The Indian River Lagoon National Estuary Program is a partnership whose members work to improve the water quality and ecological integrity of the 156-mile long estuary on Florida's east coast. The U.S. Environmental Protection Agency (EPA) designated the lagoon as an "Estuary of National Significance" in April 1990 and included the lagoon in the National Estuary Program in 1991. The IRLNEP is sponsored by the IRL Council, which was established in February 2015 as an independent special district of Florida.
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Section A.1 General Information Reporting Requirements

A.1. IRL Comprehensive Conservation and Management Plan Goals for Fiscal Year 2023 are based on 32 Vital Signs identified in the One Lagoon CCMP - "Looking Ahead to 2030". See Figure 1 below. The CCMP was certified on July 23, 2019 and adopted by the IRL Council on August 9, 2019. This FY 2022 work plan has been developed in full alignment with the new CCMP.

Figure 1. IRL Vital Signs aligning with the “One Lagoon – One Community – One Voice” Mission.
IRL Health Concern Levels
Each IRL Vital Sign was ranked by the IRLNEP Management Conference members and members of the public based on one of four levels of ecosystem health concern. Levels are shown below:

LEVEL 1: CRITICAL – Condition threatens immediate and long-term prognosis for lagoon health. Indicators are unfavorable. Trend is negative. Immediate and aggressive intervention is urgently needed to stop and reverse trend.

LEVEL 2: SERIOUS – Condition threatens long-term prognosis for lagoon health. Trend is unfavorable or uncertain. Favorable outcome is not expected without strategic intervention and long-term stewardship.

LEVEL 3: UNDETERMINED – Insufficient knowledge is available to inform decision-making and resource management for the Vital Sign. Research needs to be identified, funded, and applied to resource management.

LEVEL 4: STABLE OR IMPROVING TREND – Vital Sign is stable or trending towards improvement. Continued intervention is needed. Long-term stewardship efforts are expected to deliver favorable outcomes.


ONE LAGOON
Water Quality

Impaired Waters (Level 1 – Critical)
Impaired Waters-1: Support implementation, review, and update of IRL TMDLs as needed and as best available science evolves.

Atmospheric Deposition (Level 3 – Undetermined)
Atmospheric Deposition-1: Determine the impacts of atmospheric deposition of nutrients and other pollutants on the nutrient budget, water quality, and resources of the IRL.
Atmospheric Deposition-2: Evaluate need for additional wet and dry atmospheric monitoring stations.

Legacy Loads and Healthy Sediments (Level 2 -Serious)
Legacy Loads-1: Complete muck mapping of the entire IRL, prioritize muck dredging projects, and REDUCE source contributions of sediment and biomass that result in muck formation.

Habitats

Filter Feeders (Level 2 – Serious)
Filter Feeders-1: RESEARCH spatially explicit data on the extent and condition of existing filter feeder habitat.
**Living Resources**

**Harmful Algal Blooms – HABs (Level 1 - Critical)**
HAB-1: Support continuation of the IRL 2011 Consortium, which would function as a formal task force supported by the IRLNEP and which would develop a HAB RESEARCH and Restoration Response Plan.
HAB-2: Seek partnerships and funding to pursue RESEARCH priorities identified by the IRL 2011 Consortium that align with IRLNEP Management Conference management priorities.
HAB-3: Continue funding and scientific partnerships to understand HABs toxicity and risks to human and wildlife health.

**Biodiversity (Level 2 – Serious)**
Biodiversity-2: Work to continue, expand, update, and improve the IRL species inventory.

**ONE COMMUNITY**

**Healthy 21st Century Coastal Communities**

**Vibrant 21st Century Communities (Level 3 - Undetermined)**
Vibrant Communities-3: Promote lagoon-related nature and heritage tourism development for residents and visitors.
Vibrant Communities-4: Conduct community planning workshops to plan for Vibrant 21st Century communities.

**Distinctive Lagoon Communities (Level 3 – Undetermined)**
Distinctive Communities -1: For, Urban Waters, ensure the high density human population is LagoonFriendly TM.
Distinctive Communities-3: For Environmental Justice Communities, identify the unique challenges and opportunities along the lagoon for underrepresented and underserved communities.

**ONE VOICE**

**Communicate, Collaborate, Coordinate, Innovate**

**Monitoring and Sharing Data (Level 2 - Serious)**
Monitoring-1: Develop a comprehensive IRL monitoring plan.
Monitoring-2: Monitor IRL indicators at appropriate spatial and temporal scales to understand the status and trends associated with key indicators of the system’s health.
Monitoring-3: Support expansion of and adequate funding for the IRL Citizens Water Quality Monitoring Program.
Monitoring-4: Identify, develop, and apply next generation smart sensors, remote sensing technologies, big data analytics, and surveillance components to monitor and deliver an IRL water quality dashboard in real time.
Monitoring-5: Advance the 10 scientific RESEARCH priorities identified by the STEMAC in the 2018 Looking Ahead – Science 2030 Report. Work with IRL partners to seek funding to implement priority RESEARCH projects within the 10 priorities.

**State of the Lagoon (Level 2 - Serious)**
State of the IRL-1: Provide support for a “State of the Lagoon Technical Report” to be released every ten years.
**Technology and Innovation (Level 3 - Undetermined)**

Technology Innovation-2: Continue to support and develop a water technology directory for the www.onelagoon.org website.

Technology Innovation-3: Evaluate options for a regular, sustainable, and cost-effective water quality monitoring network using autonomous sampling.

**CCMP Implementation and Financing (Level 1 - Critical)**

Implementation-1: Begin to implement the CCMP financing and implementation plan that focuses on project and program funding, and program delivery with a focus on restoration, scientific RESEARCH, monitoring, and citizen engagement.

**Citizen Engagement and Education (Level 2 - Serious)**

Communicate-1: Facilitate implementation of the IRL CCMP consistent with “One Lagoon – One Community – One Voice” mission.

Communicate-2: Develop and implement an IRLNEP multi-year Communication Plan.

Communicate-3: Implement public education programs including the “One Community – One Voice” initiative and student Envirothon event to promote education, awareness, community place-based identities and Lagoon-Friendly behaviors. (NEW)

*NOTE Additional IRLNEP funding in FY 2023 from direct IRL Council contributions and Florida specialty license plate revenues (projected at $1,625,000) will fund CCMP restoration projects and program administration. The IRLNEP FY 2023 Business Plan is provided as a support document to this EPA Work Plan Proposal.*
<table>
<thead>
<tr>
<th>Activity</th>
<th>Project Partners</th>
<th>CCMP Vital Sign and Priority</th>
<th>IRLNEP CCMP Core Elements/Sub-Element</th>
<th>Program Title and Abstract</th>
<th>CWA 320 Funding 2022</th>
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<th>Project Start Date/Completion Date</th>
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<tbody>
<tr>
<td>1</td>
<td>University of Florida (Northern Sites) and Florida Atlantic University - Harbor Branch Oceanographic Institute (Southern Sites)</td>
<td>Harmful Algal Blooms: (Critical), Impaired Waters: (Critical), Monitoring and Data Sharing: (Serious)</td>
<td>Ecosystem Status and Trends (Assessment &amp; Monitoring)</td>
<td><strong>Harmful Algal Bloom Monitoring</strong>: Funding supports continued IRL algae and cyanobacteria monitoring  <strong>Output</strong>: Lagoon-wide algae and cyanobacterial monitoring to include species identification, distribution and abundance data. <strong>Outcome</strong>: Enhanced knowledge of algae and cyanobacteria composition, distribution and abundance; enhanced understanding of HABs.</td>
<td>$ 150,000.00</td>
<td>$ -</td>
<td>$ 150,000.00</td>
<td>Conduct bi-weekly monitoring of algae and cyanobacteria species identification, distribution and abundance. Increased funding for increased sampling during a bloom.</td>
<td>10/01/2022 - 09/30/2023</td>
</tr>
<tr>
<td>2</td>
<td>Florida Institute of Technology</td>
<td>Harmful Algal Blooms: (Critical), Monitoring and Data Sharing: (Serious), Science and Technology Innovation; (Undetermined)</td>
<td>Ecosystem Status and Trends (Research; Assessment &amp; Monitoring; Reporting)</td>
<td><strong>A Preliminary Characterization of Microcystin in Coastal-Dwelling Mammals in the Indian River Lagoon, Florida</strong>: The Study will measure MC levels in tissues and bodily fluid and correlate findings to health biomarkers in stranded bottlenose dolphins and river otters in the IRL. Findings of this study will serve as a critical preliminary step to describe exposure risks and inform future research and monitoring for the safety of humans and wildlife that utilize IRL waters.</td>
<td>$ 30,039.00</td>
<td>$ -</td>
<td>$ 30,039.00</td>
<td>1) Peer-reviewed manuscript submissions, 2) locally disseminated data reports, and 3) professional presentations describing the following findings in IRL aquatic mammals: a) MC detectability, load, and trends, establishing preliminary reference ranges based on sample type, b) systemic health status correlated to MC load, c) “proof of concept” evaluation of utilizing novel, minimally-invasive sample sites for future MC screening in free-ranging populations.</td>
<td>10/01/2022 - 09/30/2023</td>
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<td>3</td>
<td>Florida Institute of Technology</td>
<td>Legacy Loads and Healthy Sediments; (Serious), Filter Feeders; (serious), Harmful Algal Blooms (Critical), Monitoring and Data Sharing: (Serious), Science and Technology Innovation; (Undetermined)</td>
<td>Ecosystem Status and Trends (Research; Assessment &amp; Monitoring; Reporting)</td>
<td><strong>Suffocating Sand; Mapping Hypoxia and its Impacts on Benthic Nutrient Fluxes in the IRL</strong>: This study will use a relatively low-cost network of continuous monitoring stations to track the extent, duration and movement of bottom water dissolved oxygen (DO) and hypoxia in the IRL. Resulting data coupled with nutrient fluxes determined using benthic chambers at sites co-located with DO monitors will help link nutrient cycling to changes in DO.</td>
<td>$ 69,961.00</td>
<td>$ 3,937.00</td>
<td>$ 73,898.00</td>
<td>Publically available datasets for DO and reports showing the extent and duration of hypoxia plus N and P fluxes in relation to lagoon morphology, bottom composition and circulation patterns.</td>
<td>10/01/2022 - 09/30/2023</td>
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<td>4</td>
<td>Smithsonian Institution</td>
<td>Biodiversity: (Serious), Citizen Engagement &amp; Education (Serious)</td>
<td>Ecosystem Status and Trends (Research; Assessment &amp; Monitoring; Reporting)</td>
<td>IRL Biodiversity and the “IRL Species Inventory”: This project supports delivery and maintenance of the IRL species inventory and biodiversity initiative. <strong>Outcome:</strong> A complete reorganization and expansion of the species inventory website and website communications. <strong>Outcome:</strong> The refocus of public knowledge and understanding about the importance of IRL biodiversity and the need to fund and conduct an updated assessment of IRL biodiversity to evaluate status and trends since the 2011 super bloom.</td>
<td>25,000.00</td>
<td>-</td>
<td>25,000.00</td>
<td>Continue to maintain the IRLNEP-Smithsonian IRL Species Inventory website and add new species.</td>
<td>10/01/2022 - 09/30/2023</td>
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<td>5</td>
<td>Wood Environment and Infrastructure Solutions Inc.</td>
<td>Atmospheric Deposition: (Undetermined) Impaired Waters: (Critical)</td>
<td>Ecosystem Status and Trends (Assessment &amp; Monitoring; reporting)</td>
<td>Sebastian Atmospheric Deposition Station Monitoring: Data collected from this station are essential to developing a nutrient budget for the IRL, providing data for BMAP and RAP updates and evaluating nutrient deposition trends. <strong>Output:</strong> Continued data collection and monitoring station maintenance. <strong>Outcome:</strong> Evaluation of the need to expand the scope and scale of atmospheric deposition data collection.</td>
<td>29,000.00</td>
<td>-</td>
<td>29,000.00</td>
<td>Continue wet and dry atmospheric deposition monitoring at the monitoring station at Sebastian Inlet.</td>
<td>10/01/2022 - 09/30/2023</td>
</tr>
<tr>
<td>6</td>
<td>Wood Environment and Infrastructure Solutions Inc.</td>
<td>Atmospheric Deposition: (Undetermined) Impaired Waters: (Critical)</td>
<td>Ecosystem Status and Trends (Assessment &amp; Monitoring; reporting)</td>
<td>Two (2) NEW Atmospheric Deposition Stations Monitoring: Data collected from these 2 new stations will help show regional differences in deposition and will be essential to developing a nutrient budget for the IRL, providing data for BMAP and RAP updates and evaluating nutrient deposition trends. <strong>Output:</strong> Expanded data collection and monitoring station maintenance. <strong>Outcome:</strong> Evaluation of spatial trends and scale of atmospheric deposition throughout the IRL watershed.</td>
<td>60,000.00</td>
<td>-</td>
<td>60,000.00</td>
<td>Begin wet and dry atmospheric deposition monitoring at two new sites in the IRL. One in the northern IRL near Kennedy Space Center and the other in the southern IRL near Stuart.</td>
<td>10/01/2022 - 09/30/2023</td>
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<td>7</td>
<td>Applied Ecology</td>
<td>State of the Lagoon: (Serious), CCMP Implementation and Financing: (Critical), Monitoring &amp; Data Sharing: (Serious)</td>
<td>Ecosystem Status and Trends (Assessment &amp; Monitoring; Reporting)</td>
<td>State of the Lagoon Technical Report: Funding for this important multi-year initiative will generate a comprehensive state of the IRL technical document (patterned after the Narragansett Bay - State of the Bay report). <strong>Output:</strong> FY 2023: Draft Final Report <strong>Outcome:</strong> Development and distribution of the State of the Lagoon technical document before FY 2025 to advise any CCMP updates and provide guidance to address issues that need to be considered for the 2030 IRLNEP CCMP revision.</td>
<td>75,000.00</td>
<td>-</td>
<td>75,000.00</td>
<td>Develop a State of the Lagoon Technical Report to identify current status, emerging trends and future opportunities and needs for restoration and stewardship.</td>
<td>10/01/2022 - 09/30/2023</td>
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<td>8</td>
<td>IRLNEP, IDEAS, Brandt Ronat &amp; Company, Firefly Communications, and O’Hara Communications</td>
<td>Citizen Engagement &amp; Education: (Serious), CCMP Implementation and Reporting (Outreach and Public Involvement)</td>
<td>One Lagoon Comprehensive Communication Initiative: As the IRLNEP continues to implement the adopted CCMP - Looking Ahead to 2030, a more strategic and comprehensive communication campaign is needed. <strong>Outcome:</strong> Delivery of the &quot;One Community-One Voice&quot; initiative, development of infographics, development of the IRLNEP calendar, annual report, one-page fact sheets and an expanded social media outreach effort. <strong>Outcome:</strong> Enhanced brand recognition and delivery of a 10-year strategic communications campaign in alignment with the mission of IRLNEP and the revised CCMP - &quot;Looking Ahead to 2030&quot;.</td>
<td>$118,000.00</td>
<td>$ -</td>
<td>$118,000.00</td>
<td>Continue strategic delivery of the One Lagoon - One Community - One Voice Mission and Brand through a comprehensive and coordinated communication strategy.</td>
<td>10/01/2022 - 09/30/2023</td>
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<td>9</td>
<td>IRLNEP</td>
<td>Vibrant 21st Century Communities: (Serious), Distinctive Lagoon Communities: (Undertermined), Citizen Engagement &amp; Education: (Serious), CCMP Implementation and Reporting (Outreach and Public Involvement)</td>
<td>Three (3) Community Engagement Coordinators: As identified in the 2016 EPA PE, staff size was an area identified as a concern. It has been determined that expanding staff by three individuals who can assist in education and outreach messaging across the entire Lagoon watershed and provide specialized project planning and grant assistance to stakeholders within the watershed looking to implement CCMP projects and activities which will accelerate CCMP implementation and restoration. <strong>Outcome</strong></td>
<td>$165,000.00</td>
<td>$ -</td>
<td>$165,000.00</td>
<td>1. Expand IRLNEP leadership, visibility and engagement at the local community level with special focus on communicating and connecting with small, rural, under-represented, and environmental justice communities. 2. Expand IRLNEP education and outreach to target audiences including youth activities and active participation in local community events, workshops and seminars. 3. Expand efforts to support and showcase our local community partners as they develop and implement Lagoon-Friendly policies and infrastructure improvement projects (human-built and natural). 4. Expand direct engagement by IRLNEP staff with the IRL community of habitat restoration practitioners at a local level to improve sharing of new knowledge and identification of best practices to improve restoration outcomes.</td>
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<td>10</td>
<td>The Balmoral Group and Tetra Tech, Inc.</td>
<td>CCMP Implementation and Financing: (Critical), Citizen Engagement and Communication (Serious)</td>
<td>Program Implementation and Reporting (Technical Assistance, Capacity Building, &amp; Public involvement)</td>
<td>CCMP and IRL Restoration Project List Support Services: Funding supports two service contracts with The Balmoral Group and Tetra Tech, Inc. to provide services updating and prioritizing the IRL Restoration Project list, creating a project storymap, quantification and economic analysis of project benefits, and ADA accessibility of products. Outcome: Work over the life of this multi-year project will lead the 2025 update to the CCMP.</td>
<td>$ 18,000.00</td>
<td>$ -</td>
<td>$ 18,000.00</td>
<td>Outputs: (1) ADA accessible story map of IRL Council projects for the website. (2) Updated and prioritized IRL Restoration project list. (3) Economic quantification and analysis of projects.</td>
<td>10/01/2022 - 09/30/2023</td>
</tr>
<tr>
<td>11</td>
<td>IRLNEP</td>
<td>CCMP Implementation and Financing: (Critical), Science, Technology &amp; Innovation: (Undetermined)</td>
<td>Program Implementation and Reporting (Technical Assistance &amp; Capacity Building)</td>
<td>EPA Travel (EPA Work Plan Requirement): Funding supports IRL Council/IRLNEP staff travel to Washington DC for week-long EPA-National Estuary Program National Workshop (Spring) and National Estuary Program Tech Transfer Meetings (Fall). Outcome: Share best practices, new policies and success stories and lessons learned among the 28 NEPs. Outcome: Build a nationwide base of knowledge and experience through shared knowledge and best practices to guide restoration and stewardship of all of the estuaries throughout the United States and its territories.</td>
<td>$ 10,000.00</td>
<td>$ -</td>
<td>$ 10,000.00</td>
<td>Attend Fall and Spring EPA, NEP and ANEP meetings to fulfill CCMP implementation, work plan development, project management, contract management, program administration and federal compliance activities.</td>
<td>10/01/2022 - 09/30/2023</td>
</tr>
<tr>
<td>12</td>
<td>Top Ranked RFP respondents for Restoration RFP; Citizen Engagement &amp; restoration RFP and Small grants program RFP. Multiple awards for each RFP. See Section B.1 for grant awards and project details</td>
<td>Impaired Water: (Critical), Wastewater: (Critical), Stormwater: (Critical), Seagrasses: (Critical), Filter Feeders: (Serious), Citizen Engagement and Education: (Serious), Living Shorelines: (Serious), Species of Concern: (Serious), Trash Free Waters: (Serious), Spoil Islands: (Undetermined), Science, Technology &amp; Innovation: (Undetermined)</td>
<td>IRL CCMP Implementation: Water Quality and Habitat Restoration Projects</td>
<td>Nutrient Reduction, Habitat Restoration, Community-Based Restoration Projects and Small Grants: Priority areas for FY 2023 are projects that enhance water quality through nutrient reduction projects or habitat restoration projects that focus on seagrasses, filter feeders and living shorelines, community-based restoration projects that use students and/or citizens to enhance citizen engagement through &quot;hands-on&quot; restoration projects, and a small grants program for grant awards between $500-$5,000. A total of $746,063 of local funds and the match of $3,937 for Activity 3 are budgeted for these CCMP projects. These local funds are identified as the minimum 1 to 1 match to EPA Section 320 federal funds. Outcome: Restore IRL clean water and natural habitats through nutrient reduction and pollutant reduction to achieve the goals of the CWA.</td>
<td>$ 746,063.00</td>
<td>$ -</td>
<td>$ 746,063.00</td>
<td>Multiple contracts will be issues based on a competitive RFP process. Funded projects will be ranked and a list of recommended projects will be evaluated by the IRLNEP Management Conference (Management Board, STEM AC and CAC). A list of ranked projects will be provided to the IRL Council Board of Directors for final funding decision.</td>
<td>10/01/2022 - 09/30/2023</td>
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</table>

**TOTAL EPA Section 320 Request** $ 750,000.00

**Total IRL Council Local Match** $ 750,000.00
INTRODUCTION
The success of National Estuary Programs is based on the ability of a program to convene and sustain a Management Conference that represents a diverse range of watershed stakeholders and partners. For the Indian River Lagoon, that connected leadership includes scientists, resource managers, policy makers, business leaders, community leaders, and citizens with a shared dedication to IRL conservation, restoration and stewardship.

The creation of the IRL Council as an independent special district of Florida in 2015 by Interlocal Agreement reset the structure and trajectory of the 25-year IRLNEP. The focus of the new One Lagoon – One Community – One Voice mission of the IRLNEP was to expand the leadership, participation and investments of local communities along the IRL by leveraging the Congressional authority of and federal investment in a National Estuary Program to implement restoration and stewardship action recommendations identified by the IRLNEP Management Conference in the IRL Comprehensive Conservation and Management Plan (CCMP) – Looking Ahead to 2030 (adopted by the IRL Council in 2019).

Over the past 6 years, the IRL Council/IRLNEP staff has operated as a small 3-to-4-person team of full-time employees (FTEs). The growing operational demands of the IRLNEP and historic opportunities to expand extramural funding through competitive grants for projects and programs require that the IRL Council evaluate our current work force capacity to sustain and grow the effectiveness and value of the program to our stakeholders, partners and communities.

ABOUT THIS PLAN
The size and capacity of the IRL Council/IRLNEP workforce was an issue of discussion and some EPA concern during the 2016 five-year Performance Evaluation. This workforce analysis responds to those EPA concerns and reflects a long-standing discussion among IRL Council staff to evaluate the needs for program growth that would deliver the best return on investment to the program, our partners and the Lagoon community.

This workforce analysis and recommendation is presented as a staff proposal for consideration by the IRL Council Board of Directors in advance of budget planning for FY 2023. The IRL Council staff seek guidance from the IRL Council Board of Directors to shape the future structure of the IRLNEP and development of the FY 2023 tentative budget, which will be discussed in detail and adopted by the Board at the February 2022 quarterly Board of Director’s meeting. By Florida statutes, the
tentative budget for FY 2023 must be adopted on or before March 1, 2022. The final FY 2023 budget must be adopted on or before June 1, 2022. The FY 2023 EPA Work Plan and budget must be submitted to EPA on or before June 1, 2022.

IRL COUNCIL/IRLNEP WORKFORCE ANALYSIS

Strategic Direction of the IRL Council and IRLNEP
The IRLNEP CCMP identified 32 Vital Signs for IRL health with action recommendations to advance restoration, recovery and stewardship (Figure 1).

The strategic direction of the program over the next decade will be to deliver high productivity and quality programs with a focus on these 32 vital signs. Many, if not all, vital signs require a high level of engagement with our local city, county and organizational partners. With 7 counties, 38 incorporated cities, and over a dozen unincorporated towns and communities within the IRL watershed, active community engagement at the local level overwhelms the capacity of existing staff. At present, all IRL Council staff are responsible for a range of important responsibilities that span multiple job descriptions.

Current Talent and Workforce Assessment
The current IRL Council staff of four FTE’s deliver a strong foundation for program implementation. The IRLNEP has matured over the past 6 years to emerge as a high functioning and performing
National Estuary Program. With program expansion and delivery, each member of the team is working above full capacity. This is a workforce situation that is unsustainable over a long period of time. Figure 1 shows an organizational chart for the program as it currently exists.

### IRLNEP Organization Chart and Current Workload Distribution

The following list provides job titles and abbreviated workload descriptions for current IRL Council/IRLNEP staff. As a result of its small staff size, the IRL Council/IRLNEP staff operate as a distributed leadership team rather than in a hierarchical leadership structure. Leadership is often shared among members of the team based upon expertise in particular focus areas and situations. Decisions are usually made on a consensus basis versus a single decision maker in a “command and control” hierarchical position. Ultimately, the Executive Director has final decision authority for day to day administrative and program decisions.

**Executive Director (ED)**
The ED functions as the executive administrator of the program with broad executive-level responsibilities including: strategic visioning and planning; program management at all levels; financial planning and oversight; direct communications with members of the Board of Directors and their alternates; direct communications with members of the IRLNEP Management Conference; policy and program coordination and compliance with the U.S. EPA.; intergovernmental and interagency affairs at local, state, regional and federal levels; liaison with elected officials at all levels of government; liaison with community and industry leaders; and provision of senior scientist oversight on all IRLNEP documents. As the program’s senior scientist, the Executive Director must stay current with scientific literature and research relevant to IRL restoration and stewardship. The Executive Director ensures that the IRLNEP operates with a strong Management Conference structure as envisioned in Section 320 of the Clean Water Act. All major policies, program activities, and annual budgets are reviewed by the Management Conference advisory committees before staff and Management Conference recommendations are presented to the IRL Council Board of Directors for consideration and adoption.

**Deputy Director and Chief Communications Officer (CCO)**
The Deputy Director functions as an executive team leader and provides support as needed to the Executive Director. Deputy Director responsibilities can span all aspects of program administration and delivery. The Deputy Director provides direct staff supervision to IRL Council staff members. In addition to these administrative duties, the Deputy Director also serves as the Chief Communications Officer (CCO) for the IRL Council/IRLNEP. The CCO oversees all aspects of public relations for the IRL Council/IRLNEP. This includes both internal and external communications.
The CCO develops and distributes all internal announcements within the IRLNEP Management Conference, including oversight for developing and distributing agenda and meeting packages with the Administrative Coordinator. The CCO develops, reviews and distributes all written publications, such as newsletters, the IRLNEP Annual Report, the IRL Annual Calendar, video presentations, planning documents and other collaterals for special projects or events. The CCO supervises IRL Council contractors for the strategic delivery of the IRLNEP website (www.onelagoons.org), all social media, video production and any external publications. The CCO also delivers talks for community groups, local governments and non-profit organizations; sits on the advisory committees for external county organizations and non-profit groups; manages the annual IRL Envirotlon; and interacts with teachers throughout the IRL Region.

**Chief Operations Officer (COO)**
The COO is in charge of planning and overseeing all the operations, facilities and equipment management, projects, and financial activities. The COO works closely with the Executive Director and Deputy Director to create an annual work plan and budget each year that align with the program mission and priorities. That process requires preparation of a tentative budget that is reviewed and adopted by the IRL Council Board of Directors on or before March 1 and a final budget that is reviewed and adopted by the IRL Council Board of Directors on or before June 1 of each fiscal year. The COO coordinates all aspects of financial oversight of the IRL Council, budget development, budget management, and management of all IRL Council contracts. The COO provides supervisory oversight for the IRLNEP annual request for proposal (RFP) process. The COO serves as the contract developer, working with legal counsel for all contracts awarded funding each year. On average, the number of contracts that the COO manages each year exceeds 30 contracts. The COO is the point of contact for public records. The COO develops the EPA annual work plan each year for submission to EPA on or before June 1. The COO works closely with EPA Region 4 and Headquarters staff to ensure compliance with all EPA policies, procedures and reporting. The COO provides on-water boat support for projects as needed. The COO oversees all human resource issues for the IRL Council/IRLNEP and works closely with contracted support services at Special District Services, for invoicing, payroll, and audit and Torcivia, Donlon, Goddeau & Rubin, P.A. for legal services.

**Administrative Coordinator (AC)**
The Administrative Coordinator will provide meeting and event planning, coordination and communication; manage agendas and travel plans; support the Chief Operating Officer in records organization and management of the small grants program and ongoing projects; and support a variety of IRLNEP-funded programs. Primary job responsibilities include: Performing internal communications as point of contact for Management Conference members, boards and committees; Plans and schedules meetings and events; Develops meeting agendas and presentations; Develops meeting packages and provides documentation for quarterly meetings; Serves as recording secretary at board meetings and conferences, taking and distributing official minutes and fulfilling requests for meeting information as needed; Communications support as assigned. The AC also assists the COO with maintaining and organizing public records, ADA compliance for all documents that are placed on-line; managing the small grants program, invoice tracking, and other project management functions for ongoing IRLNEP projects as assigned. In addition, the AC provides support to the CCO in the form of copywriting, social media support, light design work, management of webinars and virtual platforms, and ongoing projects as assigned.

In addition to these FTE positions, the IRL Council added a contracted GIS Coordinator position in FY 2021 and FY 2022. This position is supported by grant funds from an innovation and technology harmful algal bloom (HAB) grant award by the Florida Department of Environmental Protection. This position will terminate at the end of the grant period in 2023 or as funds are exhausted.
When viewed in comparison with other NEPs throughout the national network, the IRLNEP is understaffed based on the size of the watershed and the urgent water quality and habitat restoration needs of the estuary (Table 1).

<table>
<thead>
<tr>
<th>Program</th>
<th>Area (Sq. Mi.)</th>
<th># Staff</th>
<th># Interns or Contract</th>
</tr>
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<tr>
<td>Morro Bay National Estuary Program</td>
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<td>San Juan Bay Estuary Program</td>
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<td>Sarasota Bay Estuary Program</td>
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<td>Peconic Estuary Partnership</td>
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<td>Barnegat Bay Partnership</td>
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<tr>
<td>Buzzards Bay National Estuary Program</td>
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<tr>
<td>Piscataqua Region Estuaries Partnership</td>
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<tr>
<td>San Francisco Estuary Partnership</td>
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<td>13</td>
<td></td>
</tr>
</tbody>
</table>
Coastal and Heartland National Estuary Partnership | 5,416 | 5 | 1

Partnership for the Delaware Estuary | 6,766 | 22 |

Barataria-Terrebonne National Estuary Program | 6,965 | 10 |

Long Island Sound Study | 6,971 | 16 | 1 |

Coastal Bend Bays and Estuaries Program | 12,579 | 18 |

New York-New Jersey Harbor and Estuary Program | 16,000 | 6 |

Puget Sound Partnership | 16,548 | 51 | 1 fellow |

Albemarle-Pamlico National Estuary Partnership | 23,022 | 7 | 1 |

Workforce Observations from Table 1:
- IRLNEP is one of only 5 NEPs with a staff of 4 FTEs. Within this group, the IRLNEP has the largest watershed.
- The 5 NEPs with the smallest watersheds operate with staff sizes of 6 – 14.
- The 5 NEPs with the largest watersheds operate with staff sizes of 11 – 53.

