WQPP Priorities Working Group:
Draft Recommendation to the Steering Committee

Introduction

Steering Committee Resolution

For over 25 years, the Florida Keys National Marine Sanctuary (FKNMS) Water Quality Protection Program (WQPP) has pursued a variety of corrective actions, education and outreach, monitoring, and research activities designed to better understand and address the sources of pollution contributing to water quality degradation within the Florida Keys. Despite great progress in a variety of areas, however, poor water quality continues to affect marine resources and is a primary concern among the Keys' community.

Recognizing these continuing challenges and the critical importance of good water quality for the ecological and economic well-being of the Florida Keys, the WQPP Steering Committee is committed to reevaluating the program's priorities and identifying new opportunities to more strategically pursue water quality improvements. During the fall 2019 WQPP meeting, the Steering Committee passed a resolution directing a subgroup composed of Management Committee and Technical Advisory Committee (TAC) members to investigate and recommend a shortened list of priorities for the WQPP to pursue moving forward. Fundamental to this resolution was the recognition that a number of local, state and national agencies have authority over activities that impact water quality in the Florida Keys and that the WQPP is uniquely positioned to speak as a unified voice on these issues. The directive specifically included a call to consider activities that would make a significant difference in water quality within FKNMS and where the WQPP can have a meaningful impact or serve as a key influencer.

This document represents the response to that resolution and presents a draft set of priorities for consideration by the Steering Committee. The content of this recommendation is currently relatively concise, as it is intended to be a starting point from which a more detailed series of steps to achieve each priority will be defined. Following the Steering Committee's review of the recommended priorities and approval of a final list, a phase-II facilitated planning process will be initiated to develop more detailed action plans relevant to those priorities. The scope and scale of the recommended activities vary drastically, and while some may be singular activities that can be completed relatively quickly, others may require multiple components and significant investments.

Water Quality Protection Program Prioritization Working Group Process

Between December 2019 and April 2020 a working group was established and, through a combination of collaborative meetings and individual input, succeeded in developing a narrowed list of WQPP priorities to recommend to the Steering Committee. Volunteers were solicited from the existing TAC and Management Committee, and a total of 17 individuals representing a variety of agencies and organizations participated in at least some aspect of the working group (Appendix 1).

The working group worked through a multi-step process to produce this recommendation. First, they reviewed the purpose, activities, past achievements, and strengths of the WQPP to ensure a common understanding of the program and how it can influence water quality. Overall, the group agreed that the strengths of the WQPP largely surround its diverse membership, which includes representatives from a

number of agencies and organizations with a variety of authorities and assets, as well as its ability to provide strong scientific information and serve as a forum for public input on water quality issues. In order to follow a more objective approach, the working group also reviewed the Steering Committee's resolution and, based on that guidance, agreed upon the set of criteria and a prioritization framework through which various water quality-related strategies would initially be assessed (Appendix 2).

Next, the working group discussed the various sources of water quality decline in the Keys, and collectively identified the perceived top contributors to local water quality concerns through a facilitated multi-voting process. South Florida external influences, local wastewater, local stormwater, regional external influences, and tidal flooding and climate were identified as the top contributors to water quality decline in the Keys (for the full list, see Appendix 3). The group then worked to evaluate and revise the list of potential WQPP priorities which was presented during the fall 2019 meeting. This included clarifying content, identifying gaps, and removing redundant or outdated activities. Strategies related to the top contributors to water quality issues were discussed first, followed by cross-cutting water quality management approaches not tied to specific water quality stressors, including those related to the core responsibilities of the WQPP such as education and outreach, monitoring, and data management, as well as emerging activities such as restoration.

Once the list of potential WQPP priorities was sufficiently revised, each working group member individually evaluated each strategy and ranked them as "very high," "high," "medium" and "low," against the three pre-established criteria: Water Quality Benefit, Potential WQPP Impact, and Level of Completion. The individual results were compiled and the prioritization model applied to determine the group's combined relative ranking of each WQPP strategy into Priority 1, 2, 3 and 4 bins, where 1 = Very High Priority, 2 = High Priority, 3 = Medium Priority and 4=Lowest Priority. The prioritization output was presented to the working group in a number of ways to facilitate review and help to more strategically identify the top priorities. This included presenting the list of all WQPP strategies in order by overall priority rank, by issue area, by type of activity (e.g., corrective action, research, education, etc.), and by the level of perceived water quality benefits that would ensue from implementing any given strategy. Using these initial objective results from the prioritization framework, the working group provided additional expert input to identify and justify the subset of priorities that would become the draft recommendation to the Steering Committee.

