assessment, and commit key stakeholders for completion, adoption, and implementation of the Mitigation Plan. Key stakeholders include the eight municipalities, community members and organizations for the Community Water Network, Urban Forests Network, University of Puerto Rico, FEMA, the Clinton Global Initiative of the Clinton Foundation, Enlace del Martin Pena Channel, Capetillo, Arrecifes Pro Ciudad, Fundación Luis Muñoz Marín, 7 Quillas, CESAM, SAM, Sierra Club, Basura Cero, OPAS, Scuba Dogs Society, Corredor del Yaguazo, Caras de la Américas, Para La Naturaleza, Cooperativa de Pescadores –Piñones, Inst. Dasonomia Tropical, Excursiones ECO, La Paseadora, San Juan Paddle, Aqua Fitness, Club Nautico, Centro Sor Isolina Ferré, MAC, and Casa Taft. The Estuario took solid steps towards creating the baseline needed for mitigation planning while simultaneously addressing immediate needs for local human and ecological communities.

Some of the community led efforts included: (1) emptying septic tanks to allow for their evaluation and a water status assessment for future planning and design in low lying community; (2) the creation of resilient community hubs in those estuarine areas most isolated during the hurricane; (3) the expansion of the environmental assessment programs, such as water quality monitoring and bird census data with a growing volunteer network; (4) ViveroEstuario, a plant nursery to be used for future coastal reforestation efforts, youth empowerment and citizen science workshops. Efforts completed and begun through the fiscal year 2019, have generated the information for the recovery and implementation efforts during the fiscal year 2020, guiding stakeholders, partners, and constituents in the processes.

For the fiscal year 2020, Estuario will:

- (1) Expand baseline studies that identify and correct sources of environmental degradation through the use of (a) molecular techniques to study algal blooms, and sources of fecal contaminants, (b) the creation of a health indicator to help track intervention success and (c) continued water quality and bird count monitoring.
- (2) Design and implement green infrastructure areas through (a) maintenance and restoration of the Condado Lagoon Nature Reserve ecosystem; (b) development and management of ViveroEstuario, (b) creation of new fish nursery habitat (c) work towards the extension of the Isla Verde Reserve and creation of a Marine Water Park and (d) use and expansion of the EstuarioApp tool to maintain Urban Forest areas.
- (3) Empower communities (a) through the continued arts and culture programming in key resilient hubs and (b) continued support and training for use of the resilient hubs as emergency and data collection centers (c) expanded volunteer networks (d) increased educational opportunities and (e) diversifying funding source for the Estuario and its local partners.

All activities to be carried out by the Estuario are within the Mitigation Plan framework.

## INTRODUCTION

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The San Juan Bay Estuary Program proposes (Estuario) long-term forward thinking through mitigation planning, as this is the key to breaking the cycle of disaster damage, reconstruction, and repeated damage. Mitigation planning is helping the San Juan Bay Estuary Program refocus its efforts to restore water quality and rehabilitate the San Juan Estuary system through a comprehensive mitigation plan. The Comprehensive Watershed-based Mitigation Plan will help us identify risks and vulnerabilities associated with natural disasters, and develop long-term strategies for protecting people and property from future hazard events.

By developing a Watershed-based mitigation plan, the Estuario expects to guide the eight (8) municipalities in their processes of rebuilding a more resilient estuary watershed and system. The Comprehensive Mitigation Plan will help us:

- Increase education and awareness around threats, hazards, and vulnerabilities;
- Build partnerships for risk reduction involving government, organizations, businesses, and the public;
- Guide decision makers in going for smarter and safer decisions about where to build homes and industrial facilities
- Identify long-term, broadly-supported strategies for risk reduction;
- Align risk reduction with other community objectives;
- Identify implementation approaches that focus resources on the most significant risks and vulnerabilities; and
- Communicate priorities to potential sources of funding.

Once completed, the Estuario would seek the approval of the Watershed-based Mitigation Plan from FEMA so that it can receive certain types of non-emergency disaster assistance, including funding for mitigation projects.

Estuario expects to increase awareness around threats, hazards, and vulnerabilities, and build cross-sector partnerships for risk reduction, leading future watershed development towards smarter building decisions. To optimize impact, Estuario is identifying long-term strategies for risk reduction that are aligned with community objectives, focus resources on the most considerable risks, and communicate priorities to potential funders.

The plan will be created in three (3) phases, recognizing the central role of communities in resource management and conservation, and the need for direct implementation. Estuario has employed this approach in drafting other plans, and have found significant success in implementation.

In phase one, partners are conducting a diagnostic analysis that looks at how the watershed resources and communities were impacted during Maria. The findings will be used to develop specific actions for the plan.

In phase two, Estuario will assemble at least five working groups focused on critical thematic areas identified in phase one. Forum participants will include experts and stakeholders in the thematic areas. They will review and approve the identified mitigation actions.

In phase three, Estuario will design, edit, and print the plan, and submit to FEMA for approval. Estuario will coordinate the phases and participation of partners. The University of Puerto Rico (UPR) will help certify information from the community and convene community leaders. UPR and Universidad Interamericana will

provide interns. Estuario has identified the watershed's critical stakeholders to serve as advisors in areas of interest; such as public health, housing, education, and sustainability. Currently, the Estuario is transitioning from phase I to phase II. Guaranteeing input, knowledge, and adoption of the Mitigation Plan and associated efforts requires a strong education and volunteer growth component.

The efforts of assessing and planning for the San Juan Bay Estuary study area; approximately 97 square miles, with a population of approximately 700,000 thousand people is a monumental undertaking. The Estuario's Community Resilience component, borne out of #EstuarioRevive, focuses activities towards empowerment and knowledge exchange.

Estuario's approach to Community Resilience manages water quality in a comprehensive manner. Its implementation is carried out in collaboration with community-based entities, municipal, state and federal governments, as well as independent individuals. Community Resilience of the Estuary offers the opportunity for dialogue between different sectors and the opportunity to enjoy a pleasant environment, and with a promising future.

The Estuary prepares Resilient Hubs in the communities in which it acts through the installation of solar electric power systems, clean and safe water, first aid equipment and efficient electrical appliances. In this way, the Estuary empowers a vulnerable population with resilient tools to achieve its strengthening and revitalization. The Estuary's Resilient Communities approach is governed by three fundamental principles upon which Work Plan activities are centered.

Principle 1. Each resident is the central axis of the planning and implementation of sustainable development and transformations, as defined by them.

Principle 2. The integration of different sectors in any sustainable development and transformation process to improve multi-sectorial communication and engagement, facilitating socioeconomic development and being efficient when executing actions aimed at responding to established needs.

Principle 3. The comprehensive management of the different elements that define a community. Five of these elements have been selected for the Resilient Communities: arts and culture, education, health, economic development, and green infrastructure.

## **SOURCES OF FUNDING**

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Funding from FY 2019-2020 will be provided to support the implementation of projects included in this section. Such funds come in the form of a grant from the EPA and non-federal matches.

Section 320 of the Clean Water Act (CWA), as amended, requires that funds awarded by EPA be matched on a 1:1 ratio. To comply with this mandate, the Puerto Rico Aqueduct and Sewer Authority (PRASA) will provide \$700,000 (in-kind matching funds for infrastructure investment).

Program office and staff: In FY 2020 the Program Office will consist of a group of six (6) full-time employees who will lead the implementation of all activities in the Work Plan, as well as the US Congress mandate to further the implementation of the Comprehensive Conservation and Management Plan of the San Juan Bay Estuary. A job description for each employee is included in the Grant Application.

Collaboration with other watersheds: The Estuario will continue working with other watersheds. This will be accomplished through the Relief and Recovery efforts, which is being carried out in regions outside of the study area. This effort is centered on education about the processes which the Estuario conducts to move forward its restoration and conservation agenda. Additionally, the Estuario will coordinate for the twelve year the Puerto Rico Water Quality Monitoring Day. The coordination and empowerment of over 1,000 volunteers make this day the most effective citizen science event in Puerto Rico.

Environmental Justice Communities: All activities, programs, and initiatives in this work plan take into consideration the vital interests and concerns of underserved communities in the surrounding areas of the SJBE system. Estuario fosters in its agenda the national significance of community involvement and participation in the decision-making process and access to information. Estuario establishes working relationships with stakeholders geared towards building successful collaborative efforts.

## **ESTUARIO ACCOMPLISHMENTS AND COMPLETED 2019 MAJOR PROJECTS**

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San Juan Bay Estuary Program's FY 2019 Accomplishments: During fiscal year 2019, the San Juan Bay Estuary Program made strong progress in the areas disaster relief, community empowerment, education and green infrastructure. The following information portrays a glimpse of this progress. A final report will be prepared once the fiscal year ends in September 30, 2019.

**11<sup>TH</sup> PUERTO RICO WATER QUALITY MONITORING DAY (COMPLETED):** With 160 water quality monitoring stations and 942 volunteer participants, the Estuario concluded its 11<sup>th</sup> annual water quality monitoring day throughout Puerto Rico. The annual event is the largest citizen science water quality monitoring event in Puerto Rico. People of all ages and backgrounds took on the role of citizen scientists, and gathered data on the quality of beaches, streams, lagoons, rivers and other bodies of water close to their homes, schools or workplaces. In coordination with over 85 organizations, the Estuario had 100 additional volunteer stations open to the public for monitoring and carried out enterococcus (a fecal contamination indicator) sampling to supplement the day's information and to be used around the island.

**ESTUARINE EDUCATION PROGRAM (80%):** The Estuarine Education Program is gearing up for Summer Camps support throughout the watershed with several requests for involvement already incorporated into the calendar. So far, the program has worked with more than 700 students, formalized collaboration with six schools for the Guardians of the Estuary Program, and completed five professional development workshops for formal and non-formal educators.

**ESTUARINE BIRD CENSUS (75%):** The Christmas Bird count was completed with 20 different sites throughout the watershed. Two Citizen Science Certification census were held and all data collected has been uploaded into the Citizen science platform eBird.

**COMMUNICATIONS PROGRAM (75%):** This year the Estuario rolled out its new and improved website thanks to the communications team. The team has also been working continuously to guarantee the flow of information between the Estuario and its stakeholders, through several media outlets, including Facebook, Instagram, and written press. The communications team is identifying and generating content and improving

Estuario's reach for different communications, education and engagement platforms that help identify and engage all watershed stakeholders.

**URBAN FORESTS NETWORK (60%):** The Urban Forest Network is comprised of four areas and the incorporation of a fifth is being considered. Several activities supporting the connection between forests and water quality have been carried out within the network, including:

- i. The establishment of a raingarden was coordinated with the Youth in the Environment Volunteers in the Luis Muñoz Marín Foundation. Over two hundred (200) plants were transplanted to establish the garden and incentivize more visits to the Foundation
- ii. A clean-up brigade organized to remove vegetative debris from the Doña Inés Arboretum in the Luis Muñoz Marín Foundation.
- iii. World Wetlands Day was celebrated in the Piñones State Forest by the Estuario's Educational Program. During the celebration we offered a Water Quality Monitoring station where people came to learn about our monitoring program, an educational bird census activity open to the public, and various ecological games and activities for kids.

**USED OIL AND OIL FILTER RECYCLING CAMPAIGN (52%):** The Estuario began the first stage for oil recycling recruiting two condominiums near the Condado Lagoon, identifying oil recycling companies. The recycling program will be integrated into these efforts in the second semester of this fiscal year.

**CAÑO MARTÍN PEÑA RAINWATER HARVESTING STRATEGIES (50%):** This initiative has served almost one thousand people and over a dozen community organizations in collaboration with eight environmental entities. One health fair has been carried out linking water quality to health. Participants have acquired skills relevant to designing and delivering an effective Water Quality Monitoring program in eight workshops. Several workshops regarding reduction of water pollution and green infrastructure project design have been carried out in Buena Vista Santurce, and six schools in collaboration with local organization Martin Peña Recicla. Change in attitudes and awareness are monitored and will be quantified by the end of the second semester of this fiscal year in collaboration Columbia University.

**PROPOSAL RESEARCH AND WRITING TO SUPPORT CCMP IMPLEMENTATION (50%):** Eleven (11) grants have been submitted this year and four of these have been approved for funding or recognition.

**COMMUNITY RESILIENCE AND #ESTUARIOREVIVE RELIEF EFFORTS (45%):** 200 families in one of the most affected communities after María received water conservation kits to decrease pressure on their septic tanks, for which two additional funding sources were used, Unidos por Puerto Rico and Youth and the Environment. Fifty-eight (58) people in three resilient community hubs received basic types of medical training. Ninety-three (93) people participated in the yearly waste reduction campaign. Two debris removal cleanups have been carried out this semester with an additional two in the second semester of the fiscal year. General community outreach and awareness activities have been ongoing towards relief efforts including: (a) consistent presence at Caimito's farmer's market, (b) Ocean Park Challenge (c) Informative and educational table focused on recycling in collaboration with the Municipality of San Juan (d) Ongoing workshops at Dr. Pedro G. Goyco in Calle Loiza regarding garbage disposal, recycling and waterways. Lastly, the Estuario's reach has strengthened or generated new alliances with local community groups including: Corredor del Yagüazo, Comunidad Organizada de Puente Blanco, Caras con Causa, Caimito Echa Pa'Lante, Junta Directiva del mercado Agrícola de Caimito, Centro Cultural de Caimito, Grupo VOCES, Grupo Agroecológico Güakía, Centros Sor Isolina Ferré, Universidad Carlos Albizu, Campaña Preventiva de Salud Móvil, Oficina de Control Ambiental, Oficina de Reciclaje; Municipio de San Juan, Servicio de

Extensión Agrícola de Cataño, Cine Rodante, Instituto de Cultura Puertorriqueña, DiverCinema, Inc., Bosque, huerto y Vivero de Capetillo, UPRRP, Asociación de Residentes de Villa Cañona, Loíza, Voluntary Agency Liasons, FEMA, 7quillas

**VISTA (43%):** With the support of VISTA members the Estuario has been able to increase its reach, improve documentation and tracking and create platforms for future Estuarine projects. This include oil recycling, support in the outreach strategy for mitigation planning, community resilience activities, Visitor's Center script, basic presentation and video formats, among others.

**TRACKING AND GENERAL CCMP IMPLEMENTATION (42%):** As part of the general CCMP implementation activities the San Juan Bay Estuary Program has offered support to educational and environmental activities such as: science fairs, environmental fairs and conferences with 244 participants.

**ESTUARINE WATER QUALITY VOLUNTEER MONITORING PROGRAM (40%):** To date, the Monitoring Program has completed 6 of the 11 monthly sampling events in 25 stations. The Program has also completed 28 of the 35 monthly sampling events in 11 stations across de Condado Lagoon and beaches on the north of the watershed. At least 10 events (of two sampling events scheduled) have taken place on monitoring stations regarding areas in Condado and Cataño, and four training workshops have been completed for volunteers. Video material has been recorded and the editing process and publication of two educational short videos is expected to occur the second semester of this fiscal year.

**CITIZEN SCIENCE CERTIFICATION PROGRAM (40%):** One additional module for the Citizen Science Certification Program has been created and its curriculum is under review. 10% of the program volunteers have been certified as Citizen Scientists.

**CENTER AND LIBRARY OF THE SAN JUAN BAY ESTUARY (33%):** The San Juan Bay Visitor's Center hosts the Estuario's team members and many supporting activities throughout the year. Receiving over 500 people this fiscal year, the center hosted 5 major activities related to this work plan including: (1) Water Quality Monitoring Day Open Stations, (2) one exposition related to resilience, (3) the commemoration of the 25<sup>th</sup> year of the SJBEP (4) and two workshops for the public. These activities have helped engage 752 participants so far.