Additional Considerations:
- The IRL Council is an independent and stand-alone host agency for the IRLNEP. The IRLNEP meets and exceeds the EPA matching requirements for an NEP because of annual investments from the IRL Council pursuant to the 2015 Interlocal Agreement as amended.
- The IRL Council appropriates a substantial amount of its available annual revenues to local cost-share projects identified via a competitive RFP process. The resulting contracts for these projects require extensive staff oversight, project management, and reporting.
- Unlike some NEPs, the IRLNEP is not nested in an existing government agency or university that can provide significant in-kind staff and operational support. The IRL Council and staff continue to operate the IRLNEP with very low overhead compared to other public agencies.
- The IRLNEP is one of the only NEPs in the nation with a comprehensive restoration project list that will be updated and prioritized with direct participation of our stakeholders and partners.
- After a decade of recurring seasonal harmful algal blooms (HABs), extensive loss of seagrasses, and resulting wildlife mortality events, the IRL could be considered one of the most threatened estuaries in North America. The ability of the IRLNEP to address the scale of these problems will require new revenues and expanded staff.

IRL Council Workforce Delivery

Addressing Program Needs and Leveraging Funding Opportunities
Successful and highly productive NEP programs all have a common characteristic – the capacity to work closely and consistently with the Management Conference and diverse groups of stakeholders, partners, communities and citizens to implement the program's vision, mission and goals. For sustained success, those interactions require development of personal relationships based on common vision, mutual respect and trust.
IRL Council staff have identified two priorities for program growth and success that represent essential cornerstones required to deliver action recommendations of the IRL CCMP – Looking Ahead to 2030. These two priorities are:

1. Providing expanded lagoon-wide, data-driven information with full GIS mapping capabilities to our stakeholders and partners to help inform IRL restoration planning, project development and decision-making.

2. Expanding the external communication capacity of the IRLNEP to connect, communicate, and collaborate with our 7 watershed counties, 38 incorporated cities, multiple unincorporated towns, and 1.6 million residents through active and continuous participation in local meetings, outreach events, development of shared resources and common messaging. The following are specific outcomes expected from that increased capacity.
   - Expand IRLNEP leadership, visibility and engagement at the local community level with special focus on communicating and connecting with small, rural, under-represented, and environmental justice communities.
   - Expand IRLNEP education and outreach to target audiences including youth activities and active participation in local community events, workshops and seminars. Increased efforts will yield benefits in increased public awareness and program visibility and will generate continuing support for the projects and programs being implemented to improve water and habitat quality and protect wildlife and human health.
   - Expand efforts to support and showcase our local community partners as they develop and implement Lagoon-Friendly policies and infrastructure improvement projects (human-built and natural). Planning and prioritizing actions that deliver coastal community resilience and adaptation strategies to climate change and sea level rise are high priorities. Additionally, working directly with our partners will enhance the IRLNEP’s ability to message effectively across the region, add capacity as resources are developed and shared, improve public awareness of efforts underway to remediate Lagoon issues, and combat the common misconception that little effort is being expended to bring the Lagoon back to a healthy state.
   - Expand direct engagement by IRLNEP staff with the IRL community of habitat restoration practitioners at a local level to improve sharing of new knowledge and identification of best practices to improve restoration outcomes. This includes active staff engagement with and support of the 4 Regional Restoration Centers (Marine Discovery Center, Brevard Zoo and proposed Aquarium, FAU-Harbor Branch Oceanographic Institute, and Florida Oceanographic Society) and the many organizations that work at the local level to implement projects focused on water quality improvements, habitat restoration, species recovery, and public awareness.
Proposal for IRL Council Board of Director’s Consideration

Expand IRLNEP Organizational Structure

Proposed Position Descriptions with Specific Deliverables:

**GIS Coordinator/Scientist Job Responsibilities and Duties:** This is a high-level science, technical and administrative position involving coordinating, planning, organizing, and directing GIS activities and initiatives for the IRLNEP. The GIS Coordinator is responsible for providing technical expertise and supervision of day-to-day implementation and operation of the GIS within the context of IRLNEP programs, projects and policy directives. The GIS Coordinator plans and coordinates GIS activities, manages GIS vendor contracts, plans and organizes system development, and delivers lagoon-wide GIS maps and graphic products needed by the IRLNEP and program partners. The GIS Coordinator reports directly to the Executive Director. Knowledge, skill, and experience requirements for the GIS Coordinator position include:

- A Master of Sciences degree and 3-5 years of GIS work-related experience. Preference will be given to candidates that have worked on water quality data and harmful algal bloom data that come from multiple sources and vary in their spatial and temporal scales.
- Experience working with ESRI GIS Software and Cloudbase, ArcGIS Enterprise, ArcGIS online, ArcPro, ArcMaps, Python API, R-Bridge, ArcGIS, Scene Viewer, Field Maps, Dashboards, StoryMaps, Collector, WebApps, Python Programming, R statistical software, AutoCad and Solidworks experience, DOMO, Tableau, Microsoft Office, and SQL Database Management
- Experience with water quality databases, data formatting and data processing for access in GIS as well as data QA/QC.
- Ability to work collaboratively with a variety of stakeholders including IRLNEP staff, agencies, elected officials, local governments, environmental groups, and academic organizations.
- Ability to work independently and oversee multiple projects simultaneously.
- Develops, prints and distributes maps from GIS software programs as needed by the IRLNEP and partners.
- Communicates and coordinates with IRL data collectors, user organizations, and agency GIS personnel to integrate data sets from multiple data collectors.
- Oversees and provides technical guidance regarding activities associated with implementation, operation, and enhancement of the GIS program.
- Coordinates and monitors contracts with GIS hardware, software, data conversion, and other providers of GIS products and services.
- Establishes procedures to eliminate redundant processes, determine appropriate levels of accuracy, the vertical integration of layers and the integration of more accurate data with existing databases.
- Conducts research and development of new GIS related products and procedures.

Community Engagement Coordinators. The Community Engagement Coordinators (CECs) will serve as “on the ground” IRLNEP representatives at the local community level. Through active participation in community events, meetings, citizen engagement events, seminars and workshops, the Community Engagement Coordinators will create and sustain partnerships by providing enhanced communication, cooperation, coordination and technical support. CECs will work a 40-hour week which will include some weekends and/or evening hours to participate with and attend local IRL events, festivals, symposia, meetings and workshops. CEC’s will work directly with IRLNEP partner organizations and members of the Citizen Advisory Committee within the counties they represent and work to help identify prospective local CAC members for IRL Council Board consideration when vacancies exist. CECs will expand IRLNEP outreach with a special focus on building connections and relationships with minority, underrepresented and environmental justice communities via churches, community centers, universities, companies, and social outlets.

Knowledge, skill and experience requirements for the CEC position include:
- Bachelor’s degree or an equivalent combination of three years’ experience.
- Experience in community relations, preferably in environmental science and coastal conservation, working with underrepresented or minority communities, or other intergovernmental or community relations experience.
- Knowledge about the IRL and its environmental challenges.
- Experience working with a variety of target audiences and Lagoon user groups.
- Knowledge about the IRLNEP and IRL communities is required.
- Excellent written and verbal communication skills.
- Exceptional public speaking and event planning skills.
- Be well-disciplined, flexible and adaptable, with a public servant mindset and excellent customer service skills.
- Ability to work effectively in a creative, innovative and intellectual environment.
- Exceptional attention to detail and commitment to follow-through.
- Expert knowledge of Word, Excel and PowerPoint.
Section B.1 Indian River Lagoon National Estuary Program FY 2023

Outputs and Outcomes

Outputs:

- Implement the strategic IRLNEP Outputs (deliverables) identified in the IRL One Lagoon Comprehensive Conservation and Management Plan: "Looking Ahead to 2030" (adopted August 2019) and FY 2023 Work Plan Proposal.

- Continued administration of the providing support to IRL Council and IRLNEP Management Conference.

- Specific Work Plan Outputs for FY 2023

  EPA Section 320 Funding
  - State of the Lagoon Technical Report (4th year of funding; up to 5-year contract; $75,000).
  - IRL Species Biodiversity Inventory (4th year of funding; 5-year contract; long-term project commitment; $25,000).
  - Atmospheric Deposition Monitoring (4th year of funding; 5-year contract; long-term project commitment; $29,000).
  - Atmospheric Deposition Monitoring at two (2) NEW Stations. (multi-year contract likely; $60,000)
  - Harmful Algal Bloom monitoring lagoon-wide (4th year of funding; 5-year contract; long-term project commitment; $150,000).
  - CCMP Project List inventory and prioritization update ($18,000)
  - Continuation of the One Voice initiative ($118,000)
  - Travel to conferences, meetings, and events ($10,000)
  - Three (3) Community Engagement Coordinators (salary only $165,000)
  - Suffocating Sand; Mapping Hypoxia and its Impacts on Benthic Nutrient Fluxes in the IRL (69,961)
  - A Preliminary Characterization of Microcystin in Coastal-Dwelling Mammals in the Indian River Lagoon ($30,039)

IRL Council Local Cost-Share Match

- Water Quality Projects.
  - Connect to Protect Septic to Sewer Nutrient Removal Program Y3 ($200,000)
  - Dixon Blvd at Indian River Drive Water Quality and Resiliency Project; Design and Engineering Phase (40,000)
  - Moore’s Creek Distinctive Communities Trash Reduction Project ($106,500)
  - Continued application and continued optimization of an environmentally friendly, biological denitrification bioreactor developed for use in the Indian River Lagoon using repurposed materials ($74,865)

- Habitat Restoration Projects
  - Restoration of Clam Populations in the IRL for Water Quality Improvement Y4 ($197,892)
- Community-Based Restoration Projects.
  - SE Illinois Avenue Living Shoreline Project ($85,000)
  - Phase 4 Restoration for the Lost Tre Island Conservation Area ($50,000)
  - IRL Seagrass Restoration using a Mosquito Control Impoundment ($32,500)

- Science and Innovation.
  - Enhancement of Habitat and Biodiversity with Non-plastic Restoration Materials in Mosquito Lagoon ($99,000)
  - Restore Our Shores: Community-Based Seagrass Restoration in the Indian River Lagoon ($60,000)

- Small Grants Program.
  - Multiple small contracts ranging from $500-5,000 for restoration and/or Education ($25,000)

- Provide CCMP implementation direction and oversight with CCMP alignment for all budgeting/project/contract management activities.

- Deliver facilitated stakeholder meetings throughout the IRL watershed to assist and advise development of planning documents.

- Deliver a high level of community engagement through public events, science symposia and workshops.

- Produce and distribute the IRLNEP Annual Report to communicate program progress and provide a high-level of accountability and transparency for use of public funds.

- Produce and distribute the IRL Annual Calendar with education about what individuals can do to help the IRL.

- Implement social media and communication strategies with use of expanded social media platforms.

- Provide technical support for IRL conferences and workshops focused on IRL health.

- Implement the IRL small grants program.
Outcomes

- Align IRLNEP outputs and outcomes closely with CWA Section 320 authorization and 32 vital signs for IRL health identified in the CCMP: “Looking Ahead to 2030”.

- Align IRLNEP activities with our new Mission: One Lagoon – One Community – One Voice.

- Implement One Lagoon actions to improve and protect water quality, natural habitats, and living resources.

- Implement One Community actions that contribute to healthy, sustainable and resilient communities.

- Implement One Voice actions that improve communication, collaboration and coordination.

- Implement activities that support the EPA Strategic Plan and Non-Point Source Program.

- Enhance public knowledge and awareness that lead to behavior change and better stewardship.

- Identify and deliver expanded and diversified funding for IRL restoration and stewardship.

- Fund project activities among IRL stakeholders and partners that promote and implement the 10 “Rs” for ecosystem recovery: Research - Remove - Reduce - Restore - Rebuild - Report - Resilience – Responsibility - Resolve.

- Promote innovation and transformational thinking, investment and action.

- Provide technical and program support to partners and stakeholders.
Section B.2 Proposed New and On-Going Project Reporting Requirements

Activity 1 (On-Going)

CCMP Work Plan Vital Sign and Actions:
Harmful Algal Blooms (Critical Concern)
   HAB-2: Seek partnerships and funding to pursue RESEARCH priorities identified by the IRL 2011 Consortium that align with IRLNEP Management Conference management priorities.
   HAB-3: Continue funding and scientific partnerships to understand HABs toxicity and risks to human and wildlife health.
Impaired Waters (Critical Concern)
   Impaired Waters-1: Support implementation, review, and update of IRL TMDLs as needed and as best available science evolves.
Monitoring and Data Sharing (Serious Concern)
   Monitoring-2: Monitor IRL indicators at appropriate spatial and temporal scales to understand the status and trends associated with key indicators of the systems health.

Project/Activity Name:
Harmful Algal Bloom Monitoring

Project Activity Purpose and Description:
Funding supports continued IRL algae and cyanobacteria monitoring currently being delivered by University of Florida (for the northern Lagoon) and Florida Atlantic University - Harbor Branch Oceanographic Institution (for the southern Lagoon). This FY 2023 activity is the fourth year of a 5-year renewable contract. This activity is considered an urgent, recurring annual monitoring need. Primary output: Lagoon-wide algae and cyanobacterial monitoring to include species identification, distribution and abundance data with specific focus on HABs.

Budget:
$150,000.00

Outcomes:
Short-term Outcome: Enhanced knowledge of algae and cyanobacteria composition, distribution and abundance. Enhanced understanding of HABs and their spatial and temporal variability.

Medium-term Outcome: Enhanced ability to evaluate spatial and temporal HAB trends.

Long-term Outcome: Application of long-term data to enhance prediction of bloom outbreaks, duration and intensity and adaptation/management responses.

Changes (+/-) in Pressure Targets: The current trend is negative with increased HAB occurrences, intensities and duration, especially in Banana River Lagoon. This project will help to expand scientific knowledge to better understand and reverse current status and trend.

CWA Implementation Information:
This project addresses core objectives of the Clean Water Act to protect wetlands and coastal waters through the National Estuary Program. The focus is to better understand nutrient and water quality relationships to algal species occurrences and abundance including HABs.
Activity 2 (New)

CCMP Work Plan Vital Sign and Actions:
Harmful Algal Blooms (Critical Concern)
  HAB-1: Support continuation of the IRL 2011 Consortium, which would function as a formal task force supported by the IRLNEP and which would develop a HAB RESEARCH and Restoration Response Plan.
  HAB-2: Seek partnerships and funding to pursue RESEARCH priorities identified by the IRL 2011 Consortium that align with IRLNEP Management Conference management priorities.
  HAB-3: Continue funding and scientific partnerships to understand HABs toxicity and risks to human and wildlife health.
Monitoring and Data Sharing (Serious Concern)
  Monitoring-4: Identify, develop, and apply next generation smart sensors, remote sensing technologies, big data analytics, and surveillance components to monitor and deliver an IRL water quality dashboard in real time.
  Monitoring-5: Advance the 10 scientific RESEARCH priorities identified by the STEMAC in the 2018 Looking Ahead – Science 2030 Report. Work with IRL partners to seek funding to implement priority RESEARCH projects within the 10 priorities.

Project/Activity Name:
A Preliminary Characterization of Microcystin in Coastal-Dwelling Mammals in the Indian River Lagoon

Project Activity Purpose and Description:
The Study will measure Microcystin (MC) levels in tissues and bodily fluid and correlate findings to health biomarkers in stranded bottlenose dolphins and river otters in the IRL. Findings of this study will serve as a critical preliminary step to describe exposure risks and inform future research and monitoring for the safety of humans and wildlife that utilize IRL waters.

Budget:
$30,039

Outcomes:
Short-term Outcome: An improved understanding of the health challenges faced by coastal-dwelling mammals inhabiting the IRL can inform management decisions of veterinarians, biologists, public health officials, and policymakers to help reduce MC exposure risks. Training of citizen scientists and students in laboratory methods and wildlife health.

Medium-term Outcome: Data regarding MC bodily load and concurrent health state can serve as a foundation for future biomonitoring.

Long-term Outcome: Support for future implementation of novel MC screening in free-ranging aquatic mammals using subcutaneous biopsy and respiratory secretions.

Changes (+/-) in Pressure Targets: The current trend is negative with increased HAB occurrences, intensities and duration, in the Northern IRL, Banana River Lagoon, and Mosquito Lagoon. This project will help to expand scientific knowledge to better understand impacts to animals in contact with HABs.

CWA Implementation Information:
This project addresses core objectives of the Clean Water Act to protect wetlands and coastal waters through the National Estuary Program. The focus is to better understand HAB toxicity relationships to marine mammals that may encounter these HAB toxins.
Activity 3 (New)

**CCMP Work Plan Vital Sign and Actions:**

*Legacy Loads and Healthy Sediments (Serious Concern)*
- Legacy Loads-1: Complete muck mapping of the entire IRL, prioritize muck dredging projects, and REDUCE source contributions of sediment and biomass that result in muck formation.

*Filter Feeders (Serious Concern)*
- Filter Feeders-1: RESEARCH spatially explicit data on the extent and condition of existing filter feeder habitat.

*Monitoring and Data Sharing (Serious Concern)*
- Monitoring-2: Monitor IRL indicators at appropriate spatial and temporal scales to understand the status and trends associated with key indicators of the system’s health.

*Technology Innovation (Undetermined Concern)*
- Technology Innovation-3: Evaluate options for a regular, sustainable, and cost-effective water quality monitoring network using autonomous sampling.

**Project/Activity Name:**
Suffocating Sand; Mapping Hypoxia and its Impacts on Benthic Nutrient Fluxes in the IRL

**Project Activity Purpose and Description:**
This study will use a relatively low-cost network of continuous monitoring stations to track the extent, duration and movement of bottom water dissolved oxygen (DO) and hypoxia in the IRL. Resulting data coupled with nutrient fluxes determined using benthic chambers at sites co-located with DO monitors will help link nutrient cycling to changes in DO.

**Budget:**
$69,961 (EPA), $3,937 (Local Cost-share Match), $73,898 Total IRLNEP Project share.

**Outcomes:**
*Short-term Outcome:* Quantifying the extent and duration of hypoxia in sub-basins of the IRL.

*Medium-term Outcome:* Enhanced site selection for restoration (e.g., determination of HSI) by project partners plus others and developing mechanisms to track the success of restoration projects.

*Long-term Outcome:* Improved water, sediment and habitat quality resulting from informed placement and enhanced success of restoration projects.

*Changes (+/-) in Pressure Targets:* A positive trend is predicted as restoration projects are funded and implemented.

**CWA Implementation Information:**
This project addresses core objectives of the Clean Water Act by aiding in habitat restoration site fidelity selection.
Activity 4 (On-Going)

CCMP Work Plan Vital Sign and Actions:
Biodiversity (Serious Concern)
   Biodiversity-2: Work to continue, expand, update, and improve the IRL species inventory.
Citizen Engagement and Education (Serious Concern)
   Communicate-1: Facilitate implementation of the IRL CCMP consistent with “One Lagoon – One Community – One Voice” mission.

Project/Activity Name:
IRL Biodiversity and the “IRL Species Inventory”:

Project Activity Purpose and Description:
This project supports the long-standing investment of the IRLNEP to deliver and maintain the IRL species inventory and biodiversity initiative. Primary outputs for this year of the project will maintenance and expansion of the IRL Species Inventory website.

Budget:
$25,000

Outcomes:
Short-term Outcome: Refocus public knowledge and understanding about the importance of IRL biodiversity.

Medium-term Outcome: Fund and conduct an updated assessment of IRL biodiversity to evaluate status and trends since the 2011 superbloom. Consider sponsoring another IRL Biodiversity Symposium to build on the scientific knowledge of the 1995 symposium.

Long-term Outcome: Development of quantitative targets to evaluate and track biodiversity.

Changes (+/-) in Pressure Targets: The current trend is unknown but is likely negative with increased HAB occurrences and loss of seagrass habitats. This project will help to expand scientific knowledge to better understand and reverse current status and trend.

CWA Implementation Information:
This project addresses core objectives of the Clean Water Act to protect wetlands and coastal waters through the National Estuary Program
Activity 5 (On-Going)

CCMP Work Plan Vital Sign and Actions:
Atmospheric Deposition (Undetermined Concern)
  Atmospheric Deposition-1: Determine the impacts of atmospheric deposition of nutrients and other pollutants on the nutrient budget, water quality, and resources of the IRL.
  Atmospheric Deposition-2: Evaluate need for additional wet and dry atmospheric monitoring stations.
Impaired Waters (Critical Concern)
  Impaired Waters-1: Support implementation, review, and update of IRL TMDLs as needed and as best available science evolves.

Project/Activity Name:
Sebastian Atmospheric Deposition Monitoring

Project Activity Purpose and Description:
The IRLNEP maintains the only wet-dry atmospheric deposition monitoring station along the entire IRL (until this year, see Activity 6). Data collected from this station are essential to developing a nutrient budget for the IRL, providing data for BMAP and RAP updates and evaluating nutrient deposition trends. The primary output from this funding is continued data collection and monitoring station maintenance.

Budget:
$29,000

Outcomes:
Short-term Outcome: Continue long-term data collection of wet- and dry- atmospheric deposition of nutrients.

Medium-term Outcome: Evaluate the need to expand the scope and scale of atmospheric deposition data collection throughout the IRL.

Long-term Outcome: Develop and implement a strategy for an enhanced network to monitor atmospheric deposition and changes.

Changes (+/-) in Pressure Targets: The current trend is positive with decreasing nutrient loads associated with changes in automotive standards. Long-term land-use trends and climate change impacts are unknown.

CWA Implementation Information:
This project addresses core objectives of the Clean Water Act and the nexus between water quality and Clean Air Act standards and trends.
Activity 6 (NEW)

CCMP Work Plan Vital Sign and Actions:
Atmospheric Deposition (Undetermined Concern)
  Atmospheric Deposition-1: Determine the impacts of atmospheric deposition of nutrients and other pollutants on the nutrient budget, water quality, and resources of the IRL.
  Atmospheric Deposition-2: Evaluate need for additional wet and dry atmospheric monitoring stations.
Impaired Waters (Critical Concern)
  Impaired Waters-1: Support implementation, review, and update of IRL TMDLs as needed and as best available science evolves.

Project/Activity Name:
Two (2) New Stations Atmospheric Deposition Monitoring

Project Activity Purpose and Description:
With the assistance of Florida Atlantic University, who purchased the equipment for 2 new atmospheric deposition monitoring station in the IRL Watershed (one in the north IRL and one in the south IRL) the IRLNEP will provide the operation and maintenance of these new stations to conduct wet-dry atmospheric deposition monitoring. Data collected from these new stations are essential to developing a nutrient budget for the IRL, providing data for BMAP and RAP updates and evaluating nutrient deposition trends spatially in the IRL watershed. The primary output from this funding is expanded data collection and monitoring station maintenance.

Budget:
$60,000

Outcomes:
Short-term Outcome: Spatial mapping and trends of Atmospheric Deposition of Nutrients in the IRL.

Medium-term Outcome: Regional differences, if any, will be detected by having more stations in the IRL.

Long-term Outcome: Develop and implement a strategy for a further enhanced network to monitor atmospheric deposition and changes.

Changes (+/-) in Pressure Targets: The current trend is positive with decreasing nutrient loads associated with changes in automotive standards. Long-term land-use trends and climate change impacts are unknown.

CWA Implementation Information:
This project addresses core objectives of the Clean Water Act and the nexus between water quality and Clean Air Act standards and trends.
Activity 7 (On-Going)

CCMP Work Plan Vital Sign and Actions:
State of the Lagoon (Serious Concern)
State of the IRL-1: Provide support for a “State of the Lagoon Technical Report” to be released every ten years.

Monitoring and Data Sharing (Serious Concern)
Monitoring 1: Develop a comprehensive IRL monitoring plan.
Monitoring-2: Monitor IRL indicators at appropriate spatial and temporal scales to understand the status and trends associated with key indicators of the system’s health.
Monitoring-3: Support expansion of and adequate funding for the IRL Citizens Water Quality Monitoring Program.
Monitoring-4: Identify, develop, and apply next generation smart sensors, remote sensing technologies, big data analytics, and surveillance components to monitor and deliver an IRL water quality dashboard in real time.
Monitoring-5: Advance the 10 scientific RESEARCH priorities identified by the STEMAC in the 2018 Looking Ahead – Science 2030 Report. Work with IRL partners to seek funding to implement priority RESEARCH projects within the 10 priorities.

CCMP Implementation and Financing (Critical Concern)
Implementation-1: Develop a finance plan for CCMP development and implementation, project and program funding, and program delivery with a focus on restoration, scientific RESEARCH, monitoring, and citizen engagement.

Project/Activity Name:
State of the Lagoon Technical Report

Project Activity Purpose and Description:
Funding for this important multi-year initiative will generate a comprehensive state of the IRL technical report (patterned after the Narragansett Bay - State of the Bay report). Applied Ecology, Inc will work directly with the IRLNEP Management Conference and staff. The contract is a multiple year contract (renewable up to 5 years contingent on annual progress). This funding is for Year 3 only. The total cost of this initiative is estimated at $350,000-$450,000. Primary output FY 2023 is a draft Report.

Budget:
$75,000

Outcomes:
Short-term Outcome: Development of a strategic process to implement the initiative with full and comprehensive participation of the IRLNEP Management Conference, identification of available data and gaps, preliminary synthesis of available data.

Medium-term Outcome: Development and distribution of the State of the Lagoon technical document before FY 2024-2025 to advise any CCMP updates and provide guidance to address issues that need to be considered for the 2030 IRLNEP CCMP revision.

Long-term Outcome: The State of the lagoon technical report will advise the 2030 CCMP revision.

Changes (+/-) in Pressure Targets: Positive. The State of the Lagoon technical report will provide a science-based foundation for moving forward with restoration and stewardship activities.
CWA Implementation Information:
This project addresses core objectives of the Clean Water Act to protect wetlands and coastal waters through the National Estuary Program. It addresses Section 320 guidance and authority to track CCMP progress and ecosystem changes and trends.
Activity 8 (On-Going)

CCMP Work Plan Vital Sign and Actions:
Citizen Engagement and Education (Serious Concern)
Communicate-1: Facilitate implementation of the IRL CCMP consistent with “One Lagoon – One Community – One Voice” mission.
Communicate-2: Develop and implement an IRLNEP multi-year Communication Plan.
Communicate-3: Implement public education programs including the “One Community – One Voice” initiative to promote community place-based identities and Lagoon-Friendly ™ behaviors.

CCMP Implementation and Financing (Critical Concern)
Implementation-1: Develop a finance plan for CCMP development and implementation, project and program funding, and program delivery with a focus on restoration, scientific RESEARCH, monitoring, and citizen engagement.

Project/Activity Name:
One Lagoon Comprehensive Communication Initiative

Project Activity Purpose and Description:
As the IRLNEP continues to implement the adopted CCMP - Looking Ahead to 2030, a more strategic and comprehensive communications campaign is needed. Funding supports implementation of the IRLNEP communication strategy focused on the "One Lagoon - One Community - One Voice" mission. Funding will be applied to continuing the IRLNEP branding and communication campaign; Development (which includes service contracts with IDEAS, Brandt & Ronat, Firefly Communications, and O’Hara Communications) for enhanced web/graphics to support the www.onelagoon.org website and publications; ADA accessibility, and expanded communication and outreach activities.

Budget:
$118,000

Outcomes:
Short-term Outcome: Roll-out and delivery of the "One Community-One Voice" initiative. Development of infographics. Development of the IRLNEP calendar, annual report, one-page fact sheets, other publications, guides, and fact sheets as needed, and an expanded social media outreach effort.

Medium-term Outcome: Expanded quality and quantity of IRLNEP communication activity.

Long-term Outcome: Expansion of knowledge changes citizen and community behavior towards a Lagoon Friendly core value.

Changes (+/-) in Pressure Targets: Positive trend associated with delivery of a strategic communications campaign lagoon-wide.

CWA Implementation Information:
This project addresses core objectives of the Clean Water Act to protect wetlands and coastal waters through the National Estuary Program.
Activity 9 (NEW)

CCMP Work Plan Vital Sign and Actions:
CCMP Implementation and Financing (Critical Concern)
Implementation-1: Develop a finance plan for CCMP development and implementation, project and program funding, and program delivery with a focus on restoration, scientific RESEARCH, monitoring, and citizen engagement.

Distinctive Lagoon Communities (Undetermined Concern)
Distinctive Communities-1: For, Urban Waters, ensure the high density human population is LagoonFriendly™.
Distinctive Communities-3: For Environmental Justice Communities, identify the unique challenges and opportunities along the lagoon for underrepresented and underserved communities.

Vibrant 21st Century Communities (Serious Concern)
Vibrant Communities-3: Promote lagoon-related nature and heritage tourism development for residents and visitors.
Vibrant Communities-4: Conduct community planning workshops to plan for Vibrant 21st Century communities.

Citizen Engagement and Education (Serious Concern)
Communicate-1: Facilitate implementation of the IRL CCMP consistent with “One Lagoon – One Community – One Voice” mission
Communicate-3: Implement public education programs including the “One Community – One Voice” initiative to promote community place-based identities and Lagoon-Friendly TM behaviors.

Project/Activity Name:
Community Engagement Coordinators (3)

Project Activity Purpose and Description:
Funding supports the salaries only (benefits will be paid by local cost share) of three (3) Community Engagement Coordinators. As identified in the 2016 EPA PE, staff size was an area identified as a concern. It has been determined that expanding staff by three individuals who can assist in education and outreach messaging across the entire Lagoon watershed and provide specialized project planning and grant assistance to stakeholders within the watershed looking to implement CCMP projects and activities which will accelerate CCMP implementation and restoration with a focus on underrepresented and underserved communities.

Budget:
$165,000

Outcomes:
Short-term Outcome: Identification of new grant opportunities. Successful proposal development that increases revenues for CCMP project implementation.

Medium-term Outcome: Enhanced grant writing technical skills and capacity among IRLNEP partners. Increased revenues for IRL restoration, stewardship and community outreach projects.

Long-term Outcome: Enhanced grant writing sophistication among IRLNEP partners results in significant expansion and diversification of revenues generated for CCMP project implementation.