After consideration, the group choose not to subjectively shuffle strategies among the priority bins, but rather to keep the objective model output. While all Very High/Priority 1 items were included in the recommendation, the group also added additional strategies that were initially ranked lower (Priority 2 or 3) due to their overall perceived importance in terms of their potential water quality benefit or the WQPP's ability to be a strong influencer on that issue. Similarly, while strategies with a higher level of completion were generally ranked lower, the working group identified some of these highly complete or ongoing activities for inclusion in the recommendation due to the importance of continuing those activities or seeing them through to completion. In these instances, the recommended strategies include new facets which are intended to fill identified gaps or otherwise improve upon existing WQPP endeavors. The specifics of this decision-making process are further explained within the context of each recommended priority.

Considerations for the WQPP Priorities Recommendation

A number of issues and considerations were contemplated in developing the draft recommendation to the Steering Committee.

In reviewing the language that established the WQPP within the Florida Keys National Marine Sanctuary and Protection Act, the working group acknowledged the program's responsibility not only for the "protection and restoration" of water quality, but also for the coral reefs and other living marine resources managed cooperatively by NOAA and the State of Florida within FKNMS. Noting the direct connection between water quality and the condition of seagrasses, coral reefs, and other Sanctuary resources, the working group chose to focus on actions specific to water quality improvements versus those that would directly improve habitats and living marine resources, with the understanding that water quality improvements would generate additional benefits to the Sanctuary's habitats, fish and wildlife.

The working group also contemplated the range of resource management priorities within the Florida Keys, and agreed upon the importance of focusing on those that are most immediately within the purview of the WQPP. In doing so, the group emphasized the critical importance of simultaneously continuing complimentary efforts to protect and restore the Sanctuary's marine resources – including Stony Coral Tissue Loss Disease response, coral reef restoration, and a number of other critical endeavors. However, given constraints in financial resources, time, and capacity, the group recognized the impossibility of contributing to every important effort, and thus worked to narrow the scope of this recommendation to those activities where the WQPP can have the greatest impact. The omission of specific activities from this recommendation or the larger list of WQPP strategies does not mean they are unimportant, just that they were thought to be outside the immediate purview of this group, or less likely to result in significant water quality benefits – whether those benefits may be realized across the Florida Keys or in a discrete area. Still, the working group feels strongly that additional efforts not included in this recommendation can and should continue to be simultaneously and aggressively pursued and, to the extent possible, the WQPP should continue to underscore the need to address larger scale issues by emphasizing how they impact resources locally within FKNMS. Similarly, the working group felt strongly that while the full list of WQPP strategies developed and considered for inclusion in the recommendation are important (Appendix 4), it was necessary to narrow that list via this recommendation, so that the WQPP can better focus their efforts moving forward.

In generating this recommendation, the working group also acknowledged the range of activities that the WQPP is involved in, including corrective actions, research, monitoring, and education and outreach. While the water quality benefit associated with a corrective action may be more direct or tangible than that associated with a research or educational activity, the group felt it was important to include the full suite of different types of activities in the recommendation. Specifically, those less direct activities are essential to generate the information and community participation that is necessary to make meaningful progress in improving water quality. Similarly, the group felt it was important to include strategies across a suite of spatial scales. While much effort has already gone into local water quality improvements, the group felt that it is important to continue to pursue water quality solutions locally, while also focusing greater attention regionally. Finally, the working group also included a consideration of water quality issues of most concern to the community, and recognized the importance of enhancing community participation in water quality improvement efforts.

Working Group Recommendation

The recommendation from the working group consists of strategies organized into two broad themes: external water quality influences and local water quality influences. Within these themes, the following 8 water quality issues are addressed:

External Water Quality Influences

- South Florida Regional Influences
- Tidal Flooding and Climate

Local Water Quality Issues

- Stormwater
- Wastewater
- Canal Restoration
- Sargassum and Organic Debris
- Marinas and Liveaboards
- Emerging Pollutants of Concern

The working group also recognized the importance of maintaining the WQPP's core responsibilities, and the need to identify additional strategies to continue and improve upon the program's administration moving forward. As such, this recommendation also includes strategies within the following areas:

WQPP Core Responsibilities

- WQPP Administration
- Data Collection, Analysis and Reporting
- Education and Outreach

This document provides a brief overview of each water quality issue targeted for action, along with a description of the priority activity or activities identified within that issue area, and the rationale for including those priorities in the recommendation to the Steering Committee. Implementation details, including agency leads, cost, and schedule will be developed during the next phase of this process. Table 1 provides a summary of the recommended WQPP priorities. The full list of WQPP strategies considered in developing the recommendation, along with their rank as Priority 1, 2, 3, or 4 are included in Appendix 4.