**CO-MANAGEMENT OF THE CONDADO LAGOON ESTUARINE RESERVE (30%):** The Estuario has been a constant presence in the Condado Lagoon with activities such as water quality monitoring. To increase awareness and engagement, the Estuario has held meetings with nearby businesses, CineEstuario showings and recreational events for 500 residents of the Condado area. Participation in these activities increases visibility and a sense of ownership amongst the residents for Condado Lagoon management activities.

**EXTENSION OF THE ISLA VERDE MARINE RESERVE (8%):** The Estuario Marine Reserve Advisory Committee has been partially constituted and two mechanisms for the designation of a marine reserve have been identified for evaluation by the committee.

General tasks towards completion of several activities such as the release of the Vulnerability and Risk Assessment Report, are ongoing and will culminate in September 2019.

So far, this Fiscal Year 2019 the Estuario has played a primary role in identifying impaired waters

and developing plans to restore them. Estuario assembled a Illicit Discharge Detection and Elimination Task Force to effectively correct the identified discharges. Estuario engages its citizens through the Water Community Network, Citizens Science Certification Program and through its newly created Estuario App. Through its National Estuary Program comprehensive platform, Estuario identifies polluted waters and develops plans to restore and protect coastal waters.

*External constraints:* Puerto Rico is still reeling from the devastation wrecked by Hurricanes Irma and María. The San Juan Bay Estuary Program has maintained its relief efforts, while creating a long-term recovery strategy and pushing towards the acceleration of CWA implementation initiatives such as septic tank cleanups.

## **STRATEGIC INITIATIVES FOR THE EXECUTION OF THE CCMP**

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The San Juan Bay Estuary Program (Estuario) promotes initiatives and projects directed at the execution of the actions established in the Comprehensive Conservation and Management Plan (CCMP). The CCMP divides these actions into five areas:

- (1) Water Quality and Sediment Fish,
- (2) Habitat and Wildlife,
- (3) Aquatic Debris,
- (4) Public Education and Involvement, and
- (5) Green Infrastructure.

As per the area of Special Interest in FY 2017 – 2019 Funding Guidelines, Climate Resilience, this work plan focuses activities under these five areas within the framework of a watershed Mitigation Plan and Community Resilience. The focus of the Mitigation Plan and Community Resilience initiative promotes smarter, more climate-resilient Federal investments in the face of increased risks from any of the seven classes of climate change stressors: (1) warmer summers; (2) warmer winters; (3) warmer waters; (4) increasing drought; (5) increasing storminess; (6) sea level rise; and (7) ocean acidification. The Estuario is implementing efforts to make the watershed climate resilient and help ensure that the CCMP can provide protection and restoration benefits through time.

## WORK PLAN ACTIVITIES

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### ACTIVITY 1: USE A MOLECULAR TECHNIQUE TO STUDY THE CYANOBACTERIAL BLOOMS AND SOURCES OF FECAL CONTAMINANTS IN THE SAN JOSÉ LAGOON

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#### CCMP Action(s)

WS-17 Determine the areas of highest sewage discharge in the SJBE watershed.

WS-18 Continue and strengthen the Estuario's monitoring program, including its public-science component, paying particular attention to the Río Piedras, Juan Méndez Creek, San Antón Creek, and their tributaries.

#### CWA Relevant Program(s)

- Establishing water quality standards,
- Identifying polluted waters and developing plans to restore them (total maximum daily loads),
- Addressing diffuse, nonpoint sources of pollution,
- Protecting coastal waters

#### Work Plan Priorities

Watershed Based Mitigation Plan

#### Objective(s)

Identify and detect the environmentally relevant cyanobacteria and sources of human fecal contaminants in the San José Lagoon.

#### Description

The San José Lagoon has a history of cyanobacterial blooms responsible for the significant reduction of oxygen levels, and consequently the massive death of aquatic biota. While the reduction in oxygen is suspected to be primarily responsible for the environmental impacts, many cyanobacterial species can produce toxins of both public (i.e., human) and environmental (i.e., ecosystem) health concern.

The observed increase in surface temperatures and extreme precipitation events may increase the frequency and intensity of cyanobacterial blooms, anoxic zones, and fish mass mortality events, resulting in a detrimental effect on water quality. Thus, the study of the dynamics and source of cyanobacteria blooms will permit the development of mitigation actions that will reduce the impact of future extreme events, will enhance the health of the ecosystems and its resilience to natural disasters. The detection of algal bloom causes will inform the Estuario's Comprehensive Watershed-based Mitigation Plan guiding corrective actions for discharges and opening the possibility to anticipate where the algal blooms may occur, mitigating causes, reducing their impact and improving water quality and human health.

The approach is to implement phylogenetic genes (e.g., 16S rRNA gene) analysis via next generation sequencing to identify all the different cyanobacterial groups present before, during and after blooms. The genetic diversity of these genes and the identity of the populations associated with them will be assessed using the presence of toxin producing genes and sequencing data. We will take advantage on the availability of molecular assays (i.e., qPCR assays) targeting total cyanobacteria and toxin genes (i.e., microcystin, cylindrospermopsin, saxitoxin, anatoxin). The sequencing information may also provide new targets for population-specific qPCR assays (i.e., specific genera carrying the toxin gene) that can be used to monitor for the presence of relevant cyanobacteria specific to this site.

This study will take advantage and will be integrated into the ongoing Volunteer Water Quality Monitoring Program studies. We plan to obtain filtered water samples (100 ml or less depending on sample turbidity) that will be used for the molecular analyzes. The San Juan Bay Estuary will use physicochemical data collected by the ESTUARIO to examine how this aquatic ecosystem responds to shifts in nutrient loadings and environmental conditions. We suspect that since nitrogen and phosphorous (N-P) are often the growth limiting factors in aquatic systems, high N-P loadings may exert considerable detrimental effects to these receiving waters. If needed, we could use molecular assays to target prokaryotic genes linked to different parts of the N-P cycles. If the general source of N-P loadings is linked to fecal contamination, we would also be able to assess the primary fecal source using molecular assays that are used to discriminate between human and animal sources.

It should be noted that the identification and enumeration of cyanobacteria is normally conducted via microscopical examination. The latter approach is time consuming, cannot discriminate between toxin producing and non-producing bacteria and greatly depends on the availability of trained taxonomy experts. To circumvent these issues, molecular based approaches have recently been proposed, which will be the focus of this study. Molecular techniques are relatively sensitive and can detect the cyanobacteria and their toxin genes in a timely and cost-effective manner, even before the emergence of blooms. Also relevant is the fact that this approach can be used for any other aquatic system in the Island, regardless of the composition of the cyanobacterial groups (or any other relevant microbial group) present in each different ecosystem.

#### Outputs / Deliverables

- ✓ 6 monthly samplings
- ✓ One final report with recommendations for mitigating future algal blooms, reducing fish mortality and
- ✓ Identification of the greatest sources of fecal contamination
- ✓ Present results to the IDDE Task Force for analysis and development of identification strategies of contamination sources
- ✓ Train some of the volunteer program participants for bacterial sampling technique in order to increase sampling frequency.

Outcomes

Short-term: A report with findings and recommendations regarding toxic algae’s blooms management and control submitted.

Intermediate: Actions to reduce toxic algae’s blooms implemented. Improve det

Long-term: A healthy and a resilience San José lagoon.

Milestones

1<sup>st</sup> Quarter: Quality Assurance Project Plan (QAPP) development.

2<sup>nd</sup> and 3<sup>rd</sup> Quarter: First field sampling event (monthly).

4<sup>th</sup> Quarter: Last field sampling event and report.

Staff

Scientific Director, Water Quality Monitoring Coordinator

Partners and their role(s)

The USEPA National Risk Management Research Laboratory will perform all aforementioned laboratory analysis.

Estimated budget: \$2,000

Budget detail

Product or Services	Cost	Category	Description
Lab Materials	\$1,500	Supplies	Water sample collection vials, field filtering system, and syringes.
Samplers handling & shipping for USEPA laboratory analysis.	\$500	Other	Shipping carrier cost, cardboard boxes, wrapping

## **ACTIVITY 2: ESTUARINE WATER QUALITY VOLUNTEER MONITORING PROGRAM**

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### Comprehensive Conservation Management Plan (CCMP) Action(s)

WS-17: Determine the areas of highest sewage discharges in the SJBE watershed

WS-18: Continue and strengthen the ESTUARIO's monitoring program, including its public-science component, paying particular attention to the Río Piedras, Juan Méndez Creek, San Antón Creek, and their tributaries.

PI-3: Identify potential restoration and monitoring projects within the SJBE where volunteer participation would be effective. Establish a Program to Provide Citizens with Effective and Organized Volunteer Opportunities to Support the SJBE's Restoration Projects (Water Quality Monitoring, Education, etc.).

### Clean Water Act (CWA) Relevant Programs

- Identifying polluted waters and developing plans to restore them

### Work Plan Priorities

Mitigation Planning and Resilient Communities.

### Objective(s)

To continue to be a reliable and sound source of water quality data of the San Juan Bay Estuary system and its watershed.

To establish baseline information to better measure, prioritize and manage restoration efforts.

### Description

The Estuarine Water Quality Volunteer Monitoring Program is the backbone of the San Juan Bay Estuary Program. Thanks to the water quality monitoring initiatives and volunteers, valuable data is produced, allowing the ESTUARIO to measure the progress of the CCMP implementation. The projects impact several audiences including school students, citizen scientists, university students and scholars. Furthermore, the data collected is provided to the PR Environmental Quality Board to complete the CWA sections 305(b)/303(d) Integrated Report that is submitted to EPA.

The ESTUARIO will continue with its Citizen Science Certification Program. Volunteers who opt to become certified by the ESTUARIO will carry out fieldwork exercises and will be provided with workshops focus on strengthening skills such as critical thinking, laboratory skills, and development of environmental management tools. The Water Quality Volunteer Monitoring Program Coordinator will choose the subjects to be presented in these workshops or talks, with the option of bringing in

outside speakers. These subjects will be chosen based on needed skills by the volunteers, as well as themes of ongoing environmental importance.

The ESTUARIO will continue its sponsorship, partnership, or collaboration with an outside entity (such as an academic or research institution), in this case the University of Puerto Rico, through which the ESTUARIO is presenting its Citizen Science Certification curriculum as a seminar in the Natural Sciences Department, with the purpose of complementing the current requirements for the certification with additional workshops or opportunities for educational enrichment. process. Also during the previous fiscal year, the ESTUARIO began to develop new strategies for diffusion of its water quality monitoring data, with the creation of an improved Web Atlas and also through beginning the process of the creation of an application for cellular phones (smartphones). The SBJEP will promote one of these options to the public and the volunteers who participate in the monitoring program.

The ESTUARIO will continue with a special nutrient monitoring program in selected stations in order to be able to monitor sanitary discharge indicators as part of its Water Quality Volunteer Monitoring Program. We will continue to monitor nutrients that are indicators of sanitary discharges such as: ammonia, phosphate and nitrate. This monitoring program will allow us to offer expanding water quality monitoring and public notification services to the further benefit of our estuarine communities.

#### Outputs / Deliverables

- ✓ Eleven (11) monthly sampling events to obtain water quality in-situ measurements in twenty-five (25) monitoring stations, which are part of the ESTUARIO WQVMP.
- ✓ Two sampling events will be conducted to collect water samples for lab-based analysis of (4) parameters. The sampling events will cover both wet and dry seasons.
- ✓ Two (2) training workshops for newly recruited volunteers.
- ✓ Two (2) educational workshops or talks for volunteers opting for certification.
- ✓ Thirty-five (35) weekly monitoring events in the Condado Lagoon to sample for enterococcus and continue the public notifications/advisories project. Monitor other sites with the Enterolert protocol.
- ✓ Twenty-five (25) sampling events as part of the nutrient monitoring pilot program.
- ✓ Continue partnership with an organization or University with the objective of enhancing and improving the monitoring program as part of the Citizen Science Certification Program.

#### Outcomes

Short-Term Outcome: Water Quality Volunteer Monitoring Program Data will be available for students, the DNR Water Quality Area, the public compliance office, and to academia for research and publication purposes. An annual audit of the procedures and results will be performed as stated in the Quality Assurance Project Plan (QAPP), and a “pass” in the evaluation is expected.

Intermediate Outcomes: (1) To continue the ESTUARIO's role of providing the official water quality monitoring data of the main bodies of water for the economic activity of the island and its most threatened ecosystems. (2) To maintain partnerships and knowledge exchange with academia and other organizations in the assessment and monitoring of the SJBE.

Long-term Outcomes: Improve actions for clean waters and sediments in the SJBE.

### Milestones

1st Quarter      Begin weekly enterococcus counts (The 35 weekly enterococcus counts will be completed sequentially beginning in October, 2019. The estimated milestones are subject to weather conditions and safety matters). First lab-based analysis sampling event (The lab-based analysis are performed during the wet and dry seasons of the year). Begin Monthly sampling events. Schedule training and education workshops (The proposed workshops will be scheduled depending on the volunteers' availability.)

2nd Quarter      Continue monthly and weekly sampling events

3rd Quarter      Second lab-based analysis sampling event (The lab-based analysis are performed during the wet and dry seasons of the year). Continue monthly and weekly sampling events

4th Quarter      Conclude sampling events The sampling events will be conducted monthly and completed in September, 2020.

### Staff

These activities will be led by the Water Quality Monitoring Coordinator under contract, with the support and supervision of the Scientific Director. The Water Quality Coordinator manages sampling trip-specific needs including volunteers' availability, training, equipment care, calibrations, equipment preparation and data handling. The Scientific Director is the QAPP Manager for the Estuarine Water Quality Volunteer Monitoring Program. He is responsible for the overall implementation of the QAPP, assemble the Advisory Board, allocate necessary resources to meet the project objectives, distribute sampling's results, and ensure that technical and schedule objectives are meet. The QAPP Manager is responsible for the correspondence with outside groups, including agencies responsible for approving the QAPP and the users of the collected data. The QAPP Manager resolve any procedural deficiencies identified during the data audits.

Water Quality Monitoring Coordinator: The Water Quality Coordinator manages sampling trip-specific needs including volunteers' availability, training, equipment care, calibrations, equipment preparation and data handling.

Scientific Director: The Scientific Director is the QAPP Manager for the Estuarine Water Quality Volunteer Monitoring Program. He is responsible for the overall implementation of the QAPP, assemble the Advisory Board, allocate necessary resources to meet the project objectives, distribute

sampling's results, and ensure that technical and schedule objectives are met. The QAPP Manager is responsible for the correspondence with outside groups, including agencies responsible for approving the QAPP and the users of the collected data. The QAPP Manager resolve any procedural deficiencies identified during the data audits.

Partners and their role(s)

Academia: Provide a platform for science students to do research and participate in the water quality monitoring projects. The University of Puerto Rico, Inter American University, Metropolitan University, and the Caribbean University have shown interest in this effort.

US Geological Survey: The USGS and ESTUARIO have an ongoing working relationship that includes data and information exchange.

Department of Natural and Environmental Resources: As stated by the Constitution of Puerto Rico, the waterbodies are managed by DNER. It is crucial to be in communication with the agency in order to keep it abreast of the ongoing activities and seek required permits.