Changes (+/-) in Pressure Targets: Anticipated to be positive. Delivery of the services by these individuals will demonstrate a strong return on investment associated with successful messaging, proposal development and funding.
CWA Implementation Information:
This project addresses core objectives of the Clean Water Act to protect wetlands and coastal waters through the National Estuary Program. This technical support service showcases the value of cooperative federalism.
Activity 10 (On-going)

**CCMP Work Plan Vital Sign and Actions:**

CCMP Implementation and Financing (Critical Concern)

Implementation-1: Develop a finance plan for CCMP development and implementation, project and program funding, and program delivery with a focus on restoration, scientific research, monitoring, and citizen engagement.

Citizen Engagement and Education (Serious Concern)

Communicate-1: Facilitate implementation of the IRL CCMP consistent with “One Lagoon – One Community – One Voice” mission.

**Project/Activity Name:**

CCMP and IRL Restoration Project List Support Services

**Project Activity Purpose and Description:**

Funding supports two service contracts with the Balmoral Group and Tetra Tech, Inc. to provide services to continue updating and prioritizing the IRL Restoration Project List, updating the project story map, quantification and economic analysis of project benefits, and ADA accessibility of products.

**Budget:**

$18,000

**Outcomes:**

Short-term Outcome: Better communication of IRL Council/IRLNEP projects through a story map setting.

Medium-term Outcome: Enhanced understanding of the priorities to guide IRL Restoration and provide economic drivers to promote action.

Long-term Outcome: Prioritization and update of projects will lead to helping determine the 2025 update to the CCMP.

**Changes (+/-) in Pressure Targets:** Positive. Delivery of this service is already demonstrating a strong return on investment associate with successful proposal development and funding. Continuation will build on that positive trend.

**CWA Implementation Information:**

This project addresses core objectives of the Clean Water Act to protect wetlands and coastal waters through the National Estuary Program. This technical support service showcases the value of cooperative federalism.
Activity 11 (On-Going)

CCMP Work Plan Vital Sign and Actions:
CCMP Implementation and Financing (Critical Concern)
   Implementation-1: Develop a finance plan for CCMP development and implementation, project and program funding, and program delivery with a focus on restoration, scientific RESEARCH, monitoring, and citizen engagement.
Technology and Innovation (Undetermined Concern)
   Technology Innovation-2: Continue to support and develop a water technology directory for the www.onelagoon.org website.

Project/Activity Name:
EPA Travel (EPA Work Plan Requirement):

Project Activity Purpose and Description:
Funding supports IRL Council/IRLNEP staff travel to Washington DC for week-long EPA-National Estuary Program National Workshop (Spring) and National Estuary Program Tech Transfer Meetings (Fall). Both meetings are scheduled with the Association of National Estuary Program Board of Directors meeting. Outcomes: Share best practices, new policies and success stories and lessons learned among the 28 NEPs.

Budget:
$10,000

Outcomes:
Short-term Outcome: Share best practices, new policies and success stories and lessons learned among the 28 NEPs.

Medium-term Outcome: Transition annual meetings to become more strategic and focused on urgent problems and innovative solutions. Leverage the local, state and EPA partnership for enhanced productivity, efficiency and success.

Long-term Outcome: Build a nationwide base of knowledge and experience to guide restoration and stewardship of all the estuaries throughout the United States and its territories.

Changes (+/-) in Pressure Targets: Positive. Annual discussions among the 28 NEPs and the EPA are generating positive outcomes. Best practices and technology innovations are being shared. Stronger partnerships are being developed. Example: Creation of the Florida estuaries Alliance agreement between Tampa bay, Sarasota Bay, Charlotte harbor and Indian River Lagoon NEPs.

CWA Implementation Information:
This project addresses core objectives of the Clean Water Act to protect wetlands and coastal waters through the National Estuary Program.
Activity 12 (New and On-Going)

CCMP Work Plan Vital Sign and Actions:
Nutrient Reduction and Habitat Restoration Projects (funded by IRL Council local and state revenues pursuant to the 2015 IRL Council Inter-Local Agreement)

Multiple Vital Signs addressed by projects identified through a competitive RFP process focused on restoration projects that reduce nutrients and pollutants, restore natural habitats or create living shorelines; Community-based restoration projects that engage active participation by citizens and students in water quality and habitat restoration; and small grants program.

<table>
<thead>
<tr>
<th>One Lagoon Vital Signs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Water Quality</strong></td>
</tr>
<tr>
<td>Impaired Waters</td>
</tr>
<tr>
<td>Wastewater</td>
</tr>
<tr>
<td>Stormwater</td>
</tr>
<tr>
<td>Legacy Loads</td>
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<tr>
<td></td>
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</tr>
</tbody>
</table>

Project/Activity Name:
Nutrient Reduction, Habitat Restoration, Community Based Restoration Projects, Science and Technology Innovation, and Small Grants

Project Activity Purpose and Description:
Funding for design and engineering planning or project construction that enhances water quality through nutrient reduction strategies (wastewater, septic to sewer, stormwater or legacy load removal) or habitat restoration projects that focus on restoration of seagrasses, filter feeders, wetlands and living shorelines. Funding also available for community-based restoration projects that use students and/or citizens to enhance citizen engagement through "hands-on" restoration projects, and a small grants program for grant awards between $500-$5,000.

Budget:
A total of $1,174,622 of local funds are budgeted for these CCMP projects. $750,000 of these local funds are identified as the minimum 1 to 1 match to EPA Section 320 federal funds.

Outcomes:
Short-term Outcome: Implement nutrient reduction and habitat restoration projects that quantify water quality or habitat improvements.

Medium-term Outcome: Continue to implement high-value projects and expand funding and partnerships for project implementation.

Long-term Outcome: Significant expansion of recurring annual funding to accelerate IRL restoration and stewardship.

Changes (+/-) in Pressure Targets: Positive. Every project is progress.

CWA Implementation Information:
This project addresses core objectives of the Clean Water Act to protect wetlands and coastal waters through the National Estuary Program.
Section C. Completed Major Projects/Activities
Previous Year Reporting

C.1 Summary: IRLNEP and Management Conference Accomplishments 2022

Indian River Lagoon National Estuary Program Projects/Activities funded by EPA Section 320 Funds and IRL Council Local Funds.

The IRLNEP has had a highly productive and busy year in FY 2022. Primary program activities during the year aligned closely with the six IRL Vital Signs identified in the CCMP that were ranked based on health concerns by the IRLNEP Management Conference as “LEVEL 1: CRITICAL – Condition threatens immediate and long-term prognosis for lagoon health. Indicators are unfavorable. Trend is negative. Immediate and aggressive intervention is urgently needed to stop and reverse trend.” Additional activities included or were integrated with almost all of the 32 CCMP Vital Signs for IRL health. Several additional areas of focused activity provided technical and grant writing support to communities, expanded communications and promotion of science and innovation. The 6 Vital Signs of critical concern are identified below with a highlight of activities:

ONE LAGOON

- WATER QUALITY (Impaired Waters, Wastewater, Stormwater): The IRLNEP continues to identify and fund projects that reduce nutrient, sediments and other pollutants that enter the IRL. The CCMP project list was updated. Each project stakeholder recommended one to three priority projects that can be completed within the next five years. This list will help inform project funding decisions.

- HABITATS (Seagrasses): The IRLNEP is funding the development of a One Lagoon Habitat Restoration Plan to guide habitat restoration efforts throughout the estuary.

- LIVING RESOURCES (Harmful Algal Blooms): Expanded funding was provided for Harmful Algal Bloom (HAB) monitoring through University of Florida (northern IRL) and Florida Atlantic University – Harbor Branch Oceanographic Institute (southern IRL). Innovative technology grant funding was secured from the Florida Department of Environmental Protection to demonstrate new collaborative ways to communicate HAB data to stakeholders, citizens and to inform management decisions.

ONE VOICE

- COMMUNICATE-COLLABORATE-COORDINATE (CCMP Implementation and Financing): The IRLNEP continues to seek new expanded funding from a variety of sources. The program completed a “Strategy for Financing the CCMP” technical report to estimate long-term infrastructure and restoration costs for IRL recovery and stewardship.

The IRL Council and IRLNEP continue to align annual program activities with revenue sources to deliver a performance-based budget and comprehensive program delivery. The annual EPA Work Plan herein focuses on activities that align with CCMP implementation and guidance in Section 320 CWA. Once the EPA Work Plan is accepted by the EPA, the EPA-funded activities are incorporated into an annual IRLNEP Business Plan that includes additional activities funded by IRL Council contributions and other local revenue sources. The annual EPA Work Plan, IRLNEP Business Plan, annual budgets and any revisions to budgets are reviewed and adopted by the IRLNEP Management
Conference. These documents are available to the public on one lagoon. This approach to program planning, implementation and communication delivers an effective, efficient, and financially transparent process that is easy to understand by IRLNEP stakeholders, the public and elected officials. At the end of each fiscal year, an IRLNEP Annual Report is developed and distributed to communicate program progress and use of funds (2021 Annual Report).

See section C.2 of this workplan for the current status and project milestones completed of the CWA federally funded projects that are expected to be completed by the end of FY 2022. Highlights of the IRLNEP listed below include the following milestone accomplishments that have been completed as well as those that are on-target to be completed before the June 1, 2022 deadline for submission of this FY 2023 EPA Work Plan.

**COMPLETED ACTIVITIES, OUTPUTS AND HIGHLIGHTS:**
IMPLEMENTING THE IRL COMPREHENSIVE CONSERVATION AND MANAGEMENT PLAN – LOOKING AHEAD TO 2030

**CCMP – Looking Ahead to 2030**
- The CCMP has been updated in its design look and is more user-friendly and readable. The updated copy can be found at https://onelagoon.org/resources/
- IRL CCMP Concurrence Documents in development with target completion dates
  - IRL Communication Plan (Completed, awaiting EPA certification).
  - Strategy for Financing the CCMP Technical document (Completed, awaiting EPA certification).
  - One Lagoon Habitat Restoration Plan (In management conference review, due to be completed end of 2022).
  - One Lagoon Comprehensive Monitoring Plan (In Management conference review, due to be completed end of 2022).
- Other CCMP Guidance Documents in development with target completion dates

**CCMP Implementation (Taking action to communicate, collaborate and coordinate actions that restore the Lagoon and cultivate informed stewardship throughout the IRL watershed)**
- IRLNEP staff administered over 40 projects during the fiscal year. All projects align with IRL Vital Signs and actions identified in the CCMP. Projects fall into two categories:
  - EPA-funded projects that aligned with CCMP implementation and Section 320 CWA authority (science and technology innovation projects funded through a competitive RFP process, CCMP planning, communication, concurrence document development, and Monitoring activities).
Competitive local cost-share projects funded by IRL Council annual contributions through a competitive RFP process (water quality, habitat restoration, community engagement in restoration, and small grants program).

IRL restoration project list update and prioritization. The following Table 1 provides a summary of unfunded priority projects provided by IRLNEP stakeholders and partners to date. In 2021, the IRL Council entered into a multi-year service contract with TetraTech Inc. through a competitively procured RFQ process to expand, update and prioritize the CCMP project list on an annual basis. The list will be used to assist stakeholders to prioritize projects and secure funding for high priority projects. The 2022 update is completed and the list is provided.

Table 1: 2022 Update of the IRL Restoration Project List

<table>
<thead>
<tr>
<th>Category</th>
<th>Total Number of Projects Submitted by Stakeholders</th>
<th>Number of Projects with Estimated Costs</th>
<th>Total Cost</th>
<th>TN Reduction (lbs/yr)</th>
<th>TP Reduction (lbs/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storm Water</td>
<td>523</td>
<td>470</td>
<td>$729,296,503</td>
<td>787,600</td>
<td>180,924</td>
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<tr>
<td>WWTFs and Septic Systems</td>
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<td>202</td>
<td>$1,040,318,947</td>
<td>735,448</td>
<td>49,863</td>
</tr>
<tr>
<td>Habitat Restoration</td>
<td>81</td>
<td>57</td>
<td>$519,941,00</td>
<td>18,284</td>
<td>665</td>
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<tr>
<td>Muck Removal and Navigation</td>
<td>68</td>
<td>66</td>
<td>$755,853,211</td>
<td>2,246,418</td>
<td>193,129</td>
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<tr>
<td>Citizen Engagement</td>
<td>65</td>
<td>48</td>
<td>$5,316,045</td>
<td>35,505</td>
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<td>Monitoring and Research</td>
<td>62</td>
<td>39</td>
<td>$27,496,082</td>
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<td>Capital Construction</td>
<td>4</td>
<td>4</td>
<td>$95,000,000</td>
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<td>0</td>
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<tr>
<td>TOTAL</td>
<td>1,030</td>
<td>886</td>
<td>$2,705,274,88</td>
<td>3,823,255</td>
<td>427,055</td>
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</tbody>
</table>

86.0%

<table>
<thead>
<tr>
<th>Category</th>
<th>Total Number of Projects Submitted by Stakeholders</th>
<th>Number of Projects with Estimated Costs</th>
<th>Total Cost</th>
<th>TN Reduction (lbs/yr)</th>
<th>TP Reduction (lbs/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CERP IRL South (Everglades Restoration)</td>
<td>1</td>
<td>1</td>
<td>$3,500,000,00</td>
<td>0</td>
<td>TBD</td>
</tr>
</tbody>
</table>

Total Cost $6,205,274,88

37
### County | Number of Projects
---|---
Volusia | 92
Brevard | 703
Indian River | 46
St. Lucie | 78
Martin County | 47
Entire IRL Basin | 64
---|---

1,030

- **Harmful Algal Blooms:** EPA funding in FY 2019 expanded the capacity of the IRLNEP to monitor and respond to Harmful Algal Blooms. It served as a catalyst to position the IRLNEP in a leadership role to work with local, state and federal HAB partners. The EPA investment helped the IRLNEP to secure a $963,470 Harmful Algal Bloom Innovative Technology Project Grant awarded by the Florida Department of Environmental Protection’s Office of Water Policy and Ecosystems Restoration. The project is a private-public partnership (P3) with StormCenter Communications Inc., St. Johns River Water Management District and Harbor Branch Oceanographic Institute -Florida Atlantic University.

- **Water Technology, Innovation:** The IRLNEP is working with the Economic Development Commission of Florida’s Space Coast to develop a competitive request for proposal (RFP) and administer the contract with the winning vendor to conduct a feasibility study for an Advanced Regional Wastewater Treatment facility to Kennedy Space Center and potentially some nearby communities with old and inadequate wastewater treatment facilities. The $200,000 grant was secured by EDC with technical support from the IRLNEP from the Enterprise Florida – Florida Defense Support Task Force.

### IRLNEP COMMUNICATIONS:
- **Expansion of IRLNEP Communication and Community Outreach and Engagement.**
  - Regular website expansion and updates.
  - Completion of the IRL Communication plan.
  - Contract support services for brand engagement and support of document development are being provided by contract partners to assist the program with brand engagement, website management, social media activation and video/graphic design content.
  - Continuation of the IRLNEP partnership with the Smithsonian Marine Field Station at Fort Pierce, Florida to upgrade, expand and improve the Indian River Lagoon species inventory and biodiversity website at [https://irlspecies.org/index.php](https://irlspecies.org/index.php)
**TECHNICAL SUPPORT AND CAPACITY BUILDING:**

- The IRLNEP continued a strong commitment to local community and organization capacity-building and technology transfer support. IRLNEP staff participated in the following activities and committees during FY 2022:

  - **National Level Activities**
    - Advisory Board of the Southeast and Caribbean Disaster Resilience Partnership (SCDRP).
    - Board of Association of National Estuary Programs (ANEP).

  - **State Level Activities**
    - Florida Harmful Algal Bloom (“Red Tide”) Task Force administered by the Florida Fish and Wildlife Conservation Commission (Dr. De Freese appointed by Florida Governor Ron DeSantis).
    - CareerSource FL Board of Directors (Dr. De Freese appointed by former Florida Governor Rick Scott).
    - Florida Ocean Alliance Board of Directors.

  - **Local Level Activities**
    - IRLNEP provided professional grant-writing support to our stakeholders and partners.
    - IRLNEP sponsored a second episode of Captain Benny Blanco’s Guiding Flow TV show ([Guiding Flow TV](#)).

  - **Staff Level Activities**
    - Staff worked as a team to develop a vision for the future IRLNEP organizational staffing structure based on an internal workforce analysis. Strategic staff expansion will be completed by October 1, 2022.

**BELOW AND ON THE FOLLOWING PAGES ARE PROJECTS AND ACTIVITIES LEVERAGED BY THE IRLNEP CCMP THAT HAVE BEEN INITIATED AND/OR COMPLETED BY MEMBERS OF THE IRL COUNCIL AND MANAGEMENT BOARD IN FY 2022 WITHIN THE IRL WATERSHED.**

**Volusia County Partners:**

**VOLUSIA COUNTY GOVERNMENT (ENVIRONMENTAL MANAGEMENT DIVISION):**

**CCMP Vital Signs:** Monitoring and Data Sharing, Trash Free Waters, Citizen Engagement and Education, Species of Concern, Policy Considerations, Stormwater, Wastewater

- **Monitoring and Data Sharing**
  - The Volusia County Environmental Management Division (EMD) continues to monitor numerous sites in Mosquito Lagoon (since 1988) and in the Halifax River (since 1991). Monthly and bi-monthly collections have been continuous in the lagoon from Ponce Inlet south to Oak Hill, with sites along the Intracoastal Waterway as well as at points eastward.
near Bethune Beach and south of George’s Bar. Several points are near marinas, as well as shellfish harvesting areas. Additionally, fifteen locations are currently monitored in the Halifax River along the Intracoastal Waterway from Ponce Inlet north to the Volusia/Flagler County line. Monitoring sites are widely dispersed to provide a good data set for modeling purposes for water quality requirements.

- **Trash Free Waters**
  - In September 2021, EMD hosted the International Coastal & Halifax/Indian River Cleanup. In total, 1,330 people volunteered to clean up trash along the shores of the beach, Halifax River, and Indian River Lagoon. Volunteers were located throughout Volusia County and removed 4,822 pounds of trash and recyclables.
  - In the IRL watershed, Volunteer Volusia conducted 5 jetty ambassador cleanups, 4 storm drain marking projects, and 6 beach cleanups with a total of 102 volunteers engaged. The Volunteer Volusia Coordinator provided education for 10 Project IBIS programs engaging approximately 200 students.
  - Manatee Protection Program (MPP) staff also assisted with marine debris cleanups throughout Volusia County, by promoting and/or participating in the annual International Coastal Cleanup and the St. Johns River Cleanups. They also joined Florida Shorebird Alliance Volusia Shorebird Partnership representatives to clean up monofilament and marine debris on the designated critical Wildlife Area, Rookery Island, in Port Orange.
  - Working with Volusia County school students and the Investigating Biomes in Science (IBIS) project, Manatee Protection Program staff continued their marine debris clean-up and education program. MPP staff partners with the NOAA Marine Debris Monitoring and Assessment Project to document marine debris in Rose Bay. IBIS students assist with the cleanups and data recording on a monthly basis.
  - Of the 130 recycling bins in the Monofilament Line Recycling Program, 57 are located within the Indian River Lagoon watershed. Citizens volunteer to empty the bins, document and send in the data, and then take the line to a recycling center. MPP staff and Volusia County GIS specialists developed an interactive map of all bin locations, so that interested volunteers can look to see where bins are located near them and which are available for adoption. A link to the interactive map can be found at www.volusiafishinglinerecycling.org.
  - EMD’s Monofilament Recycling Program in conjunction with the EMD Underwater Cleanups have collected a total of 13,496 pounds of monofilament fishing line and marine debris to date.
  - EMD dive team staff conducted 10 underwater cleanups, retrieving a total of 1,385 pounds of monofilament line and marine debris from within the lagoon watershed.
Participants of the September 8th Underwater Cleanup Separating leads for recycling

- MPP staff began researching areas of the IRL that have derelict crab traps. They plan to apply for permission to conduct a trap removal cleanup through the Florida Fish and Wildlife Conservation Commission’s Derelict Trap and Trap Debris Removal Program in 2022. The program provides a mechanism to authorize volunteer groups or organizations to collect derelict traps and trap debris during open or closed seasons. Once they choose a location, MPP staff will obtain authorization from the FWC. The cleanup will take place during the closed season, and staff will adhere to guidelines established in Rule 68B-55, Florida Administrative Code (FAC).

- The Coastal Division applied for and was granted $140,000 in funds from the Florida Fish and Wildlife Conservation Commission (FWC) to remove ten (10) derelict vessels from the Intracoastal Waterway (AICW) in eastern Volusia County. Removal of these vessels will begin in April 2022.

- **Policy Considerations**
  - The Indian River Lagoon Surface Water Improvements and Management Overlay Zone (AKA Class II overlay) is an Environmental Ordinance within the Land Development Code. This regulation was designed to reduce the negative impacts of development adjacent to the Indian River Lagoon and to protect this vital natural resource and the shellfish harvesting industry in that area. Environmental Permitting issued 148 permits within the Class II overlay between April 1, 2021 and March 31, 2022. 171 storm water retention inspections, and 113 native vegetation retention inspections were also completed.

- **Citizen Engagement and Education/Species of Concern**
  - The EMD operates the Marine Science Center (MSC) in Ponce Inlet, Florida to educate the public about the marine environments of Volusia County and how to help conserve habitat and reduce human impacts. The MSC also operates sea turtle and seabird rehabilitation hospitals to help release and conserve these animals that were injured in the wild. The MSC completed a new bird hospital office and bird ambassador holding area that created separation between the ambassadors and injured or sick bird intakes. The
center also completed design of a new Raptor Education and Conservation Exhibit that is scheduled to be opened in 2023. The new exhibit will allow the previous raptor exhibits to be repurposed into avian rehabilitation space. The design of a new stand-alone commissary was completed in early 2022 and will help create sterile spaces between hospital functions. The commissary is scheduled to be completed in late 2023. The exhibit gallery received an updated new exhibit that details Volusia County’s critical offshore ledge habitat and houses lobsters, black-bar soldierfish, lionfish, and other local marine life.

- Sea turtle and bird intakes have continued to be above average for the reporting period. Many of the sea turtle intakes have been lethargic, underweight, and anemic, but a definitive cause has yet to be determined. The Mary Keller Seabird Sanctuary was closed in February after the Highly Pathogenic Avian Influenza (HPAI) was reported in Brevard County and 3 positive cases were reported from intakes at the MSC. The center is working closely with the FWC on a reopening plan and has begun improvements to the public avian exhibits and bird hospital to address the possibility of future outbreaks of HPAI.

- Three Manatee Watch Volunteer Program trainings were conducted in order to teach volunteers to document manatee sightings and how to report animals in distress. These sightings serve to indicate manatee presence in our waterways and to help inform citizens about manatee habitat, biology, and physiology. Between April 1, 2020 to March 18, 2021, four manatee watch reports were submitted by volunteers in the IRL watershed. Two reports consisted of multiple animals sighted at the same time, bringing the total number of manatees documented by volunteers in the IRL to 10.

- The Volusia County Marine Mammal Stranding Team assisted with 49 marine mammal stranding calls within the Indian River Lagoon watershed between April 1, 2021 – March 18, 2022. This included 15 Bottlenose dolphins, 33 manatees, and 1 Pygmy Sperm Whale. This was done in partnership with the Florida Fish and Wildlife Conservation Commission, Hubbs SeaWorld Research Institute, Volusia County Beach Safety and Sheriff’s Marine Unit. VCMMST also worked alongside Florida Fish and Wildlife Conservation Commission while they investigated a high level of manatee mortalities during 2021-2022. They will continue to do so until the Unusual Mortality Event (UME) subsides. https://www.volusia.org/services/growth-and-resource-management/environmental-management/natural-resources/marine-mammal-stranding-network.stml

- **Citizen Engagement and Education**
  - The Be Floridian Now program collaborates with the Marine Resources Council (MRC) and staff from other local governments on the quarterly Be Floridian Now (BFN) electronic newsletter. A BFN webpage and Facebook page are also maintained through the collaboration.
  - Through the collaboration with MRC the county participates in quarterly SMART meetings with numerous local government, agency and non-profit partners along the IRL where partners share education opportunities and materials.
  - Staff also worked with partners to develop a native plant brochure, create surveys for fertilizer retailers and landscapers, and develop short educational videos. A BFN webpage and Facebook page are also maintained through the collaboration.
Volusia County hired a full time staff person to coordinate education and outreach for the BFN program and the environmental volunteer projects. BFN conducted outreach events at 9 local festivals and community events and presented to 5 community groups.

BFN Master Gardener Sale

The Be Floridian Now program collaborates with UF/IFAS Volusia County Extension Office to give presentations and develop outreach for HOAs, homeowners, and landscape contractors to promote environmental landscape practices in the IRL watershed.

During the summer fertilizer ban from June 1 through September 30, EMD staff ensured that all (33) stores selling fertilizer across the county were re-stocked with informational fliers on fertilizer and the ordinance. Additionally, displays/flyers were placed in 12 city hall buildings and 13 libraries taking the total to 58 outreach locations throughout Volusia County.

Working with Volusia County school students and the Investigating Biomes in Science (IBIS) program, staff guide students in water quality testing in Spruce Creek and educational programs regarding water quality, wildlife in the lagoon, and conservation.

Explore Volusia provided 49 programs within the IRL watershed reaching 795 people, which includes High School students in the Project IBIS program. New platforms of education were also added, which included videos developed for outreach on social media. Explore Volusia programs provide outdoor education opportunities teaching residents and visitors about the diverse habitats of Volusia County. Programs range from hiking, biking, kayaking, and Eco-Buggy tours. Experienced educators lead all programs with a focus on biodiversity and conservation to engage participants in resource stewardship.

Manatee Protection Program (MPP) staff educated Volusia County High School students, several Explore Volusia programs, and community center groups, on microplastics. Students and visitors learned about the ongoing issue and effects microplastics have in our waterways. They also participated in hands-on scientific methods on detecting microplastics from various water sources.

• **Stormwater**
  - Best Management Practice (BMP) activities:
- Street sweeping: 83 miles of roads
- Roadside ditch cleaning: 143 miles of roads
- Open channel cleaning: 128 miles of ditches
- Baffle box cleaning: 3 boxes

**Gabordy Canal at 10th Street Stormwater Treatment Facility:** The Gabordy Canal at 10th Street Stormwater Treatment Facility project is located in the New Smyrna Beach and Edgewater area of Volusia County. The project is identified in the Mosquito Lagoon Reasonable Assurance Plan as a large-scale stormwater retrofit project that includes the installation of a nutrient removal treatment facility to provide treatment for base flow and roadway stormwater runoff. This project will be co-located on the same parcel of land that was acquired for the stormwater treatment pond that is part of the County’s 10th Street widening project. The completed project anticipates a reduction in Total Nitrogen (TN) by 5,700 lbs. per year and Total Phosphorous (TP) by 1,100 lbs. per year. This project was awarded the following cost-share grants: $100,000 for design and permitting from the Indian River Lagoon Council, $1,911,784 for construction from the St. Johns River Water Management District, and $300,700 for construction from the Florida Department of Environmental Protection. On May 18, 2021, the $2,954,700 construction contract was awarded by the Volusia County Council. Notice to proceed with construction was issued in June 2021, and the project is anticipated to be completed ahead of its contract completion date of December 2022. It is anticipated to be complete during the summer 2022.
Ariel Canal Water Quality Improvement Project: The Ariel Canal Water Quality Improvements project is located in the Oak Hill area of Volusia County. The project is identified in the Mosquito Lagoon Reasonable Assurance Plan as a large-scale stormwater retrofit project that includes the installation of a nutrient removal treatment facility to provide treatment for base flow and roadway stormwater runoff. The completed project anticipates a reduction in Total Nitrogen (TN) by 1,300 lbs. per year and Total Phosphorous (TP) by 210 lbs. per year. During the final design and permitting process, an Archaeological Conservation Site and Easement located in proximity to the project was discovered. The County, through its consultant, is coordinating with the State of Florida Division of Historical Resources to ensure cultural resources compliance and to mitigate any adverse impacts to this Archaeological Conservation Site Easement. On March 15, 2022, the $1,855,770 construction contract was awarded by the Volusia County Council. The project will be funded in part through a $900,000 cost-share grant from the Florida Department of Environmental Protection, a $450,000 cost-share grant from the St. Johns River Water Management District, and the Stormwater Utility Fund. The project is anticipated to begin during May 2022.

North Peninsula Drainage Improvements: Volusia County Stormwater Division hired CDM Smith in 2015 to produce the Halifax River Stormwater Outfall Assessment report, which provided a list of projects that would reduce the amount of nutrients going into the Halifax River. County crews continue to work on the project list, which consists of ongoing replacement of existing stormwater pipes with exfiltration pipes.
• **Wastewater**
  - The Volusia County Coastal Division converted the restroom at Smyrna Dunes Park in New Smyrna Beach from septic to sewer with funding assistance from the St. Johns River Water Management District (SJRWMD) and the Florida Department of Environmental Protection (FDEP).

**EMBRY-RIDDLE AERONAUTICAL UNIVERSITY:**

CCMP Vital Signs: *Hydrology and Hydrodynamics, Harmful Algal Blooms*

- **Hydrology and Hydrodynamics/Harmful Algal Blooms:**
  - During last year ERAU performed research in the Wave Lab of the Dept. of Mathematics at ERAU-Daytona Beach on the dynamics of macro-algae under small amplitude water surface waves, wind, and water current on variable (periodic) bathymetry. These studies and experiments are necessary to better understand the natural drift of macro-algae under various atmospheric conditions and tides in the Lagoon. The research will be presented in three research papers (one submitted for publication, two in preparation) and a presentation at the 12th IMACS Conference at UGA, Athens, GA March-April 2022.

![Lagrangian floating probes](image1)

![setting the bathymetry in the tank and waves + current flow over bathymetry](image2)
CANAVERAL NATIONAL SEASHORE-MOSQUITO LAGOON:
CCMP Vital Signs: Marinas and Boating, Monitoring and Data Sharing, Species of Concern, Citizen Engagement and Communication, Trash Free Waters, Science Technology and Innovation, Monitoring and Data Sharing, Harmful Algal Blooms.

- **Marinas and Boating:**
  - Three Federal Wildlife Officers spent over 200 hours patrolling the Mosquito Lagoon (ML) by boat and enforcing State, Federal and U.S. Coast Guard regulations. The officers also worked with the Florida Fish and Wildlife Conservation Commission (FWC), and local law enforcement for resource checks, navigation/safety checks, and legal infractions. Officers assisted State agencies and researchers with rescues of injured and sick manatees and dolphins.