Table 1. Summary of WQPP Priorities recommended from the working group to the Steering Committee.

SOUTH FLORIDA REGIONAL INFLUENCES
Everglades' Restoration (1-1). Actively engage with the South Florida Ecosystem Restoration Task Force's efforts to restore the quantity, quality, timing and distribution of freshwater flow to the Everglades, Florida Bay, Biscayne Bay, and northern estuaries (Caloosahatchee and St. Lucie).
Mainland Wastewater Infrastructure (1-2). Pursue improvements to mainland wastewater infrastructure (closure of outfall pipes, upgrades to aging infrastructure, septic to sewer conversion, etc.). This may include coordination with local governments to develop resolutions and encourage timely and definitive action towards infrastructure improvements.

TIDAL FLOODING AND CLIMATE
Infrastructure Adaptation for Climate Change (5-2). Ensure wastewater and stormwater infrastructure is equipped to accommodate changing conditions associated with sea level rise and higher-intensity storms. Assess the ability of existing permitting requirements and facility designs to protect water quality, infrastructure and habitat under changing climate scenarios, and consider alternative design criteria for different types of facilities, levels of use, and/or areas. Identify and incorporate features to promote resilience, such as stormwater retention basins.
STORMWATER
Stormwater Master Plan (4-2). Support planning, development and implementation of the Monroe County Stormwater Master Plan. Develop best management practices for stormwater within Monroe County, including a consideration of better solutions to treat stormwater runoff in the Keys' environment. In addition to treatment options, prevention of stormwater via a reduction in impervious surfaces should also be considered.
Stormwater Project Implementation (4-1). Design and build more effective stormwater projects, to include stricter stormwater management and project permitting.
WASTEWATER
Shallow Injection Wells (3-5). Research/monitor shallow injection wells to determine their impact on nearshore water quality. Test wastewater or other injectate for pollutants other than nutrients, including endocrine disruptors and other emerging pollutants of concern, salinity, viruses/bacteria, etc. Determine if injected effluent appears in the coastal waters and if so, identify where, what pollutants it still contains, and whether it causes local water quality degradation.
Keys' Wastewater Regulations (3-6). Pending the results of the shallow injection well studies, consider pursuing additional corrective actions such as (a) the development of water quality standards or aquatic life criteria for endocrine disruptors or other contaminants of emerging concern, (b) investigating and/or implementing new wastewater treatment technologies to remove those contaminants, and (c) reducing the wastewater treatment plant capacity threshold for requiring deep well injection within the Keys and areas with similar porous geology (e.g., require deep injection wells cased to a minimum depth of 2,100 feet, even if the design capacity of the wastewater treatment plant is less than 1 million gallons per day).
Wastewater Master Plan (3-1). Implement Monroe County Wastewater Plan to achieve compliance with Section 403.086(10) F.S. Continue connecting package plants and septic tanks to central wastewater systems, including the Cudjoe Regional Wastewater Service Area.
Remote Area Connections (3-2). As part of implementing the Monroe County Wastewater Plan, connect Cross Key and other remaining remote areas to decentralized Advanced Wastewater Treatment or Best Available Technology treatment standards.
Infrastructure Design and Operation (3-3). Ensure the sustainability and functionality of wastewater infrastructure. Monitor collection systems for proper performance and compliance. Iteratively review and adapt regulations and best management practices for wastewater infrastructure designs (vacuum sewers, gravity vs. low-pressure systems) and operations to ensure the systems are working properly and promote optimal functionality within the Keys environment.
Compatibility with Non-Municipal Wastewater (3-4). Ensure centralized wastewater treatment systems are able to accept wastewater from non-municipal sources (e.g., marine sanitation devices), or update the collection systems as needed to accommodate that effluent.
CANAL RESTORATION
Canal Master Plan (7-1). Continue to support and implement the Monroe County Canal Master Plan and Canal Restoration Guidance Document to take steps toward restoring and improving water quality in residential canals, and reduce marine debris accumulation. Provide guidance to ensure maximum water quality benefits are achieved through canal restoration; assess options and funding sources to support operations and maintenance costs.