Estimated Budget: \$20,250

Budget detail

Product or service	Cost	Category	Description
Lab analysis for the following parameters: Fecal Enterococcus, Total Phosphorous, Nitrate/Nitrite, and Oil and Grease.	\$6,800	Other	Lab analysis for the following parameters:Fecal Enterococcus(\$47.45), Total Phosphorous(\$13.65), Nitrate/Nitrite(\$20.80), and Oil and Grease (\$27.30). These costs include all the services provided by EQ Lab (\$87 per day pick up (8 sampling days)) and sales tax. Total cost for two sampling events for 25 monitoring stations.
Reagents for Weekly bacteriological monitoring for beach stations	\$3,150	Supplies	Purchase of reagents for weekly bacteriological monitoring for beach stations.
Field Materials and supplies	\$1,000	Supplies	Calibration standards, monitoring kits, workshops supplies, field supplies.
Boat rental	\$6,500	Other	12 boat trips at \$250 per trip to the eastern axis of the mixing zone and 14 boat trips at \$250 per trip to the western axis of the ecosystem.
35 weekly enterococci monitoring events for the Condado Lagoon Notification Program (5	\$2,000	Supplies	Reagents and supplies for Condado Lagoon (Enterolert, and other supplies)  35 weekly enterococci monitoring events for the Condado Lagoon Notification Program (5 stations) as well as other

stations) as well as other sites as needed.			sites as needed. Supplies for IDEXX Quanti-Tray Enterolert method (reagent, pipettes, whirls packs, trays, others)
Nutrient monitoring events	\$800	Supplies	Reagents

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## ACTIVITY 3: DEVELOPMENT OF A WATERSHED ECOSYSTEMS SERVICES INDEX & HEALTH INDICATOR

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### CCMP Action(s)

HW-19: Identify areas in the SJBE to be designated marine protected areas and continue ESTUARIO reef and corals restoration projects

HW-22: Estimate or model the SJBE's vulnerability to the impacts of climate change and present adaption measures.

WS-18 Continue and strengthen the ESTUARIO's monitoring program, including its public-science component, paying particular attention of the Río Piedras, Juan Méndez Creek, San Antón Creek and other tributaries.

GI-1 Create a master plan for green infrastructure in the SJBE watershed and develop pilot projects for rain gardens and green rooftops, dunes and other ecosystems.

### CWA Relevant Program(s)

- Establishing water quality standards,
- Identifying polluted waters and developing plans to restore them (total maximum daily loads),
- Protecting wetlands,
- Protecting coastal waters, and
- Protecting Large Aquatic Ecosystems.

### Work Plan Priorities

Mitigation Plan

### Objective(s)

Develop indicators that measure the conditions and health of the SJBE's watershed ecosystems and provide information to evaluate environmental conditions status and trends.

### Description

The development of a watershed indicator index will help indicate the status and present trends regarding the health and environmental conditions of the SJBE's ecosystems including urban forest, beaches, dunes, coral communities, seagrasses, mangroves, and freshwater wetlands. The goal is to develop an index that provides information about the status and trends of ecological, social, and economic benefits they provide the SJBE's watershed. The watershed indicator index will help as a baseline for improvements within the watershed as a response to the implementation of mitigation actions.

This action is designed to develop a watershed index for the San Juan Bay Estuary that will be used as a "bio indicator" of the environmental condition of the estuary. An indicator such as a watershed index can be useful tools for summarizing complex information in a way that allows for data summation and public education. In guidance prepared by EPA (2008) the agency concluded

“Indicators communicate information, quantify responses, and simplify information about complex data. Indicators can be a cost-effective, accurate alternative to monitoring the individual components of a system.”

The EPA (2008) suggests that a suite of different indicators, such as the following, can be useful: 1) a water quality index, 2) a sediment quality index, 3) a benthic index, 4) a coastal habitat index, and 5) a fish tissue contaminants index. The Estuario uses a water quality index (WQI) based on the water quality data collected through the Volunteer Water Quality Monitoring Program since 2008. This WQI was adopted from the Canadian Water Quality Guidelines for the Protection of Aquatic Life and have been tested and endorsed worldwide including the United Nations Environmental Program for different water bodies.

In 2009, the ESTUARIO developed a Benthic Index used as an indicator to compare and contrast segments of the San Juan Bay Estuary system against each other, and also to track the health of the benthic communities over time both on a localized level. Benthic communities and benthic indexes are a useful tool to track degradation and improvements in watershed-level pollutant loading, as they “integrate” water and sediment quality conditions on a longer timescale than a single point in time sample in a collection bottle. Indeed, this Benthic Index was used by Proyecto Enlace to develop the environmental improvement model requested by the USACE to provide funds for the dredging of the Caño Martín Peña.

In 2011, the ESTUARIO commissioned the development of the fish tissue contaminant index and the sediment quality index. A report entitled “Estuarine Environmental Indicators for the San Juan Bay Estuary: Assessment of Sediment and Fish Tissue Contaminants” contains the results and conclusions of the contamination assessment and index development for sediments and biota. This study was carried out per procedures described in the Quality Assurance Project Plan (QAPP), which was approved by the USEPA and ESTUARIO in March 2011.

In conclusion, the SJBE has already developed four (4) of the five (5) environmental index as suggested by EPA. This action proposes a novel and comprehensive watershed indicator index.

The Estuario sustainably delivers a range of benefits and services to the people. However, we need to study, monitor, and improve its ecosystems to obtain the maximum flows of ecological, social, and economic benefits. Thus, this action proposes the development of a broad and compressive indicator index for the SJBE watershed ecosystems. Moreover, this index is tailor to measure and integrate the health of the current ecosystem, ecosystems stressors, and resilience and how the SJBE watershed ecosystems may provide benefits and services such as coastal protection for presents and future generations.

Outputs / Deliverables

- ✓ A watershed indicator index that score from 0 to 100 and represent the maximum sustainable benefits and services from the SJBE ecosystems.
- ✓ A user-friendly model program that can be run by the SJBE Staff to quantify the watershed index through time.

Outcomes

Short-term: SJBE Watershed Health Indicator Index.

Intermediate: Propose actions to improve the scores of SJBE Watershed Health Indicator Index through time. Recommendations for remediative action and/or protection

Long-term: Healthy and resilience watershed ecosystems that provide services and benefits to future generations.

Milestones

1<sup>st</sup> Quarter: Request for Proposal (RFP) announcement and RFP informative meeting and contract award.

2<sup>nd</sup> and 3<sup>rd</sup> Quarter: Contract award and commence data acquisition for past indexes and new indicators.

4<sup>th</sup> Quarter: August 2020: The watershed index, metadata, and the index model program operation instructions.

Staff

Scientific Director: Will lead the efforts, evaluated the products, and offer recommendations based on the findings.

Partners and their role(s)

The Graduate School of Planning, University of Puerto Rico. They will provide consulting support.  
Center for the New Economy. The will provide data and statistics.

Estimated budget: \$10,000

Budget detail

Product or Services	Cost	Category	Description
SJBE Watershed Health Indicator Index development	\$10,000	Contractual	The contractor will develop a watershed indicator index, as a final product.

## ACTIVITY 4: ESTUARINE BIRD CENSUS

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### CCMP Action(s)

HW-14 Protect existing populations of endangered and threatened bird species and protect and restore their habitat within the SJBE System.

PI-1: Develop and promote low-impact recreational activities within selected areas of the SJBE.

PI-3 Establish a program to provide citizens with effective and organized volunteer opportunities to support the SJBE's restoration projects

PI-4: Develop a long-term public education and outreach program.

### CWA Relevant Program(s)

- Protecting wetlands,
- Protecting coastal waters through the National Estuary Program, and
- Protecting Large Aquatic Ecosystems.

### Work Plan Priorities

Mitigation Plan and Resilient Communities

### Objective(s)

Document bird species, presence and abundance, within the San Juan Bay Estuary Watershed

Increase participation from the public in the Estuary's citizen science initiatives

Increase public awareness of the presence and function of watershed bird fauna

### Description

Birds are bio-indicators of the health of ecosystems. Conducting participatory census within the San Juan Bay Estuary Watershed helps document the presence and abundance of certain native and migratory species that use the estuary to live, eat, shelter and reproduce.

Since 1999, the ESTUARIO has been sponsoring a Christmas bird count in different areas in the San Juan Bay Estuary Watershed. The bird census is performed in coordination with the Christmas Bird Count sponsored by the National Audubon Society (<http://birds.audubon.org/christmas-bird-count>). All Christmas Bird Counts are conducted between December 14 to January 5, inclusive dates, each season. The data collected by Christmas Bird Count participants across the US and beyond over the past century have become one of only two large pools of information indicating to ornithologists and conservation biologists how the birds of the Americas are faring over time. Since 2012, the ESTUARIO has been sharing the data with the Cornell Lab of Ornithology through the eBird project (<http://ebird.org/content/ebird/acerca/afiliados/el-laboratorio-de-ornitologiacornell>) also the data is shared with the DNRA and is posted in the Estuary Atlas, so is an open source to the public.

After the passing of hurricane María in September 2017, understanding the recovery process of the Estuary's wildlife is of great importance and interest. During the 2017-2018 fiscal year, the ESTUARIO began its Citizen Science Certification Program and incorporated bird censuses as one of the modules which citizens could become certified in. This year, the ESTUARIO will continue to engage and train citizen scientists from schools, universities and the public to conduct bird censuses through the Christmas Bird Count and other bird censuses.

Observing birds is an activity that promotes the recognition of human impacts in biological systems so that they can be mitigated or avoided. It also promotes citizen participation and brings people closer to these ecosystems in a more effective way.

### Outputs / Deliverables

- ✓ One (1) Christmas bird count in at least 10 sites.
- ✓ Two (2) Preparatory Bird Census Workshops in the San Juan Bay Estuary Center, Urban Forest, schools or universities.
- ✓ Bird census data for the ESTUARIO, the National Audubon Society, and Cornell Lab of Ornithology.
- ✓ Six (6) bird censuses throughout the rest of the year, as part of the ESTUARIO's Citizen Science Certification Program.

### Outcomes

Short-term: Bird census data collected in different sites within the SJBE watershed, with volunteer participation.

Intermediate: Calculation of bird diversity index and species richness to identify relevant bird habitat using eBird citizen science project. Increase the participation of citizen scientists and community volunteers.

Long-term: Analysis of bird population and trends in the SJBE ecosystems due to environmental or climatic changes and more recently after hurricane Maria hit Puerto Rico ecosystems, including the Urban ones in the San Juan Bay Estuary Watershed region.

### Milestones

1<sup>st</sup> Quarter: The Christmas Bird Census will take place and the data will be collected and entered.

2<sup>nd</sup> Quarter: Additional bird censuses will take place and the data will be collected and entered.

3<sup>rd</sup> Quarter: Additional bird censuses will take place and the data will be collected and entered.

4<sup>th</sup> Quarter: Additional bird censuses will take place and the data will be collected and entered.

### Staff

The Education Manager and the Education Coordinator will implement this activity in collaboration with other staff members and under the supervision of the Executive Director.

The Education Manager will be responsible for coordinating all participatory bird censuses for the CBC. This includes, but is not limited to, contacting the managers of the natural areas, writing notices to volunteers and scientific citizens, coordinating directly with the coordinator of Audubon in Puerto Rico, attend all bird censuses between December 14th and January 6th, train volunteer personnel and ensure that data is entered into the ebird platform and the Atlas of the Estuary. The Education Manager will also supervise the education coordinator for assigned and support tasks. He will also supervise the education coordinator for assigned and support tasks.

Education Coordinator will be responsible for supporting the tasks assigned by the education manager before, during and after the participatory bird censuses. He/She is also responsible for coordinating with the Education Manager the preparatory workshops for volunteers, create a table in google drive for the entry of people who register, follow up in writing and telephone to registered volunteers before each census, keep up to date data entry to the ebird platform and the estuary atlas, inspect the equipment to be used during the censuses (binoculars, telescope and identification cards), enter the hours of the certification of scientific citizens of the bird module on the google drive, among other tasks

Partners and their role(s)

- Corredor del Yaguazo, Inc: Will provide volunteers and experts in the identification of birds.
- Department of Geography, University of Puerto Rico: Will provide volunteers.
- Interamerican University, Metropolitan Campus: Will provide volunteers.
- National Audubon Society: Will provide guidelines and bird census database.
- Cornell Lab of Ornithology: Will provide data-base system known as eBird.

Estimated budget: \$1,300

Budget detail

Product or service	Cost	Category	Description
Boat Trips (4)	\$1,000	Other	Four (4) boat trips at \$250 each
CBC Bird Census Volunteer Patch	\$300	Supplies	150 patches @ \$2/each approximately. The commemorative patch for the Audubon participatory and Christmas bird censuses is provided to volunteers participating in the Gamaliel Pagan Hernandez, Estuario's Christmas Bird Census.

## **ACTIVITY 5: CREATION OF FISH NURSERY HABITAT IN THE SAN JUAN BAY**

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### CCMP Action(s)

HW-17 Determine historic and present recreational fishing areas in the SJBE and develop a plan to adequately manage recreational fishery resources.

PI-3 Establish a program to provide citizens with effective and organized volunteer opportunities to support the SJBE's restoration projects.

### CWA Relevant Program(s)

- Establishing water quality standards,
- Protecting coastal waters through the National Estuary Program,
- Protecting Large Aquatic Ecosystems.

### Work Plan Priorities

Mitigation Plan and Resilient communities

### Objective(s)

The creation of juvenile fishery habitats in the San Juan Bay through the deployment of artificial structures in the San Juan Bay.

Developing skills for community residents and generate a source of income.

### Description

The San Juan Bay is the only waterbody of the SJBE system where commercial fishing is allowed. However, the base for a fishery industry strives in the availability of suitable fish nursery habitat inner waterbodies. While the activity will be implemented in inner waterbodies, this activity may constitute an enhancement of open water species numbers. This action translates into new economic opportunities for the coastal communities. One of the most significant threats to environmental quality and community resilience has been identified as a lack of financial stability. A fish habitat nursery would help stabilize nearby communities' economies, strengthening their capacity to face climate event fluctuations. The focus of this activity will be on commercial fisheries; nonetheless, both commercial and recreational activities will be enhanced.

Moreover, by improving the fisheries of the San Juan Bay, we will increase the food supply, mainly, when most needed, that is, during natural disaster events. Thus, this constitutes a mitigation action due to an expected increase in our resilience to satisfy the protein demand.

Coastal fish and shellfish depend on specific habitats for each stage of growth. Rocky and sandy bottoms on shallow shorelines are essentials for young fish seeking shelter and food. However, coastal development impacts the survival of young fish at crucial life stages by removing crucial habitat, which leads to a decrease in the adult population. Thus, the creation of nursery habitat is vital for coastal fish population survival and the improvement of commercial and recreational

fisheries. Furthermore, artificial habitats will protect and enhance marine biodiversity and contribute to the general health of the San Juan Bay.

In 2016, we published a report evaluating the different artificial structures and deployment sites suitable to create habitats for fisheries and aquatic life in the San Juan Bay. The most important consideration was safety for navigation. However, other criteria considered included that: (1) the site exhibit a sandy and/or silty bottom free of any benthic community such as seagrass beds; (2) be near a port, pier and/or walking board so people, including citizen's scientist, have the opportunity to watch and monitor from the surfaces the aquatic life attracted by the nursery modules; (3) and finally be on a shallow site not more than 15 feet deep. We conclude that the best place for a pilot demonstrative project implementation that satisfied the criteria above was under docks of San Juan Bay Marina and Club Náutico de San Juan (N18°27'32.8"; W 66°05'24.8").

The artificial nursery habitat module proposed for this project features popular ecological services based on the Habitat Suitability Analysis (HSA) (MRI, 2005) such as a surface area for the settling or recruitment of benthic organisms and crevices for shelter and reproduction. We propose an empty mesh enclosure design that protects postlarvae and young of the year fish from predation, allowing them to mature to the point at which they will escape from predation and contribute to adult populations. In addition to fish habitat enhancement and fisheries improvement, the artificial habitat structures may also encourage the colonization of native oysters and other benthic organisms, which filter the water and improve the water quality. Moreover, the deployment of artificial habitat structures will provide an opportunity for aquatic habitat education, outreach, and environmental stewardship.

This project sustains and constitutes a Blue Economy activity which refers to an ocean-based economic model which employs sustainable technologies and infrastructure to secure growth while protecting our oceans by promoting events such as fisheries enhancements.

Residents will be trained on nursery maintenance and on how to set up and monitor the modules. Further, residents will be trained on how to calculate and maintain sustainable use of their fisheries and what to do after a disaster to increase the population.