- **Monitoring and Data Sharing:**
  - National Park Service staff from the Inventory and Monitoring group continued data collection and quality control from a sonde located at the Visitor Center dock that collects continuous water quality data and is downloaded monthly. Staff has set up new locations for wetland SET stations to better monitor certain areas for long term trends.

- **Species of Concern:**
  - The Park continued monitoring and protection of state and federally listed species, including scrub jays, beach mice, and sea turtles. Over 8,000 sea turtle nests were deposited on the 24-mile stretch of beach. The park has partnered with USDA Wildlife Services for predator and hog removal.

- **Citizen Engagement and Education:**
  - Canaveral National Seashore conducted education programs and has begun to get back to pre-COVID programming. Brochures and information are provided to hundreds of guests
on daily basis. The Park had an annual visitation of 2 million visitors. New displays at the Visitor Center focus on lagoon and mangrove habitat. Signage is located at boat ramps and throughout the park to provide information on lagoon resources and current issues. Kayak trails in both districts continue to be used by the public and are very popular.

- **Trash Free Waters:**
  - The Park and partners continue to conduct regular clean ups in the lagoon and along the beaches. Numerous dumpsters of debris have been removed. The park is partnering with researchers to evaluate the impact of trash in the lagoon and nurdles on the beach.

- **Science, Technology and Innovation/ Monitoring and Data Sharing:**
  - NPS collaborates with many universities and partners for monitoring of habitats and wildlife. Research projects included dolphin health assessments and abundance by Hubbs SeaWorld, horseshoe crab behavior and morphology by the University of Florida and Marine Discovery Center, vegetation mapping by the University of Georgia, vegetation monitoring by NASA biologists, and sea turtles. The Park provides housing and logistical support for University of Central Florida and in return valuable data is conducted. Including research on climate change impact on ecosystems, brown tide effect on oyster populations, impounded restoration monitoring, and sediment elevation monitoring. The Park continues to work with state and other partners for water quality, seagrass, manatee, and invertebrate monitoring.
  - Ocean Acidification (OA) Project. In this project, NPS proposes to augment several observational campaigns by 1) adding a carbonate component to the harmful algal blooms (HABs) monitoring cruises conducted by NOAA periodically on the Western Florida Shelf in order to study potential links between HABs and OA, 2) renewing NOAA collaboration with select National Parks to complement and enhance our near-shore data collection on the Northern Gulf of Mexico and US East Coast, and 3) complementing NOAA underway surface pCO2 measurements in the Gulf of Mexico and US East Coast with underway total alkalinity measurements to help us improve our fundamental understanding of nearshore OA processes. The addition of these measurements to the current assets already present in the region would enhance our understanding of the linkage between nearshore and open ocean processes and better assess the mechanisms and impacts of OA on the biogeochemistry, biology, and their economic consequences.

- **Harmful Algal Blooms:**
  - A U.S Geological Survey review of algal toxins on public lands revealed that 471 toxic HAB events occurred at 31 national park units, including 383 reported human threshold exceedances. Park visitors often enjoy boating, fishing, shell fishing and swimming, which can increase the likelihood of exposure. This research will help us understand how best to monitor and manage for the newly drafted “Recreational Ambient Water Quality Criteria or Swimming Advisories for Microcystins and Cylindrospermopsis” (U.S. Environmental Protection Agency, 2019). The monitoring data will be available to park managers to make management decisions regarding restricted access and use of affected water bodies based on this new advisory. We also will provide data to existing staff and citizen science park monitoring programs (i.e., algae/phytoplankton ID) to better inform future monitoring efforts. Parks with pressing human and (or) wildlife health issues related to HABs can use the data from this project to better understand thresholds and the impacts of HABs on human health with the ultimate goal of providing clear management action guidance. Project products will include: (1) HAB Toolkit for park managers hosted on NPS HABs website and accessible to all Department of Interior Agencies: • Guidance on low-
cost HAB monitoring methods, including citizen science options • Rapid response protocols • HAB response decision-making flow chart with management action options and recommendations • HAB reporting form • Service-wide webinar to promote toolkit and how it can be used • Contact information for NPS co-leads, along with options for direct consultation with parks on using the toolkit • Message-boards and HAB information-sharing webpages to increase collaboration between parks experiencing HAB issues (2) Journal publications • The first article will focus on the occurrence and biogeography of toxins (USGS lead) • The second will be interdisciplinary with a focus on resource management and public.

General

NASA, Merritt Island NWR, FWC, and Canaveral National Seashore have developed a small working group to focus on and address lagoon issues such as research needs, messaging for the public, and coordinating efforts.

Brevard County Partners:

BREVARD COUNTY NATURAL RESOURCES MANAGEMENT DEPARTMENT (NRMD):
CCMP Vital Signs: Stormwater, Impaired Waters, Wastewater, Filter Feeders, Living Shorelines, Legacy Loads, Hydrology and Hydrodynamics, Monitoring and Data Sharing

• Stormwater/Impaired Waters:
  o Completed Projects in 2021:

  1. Melbourne Sherwood Park Stormwater Quality Project, Melbourne/North Indian River Lagoon: Constructed a baffle box, two wet detention ponds, and two rain gardens adjacent to the Sherwood Park subdivision to provide treatment to a 246-acre basin comprised of three residential subdivisions; estimated benefit to the lagoon: annual removal of 1,762 pounds of total nitrogen, 670 pounds of total phosphorus.

  2. Draa Field Vegetation Harvesting, Titusville/North Indian River Lagoon: Harvested aquatic vegetation within a 3-acre pond that leads to the Indian River Lagoon. This harvesting removes nutrients from the waterbody rather than recycling them through decomposition and sedimentation of the plant material into the sediment; estimated benefit to the lagoon: removal of 786 pounds of total nitrogen, 99 pounds of total phosphorus.

  3. Big Muddy Baffle Box, Indian Harbour Beach/North Indian River Lagoon: Installed a second-generation baffle box with media filter near Yacht Club Blvd; estimated benefit to the lagoon: annual removal of 436 pounds of total nitrogen, 58 pounds of total phosphorus.

  4. Thrush Drive Baffle Box, Melbourne/North Indian River Lagoon: Installed a second-generation baffle box within the Thrush Drive ditch; estimated benefit to the lagoon: annual removal of 3,661 pounds of total nitrogen, 773 pounds of total phosphorus.

  5. Titusville High Baffle Box, Titusville/North Indian River Lagoon: Installed a second-generation baffle box fitted with nutrient-reducing filtration media; estimated
benefit to the lagoon: annual removal of 1,190 pounds of total nitrogen, 166 pounds of total phosphorus.
6. Draa Field Pond Managed Aquatic Plant Systems, Titusville/North Indian River Lagoon: Installed floating islands within a 3-acre pond. The plants will incorporate dissolved nutrients from the water column into the plant biomass and will be harvested routinely to remove nutrients from the system; estimated benefit to the lagoon: removal of 256 pounds of total nitrogen, 38 pounds of total phosphorus.
7. Basin 22 Huntington Pond Retrofit, Brevard County/North Indian River Lagoon: Retrofitted an existing stormwater pond off of Huntington Road, consisting of a bleed-down to flow through denitrification media; estimated benefit to the lagoon: annual removal of 1,190 pounds of total nitrogen, to be determined of total phosphorus.
8. Jackson Court Stormwater Treatment Facility, Satellite Beach/Banana River Lagoon: Constructed a treatment train of dry retention and wet detention ponds through a nutrient removal filter structure; estimated benefit to the lagoon: annual removal of 56 pounds of total nitrogen, 8 pounds of total phosphorus.
9. Ray Bullard Water Reclamation Facility Stormwater Management Area, West Melbourne/Central Indian River Lagoon: Constructed a treatment train consisting of a 2.64-acre wet detention pond with media base filtration treating runoff from approximately 450 acres; estimated benefit to the lagoon: annual removal of 1,317 pounds of total nitrogen, 400 pounds of total phosphorus.
10. Convair Cove Stormwater Low Impact Development, Cocoa Beach/Banana River Lagoon: Removed impervious cover and replaced with interlocking pervious pavers and installed rain tanks where runoff flows through bioactivated denitrification media; estimated benefit to the lagoon: annual removal of 59 pounds of total nitrogen, 6 pounds of total phosphorus.
11. Marina B Managed Aquatic Plant Systems, Titusville/North Indian River Lagoon: Installed floating islands within a 1-acre pond. The plants will incorporate dissolved nutrients from the water column into the plant biomass and will be harvested routinely to remove nutrients from the system; estimated benefit to the lagoon: removal of 55 pounds of total nitrogen, 7 pounds of total phosphorus.
12. Basin 26 Sunset Avenue Woodchip Bioreactor, Brevard County/North Indian River Lagoon: A woodchip bioreactor is to be installed on Sunset Avenue; estimated benefit to the lagoon: annual removal of 605 pounds of total nitrogen, 92 pounds of total phosphorus.

Projects Under Construction:
1. Basin 62 Johns Road Pond Retrofit, Brevard County/North Indian River Lagoon: Retrofitting an existing stormwater pond off of Johns Road, consisting of a bleed-down to flow through denitrification media; estimated benefit to the lagoon: annual removal of 1,199 pounds of nitrogen, to be determined of total phosphorus.

Projects Under Contract and In Design
1. Scottsmoor I Aurantia Road, Brevard County/North Indian River Lagoon: Water quality improvement project treatment train that will include an upstream inflow pipe from the drainage ditch into a baffle box to capture trash, leaves, and sediment followed by a series of pipes and manifolds designed to convey baseflow and stormwater runoff from the baffle box to an underground iron-enhanced sand filter chamber where phosphorus will be removed followed by denitrification within a
second large chamber containing biosorption media; estimated benefit to the lagoon: annual removal of greater than 738 pounds of total nitrogen, greater than 31 pounds of total phosphorus.

2. Scottsmoor C Wheeler Road, Brevard County/North Indian River Lagoon: Water quality improvement project treatment train that will include an upstream inflow pipe from the drainage ditch into a baffle box to capture trash, leaves, and sediment followed by a series of pipes and manifolds designed to convey baseflow and stormwater runoff from the baffle box to an underground iron-enhanced sand filter chamber where phosphorus will be removed followed by denitrification within a second large chamber containing biosorption media; estimated benefit to the lagoon: annual removal of greater than 738 pounds of total nitrogen, greater than 31 pounds of total phosphorus.

3. Basin 1387 Kingsmill-Aurora Stormwater Project, Brevard County/North Indian River Lagoon: Constructing a traditional stormwater pond on a major tributary to Eau Gallie River to prevent nutrients and sediments from reaching the lagoon; estimated benefit to the lagoon: annual removal of 4,176 pounds of total nitrogen, 814 pounds of total phosphorus.

4. Basin 71 Flounder Creek Pond Stormwater Project, Brevard County/North Indian River Lagoon: Retrofitting an existing stormwater pond off of Flounder Creek Road, consisting of a bleed-down to flow through denitrification media; estimated benefit to the lagoon: annual removal of 856 pounds of total nitrogen, to be determined of total phosphorus.

5. Basin 2258 Babcock St Woodchip Bioreactor, Brevard County/Central Indian River Lagoon: A woodchip bioreactor is to be installed on Babcock St; estimated benefit to the lagoon: annual removal of 412 pounds of total nitrogen, 62 pounds of total phosphorus.

6. St. Johns 2 Baffle Box, Titusville/North Indian River Lagoon: Installing a second-generation baffle box fitted with nutrient-reducing filtration media; estimated benefit to the lagoon: annual removal of 1,192 pounds of total nitrogen, 611 pounds of total phosphorus.

7. Basin 998 Hampton Homes, Brevard County/Banana River Lagoon: Three denitrification bioreactor systems will be installed at the outfalls of Fourth Place, Hampton Way, and Margaret St in Merritt Island, Fl; estimated benefit to the lagoon: TBD.

8. Basin 1066 Angel Avenue, Brevard County/Banana River Lagoon: A denitrification bioreactor system will be installed on County-owned property off of Angel Ave in Merritt Island, Fl; estimated benefit to the lagoon: TBD.

9. Basin 1124 Elliot Drive Canal, Brevard County/Banana River Lagoon: The installation of a sediment trap and denitrification bioreactor system will be installed near a canal north of Elliot Drive in Merritt Island, Fl; estimated benefit to the lagoon: TBD.

10. Johnson Junior High Organic Nitrogen Denitrification Media Chamber Modification, Brevard County/North Indian River Lagoon: Denitrification media chamber modification to enhance removal of the organic nitrogen components of total nitrogen utilizing inorganic media at the location of flow with the highest dissolved oxygen; estimated benefit to the lagoon: annual removal of 206 pounds of total nitrogen, to be determined of total phosphorus.
11. Basin 960(958) Pioneer Road – Brevard County/Banana River Lagoon: Installing a Denitrification bioreactor in a side road ditch on Pioneer Road and a skimmer to facilitate harvesting on floating aquatic vegetation prior to entering the Lagoon; estimated benefit to the lagoon: annual removal of 400 pounds of total nitrogen, to be determined of total phosphorus.

12. Basin 1280B Flamingo Road – Brevard County/Banana River Lagoon: Installation of an underground chamber filled with Biosorption Activated Media and a Miami curb to direct run-off to a sediment trap from an unpaved road, reducing sediments from entering the system; estimated benefit to the lagoon: annual removal of 151 pounds of total nitrogen, to be determined of total phosphorus.

13. Basin 1304B West Arlington St Brevard County/Banana River Lagoon – Constructing an 0.08-acre dry detention facility at the west end of West Arlington Road that will be lined along the bottom and side with biosorption activated media; estimated benefit to the lagoon: annual removal of 55 pounds of total nitrogen, to be determined of total phosphorus.

- Wastewater/Impaired Waters
  - Completed Projects in 2021:
    1. Palm Bay North Area Waste Water Treatment Facility Upgrade, Palm Bay/Central Indian River Lagoon: Improved the reuse water quality of domestic wastewater with nitrogen and phosphorus removal facilities; estimated benefit to the lagoon: annual removal of 20,240 pounds of total nitrogen, 102 pounds of total phosphorus.
    2. Merritt Island Redevelopment Agency Septic to Sewer Phase II, Merritt Island/North Indian River Lagoon: Septic-to-sewer project that removed and connected 74 septic systems to sanitary sewer; estimated benefit to the lagoon: annual removal of 2,492 pounds of total nitrogen.
    3. Sylvan Estates Septic to Sewer, West Melbourne/Central Indian River Lagoon: Removed 59 septic systems and connected to sanitary sewer; estimated benefit to the lagoon: annual removal of 1,073 pounds of total nitrogen.
    4. Septic Upgrades, Private Homeowners/North Indian River Lagoon and Central Indian River Lagoon: Converted 26 conventional septic systems to aerobic advanced treatment units (ATUs) capable of preventing over 65% of groundwater nitrogen pollution from entering the lagoon from household wastewater; estimated benefit to the lagoon: annual removal of 577 pounds of total nitrogen.
    5. Quick Connects, Private Homeowners/North Indian River Lagoon: Abandoned 2 septic systems and connected effluent discharges to local sewer main lines; estimated benefit to the lagoon: annual removal of 45 pounds of total nitrogen.
  - Projects Under Construction:
    1. Osprey Waste Water Treatment Facility Upgrade, Titusville/North Indian River Lagoon: Improving the reuse water quality of domestic wastewater with treatment facility upgrades; estimated benefit to the lagoon: annual removal of 12,286 pounds of total nitrogen.
    2. South Central C, Brevard County/North Indian River Lagoon: Septic-to-sewer project to remove 142 septic systems; estimated benefit to the lagoon: annual removal of 5,146 pounds of total nitrogen.
3. Melbourne Hoag Septic to Sewer, Melbourne/Central Indian River Lagoon: Removing 5 septic systems and connecting to sanitary sewer; estimated benefit to the lagoon: annual removal of 101 pounds of total nitrogen.

4. Melbourne Pennwood Septic to Sewer, Melbourne/Central Indian River Lagoon: Removing 5 septic systems and connecting to sanitary sewer; estimated benefit to the lagoon: annual removal of 48 pounds of total nitrogen.

5. Melbourne Riverside Drive Septic to Sewer, Melbourne/North Indian River Lagoon: Removing 12 septic systems and connecting to sanitary sewer; estimated benefit to the lagoon: annual removal of 305 pounds of total nitrogen.

6. Melbourne Roxy Avenue Septic to Sewer, Melbourne/Central Indian River Lagoon: Removing 6 septic systems and connecting to sanitary sewer; estimated benefit to the lagoon: annual removal of 102 pounds of total nitrogen.

7. Melbourne South Central Zone F Septic to Sewer, Melbourne/North Indian River Lagoon: Removing 51 septic systems and connecting to sanitary sewer; estimated benefit to the lagoon: annual removal of 1,688 pounds of total nitrogen.

8. Countywide Sewer Lateral Repair/Replacement, Brevard County/North and Central Indian River Lagoon and Banana River Lagoon: Repairing and replacing sewer lateral leaks found through smoke testing and line scoping; estimated benefit to the lagoon: annual removal of 988 pounds of total nitrogen, 188 pounds of total phosphorus.

9. Micco Sewer Line Extension, Brevard County/Central Indian River Lagoon: Conversion of 31 commercial and residential properties from septic to centralized sewer; estimated benefit to the lagoon: annual removal of 1,359 pounds of total nitrogen.

Projects Under Contract and in Design:

1. Sykes Creek Zone M, Brevard County/Banana River Lagoon: Septic-to-sewer project to remove 56 septic systems; estimated benefit to the lagoon: annual removal of 1,798 pounds of total nitrogen.

2. Sykes Creek Zone N, Brevard County/Banana River Lagoon: Septic-to-sewer project to remove 78 septic systems; estimated benefit to the lagoon: annual removal of 2,784 pounds of total nitrogen.

3. Sykes Creek Zone T, Brevard County/Banana River Lagoon: Septic-to-sewer project to remove 148 septic systems; estimated benefit to the lagoon: annual removal of 3,360 pounds of total nitrogen.

4. Titusville Zones A-G Septic to Sewer, Titusville/North Indian River Lagoon: Removing 18 septic systems to sanitary sewer; estimated benefit to the lagoon: annual removal of 624 pounds of total nitrogen.

5. South Beaches Zone O, Brevard County/North Indian River Lagoon: Removing 3 septic systems to sanitary sewer; estimated benefit to the lagoon: annual removal of 92 pounds of total nitrogen.

6. South Beaches Zone P, Brevard County/North Indian River Lagoon: Removing 9 septic systems to sanitary sewer; estimated benefit to the lagoon: annual removal of 242 pounds of total nitrogen.

7. Septic Upgrades, Private Homeowners/North Indian River Lagoon, Banana River Lagoon, and Central Indian River Lagoon: Convert conventional septic systems to aerobic advanced treatment units (ATUs) capable of preventing over 65% of groundwater nitrogen pollution from entering the lagoon from household
wastewater; estimated benefit to the lagoon: annual removal of total nitrogen to be determined.

8. Quick Connects, Private Homeowners/ North Indian River Lagoon, Banana River Lagoon, and Central Indian River Lagoon: Abandon septic systems and connect effluent discharges to local sewer main lines; estimated benefit to the lagoon: annual removal of total nitrogen to be determined.

9. South Beaches Zone A, Brevard County/North Indian River Lagoon: Removing 37 septic systems to sanitary sewer; estimated benefit to the lagoon: annual removal of 1,306 pounds of total nitrogen.

10. Sharpes Zone A, Brevard County/North Indian River Lagoon: Removing 186 septic systems to sanitary sewer; estimated benefit to the lagoon: annual removal of 5,248 pounds of total nitrogen.

11. Sharpes Zone B, Brevard County/North Indian River Lagoon: Removing 136 septic systems to sanitary sewer; estimated benefit to the lagoon: annual removal of 2,692 pounds of total nitrogen.

12. South Central Zone A, Brevard County/North Indian River Lagoon: Removing 101 septic systems to sanitary sewer; estimated benefit to the lagoon: annual removal of 3,655 pounds of total nitrogen.

13. South Central Zone D, Brevard County/North Indian River Lagoon: Removing 94 septic systems to sanitary sewer; estimated benefit to the lagoon: annual removal of 3,387 pounds of total nitrogen.

14. South Banana Zone B, Brevard County/Banana River Lagoon: Removing 41 septic systems to sanitary sewer; estimated benefit to the lagoon: annual removal of 915 pounds of total nitrogen.

15. Micco Zone B, Brevard County/Central Indian River Lagoon: Removing 540 septic systems to sanitary sewer; estimated benefit to the lagoon: annual removal of 8,687 pounds of total nitrogen.

16. South Central Zone A, Brevard County/Banana River Lagoon: Removing 186 septic systems to sanitary sewer; estimated benefit to the lagoon: annual removal of 5,248 pounds of total nitrogen.

17. Merritt Island Zone C, Brevard County/Banana River Lagoon: Removing 43 septic systems to sanitary sewer; estimated benefit to the lagoon: annual removal of 1,419 pounds of total nitrogen.

18. Merritt Island Zone F, Brevard County/Banana River Lagoon: Removing 71 septic systems to sanitary sewer; estimated benefit to the lagoon: annual removal of 1,292 pounds of total nitrogen.

19. Merritt Island Zone G, Brevard County/Banana River Lagoon: Removing 1,146 septic systems to sanitary sewer; estimated benefit to the lagoon: annual removal of 11,078 pounds of total nitrogen.

20. Sykes Creek Zone R, Brevard County/Banana River Lagoon: Removing 192 septic systems to sanitary sewer; estimated benefit to the lagoon: annual removal of 2,925 pounds of total nitrogen.

21. North Merritt Island Zone E, Brevard County/North Indian River Lagoon: Removing 195 septic systems to sanitary sewer; estimated benefit to the lagoon: annual removal of 2,541 pounds of total nitrogen.
22. Cocoa Zone C, Brevard County/North Indian River Lagoon: Removing 273 septic systems to sanitary sewer; estimated benefit to the lagoon: annual removal of 3,499 pounds of total nitrogen.

- **Filter Feeders:**
  - Projects Under Construction:
    1. Brevard Zoo North Indian River Lagoon Oysters, Brevard Zoo/North Indian River Lagoon: Building 21,600 square feet of oyster bars in the North Indian River Lagoon to help reduce shoreline erosion, filter water, and trap nutrients; estimated benefit to the lagoon: annual removal of 864 pounds of total nitrogen, 22 pounds of total phosphorus.
    2. Brevard Zoo North Indian River Lagoon Oysters 2, Brevard Zoo/North Indian River Lagoon: Building 21,030 square feet of oyster bars in the North Indian River Lagoon to help reduce shoreline erosion, filter water, and trap nutrients; estimated benefit to the lagoon: annual removal of 841 pounds of total nitrogen, 21 pounds of total phosphorous.
    3. Brevard Zoo Central Indian River Lagoon Oyster Restoration, Brevard Zoo/Central Indian River Lagoon: Building 10,200 square feet of oyster bars in the Central Indian River Lagoon to help reduce shoreline erosion, filter water, and trap nutrients; estimated benefit to the lagoon: annual removal of 408 pounds of total nitrogen, 10 pounds of total phosphorous.
    4. Brevard Zoo Central Indian River Lagoon Oysters 2, Brevard Zoo/Central Indian River Lagoon: Building 16,932 square feet of oyster bars in the Central Indian River Lagoon to help reduce shoreline erosion, filter water, and trap nutrients; estimated benefit to the lagoon: annual removal of 677 pounds of total nitrogen, 17 pounds of total phosphorous.
    5. Brevard Zoo North Indian River Lagoon Oyster Project 3, Brevard Zoo/North Indian River Lagoon: Build 26,388 square feet of oyster bars in the North Indian River Lagoon to help reduce shoreline erosion, filter water, and trap nutrients; estimated benefit to the lagoon: annual removal of 1,056 pounds of total nitrogen, 26 pounds of total phosphorous.
  - Projects Under Contract and In Design:
    1. Brevard Zoo Banana River Oyster Project, Brevard Zoo/Banana River Lagoon: Build 36,894 square feet of oyster bars in the Banana River to help reduce shoreline erosion, filter water, and trap nutrients; estimated benefit to the lagoon: annual removal of 1,476 pounds of total nitrogen, 37 pounds of total phosphorous.
    2. McNabb Park Living Shoreline - Oysters, Cocoa Beach/Banana River Lagoon: Build 2,160 square feet of oyster habitat by installing oyster reef prisms, oyster gabions, and floating oyster habitat on mangrove planters (rhizolith islands) to improve habitat and overall water quality; estimated benefit to the lagoon: annual removal of 72 pounds of total nitrogen, 2 pounds of total phosphorous.

- **Living Shorelines:**
  - Projects Completed in 2021:
    1. Brevard Zoo North Indian River Lagoon Plant Project 2, Brevard Zoo/North Indian River Lagoon: Planting 610 feet of mangroves and cordgrass to reduce erosion and absorb nutrients; estimated benefits to the lagoon: annual removal of 41 pounds of total nitrogen, 14 pounds of total phosphorus.
• Projects Under Contract and In Design:
  1. Riveredge, Marine Resources Council/North Indian River Lagoon: Plant 250 feet of mangroves and cordgrass to reduce erosion and absorb nutrients; estimated benefits to the lagoon: annual removal of 17 pounds of total nitrogen, 6 pounds of total phosphorus.
  2. McNabb Park Living Shoreline – Plants, Cocoa Beach/Banana River Lagoon: Plant 360 feet of mangroves and cordgrass along the seawall, in floating mangrove planters (rhizolith islands), and in mangrove planter boxes to improve habitat and overall water quality; estimated benefits to the lagoon: annual removal of 24 pounds of total nitrogen, 8 pounds of total phosphorous.

• Legacy Loads:
  o Projects Under Construction:
    1. Grand Canal Muck Dredging, Brevard County/Banana River Lagoon: Dredging of 479,000 cubic yards of muck from 97 acres of residential canals at the north end of the Grand Canal system; estimated benefit to the lagoon: removal of 10,185 pounds of total nitrogen, 2,618 pounds of total phosphorus through muck removal, and 89,025 pounds of total nitrogen through interstitial treatment.
    2. Cocoa Beach Phase Ilb Muck Dredging, Cocoa Beach/Banana River Lagoon: 60 acres of muck removal in residential canals; estimated benefit to the lagoon: removal of 3,746 pounds of total nitrogen, 563 pounds of total phosphorus.
    3. Sykes Creek Muck Dredging, Brevard County/Banana River Lagoon: Dredging of approximately 650,000 cubic yards from 110 acres of Sykes Creek and adjacent residential canals; estimated benefit to the lagoon: removal of 19,635 pounds of total nitrogen, 2,618 pounds of total phosphorus through muck removal, and 64,278 pounds of total nitrogen through interstitial treatment.

  o Projects Under Contract and In Design:
    1. Eau Gallie Northeast Muck Dredging, Brevard County/North Indian River Lagoon: Dredging of 250,000 cubic yards from 73 acres adjacent to Eau Gallie Causeway; estimated benefit to the lagoon: removal of 10,476 pounds of total nitrogen, 1,482 pounds of total phosphorus through muck removal; and 25,410 pounds of total nitrogen, 2,313 pounds of total phosphorus removed through interstitial treatment.
    2. Merritt Island Muck Removal, Brevard County/Banana River Lagoon: Dredging of 386,000 cubic yards from 77 acres of residential canals along the west shoreline of the Banana River in Merritt Island; estimated benefit to the lagoon: removal of 8,081 pounds of total nitrogen, 1,077 pounds of total phosphorus.
    3. Rockledge A Muck Dredging, Brevard County/North Indian River Lagoon: Dredging of 125,000 cubic yards from 38 acres of the open North Indian River Lagoon adjacent to the Indian River Isles subdivision; estimated benefit to the lagoon: removal of 7,581 pounds of total nitrogen, 825 pounds of total phosphorus through muck removal; and 12,705 pounds of total nitrogen, 1,157 pounds of total phosphorus through interstitial treatment.
    4. Titusville Railroad East Muck Dredging, Brevard County/North Indian River Lagoon: Dredging of 115,000 cubic yards from 36 acres adjacent to the Titusville Railroad Bridge; estimated benefit to the lagoon: estimated removal of 5,393 pounds of total nitrogen, 227 pounds of total phosphorus through muck removal, and 11,688
pounds of total nitrogen, 1,064 pounds of total phosphorus through interstitial treatment.

5. Titusville Railroad West Muck Dredging, Brevard County/North Indian River Lagoon, Dredging of 90,000 cubic yards from 70 acres adjacent to the Titusville Railroad Bridge; estimated benefit to the lagoon: removal of 14,406 pounds of total nitrogen, 588 pounds of total phosphorus through muck removal, and 9,148 pounds of total nitrogen, 833 pounds of total phosphorus through interstitial treatment.

6. NASA Causeway East Muck Dredging, Brevard County/North Indian River Lagoon: Dredging of 285,000 cubic yards from 34 acres adjacent to the NASA Causeway in the North Indian River Lagoon; estimated benefit to the lagoon: removal of 21,872 pounds of total nitrogen, 1,047 pounds of total phosphorus through muck removal, and 28,976 pounds of total nitrogen, 2,637 pounds of total phosphorus through interstitial treatment.

7. Indian Harbour Beach Muck Dredging, Indian Harbour Beach/Banana River Lagoon: Dredging of 186,000 cubic yards from 36 acres of residential canals; estimated benefit to the lagoon: removal of 3,780 pounds of total nitrogen, 720 pounds of total phosphorus through muck removal, and 27,418 pounds of total nitrogen through interstitial treatment.


- **Hydrology and Hydrodynamics:**
  - Projects Under Contract and In Design:
    1. Crane Creek/M1 Flow Restoration, St. Johns River Water Management District/Central Indian River Lagoon: This project will treat and return diverted baseflows and storm flows back to the St. Johns River basin; estimated benefit to the lagoon: annual removal of 23,113 pounds of total nitrogen, 2,719 pounds of total phosphorus.

- **Monitoring and Data Sharing:**
  - Projects Completed in 2021:
    2. Long Point Park Denitrification Monitoring, Brevard County/Central Indian River Lagoon: Monitoring and analyzing the differences in groundwater quality pre- and post-construction of the Long Point Park Denitrification project.
    3. In-Ground Nitrogen Reducing Biofilter (INRB) Monitoring, ECT, Inc/North Indian River Lagoon: Monitoring and analyzing the effectiveness of alternative media within the INRB septic drainfield for nutrients and associated wastewater analytes.

  - Project in Progress in 2021:
    1. Living Shoreline Monitoring, University of Central Florida/North and Central Indian River Lagoon and Banana River Lagoon: Monitoring of oyster bars at 1, 3, 6, 12, 18, and 24 months post-deployment to statistically quantify success at each site. The
total number of live oysters, oyster shell length, a visual survey of oyster bridging, presence/absence of algal growth, and live predators and competitors are recorded.