SARGASSUM AND ORGANIC DEBRIS
Sargassum Management (6-1). Identify a suite of management options to successfully control and/or dispose of sargassum, including techniques for separating out plastic debris.
MARINAS AND LIVEABOARDS
Vessel Pumpout Facilities (9-2). Ensure adequate marine pumpout services and/or facilities to eliminate discharge of waste from vessels into FKNMS. Marinas should have and maintain their own pumpout facilities and assume responsibility for ensuring they have adequate pumpout capacity for the liveaboards that use that facility.
EMERGING POLLUTANTS OF CONCERN
Research Emerging Pollutants of Concern (8-2). Research emerging pollutants of concern to determine the magnitude of the problem posed by endocrine disruptors and other emerging pollutants.
Monitor Emerging Pollutants of Concern (8-3). Incorporate emerging pollutants of concern into monitoring programs to determine the composition and concentration of pollutants in FKNMS waters.
WQPP ADMINISTRATION
Staff Support (18-1). Ensure adequate staffing and support to effectively manage and advance the Water Quality Protection Program, as mandated by the FKNMSPA.
DATA COLLECTION, ANALYSIS AND REPORTING
Critical Monitoring Workshop (19-3). Set up a Critical Monitoring Workshop to evaluate the existing water quality monitoring program, and recommend changes to answer priority questions or better inform management needs. This will require (a) an articulation of key management questions, (b) an evaluation as to whether those management needs can be fulfilled via mining existing data, a special study or region-wide monitoring, and (c) recommendations from the TAC on the design of special studies or changes to the region-wide monitoring program to effectively answer management questions.
Alternative Data Analysis (19-2). Conduct alternative analyses or "mining" of the existing suite of water quality data to determine if water quality improvements, hotspot areas, or specific sources contributing to water quality degradation can be determined. Consider also incorporating other monitoring tools, such as satellite imagery, to provide additional information about regional trends.
Long Term Monitoring Programs (19-1). Continue to implement long-term water quality and ecological (coral/seagrass) monitoring. This may include changes to the monitoring design made as an outcome of the Critical Monitoring Workshop (19-3).
Evaluation of Water Quality Improvement Projects (19-4). Design a monitoring program to detect the effectiveness of corrective actions in improving water quality. While this may need to be project-specific, more general tools such as modeling or remote sensing could be developed to evaluate management actions (similar to Briceño's project with EPA in Biscayne Bay).
Data QA/QC Criteria (20-1). Require all WQPP-generated data to meet applicable USEPA QA/QC requirements and all monitoring data to be submitted in a WIN-compatible format (especially data that would be used for regulatory purposes). These basic data management criteria should be specified in all project contracts.
Historical Data Entry (20-2). Ensure all historical WQPP-generated monitoring data that has not been uploaded to WIN is added to that database in a timely manner.
EDUCATION AND OUTREACH
Public Accessibility of WQPP Information (23-4). Provide a website or other mechanism for data to be available to the public, including all reports and other outputs from projects funded through the WQPP.
Water Quality Education (23-5). Expand education and outreach efforts to inform the community about water quality in FKNMS, including the top contributors to water quality decline, strategies to remediate those issues, and opportunities for agency and individual action to support water quality improvements.

External Water Quality Influences

South Florida Regional Influences

Overview of Issue Area

The Florida Keys are part of a complex hydrological system that is influenced by waters from the Gulf of Mexico and Caribbean, as well as the Everglades, Florida Bay, Biscayne Bay and mainland south Florida. As such, Keys' water quality is highly influenced by factors that originate outside the islands or Sanctuary waters.

Everglades Restoration efforts aimed at restoring freshwater flow to downstream estuaries, including Florida Bay, are critical for addressing water quality issues in FKNMS. Elevated salinity in Florida Bay due to reduced freshwater flows and increased evaporation have contributed to hypersaline conditions and catastrophic ecosystem collapse evidenced by seagrass die offs, algae blooms, and declining fish and invertebrate populations. As freshwater flows resume, it is equally important to ensure the quality of additional water in the system is maintained.

The Florida Keys also experience water quality impacts from southern Florida, which is highly urbanized and home to 8.1 million people and a variety of industries. This region is afflicted with aging wastewater infrastructure, which has resulted in large releases of treated and untreated sewage into coastal waters overtime. Between December 2019 and February 2020 alone, broken sewer pipes in Fort Lauderdale released over 200 million gallons of sewage into streets and waterways. Such challenges are pervasive across many cities in southern Florida, and additional releases can be expected to continue without significant investments into infrastructure upgrades. Wastewater and river input from Florida's west and southwest coast also have the ability to influence water quality in the Florida Keys, especially along the bayside. Given the high level of connectivity between these waters and FKNMS, it is likely that these regional discharges also affect water quality and marine resources locally, however further research is needed to understand the magnitude of impact associated with polluted waters coming to the Keys from elsewhere in southern Florida.