A Joint Permit Application (JPA) must be submitted and been approved before the actual deployment of the nursery structures. The JPA is used to apply for permits (i.e., standard/ permits or general permits) from the US Army Corps of Engineers for work in the waters of the United States (including wetlands). The JPA is also used to apply for corresponding permits from the DNER, the PR Environmental Quality Board, USFW Services, USEPA, and NOAA.

### Outputs / Deliverables

- ✓ Deployment of five (5) nursery habitat module under existing piers.
- ✓ One final report about findings and recommendations.

### Outcomes

Short term: Five tri-dimensional artificial habitat that will provide breeding and nursery space in the San Juan Bay.

Intermediate: An 80% increase in juvenile fish population within and around the nursery structures deployment sites.

Long-term: An increase in the fisheries & catch landing in the San Juan Bay.

Milestones

1<sup>st</sup> Quarter: Meeting with stakeholders, project’s partners, agencies, and interested parties, Pre-deployment fish and aquatic life population census & eco-video documentation.

2<sup>nd</sup> Quarter: Joint Permit Application (JPA) submission.

3<sup>rd</sup> Quarter: Acquisition of the nursery’s modules, Modules deployment, post-deployment fish and aquatic life population census & eco-video documentation.

4<sup>th</sup> Quarter: Final report.

Staff

Scientific Director: Will acquire the supplies, lead the implementation, coordinate with volunteers, and monitor the fish nurseries system.

Partners and their role(s)

DNER: Field technical support and consulting.

San Juan Bay Marina/Club Náutico de San Juan: Owners of the marina facilities where deployment will take place.

Operadores / Fishermen: Will provide field support and will receive an orientation about fish nursery system creation.

Estimated budget: \$10,000

Budget detail

Product or Services	Cost	Category	Description
Joint Permit Application (JPA) submission	\$50	Other	Documents submission fees.
Acquisition of five (5) modules.	\$5,000	Supplies	Acquisition of five (5) Ponton Dock Biohut® manufactured and delivered.
SCUBA Gear	\$2,000	Other	Rent of SCUBA gear for the underwater deployment and monitoring of the fish nurseries.
Underwater Documentation	\$500	Other	Acquisition of a dedicated underwater camera for the photo-documentation and visual data acquisition of the environmental response and monitoring of the fish nurseries.

Module installation	\$2,450	Other	Fee to install module: On site platform and hand-on support during for the installation and monitoring activities.
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## **ACTIVITY 6: EXTENSION OF THE ISLA VERDE MARINE RESERVE AND WATER PARK**

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### CCMP Action(s)

HW- 19: Identify areas in the SJBE to be designated marine protected areas and continue ESTUARIO reef and coral restoration projects.

### CWA Relevant Program(s)

- Protecting coastal waters through the National Estuary Program,
- Protecting Large Aquatic Ecosystems.

### Work Plan Priorities

Mitigation Plan

### Objective(s)

Continue the work towards the extension of the Isla Verde Marine Reserve.  
Create a Marine Water Park for sustainable use and protection of the reserve.

### Description

Marine protected areas (MPAs) are defined spaces in oceans, lakes, and coastal zones whose natural and cultural resources are protected by regulatory measures (Hoagland et al., 2010). The objectives of these measures are primarily preserving aquatic diversity, recovering the number and variety of fish populations, promoting sustainable tourism, and safeguarding the integrity of marine ecosystems or communities - all objectives compatible with the goals set for itself by the ESTUARIO.

Historically, the marine resources on the SJBE coast have received, and continue to receive, what is unquestionably the most significant pressure and impact, due to their proximity to the metropolitan area (ESTUARIO, 2000). This area is made up of coastal municipalities which, as a whole, constitute the largest, most highly populated, and most use-intensive urban area in Puerto Rico.

The ESTUARIO supported the passage of Law 274 of September 26, 2012, which designated a 900 km<sup>2</sup> area of Isla Verde in Carolina as a Marine Reserve, protecting a coral system within this area. This effort was led by community group Arrecifes Pro Ciudad (Reefs for the City), which for years documented the biodiversity of the coral reef system to advocate for its protection.

The ESTUARIO also supported the passage of Law No. 112 of September 30, 2013, which designated the Condado Lagoon an estuarine reserve. This critical piece of legislation includes the creation of a commission for community co-management, a prohibition on fishing and the use of motorized watercraft in the lagoon, and production of a management plan, among other essential provisions.

The First Update of the CCMP identifies "La Pocita" (the Little Well) at Escambrón and the Boquerón

Cove (Ensenada de Boquerón) in the northwestern part of the Condado Lagoon as important resources and natural marine and coastal ecosystems whose ecological, economic, and cultural value merit evaluation as protected areas. The ESTUARIO proposes to extend the Isla Verde Marine Reserve from its current area in Carolina to the Escambrón Beach in San Juan. This plan connects "La Pocita" with Boquerón Cove and the Condado Lagoon Estuarine Reserve with the Isla Verde Marine Reserve. This connection generates an ecological corridor, which safeguards the natural resources, habitats, and wildlife along a significant part of the Estuary's coastal area. The ESTUARIO will work with the DNER and community groups toward this extension.

Last year the ESTUARIO assessed the Isla Verde Marine Reserve and explored opportunities for its extension and creation of the Estuario Marine Reserve. An extension would geographically and institutionally consolidate the management and conservation efforts of the most critical marine and coastal resources in the estuary's coastal region through the expansion of the Isla Verde Marine Reserve from its current area in Carolina to the Escambrón Beach in San Juan. As a follow-up measure, the ESTUARIO will be implementing some of the strategies and activities necessary for the creation of the Estuario Marine reserve. Keep the Advisory Committee active, and prioritize the recommendations proposed by the report created last year.

#### Outputs / Deliverables:

- ✓ At least three implementation actions to move us closer to the creation of the Estuario Marine Reserve
- ✓ One marine park proposal

#### Outcomes

Short-Term: Priority list of recommendations and an active committee

Intermediate: The extension of the Isla Verde Marine Reserve to Escambrón Beach in Old San Juan.

Long-term: Ecological and socio-economic outcomes of the extension will be the improvement of the water quality and habitats of the estuarine coastal ecosystems, with a focus on coral reef systems.

#### Milestones

1<sup>st</sup> Quarter: Call a meeting of the Advisory Committee and begin the priorities and strategy analysis

2<sup>nd</sup> Quarter: Meetings with state agencies, community leaders, community-based organizations to coordinate implementation activities

3<sup>rd</sup> and 4<sup>th</sup> Quarter: Conclude at least three implementation activities to extend the reserve.

#### Staff

The Ecosystem Restoration and Policy Coordinator will work closely with the Resources and Outreach Coordinator. The Executive Director and Science Director will oversee this activity.

Partners and Their Role(s)

DRNA: Government agency responsible for drafting the extension of the Marine Reserve.

Environmental Community Organizations: The ESTUARIO will work with environmental community organizations established along the proposed area of extension, such as Scuba Dogs Society, Arrecifes Pro Ciudad, 7 Quillas, groups which for years have advocated for the protection of the natural resources along the metropolitan coastal region.

Estimated Budget: \$9,900

Budget Detail

Product or Services	Cost	Category	Description
Ecosystem Restoration and Policy Coordinator	\$9,900	Contractual	Ecosystem Restoration and Policy Coordinator: @\$18/hour for 550 hours

## **ACTIVITY 7: CO-MANAGEMENT OF THE CONDADO LAGOON ESTUARINE RESERVE**

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### CCMP Action(s)

HW-24: Ensure implementation of Law No. 112 of 2013, which created the Condado Lagoon Estuarine Natural Reserve.

### CWA Relevant Program(s)

(6) Protecting coastal waters through the National Estuary Program,

### Work Plan Priorities

Mitigation Plan and Resilient Communities

### Objective(s)

Activities in support of the implementation of the Conservation Management Plan for the Condado Lagoon Estuarine Reserve.

### Description

Over the past decades, the ESTUARIO has worked to restore the Condado Lagoon from what used to be referred to as the septic tank of San Juan into what is now the only protected non-beach body of water in the metropolitan area. This beautiful body of water received for decades the illegal raw sewage discharges from most of the buildings located on its borders. In 2009, the last of these discharges were eliminated, and the health of the lagoon has been partially restored when illicit discharges are not occurring.

In 2013, the ESTUARIO supported the passage of Law No. 112 of September 30, 2013 by the Government of Puerto Rico, which designated the Condado Lagoon an estuarine reserve. This critical piece of legislation includes the creation of a commission for community co-management, a prohibition on fishing and the use of motorized watercraft in the lagoon, and production of a management plan, among other essential provisions. Since then, the Condado Lagoon has continued to become an crucial outdoor hub for recreational and economic activity based on low-impact non-motorized aquatic sports, attracting residents and tourists alike.

On September 20, 2017, the direct impact of catastrophic Hurricane Maria disturbed the achievements of the Condado Lagoon and its surroundings. The hurricane's destruction harmed the recreational areas and made vulnerable the quality of water of the Lagoon through sanitary discharges, placing at risk the health of the community and its visitors, and putting a hold on the variety of economic recreational and tourist activities that depend on it. In the 2017-2018 fiscal year, the ESTUARIO promptly responded by launching the Friends of the Condado Lagoon initiative as part of the #EstuarioRevive campaign, conducting reforestation activities, debris removal, and incorporating stakeholders from the local and federal government to correct sanitary and rainwater

infrastructure problems.

This year, the ESTUARIO will continue to focus on activities in support of the implementation of the Conservation Management Plan for the Condado Lagoon Estuarine Reserve. The Program will be convening residents and users of the Lagoon for meetings to raise awareness on the ecological and economic importance of the area. The Estuary Program will carry out passive recreation activities in which it will inform the public on the interagency work being carried out in the marine reserve. Support groups will be constituted to support the irrigation, cleanup, monitoring, and security of the marine reserve.

#### Outputs/Deliverables

- ✓ 5 meetings with operators and Amigos de la Laguna
- ✓ Meeting with USCOE on analysis performed by them on flooding issues.
- ✓ 12 Cine Estuario Showings

#### Outcomes

Short-Term: Ensure implementation of Law No. 112 of 2013, which created the Condado Lagoon Estuarine Natural Reserve.

Intermediate: Active public participation in improving the Condado Lagoon

Long-term: Protection of the Condado Lagoon's biodiversity.

#### Milestones

1<sup>st</sup> Quarter: 2 Meetings with Amigos de la Laguna; irrigation performed in areas as needed; 3 screenings

2<sup>nd</sup> Quarter: irrigation performed in areas as needed; video documenting the co- management of the reserve released; informational signs installed.

3<sup>rd</sup> Quarter: 3 Cine Estuario screenings; irrigation performed in areas as needed;

4<sup>th</sup> Quarter: 3 Cine Estuario screenings; irrigation performed in areas as needed;

#### Staff

The Resources and Stakeholder Coordinator under the supervision of the Executive Director will oversee this activity.

#### Partners and Their Role(s)

DNER: The ESTUARIO will work closely with the DRNA, the other entity which co-manages the Condado Lagoon Estuarine Reserve.

Environmental and Community Organizations: Organizations and initiatives which operate in the Condado area will support the co-management of the Condado Lagoon.

Friends of the Condado Lagoon: This initiative of the ESTUARIO will be the link between the Program and organizations representing businesspeople, residents and organizations operating in the area.

Estimated Budget: \$10,188

Budget detail

Product or service	Cost	Category	Description and category
Cine Estuario. Six (12) screenings	\$2,160	Contractual	12 screenings @ \$180.00 per function
Movie Permits	\$3,420	Other	Movies Permits (\$285 per movie permit @ 12 screenings)
Ecosystem Restoration and Policy Coordinator	\$4,608	Contractual	Ecosystem Restoration and Policy Coordinator: @\$18/hour for 256 hours

## **ACTIVITY 8: SOLID WASTE MANAGEMENT ACTIVITIES [ON GOING]**

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### CCMP Action(s)

AD-1: Develop and implement community-based solid waste management and recycling programs in coordination with municipalities.

AD-4: Conduct periodic aquatic debris clean-up activities at suggested SJBE locations.

AD-5: Establish Solid Waste Pollution Prevention Pilot Programs at different SJBE locations.

### CWA Relevant Program(s)

- Addressing diffuse, nonpoint sources of pollution

### Work Plan Priorities

Mitigation Plan and Resilient Communities.

### Objective(s)

Support activities related to the characterization of solid waste generated by the communities within the San Juan Bay watershed, particularly after Hurricane Maria.

Educate about solid waste management and reduction to reduce impact on the watershed based on the new information.

Reduce the amount of pollution reaching our waterways.

Reduce the amount of oil affecting the functioning of the grey infrastructure within the San Juan Bay Estuary system and its watershed.

### Description

After hurricane Maria, there was a sudden increase in solid waste material and people were forced into new patterns for using and discarding these materials. At the same time, municipalities, landfills, and recycling facilities faced complete or significant capacity loss due to economic and power conditions, significantly impacting local capacity to divert, reuse, collect, or recycle solid waste in Puerto Rico. Mainly, the use of plastics increased dramatically and has remained relatively high. The situation has also exacerbated local landfills conditions, which are not in compliance with EPA standards for operation.

Hurricane Maria proved the grave danger landfill pollution posed to communities and particularly the Estuary's watershed waterbodies. The increased amount of debris, loss of capacity and lack of compliance in local landfills became the perfect storm on top of the hurricane. Estuarine communities were exposed to contaminants in drinking water, and water bodies were impaired due to direct discharges, increased use of domestic purposes and leaching from landfills. Furthermore, communities faced increased floods and flooding risk due to infrastructure collapsed by the free debris generated directly in the aftermath of the Hurricane, increasing human exposure to different disease vectors.

To immediately address the situation, we must first understand current use patterns of solid debris within the watershed. Estuario will conduct a characterization of trash produced within the basin. the development of a waste management plan based upon this new information. The watershed solid waste management plan is part of the Watershed-based mitigation plan that is being developed with the support from the State Revolving Funds.

Correct disposal and recycling of our solid waste materials support community health and infrastructure functionality. Last fiscal year, the Estuario established an Oil Recycling Program in two condominiums. Interactions with the communities highlighted an increased awareness and desire to reduce and recycle waste beyond the oil recycling program. This prompted Estuario to propose the creation of a solid waste management campaign that informs about available alternatives and facilities for recycling. As part of the campaign, Estuario will provide support, workshops and educational material to residents, businesses and the communities. The first stage of the campaign will take place in Calle Loiza, San Juan. This campaign will be carried out in close collaboration with community residents, grassroots organizations and municipalities. The education will be focused in the following recyclable materials: plastic, cardboard, aluminum and oil recycling.

#### Outputs / Deliverables

- ✓ (1) Develop a solid waste prevention campaign to correct disposal and improve recycling in participating areas
- ✓ Incorporate solid waste prevention campaign into at least (1) coastal clean-up
- ✓ Maintain used oil and recycling campaign
- ✓ (1) Add a condominium for the extension of the used oil and used oil filter recycling campaign to other areas of the watershed
- ✓ Monitor the storm water system protection campaign

#### Outcomes

Short-Term: Launch awareness campaign in collaboration with stakeholders.

Intermediate: Reduce the amount of the solid waste and increase the recollection of the materials with potential to be recycled.

Long-term: Reduce the amount of waste or debris entering all bodies of water in the SJBE watershed. Raise awareness on the environmental consequences of improper oil disposal and how to properly dispose of oil through citizen and business action

#### Milestones

1st Quarter: Collaborators are identified and their roles established. Begin development of awareness campaign in Calle Loiza.

2st Quarter: Distribution of campaign materials in Calle Loiza.

3st Quarter: Create temporary signage and carry-out community awareness campaigns

4st Quarter: Rollout awareness campaign Campaign. Install Temporary Signage.

Staff

Stakeholders and Aquatic Debris Coordinator and Executive Director will be in charge of coordinating development of campaign, outreach and workshop sessions.