2. Oyster Bar Denitrification Study, University of Florida Institute of Food and Agricultural Sciences/North and Central Indian River Lagoon and Banana River Lagoon: Quantify sediments associated with oyster bars for denitrification, percent organic matter, oxygen demand, and nitrate, ammonium, and phosphate flux rates across the sediment-water interface. These data aid in understanding ecosystem services related to nutrient removal by oyster bars.

3. Testing Alternative Oyster Restoration Materials, Brevard County and the Indian River Lagoon National Estuary Program/Central Indian River Lagoon and Banana River Lagoon: Six alternatives to oyster shell contained in ultraviolet stabilized plastic mesh bags were deployed to determine potential utility for oyster bar construction. Structural integrity, degradation, fouling, and oyster recruitment and growth are monitored on a quarterly basis over an 18-month period. Data collected will help inform future oyster bar design.

4. County Groundwater Monitoring, Applied Ecology/North and Central Indian River Lagoon and Banana River Lagoon: Utilized groundwater monitoring wells to examine groundwater contamination throughout Brevard County. This data helps to better understand the extent of wastewater contamination in groundwater.

5. Micco Septic to Sewer Monitoring, Applied Ecology/Central Indian River Lagoon: Monitors groundwater wells around the Micco Septic-to-Sewer Conversion Project to collect pre- and post-water quality data and determine the impact of commercial septic tanks on Lagoon waters.


7. Grass Clippings Outreach, Marine Resources Council/North and Central Indian River Lagoon and Banana River Lagoon: Completed surveys and behavioral observations to identify the target for social marketing campaigns directed at changing behaviors regarding improper disposal of grass clippings. Information will be used to design future campaigns to reduce nutrient loading from grass clippings to the Indian River Lagoon.

8. Fertilizer Management Outreach, MTN Inc./North and Central Indian River Lagoon and Banana River Lagoon: Conducted surveys and focus groups to identify behaviors regarding fertilizer usage and create social marketing campaigns to modify these behaviors to reduce nutrient loading from fertilizer to the Indian River Lagoon. Messaging is being sent through social media and billboards. Beneficial behaviors are also encouraged through participation in a Lagoon Loyal Rewards Program. By logging positive behaviors through a profile on LagoonLoyal.com participants can earn points that can be exchanged for discounts to local businesses.

9. Septic Maintenance Outreach, MTN Inc./North and Central Indian River Lagoon and Banana River Lagoon: Conducted surveys and focus groups to identify septic maintenance practices and create social marketing campaigns to modify these behaviors to reduce nutrient loading from septic systems to the Indian River Lagoon. Messaging is being sent through social media, postcards, and billboards. Beneficial behaviors are also encouraged through participation in a Lagoon Loyal Rewards Program. By logging positive behaviors through a profile on
LagoonLoyal.com participants can earn points that can be exchanged for discounts to local businesses.

10. Annual Plan Updates, Tetra Tech/North and Central Indian River Lagoon and Banana River Lagoon: Coordination with the consultant to update information and data in the Save Our Indian River Lagoon Project Plan. Work involves updating costs and nutrient removals, adding new projects and removing withdrawn projects, creating new sections as needed, and making the document ADA compliant.

**BREVARD ZOO:**

CCMP Vital Signs: *Filter Feeders, Seagrasses, Living Shorelines, Citizen Education and Engagement*  
- **Filter Feeders:**  
  - Save Our IRL (SOIRL) funded projects completed:  
    1. Central IRL Oyster Project  
       - 2,760 square feet of oyster reef added to the IRL  
       - $43,450  
       - TN reduction = 110 lbs/yr.  
    2. Central IRL Oyster Project 2  
       - 1,140 square feet of oyster reef added to the IRL  
       - $18,170  
       - TN reduction = 46 lbs/yr.  
    3. North IRL Oyster Project  
       - 600 square feet of oyster reef added to the IRL  
       - $9,480  
       - TN reduction = 24 lbs/yr.  
    4. North IRL Oyster Project 2  
       - 1,386 square feet of oyster reef added to the IRL  
       - $21,725  
       - TN reduction = 55 lbs/yr.  
    5. North IRL Oyster Project 3  
       - 3,705 square feet of oyster reef added to the IRL  
       - $58,460  
       - TN reduction = 148 lbs/yr.
o Oyster Gardening (funded through Brevard County). $150,000 annually. Brevard Zoo engages waterfront community members to grow oysters off their docks for use in
restoration projects. Since 2014, almost 1,600 people have been trained to participate in this project.

- **Shuck and Share (TDC funded)**
- Since April 2021, Brevard Zoo has been utilizing our truck and materials purchased with TDC funding to expand our internal shuck and share project to 21 restaurants and one shucking house totaling 1,012,197 pounds of recycled oyster shell in the last year. This project has allowed the Zoo to divert more than five million pounds of oyster shell from the landfill to a quarantine site since 2015. The collected discarded oyster shells sit for a minimum of 90 days and then can be used in our restoration projects.

- **Filter Feeders/Citizen Engagement and Education:**
  - **Indian River Lagoon Super Clam Project** - In 2021, the Zoo’s Restore Our Shores team (ROS) chose 100 sites to plant clams in the IRL. The ROS team planted the beds in November and December of 2021, with clams from University of Florida’s super clam stock. These beds are being cared for by over 100 volunteers, all trained by ROS staff. A subset of the 100 beds was monitored from January- March of 2022. Larger clam beds were installed at three of the 100 sites, where monitoring values were the most promising. In total, the ROS team has planted 2.6 million clams in the Indian River Lagoon and will plant 400,000 more before the end of May 2022. Additional monitoring is planned for May and September of 2022. Seagrass is to be planted at 10 of the 100 sites, by Florida Oceanographic Society in summer of 2022.

Clam Planting 2021
Volunteer Contributions - Throughout all programs facilitated by Brevard Zoo's Restore Our Shores, 752 volunteers contributed 2,699.75 hours between April 2021 and March 2022.

- **Seagrasses:**
  - Funded by the IRL NEP and private donors, the Zoo will be constructing a seagrass nursery in fall of 2022, and in spring of 2023 will be planting 24 seagrass beds throughout the IRL. The planning of these projects is currently underway, and the goal of the planting of the beds is to test the readiness of specific sites in the lagoon for seagrass restoration.

**ST. JOHNS RIVER WATER MANAGEMENT DISTRICT (SJRWMMD):**
CCMP Vital Signs: Stormwater, Impaired Water, Filter Feeders, Seagrasses, Wastewater, Harmful Algal Blooms, Monitoring and Data Sharing, Legacy Loads, Living Shorelines

- **Legacy Loads/Impaired Waters:**
  - **Brevard County Grand Canal Muck Removal** - The project consists of muck dredging, dewatering, and upland disposal of 37,300 cubic yards of muck in 20 acres in the northern finger canals in Grand Canal. The estimated nutrient load reduction water quality benefit to the Banana River are 2,100 lbs/yr TN and 280 lbs/yr TP. The District cost-share amount is $983,180 of the $1,966,360 estimated construction cost. The project is under construction.
- **Cocoa Beach Muck Removal: Phase 2B** - The project includes dredging 12 canals (approximately 60 acres) in the City of Cocoa Beach that discharge to the Banana River Lagoon. The dredging will remove and dispose of 150,000 cubic yards of muck. The project is Phase 2b and is the final phase of an overall three-phase plan. The estimated nutrient load reduction water quality benefit to the Banana River Lagoon is 6,321 lbs/yr TN and 842 lbs/yr TP. The District cost-share amount was $1,500,000 of the $7,292,650 estimated construction cost. Construction is complete.

![Cocoa Beach Muck Removal: Phase 2B](image)

- **Living Shorelines:**
  - **Riverside Conservancy Living Shoreline** - The project includes the restoration of one quarter mile of living shoreline within SE Volusia County, including the planting of mangroves and salt marsh plants and placement of oyster reef modules. The District cost-share amount was $67,440 of the $92,440 project cost. The project is complete.
• **Filter Feeders/Seagrass:**
  o **Brevard Zoo Clam Restoration** - The research project involves adult clams and seed clams grown, planted, and monitored throughout portions of the Southern Mosquito Lagoon, Northern IRL, Central IRL, and Banana River, in approximately 100 distinct sites that vary in size. The District cost-share amount is $1,031,021 of the $1,121,697 estimated project cost. The project is in progress.

• **Stormwater/Impaired Waters:**
  o **Cocoa Beach Convair Cove Low Impact Development and Living Shoreline** - The project includes installation of a stormwater low-impact-development treatment train, including permeable pavers, underground rain tanks, bioactivated media barrier wall, and rain garden bioswales. Additionally, a living shoreline will be installed that includes mangroves, oysters, and grasses. The estimated nutrient load reduction water quality benefit to the IRL are 168 lbs/yr TN and 16 lbs/yr TP. The District cost-share amount is $159,479 of the $486,038 estimated construction cost. The project is under construction.

  o **Indian Harbour Beach Big Muddy Baffle Box** - The project includes the installation of a 2nd generation baffle box, bio-media and stormwater structures on Yacht Club Bld. adjacent to the Big Muddy canal. The project will provide treatment to approximately 63.8-acres of medium density residential land, which is currently untreated. The estimated nutrient load water quality benefit to the IRL is 408 lbs/yr and 71 lbs/yr TP. The District cost-share amount was $189,761 of the $379,522 estimated construction cost. Construction is complete.

  o **Indian River County Moorhen Marsh Low Energy Aquatic Plant System** - The project involves the construction of an aquatic plant (waterlettuce) based treatment system that will treat stormwater from a 6,300-acre contributing area. The system will pump 10 mgd from the North Relief Canal and into the aquatic plant treatment system. The estimated nutrient reduction water quality benefit to the IRL are 4,854 lbs/yr TN and 785 lbs/yr TP.
The District cost-share amount is $1,250,000 of the $5,500,000 estimated construction cost. The project is under construction.

- **Moorhen Marsh Low Energy Aquatic Plant System**

- **Indian River Shores Indian-Seminole Lane Treatment Train** - The project includes construction of catch basins, inlet debris baskets, polyacramide (PAM) blocks and maintenance dredging. The estimated nutrient load reduction water quality benefit are 378 lbs/yr TN and 194 lbs/yr TP. The District cost-share amount is $234,818 of the $234,818 estimated construction cost. The project is under construction.

- **New Smyrna Beach Canal C-05 Diversion Structure and Offsite Pond** - The project includes construction of a low flow diversion weir in the C-05 canal adjacent to an existing offline borrow pit back into the canal downstream of the diversion weir. The estimated nutrient load reduction water quality benefit are 1,300 lbs/yr TN and 320 lbs/yr TP. The District cost-share amount is $475,000 of the $475,000 estimated construction cost. The project has not started construction.

- **Rockledge Flow Equalization Basin Project** - The project includes the addition of a new 1.4-million-gallon influent equalization basin, associated pump station, and supporting facilities at the Rockledge wastewater treatment plant. The estimated nutrient load reduction water quality benefit to the IRL is 29,106 lbs/yr TN. The District cost-share amount is $1,917,250 of the $7,669,000 estimated construction cost. The project has not started construction.

- **Satellite Beach Lori Laine Stormwater Trunk Line Improvement Project** - The project consists of piping and earthwork to reroute stormwater conveyance to biosorption activated media (BAM)-filled trenches for nutrient removal. The estimated nutrient load reduction water quality benefit to the IRL are 129 lbs/yr TN and 28 lbs/yr TP. The District cost-share amount is $559,467 of the $2,237,868 estimated construction cost. The project is under construction.

- **Satellite Beach Stormwater Improvement** - The project includes construction of four stormwater treatment areas within the City to address stormwater that currently enters the southern end of the Banana River Lagoon with no treatment. The estimated nutrient load reduction water quality benefits to the IRL are 664 lbs/yr TN and 117 lbs/yr TP. The District cost-share amount was $153,011 of the $463,671 estimated construction cost. Construction is complete.
Titusville High School Baffle Box - The project consists of the installation of a second-generation baffle box with up-flow filter and nutrient reducing media within the 258-acre Titusville High School Basin. Stormwater within the basin currently discharges to the IRL without treatment. The estimated nutrient load reduction water quality benefits to the IRL are 502 lbs./yr TN and 86 lbs./yr TP. The District cost-share amount was $150,000 of the $470,000 estimated construction cost. Construction is complete.

Titusville Osprey Water Reclamation Nutrient Removal Upgrade - The project includes construction of biological, chemical, and physical process upgrades throughout the Osprey Water Reclamation Facility directed toward an effluent TN concentration of 3 milligrams per liter (mg/L) and an effluent TP concentration of 1 mg/L. The estimated nutrient load reduction water quality benefit to the IRL is 26,475 lbs/yr TN. The District cost-share amount is $1,350,000 of the $11,700,000 estimated construction cost. The project is under construction.

Vero Beach Stormwater Treatment Plant (Phase 1) and Vero Beach Canal to Irrigation Water Project (Phase 2) - The phase 1 project includes construction of 29,150 linear feet of reclaimed water main to transmit treated canal water for use in irrigation. The estimated water supply benefit is 3 mgd. The District cost-share amount for phase 1 is $2,189,753 of the $8,759,010 estimated construction cost. The phase 1 has not started construction. The phase 2 project includes the construction of an intake station to the filtration system to withdraw approximately 3 mgd from the Main Relief Canal that currently discharges to the IRL. Construction also includes a pipeline to the wastewater treatment plant (WTP), filters, and re-pumping station. The canal water will be filtered, screened, and treated at the existing water treatment plant. The nutrient reduction estimate water quality benefit to the IRL are 5,820 lbs/yr TN and 900 lbs/yr TP. The District cost-share amount for phase 2 is $1,500,000 of the $2,000,000 estimated construction cost. The phase 2 has not started construction.

Volusia County Ariel Canal Water Quality Improvement - The project includes the retrofitting (expansion and improvement) of an existing stormwater facility constructed 20 years ago. The project will divert storm and base flow from Ariel Canal into a wet detention pond then route it to a BAM (biologically active media) treatment area (1/3-acre). Flows from the canal will be routed through the downstream portion of the pond, then flow into the BAM treatment area, discharge back into the upstream portion of the pond and back to canal to the Mosquito Lagoon. The project will provide treatment for a 1,300-acre basin. The nutrient reduction estimate water quality benefit is 1,300 lbs/yr of TN and 201 lbs/yr of TP. The District cost-share amount is $450,000 of the $1,701,125 estimated construction cost. The project has not started construction.

Volusia County Gabordy Canal and 10th Street - The project includes the pumping of stormwater from the Gabordy Canal through a 2-acre treatment facility consisting of a 1-ft layer of sand and a 2-ft layer of BAM for denitrification and phosphorous absorption. The estimated nutrient removal water quality benefit to the Mosquito are 4,300 lbs/yr TN and 290 lbs/yr TP. The District cost-share amount is $1,911,784 of the $2,995,000 estimated construction cost. The project is under construction.

West Melbourne Ray Bullard Water Reclamation Facility Stormwater Management Area - The project includes construction of an offline wet detention pond to treat the first flush of stormwater flows from approximately 450 upstream acres that flow to Crane Creek and ultimately the IRL. The proposed pond will be located immediately adjacent to a major canal which conveys runoff from the West Melbourne area to Crane Creek and the
The pond will treat stormwater runoff with a combination of wet detention and media-based filtration (Bold and Gold shelf filter). The estimated nutrient load reduction water quality benefits to the IRL are 1,317 lbs/yr TN and 400 lbs/yr TP. The District cost-share amount was $485,747 of the $1,471,960 estimated construction cost. Construction is complete.

- **Monitoring and Data Sharing/Harmful Algal Blooms:**
  - Ocean Research & Conservation Association (ORCA) Satellite Algae Bloom and Nutrient Source Tracking - The research project is a pilot study to interpret satellite images with water quality data to attempt to identify nutrient sources and algal blooms. The District cost-share amount is $291,000 of the $291,000 estimated project cost. The project is in progress.

- **Wastewater/Impaired Waters:**
  - Brevard County Oak Point Park Sewer Conversion - The project involves the conversion of a 61-year-old package plant to central sewer. The package plant serves a 108-unit mobile home property located directly adjacent to the IRL. The estimated nutrient load reduction water quality benefit to the IRL are 186 lbs/year TN and 65 lbs/yr TP. The District cost-share amount is $350,000 of the $587,500 estimated construction cost. The project is under construction.

  - Brevard County South Central Zone C Septic-to-Sewer - The project includes abandonment of 142 residential septic tanks and connection to gravity sewer. The estimated nutrient load reduction water quality benefit to the IRL is 1,641 lbs/yr TN. The District cost-share amount is $1,166,820 of the $6,867,600 estimated construction cost. The project is under construction.
- **Environmental Learning Center Septic-to-Sewer** - The project includes removal of the existing Environmental Learning Center septic tank and replacing it with a private lift station which will be connected to an existing sewer main. The estimated nutrient load water quality benefit to the IRL is 24 lbs/yr of TN. The District cost-share amount was $63,732 of the $87,672 estimated construction cost. Construction is complete.

- **Indian River County North Sebastian Septic-to-Sewer: Phase 2** - The project includes the construction of approximately three miles of gravity sewer main, manholes, and a lift station. The project area encompasses a total of 180 parcels on septic systems in the North Sebastian area that will be connected to the gravity sewer main. The estimated nutrient load reduction water quality benefit to the IRL is 1,179 lbs/yr TN. The District cost-share amount is $1,346,517 of the $4,887,851 estimated construction cost. The project is under construction.

- **Indian River County West Wabasso Septic-to-Sewer: Phase 3** - The project includes converting 36 existing septic tanks to sewer. There are 61 total parcels in the project area and 36 parcels are developed with septic tanks. The 25 undeveloped parcels will provide a lateral stub out for future connection. A gravity sewer system will be installed and is 3,000 LF of 8" PVC gravity sewer, 13 manholes, service laterals, and two lift stations. All tanks will be abandoned, and laterals connected. The estimated nutrient reduction water quality benefit to the IRL for 36 tanks is 409 lbs/yr TN. The District cost-share amount is $1,250,000 of the $1,400,000 estimated construction cost. The project has not started construction.

- **Kashi Septic-to-Sewer** - The project includes the abandonment of 12 existing septic tanks and drainfields, installation of 3,000 linear feet of sewer pipes, 11 sanitary manholes, and connection to existing sewer at the north end of the property. The estimated nutrient load water quality benefit to the IRL is 139 lbs/yr TN. The District cost-share amount was $95,861 of the $290,488 estimated construction cost. Construction is complete.

- **Oak Hill Indian Harbor Estates Septic-to-Sewer Area 1** - Project includes the connection 280 homes to centralized sewer. Oak Hill Indian Harbor Estates is adjacent to the IRL will abandon septic tanks and connect to 10,600 linear feet of sewer line. The estimated nutrient load reduction water quality benefit to the IRL is 2,883 lbs/yr TN. The District cost-share amount is $2,500,000 of the $4,514,450 estimated construction cost. The project is under construction.

- **Ponce Inlet Ponce De Leon Circle Septic-to-Sewer** - The project includes construction of approximately 1,200 feet of 8-inch gravity sewer, 1,300 feet of force main, manholes, a lift station, and abandonment of up to 24 septic tanks and connection of those parcels to sanitary sewer in the Town of Ponce Inlet. The estimated nutrient load reduction water quality benefit to the Halifax River is 161 lbs/yr TN. The District cost-share amount is $807,206 of the $1,138,865 estimated construction cost. The project is under construction.

- **Sebastian Roseland Road Septic-to-Sewer** - The project includes construction of approximately 2,350 feet of 8-inch gravity sewer main; 11 manholes, a lift station, and removal of 13 septic tanks in direct proximity to the St. Sebastian River, which ultimately outfalls into the IRL. The estimated nutrient load reduction water quality benefit to the IRL is 150 lbs./yr TN. The District cost-share amount is $267,958 of the $803,874 estimated construction cost. The project is under construction.
- **Volusia County Smyrna Dunes Park Septic-to-Sewer** - The project consists of abandonment of the septic tank and drain-field wastewater system serving the public restroom facility located at Smyrna Dunes Park and installation of a lift station and sanitary sewer connection. The estimated nutrient load reduction water quality benefit to the IRL is 163 lbs/yr of TN. The District cost-share amount is $138,216 of the $313,400 estimated construction cost. The project is under construction.

- **West Melbourne Sylvan Drive Septic-to-Sewer** - The project involves the decommissioning of 59 residential septic systems near the M-1 Canal and connection to the central sewer system. The estimated nutrient load reduction water quality benefit to the IRL is 642 lbs/yr. The District cost-share amount was $674,629 of the $2,004,330 estimated construction cost. Construction is complete.

**FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION:**

- **Hydrology and Hydrodynamics/Wetlands:**
  - The Jensen Beach Impoundment is a 170-acre impounded mangrove wetland area that lies primarily within Martin County and is within the Jensen Beach to Jupiter Inlet Aquatic Preserve in the IRL. The purpose of the impoundment is to control *Aedes taeniorhynchus* mosquitoes while providing critical mangrove habitat in the IRL. However, in the aftermath of Hurricane Irma, over 50-acres of primarily red mangrove (*Rhizophora mangle*) habitat was lost from the impoundment due to high water levels and poor water quality, and the remaining mangroves continue to be stressed.
  
  In partnership with the County, FWC secured a $1M in NOAA Hurricane Irma Fisheries Disaster Grant funding in 2019 to restore and enhance the mangrove habitat by increasing flow to and within the impoundment. To date, four additional culverts have been installed, including one which connects the impoundment directly to the IRL (Photo 1). Removal of dead/decaying trees and accumulated sediments within the impoundment channels is expected to occur in the fall/winter of 2022/23.
• **Seagrass/Filter Feeders/Living Shorelines:**
  o Findings indicate that a long-term reduction in food availability within the Indian River Lagoon and other known manatee use areas was a contributing factor in the 2020-21 Unusual Mortality Event (UME) for manatees (*Trichechus manatus*) along the Atlantic Coast. In response to the UME, FWC worked with the U.S. Fish & Wildlife Service and other partners to explore both short- and long-term and small- and large-scale response options, including aquatic habitat restoration.
  o In June 2021, FWC surveyed agencies and organizations actively involved in aquatic habitat creation and/or restoration, either planned or ongoing, to solicit ideas for future efforts to restore and enhance manatee habitat along the Atlantic coast. Using that information, FWC hosted a virtual workshop in July 2021 during which sixteen (16) potential manatee habitat restoration projects, in various stages of development, implementation or conceptualization, were presented for consideration.
  o SB 2500 allocated $8 million in Fixed Capital Outlay (FCO) spending authority in non-recurring funds from the State’s General Revenue Fund to FWC’s Division of Habitat and Species Conservation for Fiscal Year 2021/2022. The funding was authorized to “restore manatee access to springs and provide habitat restoration in manatee concentrated areas.” Of the projects presented at the workshop, and including “shovel ready” springs projects ready to implement by FWC, seven (7) priority projects were identified for the legislative funding. Of these projects, five (5) are directly within the IRL including:
    - Blue Springs Manatee Warm-water Enhancement Project
    - Seagrass Nursery Network
    - IRL Clam & Seagrass Project
    - Satellite Beach IRL Submerged Lands Restoration Project
    - Mosquito Lagoon Living Shoreline & Oyster Restoration Project
  o Information about the selected projects and their progress can be found on [https://myfwc.com/wildlifehabitats/habitat/ahcr/manatee-projects/](https://myfwc.com/wildlifehabitats/habitat/ahcr/manatee-projects/). Funding for the above projects is to be encumbered by the end of 2022 and will be available for 3 to 5 years to complete the work.
  o In addition to the SB 2500 funding, the Fish & Wildlife Foundation of Florida has raised $867,000 to begin implementation of eelgrass (*Zostera marina*) revegetation projects in seven (7) areas within Goat Creek, Turkey Creek and Taylor Creek---all tributaries of the IRL. Plans are in place to restore submerged aquatic vegetation in additional tributaries, including the Northwest and Southwest Forks of the Loxahatchee River, Crane Creek, and North Fork of the St. Lucie River.
  o FWC provided engineering and design work for a living shoreline to replace a failing seawall at the new Riverside Conservancy Center in Edgewater, Volusia County. All necessary construction permits are in place, as well as a conservation easement along the shoreline. The Riverside Conservancy received a $107,000 ECHO grant through Volusia County for construction, which is anticipated to begin in early summer 2022.
  o FWC is working with the University of Central Florida and Marine Discovery Center to complete shoreline stabilization and reef restoration in Mosquito Lagoon. The team is evaluating alternative materials to plastic for both reef restoration and shoreline stabilization, to better understand material performance and feasibility in northern IRL conditions. Approximately 1000 linear feet of shoreline and 4-6 oyster reefs will be enhanced through this effort.
o FWC is working with the University of Central Florida, Marine Discovery Center, and the Marine Resources Council to stabilize 1500 feet of eroding shoreline in three different state parks. One of the segments, approximately 500 feet in length, is located in North Peninsula State Park, which falls within the IRL-Halifax Watershed boundary. The project utilizes only plastic-free restoration materials to create an oyster reef wave break, with native smooth cordgrass (*Spartina alterniflora*) and mangrove plants to reduce erosion along high energy segments of the Intracoastal Waterway. The project will compare oyster recruitment and growth, along with nekton use, of metal oyster bags as well as oyster “volcanoes” constructed of jute fiber with a thin coating of cement.

- **Spoil Islands:**
  o FWC led an effort with FDEP Aquatic Preserves program to quantify the public use of IRL spoil islands in anticipation of restoring or enhancing islands for ecological purposes. USFWS provided funding ($18,000) and FWC contracted the Marine Resources Council to survey visitors to various spoil islands on weekends and holidays. Surveys were completed in 2021, and the results will be incorporated in the next IRL Spoil Islands Management Plan.

- **Commercial and Recreational Fisheries/ Monitoring and Data Sharing/Biodiversity:**
  o FWC, since 1990, has ongoing monitoring of marine fisheries through fisheries independent, fisheries dependent, and life history projects for the assessment and management of fisheries resources ($300,000). In addition to fisheries monitoring, staff participate in weekly sampling of HABs in the IRL for our Harmful Algal group. FWC completed a one-year (2020), monthly monitoring program of finfish and macroinvertebrates in the Mosquito Lagoon. Merritt Island National Wildlife Refuge provided funds, Cape Canaveral NS and Florida Tech provided field staff to assist in these efforts ($72,000). The final report was completed in 2021.
  o FWC has been analyzing collected (2016-2018) fisheries-independent monitoring data to identify fish nursery habitats in the St. Lucie Estuary and Loxahatchee Rivers. South Florida Water Management District (SFWMD) provide funds to support this project ($18,000). The final report to SFWMD was completed in 2021. Results have shared via publication Stevens, P.W., R. Paperno, J.L. Beal, T.C. MacDonald, H.N. Miller, P.A. Klarmann, and C.R. Malinowski. 2022. Identifying fish habitat to help prioritize conservation and restoration projects in a coastal river. Environmental Biology of Fishes. https://doi.org/10.1007/s10641-022-01226-8.
  o **Goliath Grouper** (*Epinephelus itajara*): This is a multi-year (7-10 years) acoustic telemetry project started in 2017 that focuses on studying habitat utilization, movement patterns (seasonal and those associated with ontogenetic shifts), and responses to changing water conditions of juvenile goliath grouper along the east coast of Florida. As a companion to this effort, a genetic diversity study involving a network of commercial and recreational anglers was also initiated to investigate potential relationships between known spawning aggregations (both local and distant). To date, a large portion of this effort has been conducted in the St. Lucie River (SLR) and southern IRL areas.
  o **Spotted Seatrout** (*Cynoscion nebulosus*) and **Sheepshead** (*Archosargus probatocephalus*): The group is in the second year of a two-year acoustic telemetry project looking primarily at responses to changing water conditions associated with Everglades restoration efforts for two inshore fish species, spotted seatrout and sheepshead, in the St. Lucie River and southern IRL areas.
- Jensen Beach Impoundment (JBI): FWC, along with the Fish & Wildlife Research Institute (FWRI) and Florida Oceanographic Society (FOS), have been monitoring the impoundment to establish pre-construction baseline conditions, including water quality and flow, sediment quality and accumulation, and mangrove growth and recruitment on a quarterly basis. Utilization of the impoundment by juvenile gamefish is also being studied by FWC/FWRI. A total of four tarpon (*Megalops atlanticus*) and one common snook (*Centropomus undecimalis*) have been acoustically tagged and released within the impoundment to document recruitment and emigration of these species, as well as to determine the potential impacts of habitat restoration.

- **Fisheries/Citizen Engagement and Education:**
  - In 2021, FWC launched an intensive public engagement effort to inform the public on the results of FWC’s 2020 redfish stock assessment and gather feedback about the management of Florida redfish fishery. Consistently, stakeholders, including those that fish in the IRL, expressed concerns about their local fishing experience where were mostly driven by environmental conditions and local fishing effort. As a result, staff developed a new redfish management approach that incorporates a holistic review of ecological and human factors, as well as nine proposed management regions. In upcoming months, FWC will continue to evaluate the nine proposed management regions and will present proposed rule amendments to the FWC Commissioners. FWC also plans to host several in-person workshops around the state to gather feedback on the proposed management regions and rule amendments.
  - FWC’s saltwater aquatic education projects use curriculum-based programming often run by FWC partners to teach the public. The goal is to increase marine resource stewardship and ethical angling throughout Florida. Programs increase participants’ basic saltwater fishing skills, knowledge of fish handling and release techniques, heighten their awareness of personal responsibility toward Florida’s marine resources, increase their knowledge and understanding of Florida’s marine environment, and increase their
knowledge of saltwater fish populations and habitat conservation. Programs include Kids’ Fishing Clinics, Adult Fishing Clinics, Virtual Fishing Clinics, Youth Saltwater Fishing Camps, High School Fishing programs, web-based educational modules and tools, Aquatic Species Collection Workshops and the Monofilament Recovery and Recycling Program. To learn more, visit MyFWC.com/Marine and click on “Outreach & Education Programs.”