Recommended Strategies

- **1-1.** Actively engage with the South Florida Ecosystem Restoration Task Force's efforts to restore the quantity, quality, timing and distribution of freshwater flow to the Everglades, Florida Bay, Biscayne Bay, and northern estuaries (Caloosahatchee and St. Lucie).
- **1-2.** Pursue improvements to mainland wastewater infrastructure (closure of outfall pipes, upgrades to aging infrastructure, septic to sewer conversion, etc.). This may include coordination with local governments to develop resolutions and encourage timely and definitive action towards infrastructure improvements.

Rationale for Selection

For the purposes of this prioritization exercise, regional external influences originating from mainland south Florida were specifically separated from far field external influences originating from the Gulf of Mexico and Caribbean. South Florida regional influences were identified by the working group as the primary issue area affecting water quality within FKNMS. However, because efforts to achieve such regional water quality improvements are complex, multifaceted, and being carried out by groups largely outside of FKNMS, these strategies were initially only ranked as a Medium Priority (Priority 3) during the

prioritization exercise. Still, given the potential benefits such improvements would garner, as well as the WQPP's ability to provide scientific information and additional multi-agency and stakeholder collaboration, the working group highlighted the importance of including these strategies in the recommendation to the Steering Committee. Both Everglades Restoration and south Florida wastewater inputs potentially have a major external influences on water quality in the Sanctuary, and it is important for the WQPP to be involved in both tracking and providing guidance on these issues.

Tidal Flooding and Climate

Overview of Issue Area

Although a global issue, climate change stands to affect local water quality in the Florida Keys. Increasing ocean temperatures and ocean acidification will directly alter the physical and chemical properties of seawater which can have deleterious effects on key species and habitats. Meanwhile, sea level rise, more intense storms, and changing rainfall patterns can exacerbate local water quality concerns as more frequent coastal flooding and heavy downpours can increase runoff of nutrients, sediments and other land-based pollutants into nearshore waters, while also compromising critical water management infrastructure.

Recommended Strategy

- **5-2.** Ensure wastewater and stormwater infrastructure is equipped to accommodate changing conditions associated with sea level rise and higher-intensity storms. Assess the ability of existing permitting requirements and facility designs to protect water quality, infrastructure and habitat under changing climate scenarios, and consider alternative design criteria for different types of facilities, levels of use, and/or areas. Identify and incorporate features to promote resilience, such as stormwater retention basins.

Rationale for Selection

The working group highlighted climate change as a potential major driver of water quality impacts within FKNMS. Recognizing that options to mitigate climate change at the local level were limited, this strategy instead focuses on local adaptive capacity and ensuring the resilience of key infrastructure against increased tidal flooding and climate change which otherwise may result in the additional mobilization of local pollutants into nearshore waters. While the working group identified the limitations in the ability of the WQPP to fully address climate change-driven water quality impacts, they felt it was important and within the realm of the WQPP's sphere of influence to be proactive in preparing key water infrastructure to withstand those impacts and maintain the ability to appropriately manage stormwater and wastewater under future conditions. Although not specifically included as a strategy in this recommendation, the working group also recognized the importance of building climate resilience into other complementary natural resource management efforts, such as restoration planning.

Local Issues

Stormwater

Overview of Issue Area

Stormwater runoff washes excess nutrients, sediment, and toxins into the Sanctuary, which contributes substantially to the degradation of nearshore water quality. Management of this issue presents a unique

challenge in the Florida Keys as there is not enough elevation or land area available for conventional treatment methods such as the construction of artificial wetlands, and in some areas swales can be inundated by high tides. The Monroe County Stormwater Management Master Plan was last updated in 2001, and at that time noted that only 10-20% of residential areas had stormwater systems. Similarly, many roads had no stormwater controls, and where they were in place, stormwater systems largely consisted of drainage systems with no treatment measures. In some areas, untreated stormwater is injected into shallow wells, which also allows nutrients and other pollutants to leach into nearshore waters.

Recommended Strategies

- **4-2.** Support planning, development and implementation of the Monroe County Stormwater Master Plan. Develop best management practices for stormwater within Monroe County, including a consideration of better solutions to treat stormwater in the Keys' environment. In addition to treatment options, prevention of stormwater runoff via a reduction in impervious surfaces should also be considered.
- **4-1.** Design and build more effective stormwater projects, to include stricter stormwater management and project permitting.

Rationale for Selection

The working group identified Stormwater among the top contributors to water quality stress in FKNMS, and both strategies identified here ranked as Very High/Priority 1 items and were thus selected for inclusion in this recommendation. Stormwater is a locally significant source of pollution within the Sanctuary, but has not been addressed in the same comprehensive way as wastewater. Monroe County is currently working on updating their Stormwater Low Impact Development Manual to include best management practices, and the working group recognized that the WQPP should play a leading role in the review, development and implementation of that plan.