Partners and their role(s)

Environmental Quality Board, EPA, PRASA,  
Municipalities  
Taller Comunidad LaLa Goyco and Machuchal Limpio  
Recycling companies  
NGOs

Estimated Budget: \$10,000

Budget detail

Product or service	Cost	Category	Description and category
Collaborative Awareness Campaign	\$3,500	Other	Training & Informational Material (Editing and Printing)
Key maintenance activities for the sewer system and water quality sampling with residents.	\$1,500	Supplies	Debris removal materials such as: stormwater sewer covers and related supplies (\$500) and reagents for monthly bacteriological monitoring for sewer stations (\$1,000)
Temporary signage related to Waste Management in Calle Loiza	\$5,000	Contractual	Preparation of signs (artwork, printing and installation)

## **ACTIVITY 9: 12TH PUERTO RICO WATER QUALITY MONITORING DAY [ANNUAL EVENT]**

### CCMP Action(s)

PI-3: Establish a Program to Provide Citizens with Effective and Organized Volunteer Opportunities to Support the SJBE's Restoration Projects (Water Quality Monitoring, Education, etc.).

PI-4, 4.4: Develop educational activities for public participation.

PI-6, 6.6: Encourage an annual celebration of the SJBE at all schools located within the SJBE watershed.

PI-6, 6.7: Continue delivering talks and presentation about the SJBE at schools and related special events.

PI-7: Develop a Memorandum of Understanding between Public and Private Entities and the ESTUARIO to expand the scope of the Program's public education and outreach activities.

WS-18: Continue and strengthen the ESTUARIO's monitoring program, including its public-science component, paying particular attention to the Río Piedras, Juan Méndez Creek, San Antón Creek, and their tributaries.

### CWA Relevant Program(s)

- Identifying polluted waters and developing plans to restore them

### Work Plan Priorities

Resilient Communities

### Objective(s)

To provide citizens with opportunities in citizen science through water quality monitoring activities. This activity serves as means of educating on the importance of conservation and water quality, and fostering long term citizen science projects with the ESTUARIO.

### Description

The Puerto Rico Water Quality Monitoring Day is the largest citizen science event of the ESTUARIO and the only water quality monitoring island-wide event. Since 2009 more than 10,000 citizens have participated in the game, where hundreds of monitoring stations are visited during the year. The main event, which is celebrated in April of each year and attracts hundreds of participants, is followed by individual water monitoring activities during the rest of the year. The ESTUARIO coordinates the island-wide event with the collaboration and alliances of other organizations, academia, government agencies, and private corporations. Water quality monitoring kits are loaned to the participants and all the necessary documentation and tools for the event. Workshops on the use of the equipment and the methodology to follow during the event are given in different locations around the Island and will support groups that want to continue monitoring during the year. The data from this event is included in the World Water Monitoring Challenge Organization database. The ESTUARIO will create a short educational video about the initiative and will continue to feature the event on social

media. Volunteers will be provided with outreach outlets such as t-shirts, bags, or caps, which will serve as ongoing promotion for the event. This year, the ESTUARIO will be seeking additional sources of funding and sponsorships by private corporations to obtain more kits and resources to recruit a higher number of participants and make this island-wide initiative a self-sustain one.

### Outputs / Deliverables

- ✓ Monitoring of at least 150 stations around the Island.
- ✓ Approximately 700 participant visits to these monitoring stations.
- ✓ Four (4) workshops or capacity building activities to prepare volunteers in the four cardinal areas of the Island, North, South, East and West.
- ✓ Volunteers will participate in data gathering and analysis.
- ✓ Submit collected data to the World Water Monitoring Challenge organization.
- ✓ Social media coverage and postings.

### Outcomes

Short-Term: Monitoring of at least 150 stations around the U.S. Commonwealth of Puerto Rico. Approximately 700 participant visits to these monitoring stations. Four (4) workshops or capacity building activities to prepare volunteers in the four cardinal areas of the island, North, South, East and West. Volunteers will participate in data gathering and analysis. Submit the local data of the Territory to the World Water Monitoring Challenge organization.

Intermediate: To further engage citizens in the restoration and conservation of their urban and rural waters.

Long-term: For citizens to become agents of change to help improve water quality in their communities. For the ESTUARIO to have a better understanding of the changes of the water bodies through the long- term records of monitoring stations. For citizens to become guardians of the areas they monitor each year and provide valuable information about the ecosystem.

### Milestones

1<sup>st</sup> Quarter: Collaborators are identified and contacted.

2<sup>nd</sup> Quarter: Workshops and kits distribution take place. Island wide coordinator identified and contracted.

3<sup>rd</sup> Quarter: Data Analysis and Activity Report

4<sup>th</sup> Quarter: End of period: Data will be submitted to World Water Monitoring Challenge Organization.

### Staff

The Islandwide Coordinator will coordinate this event under the supervision of the Volunteer and Community Outreach Manager. Other ESTUARIO staff time will be invested to provide the necessary support to this activity, particularly the Water Quality Monitoring Coordinator.

### Partners and their role(s)

PR Environmental Quality Board: The government agency assigned to support this event in collaboration with the ESTUARIO. PREQB offers its facilities to provide workshops to the group leaders and recruit volunteer groups.

Department of Natural and Environmental Resources: With the active participation of the Jobos Bay National Estuarine Reserve and the Humacao Natural Reserve, the DNER has contributed over 40% of the event's participants.

Public/private schools and universities provide support through student groups.

The private sector has an important role in providing volunteers with monitoring and outreach materials.

Estimated Budget: \$10,602

Budget detail

Product or service	Cost	Category	Description
Water quality monitoring supplies	\$1,500	Supplies	Water Quality Monitoring Kits (\$18.75/Kit, 80 kits)
Lab Analysis	\$600	Other	Lab Analysis at EPA-Certified lab for nutrients, oils and enterococcus at four (4) stations.
Outreach outlets	\$3,002	Other	printing t-shirts, caps, bags
Day of event coordination	\$1,000	Other	Renting of sound, tables, chairs, tents, boat (1 boat @ \$250)
Islandwide Coordinator	\$4,500	Contractual	300 hours at \$15/hour

## **ACTIVITY 10: RESILIENT COMMUNITIES SUPPORT**

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### CCMP Action(s)

PI-3: "Establish a program for providing citizens with effective and organized volunteer opportunities to support the SJBE's restoration projects"

PI-4: "Develop a long-term community outreach and public education program."

### CWA Relevant Program(s)

- Identifying polluted waters and developing plans to restore them (total maximum daily loads),
- Protecting wetlands,
- Protecting coastal waters through the National Estuary Program, and
- Protecting Large Aquatic Ecosystems.

### Work Plan Priorities

Resilient Communities

### Objective(s)

Further engage citizens in meaningful ways by integrating cultural vibrancy through community participation and artistic expression.

Establish one exhibit using the ESTUARIO Center as a Hub to further anchor our role as a community and Estuarine information hub.

### Description

In the aftermath of Hurricane María, the Estuario engaged in an immediate relief approach to support the most affected communities within the Estuario's watershed. EPA's support was used to amplify work conducted under the Urban Water Ambassador Program, supporting thus, the Caño Martín Peña as well as additional environmental justice communities through community driven solutions. The Estuario worked with two communities in Cataño, Juana Matos and Puente Blanco; two communities in San Juan, Caimito and Caño Martín Peña; and El Ancón in Loíza. The SJBE has launched a platform to offer long term community resilience support. These efforts are part of a comprehensive watershed-based Mitigation Plan to reduce stressors that the most disadvantaged watershed communities face.

The first year of Community Resilience Coordinators, the Estuario was able to secure engagement from local grassroots organizations, provide capacity building, and commit funding and resources from third parties for the communities. Estuario transformed immediate emergency relief into a long-term recovery and empowerment strategy by providing diverse opportunities for engagement and addressing some of the most grievous environmental and social injustices the communities face. We propose hiring a part-time social worker and community coordinator for inclusion of one additional community in Cantera and continuity of the Community Resilience Activities.

The Community Coordinator would be responsible for executing the work actions identified as priorities by Community residents. Some tasks include:

- ✓ Transition immediate relief efforts into a comprehensive community resilience platform
- ✓ In collaboration with community-based organizations, develop a 12-month work plan that addresses problems identified by residents.
- ✓ Coordinate and implement the structured set of work with community-based organizations on- the-ground with the support of the Urban Water Ambassador.
- ✓ Prepare and submit monthly 1-page reports on work done and progress attained.
- ✓ Oversee the community resilience support efforts within the SJBEP.
- ✓ Serve as a liaison between disadvantage communities and federal, state and municipal governments.

In our efforts to restore water quality, healthy human communities are our stewards. The Social Worker would be responsible for documenting, evaluating and referring difficult situations observed within the communities where the Estuario provides supports. Part of the Social Workers task would also include looking at maintenance and identification of additional communities to support, in close coordination with the community resilience coordinators. As part of this year of transition funding from the EPA, the Social Worker would be tasked with turning the *Estuario* into a Practice Center for Social Work. Turning the Estuario into a practice center would allow us to have several social work graduate students do their practicum in the community hubs created. The *Estuario* Practice Center would be able to maintain, and expand the Community Support with a high degree of return on investment, and build in renewed participation throughout the years. To lead these efforts, a Community Social Worker will be recruited with strong background on community organizing. Community organization will also include recruitment of community residents for training based in their response to previous disasters.

The Urban Waters Ambassador will continue work on the Caño Martín Peña and will also actively participate in all matters related to this scope as specified below.

- ✓ Offer direction and overall oversight of assessments, development of work plans and implementation.
- ✓ Leverage resources from state and federal government and private sector organizations also working in the geographic areas to implement work plans.

#### Outputs / Deliverables

- ✓ Collaborate in the development, adoption and implementation of Caño Martín Peña Work Plan 2019-2020;
- ✓ Leverage five (5) resources to help further implementation of the Work Plan and ensure Ecosystem Restoration
- ✓ Support Project continuation of PED and subsequent phases;
- ✓ Coordination of two partnership meetings with representation of federal, state and local partners.
- ✓ Collaborate in the development, adoption and implementation of a work plan with the Cantera community that identifies support priorities
- ✓ Identify and coordinate activities with Cantera community organizations
- ✓ Support in the creation of one MOU with the School of Social Work
- ✓ Generate a work plan for Social Worker practice support for the Estuario Projects
- ✓ Generate a report that identifies and suggests solutions for social problems most identified in Estuario efforts.

## Outcomes

Short-term: Identification and implementation of community-based ecosystem restoration efforts.

Intermediate: Increased community participation, trust and stewardship in the conservation of water resources.

Long-Term: Improved community and ecosystem health.

## Milestones

1<sup>st</sup> Quarter: Completion of the recruitment process to select Community Coordinator and Social Worker. Community meetings and activities towards identifying needs. Work Plan draft as a collaboratively constructed living document.

2<sup>nd</sup> Quarter: Community meetings and activities towards identifying needs and implementing workplan actions.

3<sup>rd</sup> Quarter: Community meetings and activities towards identifying needs and implementing workplan actions.

4<sup>th</sup> Quarter: Final Reports and Recommendations

## Staff

The Resilient Community Assistant Project Manager will be responsible for scheduling and supervising Resilient Communities Support activities. The Assistant Project Manager will supervise the Community Resilient Coordinators and Social Worker.

The Executive Director will work directly with the Urban Waters Ambassador.

## Partners and their role(s)

Compañía para el Desarrollo Integral de la Península de Cantera

Corporación del Proyecto ENLACE del Caño Martín Peña

University of Puerto Rico Medical Sciences Campus

School of Social Work of the University of Puerto Rico – Río Piedras Campus

Estimated Budget: \$100,000

Budget detail

Product or service	Cost	Category	Description
Urban Waters Ambassador	\$50,000	Contractual	\$45,000 (\$76.04 per hour @591 hours), \$5,000 (travel)
Community Resilience Coordinator	\$20,000	Contractual	\$17/hour for 1,176 hour
Community Social Worker	\$30,000	Contractual	\$20/hour for 1,500 hours

## ACTIVITY 11: COMMUNITY RESILIENCE INITIATIVES

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### CCMP Action(s)

PI-3: "Establish a program for providing citizens with effective and organized volunteer opportunities to support the SJBE's restoration projects"

PI-4: "Develop a long-term community outreach and public education program."

PI-14 Create an ongoing project to compile information and make it available via alternatives such as the WebAtlas and the ESTUARIO library

### CWA Relevant Program(s)

- Identifying polluted waters and developing plans to restore them (total maximum daily loads),
- Protecting wetlands,
- Protecting coastal waters through the National Estuary Program, and
- Protecting Large Aquatic Ecosystems.

### Work Plan Priorities

Resilient Communities

### Objective(s)

To have a vibrant and active Center of the Estuary with a strong educational agenda, and workshops offered to the public at least every two months, drawing in at least 2,000 visitors during FY 2020.

Further engage citizens in meaningful ways by integrating cultural vibrancy through community participation and artistic expression.

Establish one exhibit using the ESTUARIO Center as a Hub to further anchor our role as a community and Estuarine information hub.

### Description

*Conservation through Arts and Culture:* The San Juan Bay Estuary Program recognizes the need to come up with creative ways to further engage its citizens into the process of developing a resilient watershed. After hurricane Maria, the metropolitan region has had to deal with issues not directly linked to the restoration of the water bodies that surround their homes and recreational areas. Furthermore, it has been documented that a high percentage of the residents of Puerto Rico are struggling with mental illness after hurricane Maria. Given the importance of our work, the ESTUARIO put together an engagement strategy that offers its audience creative ways to be involved. During FY19, Estuario completed three artistic campaigns yielding great results, as the community showed an increased interest in water conservation initiatives. The ESTUARIO will continue its resident artist initiative incorporating the process in the design and integration of resilient communities. During FY20, Estuario will launch two artistic campaigns.

### Outputs / Deliverables

- ✓ Two workshops within the San Juan Bay Estuary Center
- ✓ Two Artists in Residence campaigns
- ✓ One exhibit based on the Artist in Residence artworks

### Outcomes

Short-term: Increase awareness of what is the San Juan Bay Estuary system, and its particular interest areas; Increase community engagement to familiarize themselves with alternatives within their communities.

Intermediate: Continue to raise awareness on the environmental consequences of use of the Watershed.

Long-Term: Environmental and socioeconomic outcomes of this project will be improved social engagement, the improvement of the water quality of the estuarine ecosystems, community disaster recovery, and resilience of the watershed.

### Milestones

- 1<sup>st</sup> Quarter: Completion of the recruitment process to select two Artist in Residence
- 2<sup>nd</sup> Quarter: First Artistic Campaign (Center)
- 3<sup>rd</sup> Quarter: Second Artistic Campaign
- 4<sup>th</sup> Quarter: Opening of the exhibit

### Staff

The Resilient Community Assistant Project Manager will be responsible for scheduling and supervising community resilience activities. The Assistant Project Manager will supervise the Community Resilient Coordinators and bring support in the resident artists campaigns.

### Partners and their role(s)

Schools and community organizations in Old San Juan area: The ESTUARIO will seek to form partnerships between schools and community organizations, promoting the Center of the Estuary as a resource within their community.

Workshop givers, educators, artisans, and volunteers: Workshop givers, educators, and/or artisans offer the workshops, with the support of the ESTUARIO's volunteers, forming a partnership in which both the workshop- givers and the ESTUARIO benefit.

Escuela de Artes Plásticas and Escuela de Artes Culinarias

Estimated Budget: \$18,616

Budget detail

Product or service	Cost	Category	Description
Resident Artists per theme (2)	\$10,000	Contractual	\$5,000 / each artist
Exhibit Created by Resident Artist	\$3,516	Supplies	Materials for exhibit to be created by resident artist
Community Resilience Coordinator	\$5,100	Contractual	Arts & Culture \$17 / hour for 300 hours

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## **ACTIVITY 12: CITIZEN SCIENCE CERTIFICATION PROGRAM [ONGOING]**

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### CCMP Action(s)

PI-3 Establish a program to provide citizens with effective and organized volunteer opportunities to support the SJBE's restoration projects.