NASA KENNEDY SPACE CENTER (KSC):
CCMP Vital Signs: Multiple,
See the NASA Indian River Lagoon Health Initiative Plan at:

Indian River County Partners:

THE ENVIRONMENTAL LEARNING CENTER
CCMP Vital Signs: Citizen Engagement and Education, Living Shorelines
• Citizen Engagement and Education:
  o EcoAction speaker/fieldtrip series and the many community talks that ELC staff do on and off campus. ELC always talk about the Lagoon health issues and refer people to onelagoon.org for more info.
  o ELC houses environmental information from partners in our ecohub in the welcome center. ELC have native plants for sale and conducts monthly native plant walks. ELC also have native plant display gardens.
  o ELC have thousands of students (Schools, home schools and other groups) on campus learning about the Lagoon, canoeing, seining, mangrove forest walks, pond dip netting, visiting their aquariums and touch tank (in the newly renovated Discovery Station with its immersive flora and fauna habitat epoxy art flooring and interactive educational exhibits) all while learning about the Indian River Lagoon and it’s important place in our ecology. Same for the guided kayak trips and kayak rental program as well as the pontoon Eco Tours. ELC has a citizen science Mangrove observation station. ELC has nature art displays that rotate every other month and host social events for each, as well as art workshops always focusing on the native ecosystems.
  o ELC created a sustainability walk around the pond that talks about the global environmental issues and focus on water quality. ELC are the nature guides that share their knowledge with guests every day.
  o ELC has a Y-ELC Youth Environmental Leaders Corps volunteer group for 13 to 18-year-olds and their young entrepreneurs society all of who are learning about The importance of taking care of the environment, with particular focus on the IRL.
  o ELC created and facilitates the IRC Environmental Leaders Coalition. ELC shares onelagoon.org messaging on their social media. ELC talks about the health of the Indian River lagoon every day.
  o LagoonFest will be May 21, 2022 from 10-4. This will be in their new Education and Event Pavillion and Oval and they hope this venue creates a lot more opportunities to share helpful information with the community.
INDIAN RIVER COUNTY GOVERNMENT (Public Works, Utilities, Parks and Conservation): 
CCMP Vital Signs: Marinas and Boating, Citizen Engagement and Education, Trash Free Waters, Policy Considerations, Spoil Islands, Stormwater, Living Shorelines, Wetlands and Altered Marshes, Invasive Species

- Marinas and Boating:
  - Derelict Vessel Removal
    Derelict vessels have the potential to impact seagrass beds, spoil islands, oyster reefs, and personal property. Vessels may contain potential contaminants such as fuel and waste, which can enter the lagoon over time as the boat begins to deteriorate. Derelict vessels are not only damaging to the lagoon, but they are a public boating safety issue. Indian
River County has been spearheading the removal of derelict vessels within its boundaries of the Indian River Lagoon. Vessels have been removed from the water and spoil islands. Vessel removal is performed in accordance with Florida Fish and Wildlife's Best Management Practices for Derelict Vessel removal, with the vessels removed taken to the landfill for disposal. County staff remain on site to oversee the removal process. The county is currently under contract to remove an additional seven vessels in April 2022. County staff will continue to monitor derelict vessels slated for removal and pursue action to have the vessels removed in a timely manner.

Derelict Vessel Removal of an Abandoned Sailboat on the South Side of the Sebastian Inlet

- **Citizen Engagement and Education:**
  - Indian River County Storm Drain Awareness Art Project educates citizens on the importance of preventing pollution from entering storm drains. The drains are painted by local artists showcasing native species, with the slogan “Only Rain Down the Drain.” The artwork educates the public on the importance of keeping storm drains free of debris and pollution to prevent pollutants from entering the Indian River Lagoon. [https://www.ircgov.com/publicworks/stormwater/drains.htm](https://www.ircgov.com/publicworks/stormwater/drains.htm)
  - Stormwater Public Service Announcement (PSA) videos were created by the Stormwater Team of Indian River County. The PSA videos include topics covering storm drains, fertilizer, litter, dog waste, and algae. The videos are accessible to the public and are used as an outreach tool to keep citizen informed of ways they can help the Indian River Lagoon. [https://www.ircgov.com/publicworks/stormwater/PSA.htm](https://www.ircgov.com/publicworks/stormwater/PSA.htm)
  - The IRC Stormwater Educator utilizes an Enviroscape watershed model to walk students through the effects of nonpoint sources of pollution and how they can prevent pollutants from entering the lagoon when it rains. The students learn in depth about stormwater runoff and how it impacts the lagoon. The students are equipped with the knowledge of how they can help the lagoon by preventing pollution and by educating others to do the same.
Canals within the county received updated signs to keep the public aware of the connection the canals have to the lagoon. Sixty new “All Canals Lead to the Lagoon” signs replaced older faded signs along the canal systems. The signs are a reminder for the community to keep and prevent debris and pollutants from entering the canals and subsequently the Indian River Lagoon.
• **Trash Free Waters:**
  o **International Coastal Clean-up Day 2021** - In conjunction with Keep Indian River Beautiful, the Coastal Division participated in the 2021 International Coastal Clean-up day. Thirty citizens came out to assist in the efforts. Sixty pounds of trash was collected along the one mile stretch of the Wabasso Causeway. The most common items collected were cigarette butts, followed by plastic bottle caps and food wrappers. It was an excellent opportunity to engage local citizens and provide education on the impact of litter on the lagoon.

![Local Community Members Cleaning Up Litter Around the Wabasso Boat Ramp](image)

• **Policy Considerations:**
  o **Indian River County's Lagoon Management Plan** - IRC’s Lagoon Management Plan is a multi-phased approach in the county’s efforts to develop a management plan for the portion of the IRL located within the county. The research and review phase was completed in 2021. During the process, staff gained a better understanding of the issues impacting the county’s portion of the IRL. In addition, knowledge gaps in this region of the lagoon have been determined and the county is moving toward filling those gaps through additional research. Staff is currently moving forward with the plan development phase and once approved, the subsequent implementation phase will follow.

• **Wetlands/Stormwater/Living Shorelines:**
  o **Jones Pier Conservation Area** - Construction of the Jones’ Pier Conservation Area Wetland Restoration project was initiated in January 2020 to create a 4-acre herbaceous estuarine wetland on a Lagoon-front conservation area that was once an active citrus grove. In addition to created wetlands, the project includes restoration of a hydric forested hammock and creation of a living shoreline with breakwater. Water from the Lagoon is circulated through the created saltmarsh thereby providing water quality benefits and habitat for a variety of fish, wildlife and plants. This project creates open water and herbaceous wetlands in ruderal areas that were once dominated by highly invasive species such as Brazilian pepper and cogon grass. Construction of the wetland
and living shoreline has been completed. Final installation of plants within the interior of the saltmarsh is planned to be completed in May of 2022. Budgeted funds for the water quality improvement projects is $800,000.

- ** Spoil Islands/Invasive Species:**
  - Lost Tree Island Conservation Area - Lost Tree Island Conservation Area (LTICA) is a 508-acre site centrally located in the IRL. The site includes three main islands, a portion of an impoundment, and the smaller “outer islands.” The current project is the design and engineering of restoration plans for the three main islands: Duck Head Island (60.4 Acres), Earman Island (68.6 Acres) & Hog’s Head Island (48.4 Acres). The engineered
plans funded in part through a grant from the IRLNEP have been completed, and are in the process of submittal to regulatory agencies to obtain the required permits for construction. Design includes four community types including mangroves, saltmarsh, grass/shrub transition areas, and coastal hammock. The plans were designed with sustainability and resiliency in mind, ensuring that the created habitats will thrive for many future years. The County currently has funded over $1.8M towards the restoration efforts, with additional funding projected through future budget efforts and assistance from key project partners. Upland restoration on LTICA was initiated in February 2022, with clearing of exotics on Duck Head Island. Planting of these cleared uplands will be initiated in late summer 2022.

View of initiation of Exotics Removal on Duck Head Island

Overview of Restoration Design Plan

INDIAN RIVER LAND TRUST
CCMP Vital Signs: Land Conservation, Trash Free Waters, Citizen Engagement and Education, Commercial and Recreational Fisheries, and Wetlands and Altered Marshes:

- Land Conservation:
The Indian River Land Trust (IRLT) acquired 6 acres of forested uplands adjoining both its 220-acre Coastal Oaks Preserve and a 90-acre conservation tract owned by Indian River County. The 6 acres of undeveloped land are designated for commercial zoning and were being considered for a storage facility prior to purchase by IRLT. Private funds spent: $500,000.

- **Trash Free Waters:**
  IRLT conducted 3 trash cleanups along more than 2 miles of Lagoon shoreline. Nearly 30 volunteers spent 80 hours removing floatable trash and marine debris from the shoreline that amounted to 3 truck bed loads removed from the Lagoon.

- **Citizen Engagement and Education:**
  IRLT conducted 14 educational tours across 4 of its conservation properties, reaching nearly 150 people who learned about critical natural areas and wetlands and the native wildlife and plants that inhabit them.
  IRLT, in partnership with Florida Atlantic University’s Harbor Branch Oceanographic Institute (HBOI), conducted the Junior Scientist Fellows Program at its Coastal Oaks Preserve for 15 high school students from the School District of Indian River County. The students spent 3 hours at the property each Monday from mid-September through December conducting scientific research projects under the mentorship of faculty and staff at HBOI. Funds spent: $50,000.
Commercial and Recreational Fisheries/Wetlands and Altered Marshes:
IRLT, Dr. Jon Shenker (Ichthyological Research, Florida Atlantic University’s Harbor Branch Oceanographic Institute), and Dr. Aaron Adams (Bonefish and Tarpon Trust, Florida Atlantic University’s Harbor Branch Oceanographic Institute) are conducting a study to replicate the results of a previous study to show that an inexpensive modification to mosquito impoundment management can increase nursery productivity within managed mosquito impoundment wetlands. Our earlier study showed that the Rotational Impoundment Management strategy used for many mosquito control impoundments prevents juvenile snook and tarpon from leaving their initial nursery habitat during the summer months when they would typically do so. The study identified a simple and inexpensive impoundment management modification, a week-long “summer drawdown”, which enabled large numbers of juveniles of valuable recreational fishery species to leave the impoundment and join the fish populations in the wider IRL ecosystem. This study seeks to replicate and confirm the effectiveness of this modification in other impoundments, with the ultimate goal of boosting the fishery productivity of thousands of acres of impoundments in the Indian River Lagoon. The project entails tagging and tracking the movements of juvenile snook and tarpon near and through water exchange culverts between the impoundments and the Lagoon. If successful, mosquito impoundment managers and owners will have a simple tool to dramatically increase the production of juvenile sport fish at a modest expense. Grant and matching funds spent: $130,922.
St. Lucie County Partners:

SMITHSONIAN MARINE STATION AT FORT PIERCE (SMSFP):
CCMP Vital Signs: Monitoring and Data Sharing, Seagrass, Filter Feeders, Biodiversity
• **Seagrasses/Monitoring and Data Sharing**
  o Seagrass monitoring – MairneGEO monitors 3 seagrass sites annually within the vicinity of Ft. Pierce. SMS uses standardized protocols and have several partners around the world conducting simultaneous sampling. Protocols can be found at: [https://marinegeo.github.io/seagrass.html](https://marinegeo.github.io/seagrass.html) Sampling not only takes a rigorous approach to quantify seagrass characteristics but also the associated biodiversity that use seagrass as habitat (mesofauna), which is lacking on other seagrass programs around the IRL. SMS successfully completed monitoring at these sites in 2021.

• **Biodiversity/Monitoring and Data Sharing**
  o **Fouling community monitoring** – MarineGEO monitors 6 sites annually within the Ft. Pierce vicinity. Three of these sites are seagrass and 3 are artificial habitat (dock). SMS uses standardized protocols found at: [https://marinegeo.github.io/fouling-community.html](https://marinegeo.github.io/fouling-community.html) which are also used simultaneously around the world with SMS's partner sites. Fouling communities are photographed every 30 days for a total of 90 days during the summer and at which point are brought into the lab and processed for a detailed species list (including non-native identification) and biomass. Fouling communities monitoring was successfully completed in 2021.

  o **Indian River Lagoon Biodiversity and the IRL Species Inventory Update** (PIs: V. Paul and H. Sweat) The Indian River Lagoon Species Inventory is the leading open access source for information on the diversity of species and habitats of the IRL and associated ecosystems. Although the Smithsonian Marine Station has grown and improved the Inventory throughout the years with the help of the IRLNEP, many changes are necessary to revitalize this aging resource that first went online in 1999. This project is enhancing the IRL Species Inventory database and web platform by expanding it with additional species records, and by making it easier to access, navigate and update. With these renovations, the Inventory will be a reliable source for biodiversity information for students, teachers, scientists, resource managers, lawmakers and others as the state of the IRL continues to change. In 2020, all content on the preexisting Inventory was edited and migrated to a new data management system and made accessible at a new domain (IRLSpecies.org). In the past year, website styling and navigation was completely renovated to improve the user experience, a virtual tour of the IRL was added, and an occurrence data module was added with collection and observation data from a variety of expert sources. In 2022, additional content is being added to the occurrence data module, including records from SMSFP research projects and key data layers from FWC and the Florida DEP. The virtual tour is being expanded, photos are being added to help users identify common IRL plants and animals, and a feature story will be produced on the importance of long-term monitoring (IRLNEP: $25,000, October 1, 2021 - September 30, 2022).
• **Benthic Infauna and Environmental Monitoring in the Indian River Lagoon and the St. Lucie Estuary** (PIs: V. Paul and H. Sweat) Benthic infauna are important indicators of ecosystem change because they have limited mobility, reproduce quickly, and respond predictably to stress. As part of the Comprehensive Everglades Restoration Plan to restore more natural water flow across the Florida peninsula, SMSFP continues to monitor these sediment-dwelling fauna in a long-term study that began in 2005. The communities are studied in relation to changing water quality and sediment characteristics at 15 sites in the Indian River Lagoon and St. Lucie Estuary. By tracking abundance and diversity, infauna are used to help gauge overall ecosystem health as the restoration process and monitoring continues. Through statistical analyses and different taxonomic approaches, including DNA barcoding, particular species are being identified that serve as biological indicators of various ecosystem stressors. In 2021, a manuscript (Sweat et al. 2021, citation below) was published that provided a broad overview of 15 years of community change from nine key long-term monitoring sites. Work was also published on SMSFP infaunal monitoring that occurred as part of the IRL Algal Bloom Investigation in the northern IRL, Banana River and Mosquito Lagoon (Lunt et al. 2022, citation below; funded by SJRWMD). The first round of DNA barcoding was completed in 2021, resulting in 140 specimens successfully barcoded using the COI gene. These results include new records for the IRL Species Inventory and potentially new records for Florida. At five monitoring sites, eDNA surveys were conducted in collaboration with colleagues at the Smithsonian Environmental Research Center (Edgewater, Maryland) and National Museum of Natural History (Washington, D.C.) to optimize a protocol for using eDNA to supplement traditional monitoring techniques under a variety of coastal conditions. In 2022, DNA barcoding, eDNA metabarcoding and enhanced morphological identification continue in order to increase knowledge of infaunal biodiversity and distribution in response to environmental disturbances in the IRL system. (USACE for continued monitoring and
reporting: $142,461 for FY2022; additional support from the Donner Foundation for eDNA metabarcoding).


Monitoring in 2021 - 2022 (clockwise from top left): preparing to sieve a sediment grab for infauna, determining sediment color, documenting a nine-armed seastar (*Luidia senegalensis*) collected in a grab before releasing it, and baking sediment samples in a drying oven to determine water content.

- **Sponges of the Indian River Lagoon**: Uncovering the Biodiversity of a Unique Estuary (PIs: H. Sweat, I. Segura-García, V. Paul - SMSFP, A. Chaves Fonnegra, C. Díaz, S. Pomponi - HBOI) Although the Indian River Lagoon is often considered a particularly biodiverse estuary, records of sponges are lacking. Previous inventories of IRL sponges list roughly 50 species, but recent surveys estimate that the 156-mile long estuary supports 100-150 taxa. This project is surveying and identifying sponges throughout the IRL using traditional and modern genomics approaches, which will allow for a more accurate biodiversity assessment of these underrepresented and important filter feeders. In 2020 and 2021, 425 specimens were collected across a wide range of habitats from Ponce Inlet to Jupiter Inlet. Identifications are ongoing but work to date has uncovered approximately 100 sponge taxa, including nonnative and previously undescribed species. These results will be shared through peer-reviewed publications, an online sponge identification guide, and the IRL Species Inventory biodiversity database (IRLSpecies.org). (Smithsonian Global Genome Initiative: $8,779, March 1, 2020 - December 31, 2022; additional support from HBOI Foundation.)
• **Monitoring and Data Sharing/Filter Feeders**
  - Oyster reef monitoring – MarineGEO, with the help of DEP Aquatic Preserves monitors 6 oyster reefs annually within the Ft. Pierce vicinity. SMS uses standardized protocols, which can be found at: [https://marinegeo.github.io/oyster-reefs](https://marinegeo.github.io/oyster-reefs). These protocols are used simultaneously with partner sites around the east coast that focus on *Crassostrea virginica*. SMS samples both oyster demographics as well as associated biodiversity at 3 of the sites with highest oyster populations. SMS successfully completed their sampling in 2021.

• **Monitoring and Data Sharing**
  - Consumption assays – MarineGEO monitoring a variety of process-driven assays during our annual sampling. Of note, SMS monitors consumption rates (predation by fish on baited traps; “squidpops”) within several different habitats. Successful completion of such assays were completed in 2021. Standardized protocols can be found at: [https://figshare.com/articles/online_resource/MarineGEO_Predation_Assay_Protocol/14717802](https://figshare.com/articles/online_resource/MarineGEO_Predation_Assay_Protocol/14717802)
  - Photogrammetry and next-gen sequencing of marine fouling communities – MarineGEO initiated a stand-alone project in 2021 to examine the relationship between structural complexity of a community and its biodiversity. This was conducted within the IRL as well as 17 other sites around the world. SMS used photogrammetry to build 3D models of communities to estimate topographical complexity as well as used eDNA (CO1 and 18S) to sample communities for biodiversity. Structural complexity within the marine environment is a well-known factor in community composition, though it is unknown how biodiversity influences, and more importantly, maintains complexity through a positive feedback loop and supporting species co-existence. Though this is not especially beneficial to the IRL, applied ecological experiments using the IRL as a model system is particularly beneficial to the scientific community. The experiment was completed in 2021.

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**FLORIDA ATLANTIC UNIVERSITY – HARBOR BRANCH OCEANOGRAPHIC INSTITUTE**

CCMP Vital Signs: Monitoring and Data Sharing, Harmful Algal Blooms, Seagrasses, Species of Concern, Biodiversity, Contaminants of Concern, Citizen Engagement and Education

• **Monitoring and Data Sharing:**
  - *A Comprehensive Lagoon-wide Monitoring Plan for the Indian River Lagoon* (PI: D. Hanisak) HBOI is working with the IRLNEP Management Conference to develop a comprehensive lagoon-wide monitoring plan that identifies existing assets, gaps in data or analyses, emerging needs and opportunities, and specific recommendations for action. The participants above will form a Steering Committee to convene two workshops focused on monitoring, convert inputs from the workshops into guidance for the plan, and review the resulting draft IRL Monitoring Plan. Workshop participants will include local/regional researchers, technologists, data managers, planners, resource managers, and educators. (Indian River Lagoon National Estuarine Program: $75,000, October 1, 2019 to September 30, 2022)
  - *Development of a Novel Method to Determine Oceanic Particle Composition* (PI: Mike Twardowski) New methods to identify and characterize suspended particles are essential to better interpret optical measurements used as proxies in studying the IRL ecosystem. Measurements such as remotely sensed ocean color and in-water light scattering form the backbone of autonomous remote monitoring of water quality, HABs, light availability, and ecosystem health in the IRL by programs such as the CCHH and LOBO network. This
project is developing a new method to measure refractive index (RI) of suspended particles, closely related to particle density, a key property in defining dominant particle type. No such method exists as a baseline reference, so efforts to determine particle composition from light scattering measurements are ambiguous without validation. The proposed technique is phase-retrieval holography, simultaneously providing both size and RI of all particles in a given sample volume. (Save Our Seas Florida specialty license plate sales granted by the HBOI Foundation: $35,000, July 1, 2019 to June 30, 2021)

- **Development of the Florida Center for Coastal and Human Health** (PI: A. Wright) The Center will define connections between ecosystem changes from the macro to micro scale using direct sampling, remote sensing, novel genomics, metabolomics and informatics analyses coupled to toxicity testing and assessment of trophic and human impacts. The long-term goal of the Center is to develop predictive models for coastal ecosystem dynamics related to ecosystem and human health. The focus of the current project is on defining the drivers of HAB initiation, toxicity, and collapse with a goal of reducing HAB events having adverse health and economic impacts. (HBOI Foundation, two awards: July 1, 2019 to June 30, 2020, $861,797, July 1, 2020 to June 30, 2022)

- **Enhancement and Expansion of HBOI’s Indian River Lagoon Observatory Network of Environmental Sensors (IRLON)** (PI: D. Hanisak) – The purpose of this project is to strengthen and expand the existing capabilities of the Indian River Lagoon Observatory Network of Environmental Sensors (IRLON; www.irlon.org) which will allow HBOI the opportunity to: evaluate and address existing challenges with IRLON, add new technical capabilities to the existing IRLON sites to address emerging issues of the health of the Indian River Lagoon (IRL), add new utility to the IRLON website that will facilitate how users can better understand the data being generated in terms of health of the Lagoon, and expand the scope and impact of IRLON by adding three new sites in Brevard County. (HBOI Foundation, two awards: $500,000, January 1, 2020 to June 30, 2020, $865,788, July 1, 2020 to June 30, 2022)

- **Land/Ocean Biogeochemical Observatories (LOBOs) for Water Quality Sampling in the St. Lucie Estuary and Indian River Lagoon** (PI: D. Hanisak) This project supports five IRLON real-time water quality and weather stations in the St. Lucie Estuary (SLE) and nearby IRL. These data provide scientists of various disciplines from many organizations reliable, continuous observatory data to better quantify and model relationships between environmental factors and biological processes in the SLE and IRL. The data can also be used to follow the outcome of changes related to recovery measures and assist resource and policy managers with decision making. (Florida Department of Environmental Protection, two awards: $350,000, July 1, 2020 to June 30, 2021; $350,000, July 1, 2021 to June 30, 2022)

- **The Indian River Lagoon Observatory (IRLO): Ecosystem Function of a Nationally Important Estuary in Transition** (PI: D. Hanisak) IRLO’s key elements are: a network of advanced observing stations; collaboration among organizations; and long-term, ecosystem-based research. IRLO operates IRLON, IRLO’s Network of Environmental Sensors [Land/Ocean Biogeochemical Observatory (LOBO) units and weather sensors], to provide real-time, high-accuracy, high-resolution water quality/weather data; organizes and conducts the annual IRL Symposium, a forum to narrow gaps between IRL research and its management applications; and conducts research on the relationships of water quality, macroalgae, and seagrass. IRLO is a signature program for research, education, outreach, and development efforts at FAU and has been substantially leveraged by successful grantsmanship and collaborations. In FY2020, we will build on these efforts, with enhancements in data delivery and visualizations for IRLON data users and a procedure for identifying and tracking all data downloads and resulting products by our community
of stakeholders. \textit{(Save Our Seas} Florida specialty license plate sales granted by the HBOI Foundation: $592,891, July 1, 2020 to June 30, 2022\textit{)}

**Seagrasses:**

- \textit{A Demonstration Project for Seagrass Restoration in the Indian River Lagoon Based on Ruppia maritima (Widgeon Grass)} (PI: D. Hanisak) This research will contribute to the restoration of seagrass in the Indian River Lagoon (IRL) with an innovative project that will focus on the pioneering seagrass species, \textit{Ruppia maritima} (widgeon grass). \textit{Ruppia} plants will be utilized from a natural population located at the Bee Gum Point property, which is owned and maintained by the Indian River Land Trust to (1) field-test the survival and growth of \textit{Ruppia} in the IRL which has suffered large losses of seagrass since 2011 and (2) serve as inocula into the Harbor Branch Seagrass Nursery to develop a sustainable supply of this species for continued restoration efforts in the IRL. This project will (1) help restore the biological diversity, functional integrity, and productivity of the IRL, given the critical role that seagrasses play in supporting the growth of fish and invertebrates, and (2) expand public involvement and increase activities designed to protect and restore the resources of the IRL through the use of citizen scientists and public outreach. (U.S. Fish and Wildlife Services: $99,962, October 1, 2020 to September 30, 2023)

- \textit{Samsons Island Submerged Lands Restoration (SISLR), City of Satellite Beach} (PI: Dennis Hanisak) FAU Harbor Branch assisted with the seagrass restoration at the Samson’s Island Submerged Lands Restoration by transplanting shoots of HBOI seagrass nursery plants (\textit{Halodule wrightii}) and conducting the initial monitoring of the transplanted seagrass. (Sub-award from Indian River Lagoon National Estuarine Program through the City of Satellite Beach: $22,000, January 1, 2021 to September 30, 2021)

- \textit{Synoptic Assessment of the Indian River Lagoon Light Field for Seagrass Restoration Using Satellite Remote} (PI: M. Twardowski) Multi-spectral passive remote sensing imagery from new high-resolution Sentinel and Landsat imagers will be used to map vertical light attenuation (K) throughout the Lagoon (from Ponce to Jupiter Inlet) at a resolution of 10 m spatially and ~5 days temporally. Existing algorithms for K will be refined with extensive in situ optical measurements using state-of-the-art optical instrumentation during three seasonal surveys. Resulting maps of K will be combined with bathymetry maps to provide IRL-wide contour maps showing percent surface irradiance at the bottom (%Es), which will be synthesized with seagrass light requirements to assess suitable seagrass habitat. Map deliverables will fill a gap in knowledge for high spatial resolution data on light availability for seagrasses throughout the lagoon, providing needed input to assess optimal IRL locations for ongoing and future seagrass restoration and related management efforts, such as assessing impacts of water quality improvements. The algorithm deliverable will also be ready to implement for ongoing assessment after project completion. (HBOI & River Branch Foundations: $109,442, October 1, 2018 to September 30, 2021)

**Harmful Algal Blooms:**

- \textit{An In Situ Imaging System for Characterizing Toxin-Generating Blooms Affecting Dolphin Community Health} (PI: Bing Ouyang) The IRL, which spans 40% of Florida’s eastern coast, is one of the most species-diverse estuaries in North America. However, this ecosystem is being degraded over time (eutrophication, “dead zones”, algal blooms, etc.), which increase the distribution and intensity of hypoxia (low dissolved oxygen). In the last decade, several ‘fish kill’ events occurred in the IRL to hypoxic conditions (i.e., March 2016, March 2018, and November 2020. When coastal hypoxia happens in the IRL, it is
evident to the public that such an event is harmful for adult fish, as shocking “fish kill”
events can cover miles of water with fish carcasses. However, the effect of hypoxia on
early life stages (eggs and larvae) and its relationship to their development, hatching, or
future recruitment of the species has not been extensively studied. (HBOI Foundation:
$51,523, July 1, 2021 to June 30, 2022)

- **Indian River Lagoon Microalgae and Harmful Algal Bloom Monitoring – South Stations** (PI: M. MacFarland) Harmful algal blooms (HABs) are major threats to the health and stability of the Indian River Lagoon (IRL), and directly or indirectly impact the integrity of many key components of the ecosystem, including seagrasses, drift algae, benthic invertebrates (e.g. clams and oysters), fish and marine mammals. In addition, HABs can negatively impact commercially and recreationally important human uses of the IRL and can directly affect human health via the production of toxins. In this study, a network of ten strategically placed sites that span the IRL from the Mosquito Lagoon to the St. Lucie Estuary will be sampled twice per month and analyzed for phytoplankton composition, abundance, biovolume and biomass, including the identification of HAB species. (Indian River Lagoon National Estuarine Program, two awards: $50,000, October 1, 2020 to September 30, 2021, $75,000, October 1, 2021 to September 30, 2022)

- **Integrated Sampling to Assess Toxins Produced by Harmful Algal Blooms in the Indian River Lagoon** (PI: Mike Twardowski) This research documents temporal variability in toxin concentrations from Harmful Algal Blooms in the Northern Indian River Lagoon, Banana River Lagoon, and Mosquito Lagoon and combines them with data on environmental conditions to identify biogeochemical drivers of toxin production. Currently, toxins are not analyzed as part of ambient water quality surveys, and adaptive sampling of blooms may miss periods when toxins are produced. Solid Phase Adsorption Toxin Testing (SPATT) bags will be deployed on existing water quality towers maintained by the St. Johns River Water Management District. These SPATT bags will integrate exposure to toxins over one-month periods. Targeted toxins will be selected using information on blooms reported during deployments. Multivariate statistical models will be used to identify associations between integrated toxin concentrations and potential biogeochemical drivers. Overall, monthly deployments of SPATT bags will provide insights into the presence of toxins, correlations between toxicity and ambient conditions that can inform management, and valuable information on the cost:benefit ratio associated with a network to monitor toxins. (Indian River Lagoon National Estuarine Program: $68,267, October 1, 2021 to September 30, 2022)

- **Integrating Harmful Algal Bloom (HAB) Data across Platforms and Establishing a Virtual HAB Information Center** (PI: D. Hanisak) FAU Harbor Branch serve as an IRL Council teammate to provide important Harmful Algal Bloom (HAB) data measured from the IRLON network. The current provisional data will be QA/QC’ed to become trusted data. These data will be integral to the sessions in the GeoCollaborate Instance #2 Communicating the Bloom – IRL HAB Hindcast, and Instance #3 Emergency Response and Planning. (IRL Council: $124,582, June 2, 2021 to February 28, 2023)

- **Environmental Hypoxia in the Indian River Lagoon (IRL) and its Effects on Native Fish Species during Early Development** (PI: Bing Ouyang) Both Florida coasts and the Indian River Lagoon (IRL) are home to a significant population of bottlenose dolphins (*Tursiops truncatus*). Previous studies have shown that these communities are vulnerable to increasing incidences of harmful algal blooms (HABs) of different phytoplankton species. A novel approach to develop an integrated in situ holography-cum-fluorescence imaging system to characterize HAB causing phytoplankton is proposed. Digital holographic microscopy provides information on the characteristics and spatial distributions of particles/organisms and their motion within the given sampling volume, while
fluorescence imaging can detect the presence of chlorophyll within phytoplankton populations. Uniquely, combining both techniques can create an instrument with the ability to simultaneously image and discriminate between living/non-living cells. This would allow scientists, for example, to establish the variations in the ratio of living to dead cells within a bloom. (HBOI Foundation: $51,523, July 1, 2021 to June 30, 2022)