Wastewater

Overview of Issue Area

Wastewater has long been recognized as a major contributor to nearshore water quality degradation and, as such, has been a primary focus of local activities to improve water quality. Substantial efforts have been made in implementing the Monroe County Wastewater Master Plan, including upgrading facilities to advanced wastewater treatment, decommissioning septic systems, and installing central sewer systems, all of which is critical for reducing local wastewater impacts to Sanctuary waters. However, despite great progress in addressing wastewater, there are still parts of the Master Plan that have yet to be implemented, including areas where septic remains to be converted to sewer, that require continued oversight and attention. Additionally, there are lingering concerns about the efficacy and functionality of the existing regulations and infrastructure, particularly considering the unique geology of the Florida Keys, which require additional scientific investigation and potential corrective action. Particularly, concerns remain about the use of shallow injection wells which, in addition to wastewater, are also being used to dispose of untreated stormwater and to increase flushing of degraded canal waters. Additional information is needed to more comprehensively evaluate the impacts those wells may or may not have on nearshore waters and marine life.

Recommended Strategies

- **3-5.** Research/monitor shallow injection wells to determine their impact on nearshore water quality. Test wastewater or other injectate for pollutants other than nutrients, including endocrine disruptors and other emerging pollutants of concern, salinity, viruses/bacteria, etc. Determine if injected effluent appears in the coastal waters and if so, identify where, what pollutants it still contains, and whether it causes local water quality degradation.
- **3-6.** Pending the results of the shallow injection well studies, consider pursuing additional corrective actions such as (a) the development of water quality standards or aquatic life criteria for endocrine disruptors or other contaminants of emerging concern, (b) investigating and/or implementing new wastewater treatment technologies to remove those contaminants, and (c) reducing the wastewater treatment plant capacity threshold for requiring deep well injection within the Keys and areas with similar porous geology (e.g., require deep injection wells, cased to a minimum depth of 2,100 feet, even if the design capacity of the wastewater treatment plant is less than 1 million gallons per day).
- **3-1.** Implement Monroe County Wastewater Plan to achieve compliance with Section 403.086(10) F.S. Continue connecting package plants and septic tanks to central wastewater systems, including the Cudjoe Regional Wastewater Service Area.
- **3-2.** As part of implementing the Monroe County Wastewater Plan, connect Cross Key and other remaining remote areas to decentralized Advanced Wastewater Treatment or Best Available Technology treatment standards.
- **3-3.** Ensure the sustainability and functionality of wastewater infrastructure. Monitor collection systems for proper performance and compliance. Iteratively review and adapt regulations and best management practices for wastewater infrastructure designs (vacuum sewers, gravity vs. low-pressure systems) and operations to ensure the systems are working properly and promote optimal functionality within the Keys environment.
- **3-4.** Ensure centralized wastewater treatment systems are able to accept wastewater from non-municipal sources (e.g., marine sanitation devices), or update the collection systems as needed to accommodate that effluent.

Rationale for Selection

The working group identified wastewater among the top contributors to water quality stress in FKNMS. Although this was recognized as having a high level of completion, the working group identified the importance of the WQPP's continued focus on this issue, both to ensure the completion of infrastructure upgrades as well as the effectiveness of that system in protecting nearshore water quality. Furthermore, as other communities around Florida look to upgrade aging infrastructure and better manage their wastewater, the group recognized that the lessons learned in the Florida Keys may be critical for informing those regional improvements. Thus, it is even more important for Monroe County to accurately demonstrate what is truly needed to sufficiently manage wastewater for the protection of economically important marine resources.

Canal Restoration

Overview of Issue Area

There are over 500 canals in the Florida Keys, many of which were excavated to depths greater than fifteen feet, have dead-ends, and are otherwise structured or oriented in a way that provides little or no tidal flushing. Decades of stormwater and wastewater inputs have led to high nutrient and bacteria concentrations in canals, while inputs of floating seagrass and sargassum allow for accumulations of decomposing organic material and result in low dissolved oxygen. Monroe County has developed a Canal Management Master Plan and implemented a number of restoration demonstration projects, but chronic water quality issues continue in many canals that have yet to be restored. Such poor water quality within residential canals may contribute to detrimental ecological impacts in nearshore waters across FKNMS. The University of Miami is currently conducting a study to determine the extent to which canals contribute to nearshore water quality degradation. The result of this study will help inform next steps and refine priorities for canal restoration.

Recommended Strategy

- **7-1.** Continue to support and implement the Monroe County Canal Master Plan and Canal Restoration Guidance Document to take steps toward restoring and improving water quality in residential canals, and reduce marine debris accumulation. Provide guidance to ensure maximum water quality benefits are achieved through canal restoration; assess options and funding sources to support operations and maintenance costs.