PI-4: Develop a long-term public education and outreach program.

PI-7: Develop a Memorandum of Understanding between public and private entities and the SJBE Program to expand the scope of the Program's public education and outreach activities.

GI- Action, 1.1, 1.10: Create a master plan for green infrastructure in the SJBE watershed and develop pilot projects for rain gardens and green rooftops, dunes and other ecosystems

### CWA Relevant Program(s)

- Identifying polluted waters and developing plans to restore them (total maximum daily loads),
- Protecting wetlands,
- Protecting coastal waters through the National Estuary Program, and
- Protecting Large Aquatic Ecosystems.

### Work Plan Priorities

Resilient Communities

### Objective(s)

To institutionalize and integrate its citizen science program across the ESTUARIO watershed, using the successful example of its current Water Quality Monitoring Program Citizen Science and Participatory Bird Census Certification.

Implement a new Citizen Science Certification Program.

Develop a similar curriculum of theory and hands-on experience, offering a Citizen Scientist Certification in its other restoration projects that require a long-term volunteer commitment. By the end of this fiscal year we will have 4 working modules.

### Background

The ESTUARIO successfully established its Citizen Science Certification Program in Fiscal Year 2018, creating a curriculum for the Volunteer Water Quality Monitoring Program. The ESTUARIO used the example of its successful Volunteer Water Quality Monitoring Program to create the module for Participatory Bird Censuses. Each of these modules is comprised of an introductory theory component, fieldwork, and additional workshops to deepen understanding of specific topics. The ESTUARIO also achieved the endorsement of this curriculum by the Rio Piedras Campus of the University of Puerto Rico (UPR). The Department of Environmental Sciences of the UPR agreed to house the curriculum as a seminar included in its course offerings, and the Geography Department at the Social Science College agreed to add an elective course during the 2nd semester of the 2018-2019 year. The Seminar course

was given for the first time in Spring 2018 as well as the Internship elective course in 2019 by the team of the San Juan Bay Estuary Program.

### Description

In FY 2019, the certification expanded by creating a module. This year FY2020, the ESTUARIO will strengthen its Citizen Science Certification Program by offering the three modules developed to potential citizen scientists. The ESTUARIO will also continue to build partnerships with other institutions of learning and other organizations to continue to recruit students and citizens interested in becoming certified.

### Outputs/Deliverables

- ✓ Offer three (3) introductory workshops, one for each of the three modules (one of which is already included in the Water Quality Monitoring Program outputs).
- ✓ Offer six (6) enrichment workshops, two for each of the three modules (two of which are already included in the Water Quality Monitoring Program outputs).

### Outcomes

Short-Term: An Estuarine Citizen Science curriculum that includes three modules related to priority areas for the ESTUARIO, and the recruitment of citizen scientists.

Intermediate: An Estuarine Citizen Science curriculum that includes engagement, training, field experience and reporting for each of the restoration projects included in the work plan, and the recruitment of citizen scientists.

Long-term: Green workforce developed; empowered citizens and sustainable management of the SJBE watershed.

### Milestones

1st Quarter: Volunteers recruited

2nd Quarter: Introductory workshops provided

3rd Quarter: Enrichment workshops completed and three modules published.

4th Quarter: 2 cohorts certified

### Staff

The Water Quality Monitoring and Citizen Science Coordinator implements the Water Quality Monitoring module and coordinates the overall Citizen Science Certification Program. The Resource and Stakeholders and Aquatic Debris Coordinator implements the Microplastics Module, which was designed and implemented during the previous Work Plan 25. The Education Manager implements the participatory bird census module of this activity

Partners and Their Role(s)

University of Puerto Rico – Río Piedras Campus: Will include the Citizen Science curriculum in its course offerings as a seminar or as an Internship Course.

CECIA Environmental Education Center of the Interamerican University – Metro Campus: Will partner with the ESTUARIO to recruit and offer workshops to students interested in becoming certified.

Institutions of learning: The ESTUARIO will also continue to build partnerships with other institutions of learning and other organizations to continue to recruit students and citizens interested in becoming certified.

Estimated Budget: \$2,500

Budget Detail

Product or Service	Cost	Category	Description
Boat Trips (6)	\$1,500	Other	Six (6) boat trips for modules implementation (\$250 per trip)
Educational Materials	\$1,000	Supplies	Educational materials, field supplies.

## **ACTIVITY 13: ESTUARINE EDUCATION PROGRAM [ONGOING AND NEW]**

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### CCMP Action(s)

PI-1: Develop and promote low-impact recreational activities within selected areas of the SJBE.

PI-4: Develop a long-term public education and outreach program.

PI-5: Develop an ecotourism program to promote sustainable, low-impact enjoyment of SJBE's natural resources as a means to further their conservation.

PI-6: Develop an Environmental Education Program to Target Young Audiences at Schools and other Non-Formal Educational Institutions throughout the SJBE Watershed.

PI-8: Promote better understanding of estuarine resources among regulatory enforcement agencies and personnel.

### CWA Relevant Program(s)

- Protecting wetlands,
- Protecting coastal waters through the National Estuary Program, and
- Protecting Large Aquatic Ecosystems.

### Work Plan Priorities

Resilient communities

### Objective(s)

The main objective of this activity is to reach school populations (students and educators) as well as communities throughout the watershed, engaging them through facilitated educational lessons, activities, Guide tours, Citizen Science Activities, interpretive programs and special Educational projects opportunities.

To increase the recreational and sustainable enjoyment of the SJBE Watershed.

### Description

The Education Program is comprised of the following activities: Educational Field trips; Facilitation of Curricular Lessons; Guardians of the Estuary; Summer Educational Program; Professional Development Workshops; and a new activity for this year: Estuarine Professional Development Workshop/Field Trips for Environmental Interpreters and non-formal educators.

Community Resilience is a community's capacities, skills, and knowledge that allow it to participate in recovery from disasters fully. It is so that education and citizen activities can provide better knowledge and understanding about our environment and our shared space, from the forests to the city to the coast. Education activities will expand community tools to face extreme situations and help disseminate and integrate Mitigation Plan feedback and activities.

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## EDUCATIONAL FIELD TRIPS

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Educational Field Trips within SJBE Watershed: The ESTUARIO will continue to offer engaging educational field trips for schools and other communities of learning participating in the "Contacto Verde" educational requirement for public schools as part of the Law #35 of 2015.

These Educational Field Trips will provide students and teachers an experiential contact with the flora, fauna, and ecosystems that are part of the SJBE and its ecosystems from the mountain to the estuary. The activities in these educational field trips will include an introduction of the ESTUARIO and the SJBE; identification and documentation of flora and fauna; a water quality monitoring workshop; fieldwork and research in the Urban forest network and marine debris and microplastic workshop. (Ten (10) Educational Field Trips)

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## CURRICULAR LESSONS OR WORKSHOPS

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Facilitation of Curricular Lessons with Schools and Communities of Learning: The ESTUARIO will continue visiting schools and other communities of learning within its watershed to facilitate in students and teachers the acquisition of knowledge about the estuary watershed, water quality, climate change, flora and fauna, stormwater and storm sewers among other topics. (Ten (10) facilitation of Curricular Lessons)

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## GUARDIANS OF THE ESTUARY SCHOOL PROGRAM

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Guardians of the Estuary (Guardianes del Estuario): The ESTUARIO uses education as a useful tool for adequate restoration and conservation of the SJBE's watershed. Guardians of the Estuary consists of encouraging schools to adopt a nearby body of water within the SJBE watershed and monitor the water quality. The Program provides students and teachers the opportunity to become scientific researchers in their schools, fostering education in the STEM fields. Students will learn about the technical aspects of taking water samples and studying the quality of a body of water. They will share knowledge with communities of learning in addition to celebrating the true values and the importance of the fauna, flora, and ecosystems of the SJBE system. Students will gain awareness regarding the challenges the SJBE watershed is exposed.

The ESTUARIO will work with at least five (5) schools within the SJBE watershed and give them a water quality monitoring suitcase of materials for one year. Each school will have a teacher that will serve as a leader and as the contact person between the school and the ESTUARIO. A portion of these schools will come from the 12 critical areas identified by the Discharge Detection Program in the areas in which the Community Water Quality Monitoring Network operates. (Five (5) Schools participating in Guardians of the Estuary).

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### SAN JUAN BAY ESTUARY WEEKLONG SUMMER WORKSHOP:

This weeklong summer workshop will be offered to a group of young people living within the SJBE watershed. Through a variety of creative, participatory and hands-on activities, all related to the environment and human health, participants will learn firsthand about the SJBE, its fauna, flora and ecosystems, and what actions, as young citizens and leaders, they can take to take part in restoration and conservation of the SJBE watershed. (One (1) Weeklong Summer Workshop)

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### SCOUTS MERIT BADGE WORKSHOPS PROGRAM:

Using the SJBE watershed as a living laboratory, the ESTUARIO will offer young scouts and scout leaders at least one merit badge related with any of the topics related to our Estuary ecology, biodiversity and its ecosystems; such as (Bird Study, Oceanography, Nature, Soil and Water Conservation, Environmental Science, Forestry, Fishing, Sustainability, among other merit badges from the Scouts BSA movement)

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### CHILDREN'S COMMUNITY ESTUARINE LEADERSHIP WORKSHOP SERIES:

The workshop series will teach children about the Estuary and their community from an environmental perspective using different tools, such as participative cartography, water quality monitoring, art activities, and bird censuses. Children are given a pre-test and post-test to be able to measure their learning (One (1) Workshop Series)

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### ESTUARINE PROFESSIONAL DEVELOPMENT WORKSHOP FOR TEACHERS AND EDUCATORS:

Using the SJBE watershed as a living laboratory, the ESTUARIO will convene teachers and educators to gain knowledge on topics related to our Estuary ecology, biodiversity and its ecosystems. The SJBE Visitor's Center in Old San Juan will become the hub for two (2) workshops to introduce educators to the estuarine context of one of the oldest cities of the Caribbean basin. This city is located on the shores of the San Juan Bay, which, from manatees to dolphins, is a habitat for hundreds of species. These workshops will count as credits for the Citizen Science Certification Program. (Two (2) Workshops for Educators)

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### ESTUARINE PROFESSIONAL DEVELOPMENT WORKSHOP/FIELDTRIPS FOR ENVIRONMENTAL INTERPRETERS, ENVIRONMENTAL COMMUNITY GUIDES AND NON-FORMAL EDUCATORS:

Using the SJBE watershed as a living laboratory, the ESTUARIO will convene teachers and educators to gain knowledge on topics related to our Estuary and its ecosystems. The Workshops or field trips will be coordinated to demonstrate the best practices in interpretation using the standards the National Association for Interpretation (NAI). These workshops will count as hour's credits for the recertification requirements of the Certified Interpretive Guide. Also we are going to include the Certified Interpretive Guide Workshop from NAI to support community groups in the San Juan Bay Estuary Region to promote the best practices of guided tours and ecotourism's activities.

### Outputs / Deliverables

- ✓ Ten (10) Educational Field Trips
- ✓ Ten (10) curricular Lessons and/or workshops with schools and/or other communities of learning
- ✓ Five (5) schools participating in the Guardians of the Estuary School Program
- ✓ One (1) San Juan Bay Estuary Weeklong Summer Workshop (4-5 days)
- ✓ One (1) Scouts Merit Badge Workshop
- ✓ One (1) Children's Community Estuarine Leadership Workshop Series
- ✓ Two (2) Estuarine Professional Development workshops for teachers and educators
- ✓ Two (2) Estuarine Professional Development Workshop/Fieldtrips for Environmental Interpreters and non-formal educators

### Outcomes

Short-Term: The ESTUARIO Education Program expects to reach an average of 2,000 participants during the fiscal year.

Intermediate: For the ESTUARIO Education Program to have a thematic, organize, relevant, entertaining and meaningfully events programming, with a Calendar of recurring events open to public and private schools, homeschoolers, scouts, environmental clubs, senior citizens, families and the public.

Long-term: To increase the visibility, diverse and level-adequate of Estuary Education Program as a valuable resource to the community, community and schools-focused estuarine education programming from talks to forest and nature-based education.

### Milestones

1st Quarter: Meeting and Agreement Signing with the 5 Schools to be part of the Guardians of the Estuary School Program. Coordination of the curricular Lessons and/or workshops with schools and/or other communities of learning, Coordination of the Educational Field Trips

2nd Quarter: Will complete the 25% of the curricular Lessons and Field Trips, Coordinate the Scouts Merit Badge Workshop, Coordinate the Estuarine Professional Development Workshop/Fieldtrips for Environmental Interpreters and non-formal educators, Coordinate the Children's Community Estuarine Leadership Workshop Series

3rd Quarter: Will complete the 50% of the curricular Lessons and Field Trips, Organize the San Juan Bay Estuary Weeklong Summer Workshop, Coordinate the Estuarine Professional Development workshops for teachers and educators

4th Quarter: Will complete the 100% of the curricular Lessons and Field Trips and all others Outputs.

### Staff

The Education Manager will be implementing these activities and projects from October 2019 to September 2020 with the aid of the Education and the Water Quality Coordinator.

The Education Manager will oversee this activity, in coordination with the Scientific Director and Water Quality Monitoring Coordinator, under the direction of the Executive Director.

The Education Coordinator will be responsible for supporting the tasks assigned by the education manager before, during and after the participatory bird censuses. The Education Coordinator will also be responsible for coordinating with the Education Manager the preparatory workshops for volunteers, create a table in google drive for the entry of people who register, follow up in writing and telephone to registered volunteers before each census, keep up to date data entry to the ebird platform and the estuary atlas, inspect the equipment to be used during the censuses (binoculars, telescope and identification cards), enter the hours of the certification of scientific citizens of the bird module on the google drive , among other tasks.

### Partners and their role(s)

Puerto Rico Department of Education: The DE will allow students and teachers from public schools to participate in the ESTUARIO's education projects and activities.

University of Puerto Rico, Rio Piedras Campus: (Department of Geography and the Department of Environmental Sciences) The UPR will allow co-coordinating teachers workshops and field trips and use of the facilities as rooms or amphitheatres.

Interamerican University, Metropolitan Campus (CECIA) CECIA will allow the student to participate and supporting the educational efforts with schools and/or other communities of learning.

Private schools: These schools will allow us access to their students and teachers to collaborate in the development of estuarine educational projects and activities.

Home Schoolers Networks:

These Parent Education Based Groups will allow us access to their children to collaborate in the development of estuarine educational projects, field trips and environmental education activities. Community-based organization within the SJBE watershed: These community organizations will help the ESTUARIO access the people in their communities for the ESTUARIO to facilitate estuarine educational experiences.

Department of Natural and Environmental Resources: The DRNA will give access to use and deliver workshops, bird census and field trips in the States Forest or National Parks Sites.

National Association for Interpretation (NAI) Will be a partner for the Professional certification "Certified Interpretive Guide" That the Estuary offer to promote the best practices in Ecotourism, Nature Guide and Environmental Education and Interpretation through the San Juan Bay Estuary Ecosystems and Urban Forrest Network

Estimated Budget: \$40,294

Budget detail

Product or service	Cost	Category	Description
Education Manager	\$34,944	Contractual	1,456 hours @ \$24.00 per hour for one year
Educational Boat Trips	1,250	Other	Five (5) boat trips at \$250 per boat trip.
Educational supplies	1,500	Supplies	Educational materials and educational supplies for educational activities and summer workshop/Leadership Workshop
Summer Camp/Workshop Transportation and boat/kayaks rental	\$1,200	Other	Summer Camp/Workshop Bus Transportation (\$350 per bus @ 2 buses) and boat for 20 students @ \$250 per trip (2 boat trips)
Guardians of the Estuary monitoring activities	\$800	Supplies	(1) Monitoring Tool Case
Guardianes Banner or Flag	\$600.00	Supplies	Guardians of the Estuary banners or flags. One for each of the 5 schools

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## **ACTIVITY 14: COMMUNICATIONS PROGRAM [ONGOING]**

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### CCMP Action(s)

PI-2: "Post Educational and Interpretive Signs at Highly Visible, Heavy Traffic Areas throughout the SJBE Watershed (Bridges, Roads, Parks, Marinas, Ports, Waterfronts, etc.) to Educate the Public on the System's Components, Functions, and Values."