- **Biodiversity:**
  - *Exploring and Preserving the Biodiversity of Sponges in the Indian River Lagoon* (PI: S. Pomponi) There have been ecological studies of the IRL that have included sponges, but these studies have been restricted to certain habitats (e.g., mangroves) and only in a few areas of the IRL. This project will be the first comprehensive base-line study of sponge biodiversity in the IRL. These data will contribute to a better understanding of IRL ecosystem diversity, which will be needed for future restoration initiatives. (*Save Our Seas* Florida specialty license plate sales granted by the HBOI Foundation: $120,000, July 1, 2020 to June 30, 2022)
  - *Linking the Harbor Branch Oceanographic Museum (HBOM) to the Indian River Lagoon Species Inventory* (PI: M.D. Hanisak) The Indian River Lagoon is facing many perilous challenges, including climate change, pollution, population growth, habitat fragmentation, and exotic species invasions. Species collected nearly 50 years ago are an important baseline to determine IRL biodiversity. In addition to the scientific use of the HBOM data and images, resource managers, lawmakers, and the public must be kept aware of what is at risk of being lost forever. (HBOI Foundation, $40,000, July 1, 2020 to June 30, 2022)

- **Contaminants of Concern/Species of Concern:**
  - *Observation and Modeling of Hg Distributions in the Indian River Lagoon for Protecting Wild Dolphin* (PI: M. Jiang) The topic of animal and human exposure to Hg and other metals in the IRL has received significant attention recently. This study will represent the first systematic effort to not only provide more information about Hg distributions and speciation, but also to document the sources and to understand the key processes that control these distributions. The resulting Hg transport model will synthesize this information into a predictive model to facilitate management applications. The model results can be used to evaluate dolphin Hg exposure in the IRL in conjunction with dolphin movement data from HBOI dolphin monitoring program. The model can be further developed to simulate other metals, bacteria, and other containment (e.g. microplastic). Application of such a model can also help research on trophic transfer and accumulation of Hg and other metals in apex predators in the IRL. (*Protect Wild Dolphins* Florida specialty license plate sales granted by the HBOI Foundation: $300,000, July 1, 2020 to June 30, 2022)
  - *The Indian River Lagoon Observatory (IRLO): Addressing Emerging Environmental Issues in a Nationally Significant Estuary* (PI: D. Hanisak) IRLO’s key elements are: a network of advanced observing stations; long-term, ecosystem-based research; and collaboration among organizations. IRLO operates the IRLO Network of Environmental Sensors (IRLON) to provide real-time, high-accuracy, high-resolution water quality/weather data; conducts research on the relationships of water quality, macroalgae, and seagrass; and organizes and conducts the IRL Symposium, a forum to narrow gaps between IRL research and its management applications. IRLO is a signature program for research, education, and outreach efforts at FAU and has been substantially leveraged by successful grantsmanship and collaborations. In FY2022, we will continue to build on these efforts, capitalizing on IRLON’s capabilities that address two emerging IRL issues (harmful algal blooms and coastal acidification). These efforts will be significantly leveraged by our grantsmanship
and expanded collaboration with internal and external researchers and management agencies. *(Save Our Seas Florida specialty license plate sales granted by the HBOI Foundation: $610,181, July 1, 2021 to June 30, 2022)*

- **Species of Concern:**
  - *Dolphin Spotter: A New Land-based Citizen Science Program* (PI: G. Barbarite) Photo identification is a non-invasive, opportunistic method that can be used to better understand the ecology, behavior, and distribution of wild dolphins. FAU Harbor Branch’s Stranding and Population Assessment Team regularly conducts surveys of dolphins living in the Indian River Lagoon and maintains a database to support research efforts. We seek to complement and expand upon this work by establishing a new “Dolphin Spotter” citizen science program. Through this initiative, members of the public will be encouraged to submit observations and photos that have been taken on their personal cellphones or cameras while viewing dolphins from shore. This proposal aims only to support the outreach and community engagement component of this project, all photos and data will be managed through existing efforts. *(Protect Wild Dolphins Florida specialty license plate sales granted by the HBOI Foundation: $54,430, July 1, 2021 to June 30, 2022)*
  - *HBOI’s Florida Dolphins Stranding and Population Assessment Program* (PI: S. Burton) The FAU HBOI stranding and population assessment program will respond to stranded or entangled dolphins and participate in rescues/interventions along the east coast of Florida and throughout the state. In addition, the team will perform population assessments using proven photo identification techniques and new technologies. These activities are authorized through the U.S. National Marine Fisheries Service (NMFS). Educational and outreach activities including presentations and attendance at environment fairs are also conducted by the team. *(Protect Wild Dolphins Florida specialty license plate sales granted by the HBOI Foundation, two awards: $260,266, January 1, 2020 to June 30, 2021: $956,890, July 1, 2020 to June 30, 2022)*
  - *Impacts of Disturbance, Disease, and Environmental Degradation on Estuarine and Oceanic Wild Florida Dolphins* (PI: Greg O’Corry-Crowe) Our research and publications on bottlenose dolphins in the Indian River Lagoon and Florida’s Atlantic coast have demonstrated: (1) population structure between estuarine and oceanic environments, (2) a chain of discrete social communities in IRL dolphins, (3) different movement patterns and habitat preferences between individuals, (4) movement of IRL dolphins into the ocean, freshwater canals and rivers, and (5) unique immunogenetic profiles between individuals. Other HBOI-FAU research is revealing that environmental impacts are not uniformly distributed within the IRL. Individual dolphins, distinct communities, and discrete populations may be exposed to and impacted by environmental challenges differently, such as harmful algal blooms, point sources of pollution, microplastics, and disturbance from human activities. Responses are also likely to vary; therefore, risk assessments must be conducted at the individual, community, and population level. We propose to build on this research by combining emerging technologies, including eDNA and microbiome studies with genomic profiling, with detailed field sampling and other HBOI-SLP funded studies on health, strandings, stock assessment, and photo-ID. We also propose to investigate the lesser studied species of dolphins in Florida waters, including analyses of pelagic dolphin strandings. This component will be integrated with a separate study using wave gliders and PAM to monitor dolphin species and their prey, and to map their environment along Florida’s coast. Part of our work will focus on the impacts of the demolition of the old Fort Pierce bridge and construction of the new bridge on dolphins. We will initiate comparative studies with the Sarasota dolphin project. We will produce educational videos of researchers and their work for public outreach. *(Protect Wild*
Dolphins Florida specialty license plate sales granted by the HBOI Foundation: $226,797, July 1, 2021 to June 30, 2022

- Marine Mammal Pathology, Tissue Archives, and Database (PI: Annie Page-Karjian) The marine mammal program at FAU Harbor Branch provides an on-call response network for stranded marine mammals in Florida. For each dolphin in our response area that dies, a gross necropsy is performed, along with a suite of histopathological analyses and ancillary diagnostics, as appropriate. Multiple representative tissue samples, along with in-depth biological data, are collected from each animal and stored. These samples and data are used to inform and support ongoing research, and form the foundation of the FAU Harbor Branch marine mammal stranding database and tissue archives. (Protect Wild Dolphins Florida specialty license plate sales granted by the HBOI Foundation, two awards: $37,879, January 1, 2020 to June 30, 2020; $76,000, July 1, 2020 to June 30, 2022)

- Citizen Engagement and Education:
  - HBOI works to foster IRL research via the annual Indian River Lagoon Symposium (IRLS), which it hosts and organizes as part of a multi-institution steering committee. The IRLS attracts over 300 scientists, resource managers, and students, and provides a forum for all researchers and agencies working in the IRL to share research findings and discuss challenges and opportunities. The program and abstracts for all of the symposia (2012-2021) are available at: http://indianriverlagoon.org/symposium.html.
  - The breadth of HBOI IRL research is reflected in its Mission: Ocean Discovery public outreach program, which includes:
    - Ocean Science Lecture Series, a forum for HBOI researchers and guest speakers to inform the public about their work.
    - the Ocean Discovery Visitor’s Center, a museum-style visitor center that features interpretations of HBOI research and nearby marine environments including the IRL via a continually evolving array of interactive exhibits, small live animal tanks, video, and other displays.
    - the Immersion Tour program, which offers visitors an up-close look at the HBOI site and its laboratories.
    - the Indian River Lagoon Research Boat Tour, an opportunity for the public to learn about the IRL, relevant research, and wildlife encountered.
    - the Ocean Discovery Experience, an off-site after-school program that introduces children (ages 9-12) in underserved communities to marine science.
    - DNAngler, a citizen science project designed to engage the community in innovative molecular techniques used to detect different fish species in the water.
  - Another outreach tool is the IRL video, an overview of the estuary and some of the ways HBOI is investigating its challenges. (www.youtube.com/watch?v=1v6KlaUA18Q&list=UU6YvxeMtmn-a5NhMKvk-Jg).
  - The IRL also is an integral part of the curricula for HBOI educational programming, which includes:
    - FAU College of Science and HBOI Semester By The Sea, a semester-long undergraduate immersion in marine science located at HBOI.
    - graduate student training for FAU students pursuing advanced degrees in biological and environmental sciences, including a new Marine Science & Oceanography M.S degree that was launched in August 2017, with initial graduates in May 2019.
    - Harbor Branch Summer Intern Program, a competitive program that attracts top undergraduate and graduate students worldwide for a 10-week immersion in marine science and engineering projects.
- **Marine and Oceanographic Academy**, a magnet high school program located at HBOI associated with Fort Pierce Westwood Academy and created in partnership with the St. Lucie County School District;
- **Lincoln Park Academy Harborside**, a another partnership with the St. Lucie County School District which brings juniors and seniors in Lincoln Park Academy's International Baccalaureate Program to FAU Harbor Branch for classes that include lectures, labs, and field activities.
- FAU Pine Jog’s and HBOI’s **H2o to Go Summer Research Institute**, a week-long, residential research institute for high school students focused on the interconnectedness and complexity of South Florida water systems and the environmental issues facing them.
- The **Indian River County Junior Scientists Fellows Program**, a HBOI partnership with the Indian River Land Trust to engage high school students in the research and care of an environmentally sensitive, 185-acre preserve.

**DEPARTMENT OF AGRICULTURE AND CONSUMER SERVICES (FDACS):**

**CCMP Vital Signs:** *Wetlands, Land Conservation, Stormwater, Wastewater, Impaired Waters, Citizen Engagement and Education.*

- **Wetlands/land conservation:**
  - Agricultural Producers in the IRL basin have partnered with FDACS via 21 cost share projects to install exclusion fences to protect water resources and improve water quality leaving their site.

- **Stormwater/Wastewater/Impaired Waters:**
  - Agricultural Producers in the basin have partnered with FDACS via cost share projects to install culverts, exclusion fences, pipe and riser structures, etc. to protect water resources and reduce nutrient runoff.
  - Agricultural Producers in the basin have partnered with FDACS via cost share projects to implement precision agricultural practices in the IRL basin to ensure appropriate nutrient application and reduce nutrient runoff.
  - Agricultural Producers in the IRL NEP basin have enrolled 335,231 acres (73% of all agricultural lands in the basin) in the FDACS BMP programs.
  - As a coordinating agency, FDACS support DEP in the implementation of BMAPs by tracking progress with enrollment and implementation of agricultural BMPs, verifying implementation of agricultural BMPs and assists DEP with compliance and enforcement challenges. The load reductions achieved by Agricultural Producers through the implementation of agricultural BMPs within the Indian River Lagoon BMAP and the St. Lucie BMAP can be found in FDEP's BMAP reports located at [https://floridadep.gov/dear/water-quality-restoration/content/basin-management-action-plans-bmaps](https://floridadep.gov/dear/water-quality-restoration/content/basin-management-action-plans-bmaps)

- **Science and Technology Innovation:**
  - FDACS OAWP supports research to provide the scientific and technical justification for the BMP program and to investigate new, innovative practices that improve and quantify nutrient and irrigation use efficiencies. Studies must address at least one OAWP research priority. OAWP’s research priorities and proposals are reviewed annually by a working group comprised of agricultural industry representatives, federal and state agencies, educational institutions, and other stakeholder partners. For more information, visit the FDACS BMP Research website: [https://www.fdacs.gov/Agriculture-Industry/Water/Agricultural-Best-Management-Practices/BMP-Research](https://www.fdacs.gov/Agriculture-Industry/Water/Agricultural-Best-Management-Practices/BMP-Research)
• **Citizen Engagement and Education:**
  - FDACS works with producers, industry groups, and University of Florida Extension agents enrolling producers, conducting IVs, and educating producers regarding BMP implementation.
  - **BMP Enrollment**
    - To enroll in the FDACS BMP program, agricultural landowners and producers must meet with an OAWP representative on site to determine the commodity manual and BMPs that are applicable to their operation(s), and then collaborate with the OAWP representative to complete a Notice of Intent to Implement the BMPs (NOI) and the BMP checklist from the BMP manual. Because many agricultural operations are diverse and are engaged in the production of multiple commodities, a landowner or producer may submit multiple NOIs for a single parcel.
    - The process of enrolling agricultural landowners and producers in the BMP program requires site visits to determine the water resource concerns on site and in the surrounding area, evaluation of production methods and activities, documentation of parcel information, as well as site mapping, and data entry. BMP program enrollment efforts initially focused on higher intensity agricultural operations such as nurseries and dairies, irrigated acreage, and on parcels greater than 50 acres to achieve the greatest benefits to water resources. In recent years, smaller, bona fide agricultural operations have come into focus. OAWP continues to prioritize enrollments within BMAP areas, specifically those identified in SB 712 such as the Indian River Lagoon watershed, and those properties where enrollment and proper implementation of the Applicable BMPs will achieve the greatest benefits to water resources from nutrient reduction.
    - Within the IRL NEP there around 460,700 acres of agriculture. As of April 2022, approximately 335,231 of these acres are enrolled the FDACS BMP program. The majority of the agricultural acres and enrollments are in St. Lucie and Martin counties.
  - **BMP Implementation Verification**
    - FDACS is required to verify that agricultural landowners and producers are properly implementing the Applicable BMPs identified in their NOIs. SB 712 established the requirement for FDACS to conduct IV site visits every two years to verify proper implementation of BMPs and to retain records related to the application of nitrogen and phosphorus nutrient sources. During an IV site visit, FDACS representatives evaluate nutrient management, irrigation management, and water resource protection BMPs to verify their proper implementation on the enrolled property and review the required records that producers must maintain to demonstrate compliance with the BMPs. The FDACS representative and agricultural landowner or producer may also identify additional Applicable BMPs to be implemented moving forward; cost-share opportunities for BMPs or other practices and projects; and discuss topics related to water quality, water conservation, BMAPs and BMP requirements, or changes in the BMP program. At the conclusion of or within a short period after completion of the IV site visit, the OAWP representative provides the landowner or producer with a list of any additional Applicable BMPs that were identified during the IV site visit; any corrective actions to be undertaken; timeframes for completion; and any opportunities for cost share for eligible practices or projects on the property. The landowner or producer is required to acknowledge receipt of this information and will execute a new BMP checklist or corrective action form identifying any additional BMP or corrective actions.
Cost-Share Funding for BMPs
- Enrolled producers are eligible to receive funds from FDACS to implement certain BMPs based on evaluation and approval of the operation and availability of funding. The BMP cost-share program has greatly enhanced the implementation of BMPs and other practices and projects in priority areas and included large-scale innovative technologies. Agricultural technology and precision nutrient application methods are often more expensive than traditional fertilizer broadcasting or irrigation methods, making these practices cost-prohibitive for many producers. It is imperative that innovative agricultural production methods are available to producers so that they can meet water quality goals while remaining financially viable. Providing cost-share for some of the expense to implement nutrient and irrigation reduction methods enables FDACS to assist producers with improving nutrient use efficiency by reducing inputs, and conserving water.
- 260 cost share projects have been granted to grow agricultural growers within the IRL NEP.
- Most of the projects cot shared are structures for water control and automated/precision irrigation.

HWTTS
- The Hybrid Wetland Treatment Technology (HWTT) is a complete system that integrates best aspects of chemical and wetland treatment technologies. A primary means of analyzing the technical capabilities of this system is through study of its effectiveness in removing phosphorus.
- There are 3 HWTT projects within the IRL NEP, Bessey Creek, Danforth Creek, and Ideal Grove.
- Danforth: This system is situated on nine acres of land adjacent to an existing 11-acre storm-water project (referred to as Danforth Creek Phase I STA) owned by Martin County. The site lies within Section 23, Township 38S, Range 40E, encompassing Tract 35 of the Palm City Farms Subdivision. The system contains two parallel contact ponds, a settling pond, and downstream Floating Aquatic Vegetation and Submerged Aquatic Vegetative wetlands. This facility treats approximately 35% to 55% of the total annual runoff originating from an estimated 2,300 acres of urban and agricultural land located upstream of the project site.
- Bessey Creek: This system is located south of Citrus Boulevard, approximately one mile north of SR 714 in Martin County, on twenty-three acres of county-owned land within Section 10, Township 38 South, Range 40 East. The HWTT system is situated within the western portion of the Western Palm City Corridor (WPCC), formally designated as a wetland treatment system serving 305 acres of the Bessey Creek Watershed.
- Ideal Grove: situated within an irrigated citrus grove in western St. Lucie County. The small canal to the north of the treatment system ("North Canal") serves as a collector ditch for grove runoff and groundwater. Due to fertilizer usage in the grove, the water in the collection canals is nutrient-enriched. A large regional canal (the "Rim Ditch") immediately west of the grove site serves as a pumped supply of water to the canal that runs along the south side ("South Canal") of the treatment facility. This relatively large canal carries Rim Ditch water from west to east, and then a lateral canal flows about 0.5 miles north to a grove irrigation pump, which feeds water into drip irrigation emitters throughout the grove. The system consists of a 0.7-acre pond, equipped with both shallow and deep zones, that was initially divided into equal size parallel flow paths with a flexible boom and barrier.
Martin County Partners:

MARTIN COUNTY GOVERNMENT (PUBLIC WORKS DEPARTMENT):
CCMP Vital Signs: Citizen Engagement and Education, Seagrasses, Living Shorelines

- **Citizen Engagement and Education**
  - The Water Ambassador Education program has continued during the reporting period.

- **Seagrasses**
  - The County is working with FWC and other partners to identify areas in the IRL that would be potentially viable for a seagrass restoration project. A design proposal is expected to be submitted in the near future.

- **Living Shorelines**
  - **Indian River Lagoon Hybrid Living Shoreline at Indian Riverside Park** - The County is currently in the design phase of developing a resilient living shoreline at Indian Riverside Park that will stabilize the shoreline, support a wide variety of species, and provide an example of the benefits of nature-based solutions. This project includes design, engineering, permitting, and construction of segmented rock breakwaters placed ~75-150 ft offshore across a ~2500-ft section of shoreline. By reducing onshore wave energy, the breakwaters promote mangrove growth and decrease turbidity, increasing the likelihood of success of seagrass recruitment, such as the endangered Johnson’s seagrass (Halophila johnsonii).

CITY OF STUART:
CCMP Vital Signs: Stormwater, Living Shorelines

- **Stormwater**
  - **Tressler Drive Water Quality Improvement Project** – Construction for the Tressler Drive Water Quality Improvement Project is anticipated to commence in May 2022. The project will redirect stormwater runoff to a treatment train, where a baffle box will provide nutrient and sediment removal. The baffle box will discharge to a bioswale, which will provide retention and removal of additional nutrients and sediment prior to discharge to Poppleton Creek and ultimately to the St. Lucie River. It is estimated that 40.92 pounds per year of Total Nitrogen (TN) and 7.67 pounds per year of Total Phosphorus (TP) will be kept from entering the lagoon.

- **Living Shorelines**
  - **SE Illinois Avenue Living Shoreline Demonstration Project** – The project design is anticipated to commence in May 2022. The project consists of a living shoreline that will protect against erosion and provide habitat for marine species and wading birds. The living shoreline plantings will also provide nutrient removal from the existing stormwater discharge entering the St. Lucie River at this location. A buffered shoreline will be constructed at the north end of SE Illinois Avenue to provide filtration for stormwater runoff from the northern portion of the SE Illinois Avenue right-of-way and adjacent properties. It is estimated that 18.77 pounds per year of Total Nitrogen (TN) and 2.82 pounds per year of Total Phosphorus (TP) will be kept from entering the lagoon.
FLORIDA OCEANOGRAPHIC SOCIETY:
CCMP Vital Signs: Filter feeders, Seagrasses, Living Shorelines, Citizen Engagement, Monitoring and Data sharing

- Filter feeders/Living Shorelines/Citizen Engagement/Monitoring and Data sharing
  - **Oyster Reef Monitoring** - FL.O.O.R. (Florida Oceanographic Oyster Restoration program) monitors the development and health of natural and constructed oyster reefs in the Indian River Lagoon (IRL) and St Lucie Estuary (SLE). Recruitment, growth, and survival of oysters is measured to evaluate the success of oyster restoration projects and to better understand oyster health within the estuary. In June of 2020, FOS began monthly spat monitoring using ‘oyster t’s’ in the IRL and SLE (n = 3) (Fig 1). Seeing the need for more long-term oyster spat monitoring, an experiment was set up in June 2021 that utilizes newly developed concrete spat modules mounted to PVC “trees” (Fig 2). Concrete modules are left out for 6 and 12 months, to allow for settlement and growth of spat. The 12-month collection will be in June 2022, and this study will provide insight into the differences in growth and mortality rates among oyster spat related to ecological stressors. Additionally, a small subset of oysters are harvested bi-annually to assess oyster condition index. Collectively, these data can be used to better understand oyster health within the lagoon and estuary. Monthly spat data is reported on our website.

![Image of oyster t's](image1.jpg)

**Figure 1.** Oyster t’s used for short term spat monitoring.
Figure 2. Oyster tree’s used for long term spat monitoring.

- **Shuck & Share** - Florida Oceanographic is a participating member of Shuck & Share, a regional program established to divert oyster shell from landfills to restoration efforts in the Indian River Lagoon. Since 2010, FOS has collected 361 tons (772,000 lbs.) of oyster shell, which includes 44.5 tons (88,900 lbs.) collected in 2021. This shell is then bagged, incorporated into plastic free modules, or used for spat monitoring. In 2021, a total of 126 volunteers dedicated approximately 404 hours by bagging 6,712 oyster shell bags for oyster reef restoration (Fig 3).

Figure 3. Volunteers helped FOS bag the 44.5 tons of oyster shell that we collected this year.
○ **Plastic-Free Restoration** - Funding through the IRLNEP ($22,364) allowed FOS to develop and construct concrete plastic-free modules for restoring oyster reefs. The modules were specifically aimed at being constructed and deployed by a wide range of citizen scientists. FOS constructed three different modules; oyster blocks, oyster prisms (UF prototype) and oyster COREs (UF prototype). Construction of modules resulted in 536.75 volunteer hours (Fig 4). Deployment of modules is planned for spring 2022. Modules will be monitored monthly for spat and benthic community recruitment to determine the efficacy of the modules.

![Plastic free module (prism) construction with the help of volunteers.](image)

**Figure 4.** Plastic free module (prism) construction with the help of volunteers.

○ **Jensen Beach Impoundment Restoration Monitoring** - The Jensen Beach Impoundment (JBI) is a 170-acre impounded mangrove wetland which was originally created for mosquito control. The stress of altered hydrology (chronic) and standing water (acute) following Hurricane Irma in 2017 led to the death of over 50 acres of mangroves and stressed an additional 30 acres. Externally funded habitat restoration in the JBI is being implemented through a partnership with FWC and Martin County, with planned completion of construction by June 2022. This project, funded through the IRLNEP ($42,519), is monitoring the water quality, hydrology, forest elevation, vegetation, and soil in areas that show signs of low, moderate, and severe stress within the impounded wetland (Fig 5). Monitoring will continue after restoration of the forest to evaluate forest recovery following the addition of culverts and clearing of ditches to improve water flow.
Living Docks and Oyster Gardening – New Project/Program - FOS is partnering with Florida Institute of Technology (Florida Tech) to expand their Living Docks program to the southern IRL and SLE. This easy and inexpensive restoration tool will engage the community through volunteer matting events (Fig 6) and private dock buy in and create a diverse benthic community which will improve water quality and habitat. A 2- year pilot study will start in the summer of 2022 to test the efficacy Living Docks in southern IRL and SLE. A subset of the docks utilized will have Oyster Gardens associated with them to quantify the impact that Oyster Gardening has on Living Dock recruitment. FOS plans to quantify water quality and benthic communities at each dock. With the results from this study, FOS plans to expand the Living Docks and Oyster Gardening programs throughout the IRL and continue to improve water quality and restoration.
• **Seagrasses/Citizen Engagement/Monitoring and Data sharing/Filter Feeders**
  o **Water Quality Program** - Since 1998, Florida Oceanographic Society’s Citizen Science Water Quality Monitoring Program has recorded water temperature, salinity, dissolved oxygen, pH, and water clarity on a weekly basis. In 2021, our team of 47 volunteer water quality testers sampled sites throughout the Southern IRL and SLE over 1,550 times. FOS added 15 sites to their program, growing from 30 to 45 sites across ten zones of the river, estuary and lagoon system. The average grade in 2021 (81.7%) was higher than that of 2020 (74.9%), with a high of 93% (Ideal) and a low of 66% (Poor). Summer and winter grades were notably higher in 2021 than in 2020. The 52 reports published this year were shared with over 20,000 people through newsletter subscribers and social media platforms, helping to increase awareness of local water quality issues.

  o **Citizen Science Seagrass Network (CSSN)** - The FOS CSSN identified and established 10 seagrass sites throughout the southern IRL and SLE in spring 2021. These 10 sites are assigned to citizen scientists who are trained in seagrass survey methods. Volunteers survey their site on a monthly basis and record water quality, seagrass and algae species composition, percent coverage and canopy height. From April 2021 to March 2022, 12 volunteers donated over 150 hours of their time to attend educational seagrass webinars, on-site training and in undertaking their monthly seagrass surveys. Over 80 surveys have been done since the program’s inception, resulting in 322 data points. Data is compiled by FOS staff and the frequency occurrence of seagrass and algae species is plotted and updated monthly on the Florida Oceanographic website [https://www.floridaocean.org/seagrasses](https://www.floridaocean.org/seagrasses). Seagrass and algae percent coverage data is also compared to site salinity and the resulting graph is incorporated into our weekly water quality report ([https://www.floridaocean.org/water-quality](https://www.floridaocean.org/water-quality)) which is disseminated via email and through our social media channels. In 2022 FOS aims to expand their program by increasing the number of sites sampled on a monthly basis. Additional sites will allow FOS to assess seagrass ecosystem health over a larger geographical area and engage a wider range of volunteers. This will allow FOS to increase public awareness of seagrass and educate the public on threats to seagrass ecosystems in the IRL.

  o **Brevard Zoo Clam Restoration** - FOS partnered with Brevard Zoo and the University of Florida to restore clam and seagrass populations in conjunction with one another in the northern IRL. Of the 100 sites that are receiving clam beds, FOS will be planting seagrass (*Halodule wrightii*) at 10 of them in June 2022. The seagrass and clam units will be monitored to assess how co-restoration of foundation species affects restoration trajectory.

• **Citizen Engagement and Education**
  o **Daily Educational Programming** - Each day, environmental educators at the Florida Oceanographic Coastal Center lead two 30-minute presentations focused on the health of the Indian River Lagoon. These programs reach more than 60,000 visitors per year.
  o **Field Trips** - Florida Oceanographic Society offers a range of grade-specific, standards-based field trip programs for students in pre-kindergarten through college. All of these field trip programs touch on the Indian River Lagoon to some degree.
  o **Summer Camps** - Florida Oceanographic Society's marine science summer camp programs teach children about the Indian River Lagoon and other coastal ecosystems.
Educational Exhibits: Educational exhibits at the Florida Oceanographic Coastal Center are designed to tell the story of the Indian River Lagoon. These exhibits, which range from low tech (e.g., signage, IRL-themed aquariums) to high tech (audio-visual interactives), are designed to expose visitors of all ages to the story of the Indian River Lagoon.

Community Outreach Lectures: Educators from Florida Oceanographic Society regularly give outreach presentations for community groups. Most of these lectures relate to the Indian River Lagoon.

Coastal Lecture Series: Florida Oceanographic Society runs an annual lecture series, which reaches approximately 2,000 attendees per winter. Many lecture topics are directly or indirectly relevant to the Indian River Lagoon.

SOUTH FLORIDA WATER MANAGEMENT DISTRICT (SFWMD):

CCMP Vital Signs: Monitoring and Data Sharing, Stormwater, Impaired Waters, Land Conservation, Wastewater, Invasive Species, Living Shorelines, Citizen Education and Engagement

The South Florida Water Management District (SFWMD) continues to lead localized Indian River Lagoon (IRL) restoration efforts and CCMP implementation throughout the southern IRL watershed. Recent achievements include:

- Continued implementation of the Northern Everglades and Estuaries Protection Program (NEEPP) and associated watershed protection plans for Lake Okeechobee and the St. Lucie and Caloosahatchee River estuaries.
- SFWMD operated 35 regional projects in the Northern Everglades watersheds during WY2021 (May 1, 2020 – April 30, 2021), and projects collectively provided almost 130,000 ac-ft of storage.
- Amendments to Chapter 40E-61, Florida Administrative Code became effective in April 2021. The previous rules were expanded to encompass the entirety of the three Northern Everglades watersheds and requires nonpoint source dischargers not implementing best management practices to submit a SFWMD-approved water quality monitoring plan and regularly report associated monitoring data.
- SFWMD continued implementation of the Research and Water Quality Monitoring Program to assess ecological health and progress toward achieving water quality and storage objectives. Activities include including an extensive monitoring ecological and water quality monitoring network, applied research, and model development and application.

Stormwater/Land Conservation:
- Construction of the final phases of the Kissimmee River Restoration Project (KRRP) was completed in July 2021, physically restoring one-third of the Kissimmee River and its floodplain. The KRRP is cost-shared equally between USACE and SFWMD and includes acquisition of more than 100,000 acres of land, backfilling 22 miles of the C-38 Canal, reestablishing flow to 40 miles of remnant river channel, removal of two water control structures, and implementation of a comprehensive ecological evaluation program.

Stormwater:
- The S-191A pump station was completed in August 2021. This milestone marks the completion of the approximately 1,700-ac Lakeside Ranch Stormwater Treatment Area
(STA) Phases 1, 2, and 3. This eight-celled STA diverts and treats water from the S-191 Basin before discharging to Lake Okeechobee.