Rationale for Selection

Canals were ranked among the top ten contributors to local water quality concerns, and the recommended strategy was specifically ranked as a High Priority (Priority 2). The working group recognized that canal restoration is a high priority for the community and that canals are likely contributing to water quality and resource impacts in nearshore waters. As such, they felt it was important to continue to participate in and provide guidance to Monroe County's efforts to restore canal hydrology and water quality, particularly considering the scope and scale of canal restoration and the associated implications for water quality. Much work has already been done and will continue, especially as the Florida Department of Economic Opportunity implements a new Work Plan for canal restoration through its Area of Critical State Concern Program.

Sargassum and Organic Debris

Overview of Issue Area

Sargassum is a floating marine algae that is carried by currents, waves and tides to south Florida and throughout the Caribbean from the Sargasso Sea and northwestern Gulf of Mexico. Sargassum is ecologically important as it provides habitat for protected and commercially important species, provides a food source for birds and other wildlife, and helps stabilize shorelines. However, for the past several years, massive quantities of Sargassum have been washing up on beaches and clogging canals. In addition to being unsightly and producing an unpleasant smell, large accumulations of Sargassum may reduce dissolved oxygen, increase nutrients and otherwise impact water quality in canals and nearshore waters.

Recommended Strategy

- **6-1.** Identify a suite of management options to successfully control and/or dispose of sargassum, including techniques for separating out plastic debris.

Rationale for Selection

Monroe County recently initiated a project to develop a Sargassum Management Master Plan and so this strategy did not initially rate among the top priorities due to a perceived very high level of completion. However, the working group recognized the high water quality benefits associated with this activity, the importance of sargassum management for long-term canal restoration, and the likelihood that the WQPP could meaningfully contribute to the effort. The working group also noted that such a strategy requires some caution in that managing sargassum should not be so effective that this ecologically important organic matter is removed entirely from the system.

Marinas and Liveaboards

Overview of Issue Area

Vessel wastewater associated with Marine Sanitation Devices (MSDs) generally undergoes minimal treatment and includes harmful chemicals which can exacerbate natural resource impacts if improperly disposed of into the environment. The cumulative effect of high volume or repetitive disposals within nearshore waters, or more concentrated disposal in some marinas or anchorages, is of particular concern. All Sanctuary waters are protected from potentially harmful sewage discharge, and pumpout facilities are located throughout the Keys to assist boat operators in protecting waters from wastewater disposal. However, inadequate or inconvenient facilities and potential shortfalls in capacity to sustain free on-water pumpout services may make compliance difficult and result in an increase in discharges to Sanctuary waters.

Recommended Strategy

- **9-2.** Ensure adequate marine pumpout services and/or facilities to eliminate discharge of waste from vessels into FKNMS. Marinas should have and maintain their own pumpout facilities and assume responsibility for ensuring they have adequate pumpout capacity for the liveaboards that use that facility.

Rationale for Selection

Given the existing mobile pumpout service and ongoing efforts to expand shore-based facilities, this strategy was initially only ranked as a Medium Priority (Priority 3) due to the perceived very high level of completion. However, the working group recognized that inadequate or reduced service options would likely reduce compliance with the no discharge rule, and highlighted this as an issue of local water quality concern. Considering the potentially very high water quality benefits associated with this activity, and the water quality degradation that could occur without adequate pumpout services, this strategy was included as a recommended priority for the WQPP.

Emerging Pollutants of Concern

Overview of Issue Area

Emerging pollutants of concern include pharmaceuticals, personal care products and other contaminants detected at low levels in surface water that may cause ecological or human health impacts. Many of these contaminants act as endocrine disruptors, which affect hormone function and can result in developmental, reproductive, and other health effects. Such pollutants are of concern because they are largely unregulated, may be inadequately addressed by existing wastewater treatment practices, and much is unknown about how pervasive they are in the environment or the extent of their ecological impact.

Recommended Strategies

- **8-2.** Research emerging pollutants of concern to determine the magnitude of the problem posed by endocrine disruptors and other emerging pollutants.
- **8-3.** Incorporate emerging pollutants of concern into monitoring programs to determine the composition and concentration of pollutants in FKNMS waters.

Rationale for Selection

The two strategies included within this issue area initially ranked as High (Priority 2) and Very High Priority (Priority 1), respectively. Due to the uncertainties associated with emerging pollutants of concern, along with their potential contribution to local water quality and ecological degradation, the working group identified this as an issue which would benefit from further investigation and attention by the WQPP.