PI-11 Continue and strengthen a long-range communications project on the San Juan Bay Estuary

PI-14 Create an ongoing project to compile information and make it available via alternatives such as the WebAtlas and the ESTUARIO library

### CWA Relevant Programs

- Identifying polluted waters and developing plans to restore them
- Addressing diffuse, nonpoint sources of pollution,
- Protecting wetlands,
- Protecting coastal waters, and
- Protecting Large Aquatic Ecosystems.

### Work Plan Priorities

Mitigation Plan and Resilient Communities

### Objective(s)

To increase knowledge among the general population of what is an Estuary.

Increase and share knowledge of how to implement resiliency strategies designed by the Estuary.

Identify and educate about critical watershed areas.

### Description

The communications strategy is fundamental to disseminate the efforts of the Estuario. Storytelling is used to develop creative stories to get closer to our audience. The Estuary has an infinite number of stories to share. Such was the case of the community resilience unit in El Ancón, Loíza. Through the distribution of a desalination plant, we tell the story of El Ancón, the efforts of the students of "Nuestra Escuela," and the work that the Estuary is developing in that community. We were able to appear on the front page of the largest circulation newspaper in Puerto Rico. These are the stories the Estuary tells through its Communications efforts. The relationship with the media is essential, to make a good "pitch" to reporters seeking a unique story. This involves researching, writing, and monitoring of those media.

Social media efforts are essential to share our message. Networks are recognized as a leading communications tool and thus, the key to our efforts. A communication strategy is implemented and includes announcements, events, arts, communities, shared posts, videos and all types of educational material. This includes the three active social networks of the Estuary, Facebook, Instagram, and Twitter. The Communications component will be in charge of 150 new social media contents, including educational information about the SJBE species, activities of the organization included in this work plan, and other information. 24 new educational videos or Facebook Lives of 30s to 3min to inform the public about the initiatives of the ESTUARIO, coverage of the activities, volunteer recruitment, and events with students.

Visual communication is equally relevant. For this reason, short videos are produced to draw the attention of the audience. The production of these videos involves strategy, identification of highlights and message we want to showcase, work on the site, and editing of videos. In the case of live videos, it further requires site coordination and direction and drafting of talking points and guidelines.

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## COMMUNITY RESILIENCE AND SOLID WASTE MANAGEMENT

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During the year, we will focus on Community Resilience projects and the Solid Waste Management Plan as major projects, effectively supporting efforts through social networks, communication campaigns, media relations, and interest columns, among others.

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## WATER QUALITY MONITORING DAY

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The Water Quality Monitoring Day is an educational event that requires distinct communication and public relations efforts. All of these efforts are related to an excellent relationship with the media, previously started by the communication contractor. The efforts include:

- Drafting of pre- and post-event press releases.
- Coordination and execution of Media Tour.
- Production of promotional videos.
- Development and implementation of social media strategy, pre, during and post event.
- Establishing alliances to spread the education and awareness message.
- Press conference: Requires, hiring of suppliers, invitation and follow-up to the media. Coordination with government agencies and private entities. Monitoring of media and social networks, which includes answering citizens questions and comments, among others.

In addition, the Communications Contractor will prepare three communication pieces related to the 12th Water Quality Monitoring Day. A communication piece to help increase volunteer recruitment. A content/press release will be prepared for publishing on the day of the main activity. A third piece will be used to inform the citizens about the results of all the water tests conducted during the WQMD.

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## VISITOR'S CENTER

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Promoting the Visitor Centre is key for the Estuary, as the citizen would obtain first-hand knowledge of our projects, community involvement and similar events. The role of communications is to create engagement with the audience in an effective way in order to communicate our work. Social media posts to promote and highlight the six (6) workshops, talks, or activities that the San Juan Bay Estuary Visitor's Center.

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## CITIZEN SCIENCE CERTIFICATION PROGRAM

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Social media posts to promote the program and benefits behind certification.

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## URBAN FORESTS NETWORK

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A communication piece with the members of the network about the efforts carried out by this initiative. The communications contractor will also help the Executive Director in the development of other press

releases and in the coordination of social media presence. A communication piece about the Urban Forest Network. A publication in an outlet and or web page.

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## WEBSITE

Maintain and update the San Juan Bay Estuary websites and social media to become a source of information and resources. Repository of alternatives for watershed activities. Maintain web atlas as a source of frequency and abundance of species in the estuary to better feed indicators and to measure the success of the implementation of the mitigation plan. Maintain the website Estuario.org working effectively, add new content drafted by the communications contractor to the website, as well as the announcements of the entity, and keep improving it to serve as the recipient of all the electronic publications of the ESTUARIO.

In collaboration with the webmaster, the communication strategy is developed, which involves keeping the page active with events, updating the page with new information and promoting its use.

### Outputs / Deliverables

- ✓ Four (4) communication pieces about the Mitigation Plan Campaign
- ✓ Three communication pieces related to the 12th Water Quality Monitoring Day
- ✓ At least 6 social media posts to promote the Visitors center activities
- ✓ A communication piece about the Urban Forest Network
- ✓ A communication piece about the Green Infrastructure Master Plan
- ✓ 150 new social media contents, including educational information about the SJBE species, activities of the organization included in this work plan, and other information.
- ✓ 24 new educational videos or Facebook Lives of 30s to 3min to inform the public about the initiatives of the ESTUARIO, coverage of the activities, volunteer recruitment, and activities with students.
- ✓ Maintain the website Estuario.org working effectively, add new content drafted by the communications contractor to the website, as well as the announcements of the entity, and keep improving it to serve as the recipient of all the electronic publications of the ESTUARIO.

### Outcomes

Short-Term: At least six contents for phases.

Intermediate: Increase of 25% of the actual social media interactions.

Long-term: Sustain content generations of both phases. Strengthen public recognition and engagement

### Milestones

Throughout the Fiscal Year: Communications Program will provide support for each of the activities outlined in this work plan throughout the fiscal year.

Staff

These activities will be planned and carried out by the Communications Contractor in direct coordination with the Executive Director and with the support from ESTUARIO staff.

Website developer

Education manager

Resources and Outreach Coordinator

Partners and their role(s)

Media corporations; youth organizations and citizens; education and public participation ESTUARIO managers.

Estimated Budget: \$41,750

Budget detail

Product or service	Cost	Category	Description
Communications Contractor	\$30,000	Contractual	\$50/hour for a total of 600 hours
Maintenance of the website Estuario.org	\$4,250	Contractual	Contractual: Maintenance of the website Estuario.org (56 hrs. approximately @ \$75.00 per hour)
Graphic Artist & Social Media and Educational Campaigns Assistant	\$6,000	Contractual	Graphic Artist & Social Media and Educational Campaigns Assistant 400 hrs. @ \$15 / per hour
Facebook / Instagram Ads	\$1,500	Other	Facebook / Instagram Ads

## ACTIVITY 15: GREEN INFRASTRUCTURE: APP MAINTENANCE

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### CCMP Action(s)

GI-1; 1.1: Create a green infrastructure internship or position to coordinate this action's strategies and others in the GI category.

GI-1; 1.3: Using information in Strategy 1.2, identify existing green infrastructure and areas of opportunity for expansion and improvement of this infrastructure.

PI- 1: Develop and promote low-impact recreational (and educational) activities in selected areas of the SJBE.

PI-6: Develop an Environmental Education Program to target young audiences at schools and other non-formal educational institutions throughout the SJBE watershed.

PI-7: Develop a Memorandum of Understanding between Public and Private Entities and the ESTUARIO to expand the scope of the Program's public education and outreach activities.

### CWA Relevant Program(s)

- Protecting wetlands,
- Protecting coastal waters through the National Estuary Program, and
- Protecting Large Aquatic Ecosystems.

### Work Plan Priorities

### Objective(s)

To promote improved water quality and recreational, passive, scientific, and educational activities in the forests comprising the ESTUARIO's Urban Forest Network, which are an important part of the web of green infrastructure in the SJBE watershed.

### Description

In the previous fiscal years, the ESTUARIO formed the Urban Forest Network, consisting of four forests: San Patricio State Forest, Piñones State Forest, Doña Inés Park, and Julio Enrique Monagas Park. This year, the ESTUARIO will focus on facilitating support and channeling for each forest according to its needs and strengthening the collaboration among the members. Support will focus on (1) helping to rehabilitate the forests that have not yet been able to open to the public due to overhanging and fallen debris; and (2) developing urban forests, which are more resilient to future extreme weather events, in coordination with the creation of the Watershed-based Mitigation Plan moreover, Green Infrastructure Master Plan (described below) and (3) include an additional urban forest.

Healthy urban forests are critical environmental resources in the face of hurricanes, as they provide a green infrastructure that helps reduce the amount of stormwater runoff that enters storm sewers and streams by intercepting rainfall with the tree canopy and infiltrating the rainfall into

the soil. Tree roots also help reduce erosion by stabilizing stream banks, thereby protecting stream habitat and preventing accelerated sediment movement downstream.

The ESTUARIO will work with the community groups (listed below under "Partners") and government entities which manage these forests, to strengthen the Urban Forest Network in a way that is responsive to the context and needs of each forest and serving as an alliance among the groups and respective urban forests. The ESTUARIO will also incorporate the Urban Forest Network into its Estuario App to further make information about the forests accessible to the public in a one-stop location.

### Outputs / Deliverables

- ✓ The incorporation of one (1) additional urban forest in the SJBE watershed into the Urban Forest Network.
- ✓ Rescue of previous spaces abandoned since Hurricane Maria
- ✓ Four (4) meetings with each of the entities that manage the urban forests, to establish their priorities and how the ESTUARIO can offer support in the areas of promoting improved water quality as well as recreational, passive, scientific, and educational activities.
- ✓ Four (4) activities that support improved water quality and/or as recreational, passive, scientific, and educational activities, as determined in the meetings with each of the entities.
- ✓ Implementation of the Urban Forest Passport activities

### Outcomes

Short-Term: To continue direct communication, coordination and support amongst managers of urban parks, research sites and recreational areas in the San Juan Bay Estuary watershed. Management and community organization for the maintenance of urban forests.

Intermediate: To protect green corridors and areas. To increase appreciation and awareness by the residents and visitors of the San Juan Bay Estuary watershed. To pilot green infrastructure projects such as raingardens, urban farming, rain barrels and green roofs.

Long-term: To increase the percentage of green areas and reduce the impervious surface of the watershed.

### Milestones

1<sup>st</sup> Quarter: Meetings with Urban Forests to identify areas of support.

2<sup>nd</sup> Quarter: Meetings with Urban Forests to identify areas of support; Begin support activities.

3<sup>rd</sup> Quarter: Continue support activities.

4<sup>th</sup> Quarter: One additional forest incorporated into the Network.

Staff

The Green Infrastructure Coordinator will manage this project under the supervision of the Executive Director, and with support from the Scientific Director.

Partners and their role(s)

- ✓ Community Organizations: The ESTUARIO will engage the following community organizations or centers managing the forests which are part of the Urban Forest Network, or which could potentially be incorporated:
  - Centro Ambiental De Santa Ana (CASA), administered by the Sociedad de Historia Natural de Puerto Rico. (Julio Enrique Monagas National Park)
  - Corporación Piñones se Integra (COPI) (Piñones State Forest)
  - Yaguazo Corridor (Las Cucharillas Wetlands)
  - Comunidad Asociada de Caparra Heights, Inc. (CACHI) (San Patricio State Forest)
  - Luis Muñoz Marín Foundation (Doña Inés Park)
  - Corredor Ecológico de San Juan
  - Antiguo Acueducto in the UPR Botanical Gardens
  - CAUCE
- ✓ Department of Natural and Environmental Resources: The ESTUARIO will collaborate with the DNER, which co-manages the Piñones State Forest and the San Patricio State Forest.
- ✓ Compañía de Parques Nacionales: The ESTUARIO will collaborate with the National Parks Company, which manages the Julio Enrique Monagas National Park.

Estimated Budget: \$12,800

Budget detail

Product or Service	Cost	Category	Description
Ecosystem Restoration and Policy Coordinator	\$10,800	Contractual	Ecosystem Restoration and Policy Coordinator: @\$18/hour for 600 hours
App maintenance	\$2,000	Contractual	App maintenance: 50 hours at \$40/hour aprox.

## ACTIVITY 16: PROPOSAL RESEARCH AND WRITING TO SUPPORT CCMP IMPLEMENTATION

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### CCMP Action(s)

The CCMP establishes the importance of obtaining the necessary resources for the execution of the established actions and in this way achieve the restoration and conservation of the San Juan Bay Estuary System. Therefore, the research and writing of proposals is a fundamental piece in order to comply with the CCMP actions.

### CWA Relevant Program(s)

- Protecting wetlands,
- Protecting coastal waters through the National Estuary Program, and
- Protecting Large Aquatic Ecosystems.

### Work Plan Priorities

Mitigation Plan and Community Resilience

### Objective(s)

To further the implementation of ESTUARIO's CCMP and annual work plan with funding from federal, state, local, and private (for profit and non-profit) grantors and guaranteeing proper implementation of received funds.

Incorporate compliance, reporting and actions' tracking in all Work Plan and proposed activities.

### Description

The ESTUARIO's CCMP implementation is one of the most ambitious environmental restoration plans in the history of Puerto Rico. The plan includes public works of hundreds of millions of dollars, such as the dredging of the Martín Peña Channel, the relocation of hundreds of families, and the elimination of all raw sewage discharges into the ecosystem. It will be beneficial to complement existing funding alternatives with a contractor who works in the competitive grant-writing field. The grant writer's task is to identify and submit proposals to the government, foundations, and corporations during the year.

Responsibilities include: funding identification; eligibility determination; grant writing; grant submittal; grant award reporting activities; oversee compliance with federal regulations during award project activity implementation; maintain communication with program officers from the different funding agencies as well as with grantors from local government, private institutions or foundations; and update and upkeep of the DUNS, [sam.gov](http://sam.gov), [grants.gov](http://grants.gov), e-grants, and NOAA grants online accounts. Other responsibilities include developing all letters of support and memorandums of understanding as required by grantors. The grant writer will maintain an updated username/password sheet and provide it upon each update to the Executive Director (AOR/POC). The grants are linked to ESTUARIO's mission and advance the CCMP and work plan.

Outputs / Deliverables

- ✓ Submit monthly reports to the Executive Director updating on activities including: funding availability, status of grant writing efforts, and related subjects.
- ✓ Meet with Executive Director every two months to identify program priorities.
- ✓ Submit at least one proposal every two months.
- ✓ Provide updated username/password list on a monthly basis to AOR/POC with expiration dates.

Outcomes

Short-Term: Continue Estuario’s contract with current grant writer.

Intermediate: Estuario expects to submit at least 6 proposals to different entities during the fiscal year.

Long-term: Through grant proposal writing the Program expects to be able to finance and complete several of its CCMP actions.

Milestones

At the end of the fiscal year (September, 2020) the organization will have submitted at least six proposals.

Staff

The Executive Director will work hand in hand with the grant specialist to identify needs and necessary funds to implement the CCMP.

Partners and their role(s)

Private foundations, federal agencies, and state and municipal agencies will be the main source of potential funding of CCMP actions and activities.