- Substantial repairs to the Nubbin Slough STA levee and seepage ditch were completed in August 2021, restoring storage and treatment capacity within the project. This two-celled STA diverts and treats runoff from Nubbin Slough before it enters Lake Okeechobee.
- The SFWMD Governing Board approved the contract to build the Lower Kissimmee Basin Stormwater Treatment Project in December 2021. The 3,400-acre project is located north of Lake Okeechobee and will use a combination of wetland systems and innovative technology to improve regional water quality.
- During WY2021, 24 projects were operational in the LOW. Collectively, these projects provided an estimated storage volume of approximately 66,806 ac-ft. Notably, WY2021 included the first full year of operation for the Brighton Valley NE-PPP priority project.

- **Stormwater/Impaired Waters:**
  - **City of Stuart, Tressler Drive Water Quality Project** - Tressler Drive Water Quality Improvement Project will improve the quality of runoff entering the St. Lucie River to advance toward BMAP goals. Stormwater runoff currently discharges directly to Poppleton Creek. The project will redirect the runoff to a baffle box and bioswale, removing an estimated 40.92 pounds per year of total Nitrogen and 7.67 pounds per year of Total Phosphorus.
  - In partnership with USACE, progress continued on important Comprehensive Everglades Restoration Plan (CERP) IRL – South projects. Including:
    - The C-44 Reservoir and STA completed construction and began operational testing and monitoring prior to transferring to full operation in late 2022. The C-44 Reservoir and STA capture local runoff from the C-44 Basin, reducing average annual total nutrient loads and improving the salinity regimen for the St. Lucie River Estuary and the southern portion of the IRL. The Reservoir and STA provide a total 60,500 ac-ft of new water storage (50,600 ac-ft in the reservoir and 9,900 ac-ft in the STA) and 6,300 acres of new wetlands.
    - Construction was completed on the Allapattah Flats Parcels A and B Wetland Reserve project. This Natural Lands component of the IRL-South project includes restoration of more than 6,700 acres of wetlands.
    - Construction began on the C-23/24 STA in February 2022. The C-23/24 STA is designed to treat water from the C-23 and C-24 Basins and encompasses more than 2,500 acres. Once operational, the project will reduce the sediment, phosphorus, and nitrogen going to the St. Lucie River Estuary and the southern portion of the IRL.
    - The SFWMD Governing Board approved purchase of 1,583 acres in St. Lucie County needed to build the C-25 Reservoir and STA and design efforts are underway.
    - Design for additional IRL-South projects is ongoing, including the C-23/24 North Reservoir, C-23/24 South Reservoir, and C-23/44 Interconnect projects currently in design.
  - During WY2021, 8 projects were operational in the SLRW. Collectively, these projects provided an estimated storage volume of approximately 56,323 ac-ft. Notably, several projects recently completed construction and began operation, including Bluefield Grove Water Farm (C-23) and Scott Water Farm (C-25) estimated to provide a combined storage benefit of approximately 57,000 ac-ft per year.
Design is set to kickoff for the C-23/24 Interim Storage – Section B project. The project will be designed to capture surface water from the C-23/24 watersheds and store it on available SFWMD lands.

Facility operations continued for the Ten Mile Creek Water Preserve Area.

During WY2021, the five operational active and passive projects in the SLRW under the DWM Program collectively provided an estimated storage volume of approximately 26,200 ac-ft (32.3 million m³). Notably, as priority projects in the SLRW, the design and permitting phase of the Scott Water Farm and Bluefield Grove Water Farm NE-PPP projects was completed in June 2020 and July 2020, respectively. Operations also continued for the Caulkins NE-PPP project, which currently has an estimated storage volume of approximately 60,000 acre-feet per year (ac-ft/yr) or 74.0 million cubic meters per year [m³ /yr], the greatest of any single operational DWM project in the Northern Everglades watersheds.

- **Monitoring and Data Sharing:**
  - SFWMD continues to monitor and collect data when needed to assist with understanding legacy phosphorus and how to reduce it.
  - SFWMD continues with the Pollutant Control Program. This program is a multi-faceted approach for improving the management of pollution sources within the Northern Everglades watersheds. It includes source control programs, such as BMPs, on-site treatment technologies, stormwater and wastewater infrastructure upgrades and master planning, and regulatory programs focused on water quality and quantity.
  - SFWMD continues their Research and Water Quality Monitoring Program. This program primarily assesses ecological health and progress toward achieving the water quality and storage targets and the plans, programs, and other responsibilities in the Watershed Protection Plans. The activities comprising FY2020 expenditures include ecological and water quality monitoring, applied research, model application and development, and exotic species control.
  - SFWMD through the CERP RECOVER program is monitoring southern IRL and St. Lucie Estuary seagrass, oysters, and water quality parameters in partnership with the U.S. Army Corps of Engineers.

- The percentage of days when the 14-day moving average was within the optimum salinity envelope (14 to 45) for *Halodule wrightii* (shoal grass) in the lower St. Lucie estuary (A1A salinity monitoring station) was 83% in WY2021, which was substantially lower than the 99% observed in WY2020. Seagrass percent cover at Willoughby Creek was low (< 1%) in WY2021 and consisted of *H. wrightii* and *Halophila johnsonii* (Johnson's seagrass), both euryhaline species. At the St. Lucie Inlet monitoring site, which is located adjacent to the inlet at the downstream reach of the estuary, salinity was more stable with an average of 33 recorded in WY2021 from a nearby water quality monitoring station in the IRL (IRL-15C). As a result, seagrass at the Saint Lucie Inlet site was higher in percent cover (23%) and more diverse than at Willoughby Creek. The seagrass community was co-dominated by *H. wrightii* and *H. johnsonii* in WY2019 but shifted to a *H. wrightii* dominated meadow in WY2020 and WY2021. In WY2021, *Syringodium filiforme* (manatee grass) and *Thalassia testudinum* (turtle grass) were also present at the inlet site but contributed less than 1% to total seagrass cover.

- The percentage of days when the 14-day moving average salinity was within the optimum salinity envelope (10 to 25) for adult eastern oysters in the central estuary (US1 Bridge salinity recording station) was 55% in WY2021, which was close to the long-term average of 57% (WY2001–WY2021). Conversely, the percentage of days when the 14-day moving average salinity was in the stressed (5 to 10) and damaging (<
5) salinity envelopes was 26% and 19%, respectively, both of which were higher than the long-term averages. Mean live oyster densities declined from 656 ± 478 oysters/m² during the WY2020 dry season to 145 ± 187 oysters per square meter (oysters/m²) in the WY2021. Larval recruitment was protracted over the peak settlement months of the wet season in WY2021, as occurred in WY2020, likely in part due to preceding favorable salinity conditions. The prevalence and infection intensity of dermo (*Perkinsus marinus*, a protozoan parasite) in adult oysters remained low with < 10% of oysters infected.

- The Coastal Ecosystems Section continues efforts in water quality modeling to improve the understanding of nutrient and algal dynamics in the St. Lucie Estuary. Recent progress included development and application of a box model that yielded R² values between modeled and observed values of 60% to 70% for nutrient concentrations and 45% for chlorophyll a concentrations. Model results indicate that physical transport and mixing is a dominant process for nutrients as well as algal concentrations in a small, well-flushed estuary like the St. Lucie. Additionally, the model suggests the importance of external sources of phytoplankton especially from upstream and Lake Okeechobee. The box model can also be used to assess the contribution of internal loading of nutrients from benthic fluxes which can be an important component of the nutrient budget for an estuary.

- A phytoplankton study to determine how management of freshwater inflows affects phytoplankton dynamics in the St. Lucie Estuary was initiated in 2019. Objectives of this study include gaining a better understanding of the abundance, distribution, and species composition of phytoplankton during wet and dry seasons, and under different flow and salinity regimes. Samples were collected at 10 fixed sites along the C44 canal, in the North and South Forks, and in the middle and lower estuary. The first two years of data are currently being summarized and year 3 monitoring is currently underway. To date, a total of 261 phytoplankton species have been identified, vouchered and photomicrographed by Dr. Thomas Frankovich (FIU).

- The Coastal Ecosystem Section continues to monitor water quality parameters associated with nutrient and algal concentrations, suspended particulates, water color and salinity. The objective of this study is to better understand spatially continuous water quality and zooplankton (Particulate Organic Matter) dynamics over a wide range of freshwater inflows, including both periodic and event-based sampling (i.e., algal bloom conditions).

- A collaboration with Florida Atlantic University and the University of South Florida on a NASA grant has been established to develop validated algorithms and ground truth satellite-based fluorescence measurements with in situ chlorophyll a, phycoerythrin, and phycocyanin values obtained during bimonthly water quality monitoring to assess and monitor algal blooms in the St. Lucie Estuary. This collaboration also aims to develop physical-biological models to better understand bloom dynamics and a potential bloom probability matrix to predict blooms using current and future conditions.

- **Citizen Education and Engagement:**
  - **The Indian River Lagoon Exhibit Improvement and Expansion (IRLEIE) Project** - This project will complement the Oxbow’s education programs and the St. Lucie Water Champions (SLWC) initiative, an educational campaign which promotes clean water advocacy to youth and adults. It will increase awareness and understanding of current water quality improvement and habitat restoration projects throughout St. Lucie County. Ultimately, the IRLEIE Project will increase the community’s knowledge of the
Lagoon, how it is threatened, and how every citizen can make a positive impact, all leading to greater awareness and stewardship of this priceless waterway.

- **Impaired Waters/Wastewater:**
  - **Richard E. Becker Preserve Septic to Sewer Conversion, Phase 2** – St. Lucie County Environmental Resource Management will construct Phase 2 of this project, which is shovel ready and includes the abandonment of the current septic system, backfill the septic tank with clean fill, construct sewer lift station, place water quality testing equipment in Ten Mile Creek to monitor conditions prior to post construction and reduce wastewater effluent leaching into river.

- **Living Shorelines:**
  - **River Pines H.O.A., Incl. Environmental Restoration and Water Quality Improvements River Pines** – Treat exotic vegetation in 16-acres of mangrove swamp along the Indian River Lagoon. They will also plant approximately 300 native plants in the adjacent tidal pond to control erosion and assist with water quality.

- **Invasive Species:**
  - **Riverbend Park Exotic Vegetation Management** - Palm Beach County Parks and Recreation Department proposes removal of exotic vegetation from approximately 160-acres as part of the ongoing park management.
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<tr>
<td>1</td>
<td>University of Florida (Northern Sites) and Florida Atlantic University - Harbor Branch Oceanographic Institute (Southern Sites)</td>
<td>Harmful Algal Blooms: (Critical), Impaired Waters: (Critical), Monitoring and Data Sharing: (Serious)</td>
<td>Harmful Algal Bloom Monitoring: Funding supports continued IRL algae and cyanobacteria monitoring Output: Lagoon-wide algae and cyanobacterial monitoring to include species identification, distribution and abundance data. Outcome: Enhanced knowledge of algae and cyanobacteria composition, distribution and abundance; enhanced understanding of HABs.</td>
<td>$150,000.00</td>
<td>Conduct bi-weekly monitoring of algae and cyanobacteria species identification, distribution and abundance. Increased funding for increased sampling during a bloom.</td>
<td>10/01/2021 - 09/30/2022</td>
<td>On schedule. Routine monitoring in progress. First and second quarters completed.</td>
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<td>2</td>
<td>Florida Atlantic University - Harbor Branch Oceanographic Institute</td>
<td>Harmful Algal Blooms: (Critical), Monitoring and Data Sharing: (Serious)</td>
<td>Integrated Sampling to Assess Toxins Produced by Harmful Algal Blooms in the Indian River Lagoon: The proposed study will document temporal variability in toxin concentrations from Harmful Algal Blooms in the Northern Indian River Lagoon, Banana River Lagoon, and Mosquito Lagoon and combine them with data on environmental conditions to identify biogeochemical drivers of toxin production. Outcomes: Toxic results provide immediate insights into the spatiotemporal dynamics of toxicity. Long-term goals revolve around identifying potential biogeochemical drivers for the production of targeted toxins and providing guidance for future work to confirm causal links and design strategies to mitigate or control the production of toxins.</td>
<td>$68,267.00</td>
<td>Outputs: 1) temporal concentrations of toxins (μg/L) at each site; 2) multivariate statistical assessments to identify potential biogeochemical drivers of toxins; 3) quarterly and final reports with preliminary and overall results; and 4) at least one peer-reviewed publication near the end of the project.</td>
<td>10/01/2021 - 09/30/2022</td>
<td>On schedule. Sampling has been conducted as outlined in the QAPP.</td>
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<td>3</td>
<td>Florida Fish and Wildlife Conservation Commission</td>
<td>Hydrology and Hydraulics: (Serious), Living Shorelines: (Serious), Wetlands and Altered Marshes: (Serious), Biodiversity: (Serious), Monitoring and Data Sharing: (Serious)</td>
<td>Monitoring Improved Hydrology, Water Quality, and Mangrove Recovery in the Jensen Beach Impoundment (JBI): This proposed study will monitor the water quality, hydrology, forest elevation, vegetation, and soil in areas that show signs of low, moderate, and severe stress within the JBI. Outcomes: 1) Restoration success will be evaluated in the JBI and enable adaptive management of the site (short-term benefit). 2) Changes in water quality, hydrology, elevation, and vegetative growth will be compared before and after restoration (medium- to long-term benefit). 3) Recommendations on appropriate hydrologic conditions for other impounded IRL wetlands will be provided to avoid future habitat mortality events due to storms and sea-level rise (long-term benefit).</td>
<td>$31,733.00</td>
<td>Outputs: Water quality, vegetation, and soil characteristics will be monitored to assess the recovery of the JBI forest and its ecosystem services. A final report evaluating the success of the JBI hydrologic restoration in forests with low, moderate, and severe degrees of stress will be produced (Deliverable 1). A set of recommendations for appropriate hydrologic conditions in impounded mangrove forests will enable adaptive management of the JBI and enable improved hydrologic management of other IRL impoundments (Deliverable 2). All scientific findings will be prepared into one or more manuscripts for peer-reviewed journal publication (Deliverable 3).</td>
<td>10/01/2021 - 09/30/2022</td>
<td>On schedule. First quarter reports delivered. 2nd quarter reports due shortly.</td>
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<td>4</td>
<td>Smithsonian Institution</td>
<td>Biodiversity: (Serious), Citizen Engagement &amp; Education (Serious)</td>
<td><strong>IRL Biodiversity and the &quot;IRL Species Inventory&quot;</strong>: This project supports delivery and maintenance of the IRL species inventory and biodiversity initiative. Output: A complete reorganization and expansion of the species inventory website and website communications. Outcome: The refocus of public knowledge and understanding about the importance of IRL biodiversity and the need to fund and conduct an updated assessment of IRL biodiversity to evaluate status and trends since the 2011 super bloom.</td>
<td>$25,000.00</td>
<td>Continue to maintain the IRLNEP-Smithsonian IRL Species Inventory website and add new species.</td>
<td>10/01/2021 - 09/30/2022</td>
<td>On schedule. First quarter reports delivered. 2nd quarter reports due shortly.</td>
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<td>5</td>
<td>Wood Environment and Infrastructure Solutions Inc.</td>
<td>Atmospheric Deposition: (Undetermined)</td>
<td><strong>Atmospheric Deposition Monitoring</strong>: Data collected from this station are essential to developing a nutrient budget for the IRL, providing data for DMAP and RAP updates and evaluating nutrient deposition trends. Output: Continued data collection and monitoring station maintenance. Outcome: Evaluation of the need to expand the scope and scale of atmospheric deposition data collection.</td>
<td>$28,000.00</td>
<td>Continue wet and dry atmospheric deposition monitoring at the only monitoring station along the IRL (at Sebastian Inlet)</td>
<td>10/01/2021 - 09/30/2022</td>
<td>On schedule. Regular monitoring continues with improved coordination among partners. The first quarter has been completed and invoiced.</td>
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<td>6</td>
<td>Applied Ecology</td>
<td>State of the Lagoon: (Serious), CCMP Implementation and Financing: (Critical), Monitoring &amp; Data Sharing: (Serious)</td>
<td><strong>State of the Lagoon Technical Report</strong>: Funding for this important multi-year initiative will generate a comprehensive state of the IRL technical document (patterned after the Narragansett Bay - State of the Bay report). Output FY 2022: draft stressor chapters. Outcome: Development and distribution of the State of the Lagoon technical document before FY 2025 to advise any CCMP updates and provide guidance to address issues that need to be considered for the 2030 IRLNEP CCMP revision.</td>
<td>$75,000.00</td>
<td>Develop a State of the Lagoon Technical Report to identify current status, emerging trends and future opportunities and needs for restoration and stewardship.</td>
<td>10/01/2021 - 09/30/2022</td>
<td>On schedule. First and second quarters completed.</td>
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<td>7</td>
<td>IRLNEP, IDEAS Brandt Ronat &amp; Company, Firefly Communications, and O'Hara Communications</td>
<td>Citizen Engagement &amp; Education: (Serious), CCMP Implementation and Financing: (Critical)</td>
<td><strong>One Lagoon Comprehensive Communication Initiative</strong>: As the IRLNEP continues to implement the adopted CCMP - Looking Ahead to 2030, a more strategic and comprehensive communications campaign is needed. Output: Delivery of the &quot;One Community-One Voice&quot; initiative, development of infographics, development of the IRLNEP calendar, annual report, one-page fact sheets and an expanded social media outreach effort. Outcome: Enhanced brand recognition and delivery of a 10-year strategic communications campaign in alignment with the mission of IRLNEP and the revised CCMP - “Looking Ahead to 2030”.</td>
<td>$205,225.00</td>
<td>Continue strategic delivery of the One Lagoon - One Community - One Voice Mission and Brand through a comprehensive and coordinated communication strategy.</td>
<td>10/01/2021 - 09/30/2022</td>
<td>On schedule. Multiple technical reports have been edited and</td>
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<td>8</td>
<td>IRLNEP with Natua Strategies, T. Pinney and Associates and Angie Brewer Inc.</td>
<td>CCMP Implementation and Financing: (Critical), Distinctive Lagoon Communities: (Undetermined), Impaired Waters: (Critical)</td>
<td>Grant Writing Support: Funding will support the renewable contracts of three grant writer support contracts with Natua Strategies, T. Pinney and Associates, and Angie Brewer Inc. to provide grant writing technical support to IRLNEP Management Conference stakeholders and partners. Output: Identify new grant opportunities and provide technical grant writing support to local governments and community partners at no cost to them. Outcome: Build grant writing technical skills and capacity among IRLNEP partners. Increased revenues for IRL restoration, stewardship and community outreach.</td>
<td>$40,000.00</td>
<td>Continue to provide grant writing technical assistance to our local government and community partners in need through renewable contracts with Natua Strategies, T. Pinney and Associates and Angie Brewer Inc.</td>
<td>10/01/2021 - 09/30/2022</td>
<td>Behind Schedule. There has been no use of this service and is likely to be reallocated to other projects such as the state of the lagoon technical report.</td>
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<td>9</td>
<td>The Balmoral Group and Tetra Tech, Inc.</td>
<td>CCMP Implementation and Financing: (Critical), Citizen Engagement and Communication (Serious)</td>
<td>CCMP and IRL Restoration Project List Support Services: Funding supports two service contracts with The Balmoral Group and TetraTech, Inc. to provide services updating and prioritizing the IRL Restoration Project list, creating a project storymap, quantification and economic analysis of project benefits, and ADA accessibility of products. Outcome: Work over the life of this multi-year project will lead the 2025 update to the CCMP.</td>
<td>$66,775.00</td>
<td>Outputs: (1) ADA accessible story map of IRL Council projects for the website. (2) Updated and prioritized IRL Restoration project list. (3) Economic quantification and analysis of projects.</td>
<td>10/01/2021 - 09/30/2022</td>
<td>On schedule. A one lagoon heritage and nature trail story map was developed and the CCMP project inventory is being updated with prioritized projects.</td>
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<tr>
<td>10</td>
<td>IRLNEP</td>
<td>CCMP Implementation and Financing: (Critical), Science, Technology &amp; Innovation: (Undetermined)</td>
<td>EPA Travel (EPA Work Plan Requirement): Funding supports IRL Council/IRLNEP staff travel to Washington DC for week-long EPA-National Estuary Program National Workshop (Spring) and National Estuary Program Tech Transfer Meetings (Fall). Outcome: Share best practices, new policies and success stories and lessons learned among the 20 NEPs.</td>
<td>$1,000.00</td>
<td>Attend Fall and Spring EPA, NEP and ANEP meetings to fulfill CCMP implementation, work plan development, project management, contract management, program administration and federal compliance activities.</td>
<td>10/01/2021 - 09/30/2022</td>
<td>On Schedule. Staff participated in the BASIS7-ANEP meeting in St. Petersburg Florida 2/28-3/4</td>
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<td>Project Partners</td>
<td>CCMP Action Plan &amp; Priority</td>
<td>Project Title and Abstract</td>
<td>CWA320 Funding FY 2022</td>
<td>Project Deliverables</td>
<td>Project Start Date / Completion Date</td>
<td>Project Status</td>
</tr>
<tr>
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</tr>
<tr>
<td>11</td>
<td>Top Ranked RFP respondents for Restoration RFP; Citizen Engagement &amp; restoration RFP and Small grants program RFP. Multiple awards for each RFP. See Section B.1 for grant awards and project details</td>
<td>Impaired Water: (Critical); Wastewater: (Critical); Stormwater: (Critical); Seagrasses: (Critical); Filter Feeders: (Serious); Citizen Engagement and Education: (Serious); Forage Fishes: (Serious); Species of Concern: (Serious); Trash Free Waters: (Serious)</td>
<td>Nutrient Reduction, Habitat Restoration, Community Based Restoration Projects and Small Grants: Priority areas for FY 2022 are projects that enhance water quality through nutrient reduction projects or habitat restoration projects that focus on seagrasses, filter feeders and living shorelines, community-based restoration projects that use students and/or citizens to enhance citizen engagement through &quot;hands-on&quot; restoration projects, and a small grants program for grant awards between $500-$5,000. A total of $699,233 of local funds and the match of $10,767 for Activity 3 are budgeted for these CCMP projects. These local funds are identified as the minimum 1 to 1 match to EPA Section 320 federal funds. Outcome: Restore IRL clean water and natural habitats through nutrient reduction and pollutant reduction to achieve the goals of the CWA.</td>
<td>$700,000.00</td>
<td>Multiple contracts will be issues based on a competitive RFP process. Funded projects will be ranked and a list of recommended projects will be evaluated by the IRLNEP Management Conference (Management Board, STEM AC and CAC). A list of ranked projects will be provided to the IRL Council Board of Directors for final funding decision.</td>
<td>10/01/2021 - 09/30/2022</td>
<td>On schedule. All awarded projects are under contract and are in progress.</td>
</tr>
</tbody>
</table>

**Total** | **$ 1,400,000.00** |
C.3 IRLNEP Clean Water Act Implementation

The IRLNEP CCMP, authorized by Section 320 of the Clean Water Act (CWA) and in compliance with the CWA, has developed extensive partnerships with federal, state and local governments both within the IRLNEP Management Conference and outside of the Management Conference. The IRLNEP has developed a unique partnership with private-sector industry called the Indian River lagoon Innovator and Investor Network (IRLII²). This network represents an opportunity for industry to partner with the IRLNEP in technology development and innovation as well as special projects. These extensive and diverse partnerships form the framework for consensus building and delivery of science-based ecosystem management strategies designed to restore and maintain the water quality, wetlands and other natural habitats of the IRL.

The FY 2023 IRLNEP Work Plan directly or indirectly supports all the CWA core programs. Highlighted in this section are two related examples of IRLNEP Work Plan activities that directly support CWA Implementation.

Harmful Algal Blooms
Work Plan Activities #1 & 2

These two related projects respond to the chronic and acute water quality declines that the Indian River Lagoon has experienced since the 2011 “super bloom”. Recurring blooms of picocyanobacteria and the Texas brown tide organism (*Aureounbra lagunensis*) have caused a 60% reduction in seagrass coverage, threatening both estuary health, marine mammal health, human health, and the $7.6 billion annual economy that the IRL supports. These projects directly support expanded scientific communication, collaboration and innovation to address the causes and management interventions necessary to lower nutrient pollution and decrease the intensity and persistence of HABs impacting the IRL.

Clean Water Act Implementation Information

The IRLNEP has a primary role in these projects. These activities directly support the objectives of the CWA to “restore and maintain the chemical, physical, and biological integrity of the estuary, including restoration and maintenance of water quality, a balanced indigenous population of shellfish, fish and wildlife, and recreational activities in the estuary, and assure that the designated uses of the estuary are protected...”
C.4 Discussion of External Factors Impacting the IRLNEP FY 2022 Work Plan Implementation

At the present time, all IRLNEP Work Plan projects are being implemented on schedule and within budget with the exception of projects under budget as indicated in Section C.2 of this workplan. IRLNEP staff is in continuous communication with the project leads to ensure that project outputs and outcomes are achieved. This is the third year that the IRLNEP is submitting a Work Plan based on the One Lagoon CCMP revision: “Looking Ahead to 2030”. This CCMP is in was adopted at the August 9, 2019 IRL Council Board of Directors Meeting.

The EPA workplan submitted herein is part of a detailed IRLNEP tentative Budget that was reviewed by the IRLNEP Management Conference and adopted by the IRL Council on February 12, 2021. A detailed Business Plan that includes all the projects and CCMP implementation including this workplan for FY 2022 has been developed. The Business Plan and detailed budget are attached as addenda to this FY 2022 Work Plan. The EPA workplan priorities for FY 2022 implement critical CCMP action plan outputs that were identified as high-priority IRLNEP responsibilities. More importantly, these outputs were identified in the CCMP revision and during the last 5-year EPA Program Evaluation as important deliverables to achieve an excellent level of performance associated with the EPA standardized performance measures for program management core elements and sub-elements.

IRLNEP Program Priorities for FY 2022 include:

**EPA Workplan Outputs – multiple deliverables detailed in the Work Plan herein ($700,000)**

**IRL COUNCIL STATE AND LOCAL COST-SHARE CONTRIBUTION:**
In addition to the EPA workplan proposal, the IRL Council has appropriated an additional $700,000 of state and local funding to implement water quality and habitat restoration projects, to administer all aspects of the IRLNEP program with a modest cash reserve. Total program operating expenditures and reserves is budgeted at 29% of the total $2,325,000 in budgeted expenditures.

In FY 2022, the IRLNEP anticipates that the following external factors may influence program implementation and success during the upcoming fiscal year:

**IRLNEP MANAGEMENT CONFERENCE:**
Continued evolution and success of the IRLNEP will required strong leadership and guidance from each component of the Management Conference (i.e. IRL Council Board of Directors, Management Board, Science, Technology, Engineering and Modeling (STEM) Advisory Committee and Citizens Advisory Committee). A continuing challenge during FY 2022 will be to engage each committee at the appropriate level to optimize program productivity and ensure volunteer engagement satisfaction. Meaningful, productive and efficient volunteer engagement is essential. A continuing program challenge is to cultivate an IRLNEP Management Conference culture to achieve the Mission of “One Lagoon – One Community – One Voice”. There has been progress on this challenge over the past year by bringing a topic and a speaker to present at each quarterly meeting to engage the management conference in issues that are of significant importance to understanding factors that influence Lagoon and/or human health.
FUNDING:
Gratefully and most appreciated, the IRLNEP saw its 2nd in as many years increase in federal appropriations for FY 2022 and there is hope that now that the NEP has been reauthorization that future appropriations are at the full amount and would lead to a significant increase. Continued staff efforts will be required to ensure that annual funding levels continue to move in a positive direction. The commitment of recurring funding from IRL Council partners to the Interlocal Agreement represents a strong foundation for support. Agency funding commitments in the Inter-Local Agreement was approved by the IRL Council in 2020 by resolution.

The IRL Council and IRLNEP Management Conference support efforts to maintain and expand Congressional appropriations for NEPs, Everglades restoration, and other federal programs that help to advance CCMP implementation. These efforts have produced significant House and Senate member support for NEP Congressional appropriations.

FRAGILE HEALTH STATUS OF THE IRL:
The greatest external factor remains the recurring algal blooms, loss of seagrasses and uncertain health status of the IRL. During the summer and end of FY 2020 and the beginning of FY 2021 a severe nano cyanobacteria bloom occurred in the Northern Indian River Lagoon, Banana River Lagoon, and Southern Mosquito Lagoon. A fish kill event took place in all the lagoons as the bloom crashed during the holidays. Alarmingly in the winter of FY 2021 an extensive manatee mortality event began and is still going although it has slowed in the rate. Initial indications from Florida Wildlife Commission necropsies are that the manatees are dying from malnourishment. The loss of seagrass is now being felt at the upper trophic levels. The IRLNEP must remain ready to respond to changing IRL conditions and events.

The reorganization of the IRLNEP has placed the program in a position of high visibility and growing regional authority. Part of that visibility has led to the IRLNEP being awarded a science and innovation grant with the Florida Department of Environmental Protection to use an innovative technology to communicate harmful algal bloom information to the public and for use in emergency response and planning. This project is a public private partnership (P3) and will showcase the IRLNEP as the trusted source of IRL science information and a unifying organizational hub for IRL stakeholders, communities and citizens. Preliminary estimates of IRL infrastructure and restoration costs approach $5-6+ billion. Current levels of local, state and federal funding are currently insufficient to achieved desired restoration outcome in a reasonable timeline. A significant increase in funding is required for full and timely restoration to be successful. Independent ROI value estimates show that for every $1 spent on restoration, a range of $20-$33 is returned in IRL economic value.
## Section D. Clean Water Act Travel Funds

### Indian River Lagoon National Estuary Program FY 2022 Travel Cost

<table>
<thead>
<tr>
<th>Personnel</th>
<th>Travel Dates</th>
<th>Purpose</th>
<th>Location</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kirsten Ayres</td>
<td>11/26/2021-11/30/2021</td>
<td>IRL COUNCIL Meeting</td>
<td>Sebastian, FL</td>
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<tr>
<td>Ashley Malcolm</td>
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<td>Duane De Freese</td>
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<td>Kathy Hill</td>
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<td>Daniel Kolodny</td>
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<td>Kirsten Ayres</td>
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<td>Randy Parkinson</td>
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<td>Charles Jacoby</td>
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<td><strong>Total</strong></td>
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<td><strong>$10,181.88</strong></td>
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### Anticipated travel costs in FY 2022

<table>
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<th>Travel Dates</th>
<th>Purpose</th>
<th>Location</th>
<th>Cost</th>
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<tr>
<td><strong>Total</strong></td>
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