Estimated Budget: \$46,800

Budget detail

Product or service	Cost	Category	Description
Grant Writing Specialist / Compliance and implementation tracking	\$46,800	Contractual	Contract using NEP CWA 320 funds for CCMP action plan activities (\$30 per hour for a total of 1,560 hours)

## ACTIVITY 17: TRACKING AND GENERAL CCMP IMPLEMENTATION [ONGOING]

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### CCMP Action(s)

All

### CWA Relevant Program(s)

- (1) Establishing water quality standards,
- (2) Identifying polluted waters and developing plans to restore them (total maximum daily loads), (3) Permitting discharges of pollutants from point sources (National Pollutant Discharge Elimination System permits),
- (4) Addressing diffuse, nonpoint sources of pollution,
- (5) Protecting wetlands,
- (6) Protecting coastal waters through the National Estuary Program, and
- (7) Protecting Large Aquatic Ecosystems.

### Work Plan Priorities

Mitigation Plan and Resilient Communities

### Objective(s)

Every year the ESTUARIO participates in a myriad of activities and projects that result from the collaboration of the organization with its partners. Through this general activity we recognize this daily reality of our organization that at the same time offers the opportunity to further CCMP implementation.

### Description

The Program will continue several ongoing projects which further CCMP implementation, focused on Mitigation Planning and strengthening of Resilient Communities. The ESTUARIO will also update a tracking system to visualize progress achieved towards the implementation and compliance with the CCMP. Some of the ongoing and overarching tasks that are carried out on a continuing basis include:

#### *Collaborations*

- Create fish and plan nurseries with local community groups.
- Continue and strengthen the ESTUARIO's ongoing collaboration with other watershed initiatives.
- Creation and strengthening of Community Resilience Hubs with identified organizations within the Estuario.

#### *Support regulatory agencies*

- Offer and Increase support to regulatory agencies, particularly during environmental emergencies
- Analyze and offer comments to projects submitted to the ESTUARIO by the Planning Board, USACE, and other agencies.
- Create a Mitigation Plan that integrates in a comprehensive manner, regulatory requirements and community needs for current and future Mitigation Actions.

#### *Improve Water Quality, Habitat Restoration, and documentation*

- Continue the annual bird census coordinated by the ESTUARIO and other organizations of the watershed.
- Updated tracking format that will allow to visualize progress achieved towards the implementation and compliance with the CCMP.
- Take part in the coordination and implementation of CCMP actions as they arise during the implementation of the work plan.

*Increase awareness and education initiatives*

- Offer support to educational and environmental activities such as: science fairs, environmental fairs and conferences.
- Improved awareness of Estuario activities within the watershed.

Outputs/Deliverables

- ✓ This activity's output will be improved and timely reporting of all CCMP related activities and outputs by current San Juan Bay Estuary Program staff and team members.
- ✓ Increased coordination and implementation of CCMP actions as they arise during the implementation of the work plan.

Outcomes

Short-Term: Identification of partners actively working on activities implementation. Coordinate, collaborate and support the implementation of CCMP actions, which could be through both, ongoing or new activities.

Intermediate and Long-term: Keep developing the partnerships and networks needed to implement the ESTUARIO' s CCMP. Increased speed at which CCMP needs and actions are identified, addressed and reported.

Milestones

The ESTUARIO will coordinate and support CCMP implementation activities during the entirety of the 2019-2020 fiscal year.

Staff

All staff members will be involved in activities directed at the support and tracking of the CCMP implementation.

Partners and their role(s)

Staff will be working with all main stakeholders of the San Juan Bay Estuary.

Estimated Budget: Staff salaries

## ADMINISTRATIVE SUPPORT

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### LIST OF STAFF AND DESCRIPTION OF RESPONSIBILITIES

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The SJBE Program Office is responsible for providing information on the implementation status and coordinating the progress of the forty-nine (49) CCMP actions, as well as the 2015 CCMP Update. The group is also responsible for reporting on the results of programmatic and environmental monitoring, and for aiding federal, state, and local stakeholders in the implementation of the CCMP. During this FY the staff funded under this grant is as follows:

### FULL TIME PERSONNEL

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Executive Director: [Brenda Torres Barreto, MEM, LEED AP] Responsible for the implementation of decisions adopted by the Board, management of the office, coordination of tasks of the ad hoc committees, developing partnerships, and conducting public awareness and participation functions.

Science Director: [Jorge Bauzá Ortega, PhD, QEP] Responsible for the development, identification, and recommendation of opportunities to help fulfill the action plans included in the CCMP, with special emphasis on those related to water and sediment quality, and fish and wildlife habitats. Oversees coordinating the Water Quality and Environmental Indicators Program, as well as all current work plan activities involving technical and scientific components.

Stakeholders and Aquatic Debris Coordinator: [Cristina Ramírez Colón] Responsible for coordinating, organizing, and executing all stakeholders and public outreach activities related to the Program. Due to Cristina Ramirez expertise in solid waste management, this position coordinates aquatic debris related activities. Responsibilities include: organizing workshops and seminars, promoting volunteer engagement strategies, overseeing waste management analysis and developing action plans to address aquatic debris problems in the watershed and estuarine system. Additionally, this position works with the Citizen Advisory Committee, and is the person in charge of keeping its minutes and attendance list.

Water Quality Monitoring and Citizen Science Certification Program coordinator [Harold Manrique Hernández] Responsible for coordinating the Water Quality Monitoring Program with volunteers, and the Scientific Citizen Certification Program. This position helps with development and communication of data related to baseline conditions through habitat, restoration projects, volunteer monitoring and other data sets. The coordinator is responsible for responding to common inquiries or complaints from citizens, government agencies, or academia.

Assistant to the Executive Director: [Cathy Ortiz Gómez]: Responsible for assisting the Executive Director in the conceptualization, budgeting and implementation of work plan activities. She is the face at the Estuario's Visitors Center during daily operating hours and support other staff members when needed. She works in tandem with and under the direction of the Executive Director. Responsible for keeping documentation and required files in order.

Office Manager: [Carmen Rosa Valentín Del Río] Performs administrative and clerical duties in support of the Program's Executive Director using Word, Excel, and Quick Books Pro. Reviews contracts to ensure compliance with EPA grant and/or state requirements in coordination with the Assistant to the Executive Director. Is also responsible for the preparation of the required documentation for audits.

## BUDGET

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### FISCAL YEAR 2019-2020 BUDGET

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TABLE 1: BUDGET SUMMARY FISCAL YEAR 2019-2020

CATEGORY	AMOUNT
PROGRAM OFFICE BUDGET	\$ 347,000
TRAVEL	\$6,000
IMPLEMENTATION ACTIVITIES	\$347,000
TOTAL	\$ 700,000

TABLE 2: PROGRAM OFFICE BUDGET DETAIL

CATEGORY	AMOUNT
Salaries and Fringe Benefits	283,186
Utilities	4,875
Rent	19,550
Accountants and Annual Auditing	21,847
Office Insurance and Officers' and Directors' Insurance	4,700
Supplies	4,192
Miscellaneous Office Expenses	5,000
Office Maintenance	3,650
TOTAL	\$347,000

TABLE 3: TRAVEL BUDGET DETAIL

Date	Activity	Place/Staff	Purpose	Expense
October 2019	Fall Meeting NEP	Delaware Center for the Inland Bays	Regional Meeting	\$3,000

February- March 2020	NEP Annual Meeting	Washington, DC	Required travel under EPA Funding Guidance for NEPs	\$2,500
Local travel				\$500
Total				\$6,000

**Table 4**

**ACTIVITIES DETAIL FOR FY 2019-2020**

Activity	AMOUNT
1. Use a molecular technique to study the cyanobacterial blooms and sources of fecal contaminants in the San José Lagoon	2,000
2. Estuarine Water Quality Volunteer Monitoring Program	20,250
3. Development of a Watershed Ecosystems Services Index & Health Indicator	10,000
4. Estuarine Bird Census	1,300
5. Creation of Fish Nursery Habitat in the San Juan Bay	10,000
6. Extension of The Isla Verde Marine Reserve And Water Park	9,900
7. Co-Management of The Condado Lagoon Estuarine Reserve	10,188
8. Solid waste management activities	10,000
9. 12TH Puerto Rico Water Quality Monitoring Day	10,602
10. Community Resilience	18,616
11. Resilient Communities Support	100,000
12. Citizen Science Certification Program	2,500
13. Estuarine Education Program	40,294
14. Communications Program	41,750
15. Green infrastructure master plan: app maintenance	12,800
16. Proposal Research and Writing to Support CCMP Implementation	46,800
<b>TOTAL</b>	<b>\$347,000</b>

**END OF DOCUMENT**



## APPENDICES

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## CCMP GOALS AND ACTIONS

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### WATER AND SEDIMENT QUALITY (WS)

GOAL: 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.

Action WS-2: Relocate families living adjacent to the Martín Peña Channel.

Action WS-3: Eliminate unauthorized raw sewage discharges (bypasses) from PRASA's collection system and pump stations into the SJBE.

Action WS-4: Eliminate illegal commercial and residential sewage discharges into the stormwater sewer system.

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.

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

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

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

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.

Action WS-10: Develop toxics criteria for sediment in the SJBE.

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

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

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.

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

Action WS-15: Assess the establishment of non-commercial watercraft special use areas in

the SJBE.

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.

#### CCMP Update

WS-17 Determine the areas of highest sewage discharge in the SJBE watershed

WS-18 Continue and strengthen the ESTUARIO's monitoring program, including its public-science component, paying particular attention to the Río Piedras, Juan Méndez Creek, San Antón Creek, and their tributaries

WS-19 Document the location and length of the freshwater tributaries in the watershed of the San Juan Bay Estuary, with special attention to the Río Piedras, Juan Méndez Creek and San Antón Creek and their tributaries

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## HABITAT, FISH, AND WILDLIFE (HW)

GOAL: Enhance and maintain an ecosystem which supports an optimum diversity of living resources on a sustained basis.

Objective 1: Preserve and restore ecologically important habitat.

Action HW-1: Plant mangroves along the western shoreline of San Juan Bay.

Action HW-2: Restore seagrass beds in the Condado Lagoon

Action HW-3: Plant mangroves along the shores of the Condado Lagoon.

Action HW-4: Designate a section of the Martín Peña Channel and lands adjacent to the Puerto Nuevo River as a Nature Reserve.

Action HW-5: Plant mangroves along the shores of the San José and Los Corozos Lagoons.

Action HW-6: Designate the Torrecilla Alta-Vacia Talega area as part of the Piñones State Forest Nature Reserve.

Action HW-7: Restore seagrass beds within the SJBE.

Action HW-8: Designate Las Cucharillas Marsh as a Nature Reserve.

Objective 2: Protect species relative abundance and diversity.

Action HW-9: Establish management measures within the SJBE system for the land crab *Cardisoma guanhumi*.

Action HW-10: Implement a sea turtle recovery plan.

Action HW-11: Assess the impacts of power plant entrainment on fishery resources.

Action HW-12: Assess the impact of thermal discharges on biological communities in San Juan Bay.

Action HW-13: Enhance and protect critical plant species within the SJBE

Action HW-14: Protect existing populations of endangered and threatened bird species and protect and restore their habitat within the SJBE system.

Action HW-15: Estimate the population and habitat use of the West Indian manatee within the SJBE and establish manatee protection zones.

Action HW-16: Substitute cayeput trees (*Melaleuca quinquenervia*) with native species and prohibit planting of the tree in the SJBE.

Objective 3: Enhance economically valuable fisheries resources and ensure their sustainability.

Action HW-17: Determine historic and present recreational fishing areas in the SJBE and develop a plan to adequately manage recreational fishery resources.

Action HW-18: Support enactment of the new fisheries law by the legislature and the governor.

CCMP Update

HW-19 Identify areas in the SJBE to be designated marine protected areas and continue ESTUARIO reef and corals restoration projects

HW-20 Approve a management plan and continue to buy land in the San Juan Ecological Corridor

HW-21 Update the land-use map for the SJBE

HW-22 Estimate or model the SJBE's vulnerability to the impacts of climate change, and present adaptation measures

HW-23 Study and control undesired invasive species in the SJBE

HW-24 Ensure implementation of Law No. 112 of 2013, which created the Condado Lagoon Estuarine Nature Reserve

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## AQUATIC DEBRIS(AD)

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GOAL: Improve habitat quality and enhance the aesthetic, recreational, and economic values of the SJBE by ensuring that the watershed is free of aquatic debris.

Objective 1: Significantly reduce the amount of aquatic debris that reaches all estuarine waters

Action AD-1: Develop and implement community-based solid waste management and recycling programs in coordination with municipalities.

Action AD-2: Continue to implement the Action Plan Demonstration Project developed in Piñones, Loíza.

Action AD-3: Continue the annual aquatic debris clean-up event held in Islote de la Guachinanga.

Action AD-4: Conduct periodic aquatic debris clean-up activities at suggested SJBE locations.

Action AD-5: Establish Solid Waste Pollution Prevention Pilot Programs at different SJBE locations.

Objective 2: Develop, promote, and implement voluntary compliance and pollution prevention initiatives.

Action AD-6: Implement measures to detect, correct, and control illegal dumping activities and enforce Puerto Rico's Anti-Littering Law (Law No. 11 of 1995).

Action AD-7: Enforce the Law for the Management of Used Tires (Law No. 171) and other regulatory measures related to the illegal dumping of used tires within the estuary system and its

drainage basin.

#### CCMP Update

AD-8 Develop a project to reduce and prevent pollution in marinas, fishing villages, and yacht clubs in the San Juan Bay Estuary

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### PUBLIC EDUCATION AND INVOLVEMENT (PI)

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GOAL: Maximize public involvement in the implementation of the CCMP.

Objective 1: Increase the public's awareness of the estuary's functions and values.

Action PI-1: Develop and promote low-impact recreational activities within selected areas of the SJBE.

Action PI-2: Post educational and interpretive signs at highly visible, heavy traffic areas throughout the SJBE watershed (bridges, roads, parks, marinas, ports, waterfronts, etc.) to educate the public on the system's components, functions, and values.

Action PI-3: Establish a program to provide citizens with effective and organized volunteer opportunities to support the SJBE's restoration projects (water quality monitoring, education, etc.).

Action PI-4: Develop a long-term public education and outreach program.

Action PI-5: Develop an ecotourism program to promote sustainable, low-impact enjoyment of SJBE's natural resources as a means to further their conservation.

Action PI-6: Develop an Environmental Education Program to target young audiences at schools and other non-formal educational institutions throughout the SJBE watershed.

Action PI-7: Develop a Memorandum of Understanding between public and private entities and the SJBE Program to expand the scope of the Program's public education and outreach activities.

Action PI-8: Promote better understanding of estuarine resources among regulatory enforcement agencies and personnel.

#### CCMP Update

PI-9 Promote public access to the SJBE's bodies of water and sandy beaches

PI-10 Do a study on the economic values of the environmental assets and services of the San Juan Bay Estuary system

PI-11 Create a long-range communications project on the San Juan Bay Estuary, to include social media and a method to measure knowledge about the ecosystem

PI-12 Keep elected officials and heads of agencies informed as to progress on the restoration of the Estuary, its challenges and accomplishments

PI-13 Develop a series of hand - books for the public to promote the concept of watershed and protect the SJBE's bodies of water, including the ecosystem's main rivers and creeks

PI-14 Create an ongoing project to compile information and make it available via alternatives such as the WebAtlas and the ESTUARIO library

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## GREEN INFRASTRUCTURE (GI)

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### CCMP Update

GI-1 Create a master plan for green infrastructure in the SJBE watershed and develop pilot projects for rain gardens and green rooftops, dunes and other ecosystems

GI-2 Create a pilot project for reversing the channelization by concrete of a segment of a river, creek, or freshwater tributary within the SJBE

GI-3 Promote the use of alternate means of transportation, such as bicycles, in the context of Smart Growth