WQPP Core Responsibilities

The working group additionally recommended several strategies related to the core responsibilities of the WQPP, including general administration, data collection, analysis and reporting, and education and outreach. Without these key components, the WQPP's ability to meaningfully contribute to water quality improvements within FKNMS will be limited.

WQPP Administration

Recommended Strategy

- **18-1**. Ensure adequate staffing and support to effectively manage and advance the Water Quality Protection Program, as mandated by the FKNMSPA.

Rationale for Selection

The working group recognized that ensuring the continuity and strength of the WQPP is critical for achieving other priority water quality activities. Proper administration of the program requires a certain level of staff support and resources, which have declined since the program's inception. In particular, when the Florida Keys National Marine Sanctuary and Protection Act (FKNMSPA) established the WQPP, it specifically called for an EPA-appointed Liaison Officer to be located in the State of Florida and provide administrative and technical support in implementing the program. While EPA, DEP and NOAA offer part-time staff support in administering the program, such a dedicated position is currently lacking. The WQPP is uniquely positioned to speak as an integrative voice on issues that cross multiple jurisdictions

and agencies, and sustained support for scientific and administrative staffing is necessary to be effective in this role.

Data Collection, Analysis and Reporting

Recommended Strategies

- **19-3.** Set up a Critical Monitoring Workshop to evaluate the existing water quality monitoring program, and recommend changes to answer priority questions or better inform management needs. This will require (a) an articulation of key management questions, (b) an evaluation as to whether those management needs can be fulfilled via mining existing data, a special study or region-wide monitoring, and (c) recommendations from the TAC on the design of special studies or changes to the region-wide monitoring program to effectively answer management questions.
- **19-2.** Conduct alternative analyses or "mining" of the existing suite of water quality data to determine if water quality improvements, hotspot areas, or specific sources contributing to water quality degradation can be determined. Consider also incorporating other monitoring tools, such as satellite imagery, to provide additional information about regional trends.
- **19-1.** Continue to implement long-term water quality and ecological (coral/seagrass) monitoring. This may include changes to the monitoring design made as an outcome of the Critical Monitoring Workshop (19-3).
- **19-4.** Design a monitoring program to detect the effectiveness of corrective actions in improving water quality. While this may need to be project-specific, more general tools such as modeling or remote sensing could be developed to evaluate management actions (similar to Briceño's project with EPA in Biscayne Bay).
- **20-1**. Require all WQPP-generated data to meet applicable USEPA QA/QC requirements and all monitoring data to be submitted in a WIN-compatible format (especially data that would be used for regulatory purposes). These basic data management criteria should be specified in all project contracts.
- **20-2**. Ensure all historical WQPP-generated monitoring data that has not been uploaded to WIN is added to that database in a timely manner.

Rationale for Selection

As directed in the FKNMSPA that established the WQPP, monitoring is one of the fundamental responsibilities of the program. Water quality, coral reef, and seagrass monitoring programs have been in place within FKNMS for more than 25 years. Monitoring information is critical for understanding sources of pollution and the status of marine resources, as well as informing necessary corrective actions and other management decisions. Recognizing that the science, technology, and issues associated with water quality in the Keys are constantly evolving, the working group emphasized the importance of evaluating the existing monitoring programs to determine where enhancements can be made moving forward. Beyond the data collection itself, the group also identified the importance of robust data analysis and proper data management for ensuring the resources expended on monitoring programs are able to return valuable information to support water quality improvements and other management solutions.

Education and Outreach

Recommended Strategies

- **23-4.** Provide a website or other mechanism for data to be available to the public, including all reports and other outputs from projects funded through the WQPP.
- **23-5.** Expand education and outreach efforts to inform the community about water quality in FKNMS, including the top contributors to water quality decline, strategies to remediate those issues, and opportunities for agency and individual action to support water quality improvements.

Rationale for Selection

Education and outreach is another fundamental responsibility of the WQPP. The working group recognized that fostering a better understanding of water quality issues and improvement strategies, ensuring greater accessibility of water quality data and other WQPP outputs, and enhancing opportunities for public participation are critical for achieving meaningful progress towards water quality solutions within FKNMS. One Education and Outreach strategy specific to education on stormwater issues and prevention (strategy 4-4) was ranked as a Very High Priority (Priority 1) and thus was initially recommended by the working group as a WQPP priority. However, upon further review of several other strategies ranked as High Priority (Priority 2), the working group felt strongly that a hybrid recommendation be developed that would better encompass education and outreach across a variety of water quality issues. As such, a newly-developed strategy (23-5) emerged for incorporation into this draft recommendation.

Next Steps

As previously noted, following the Steering Committee's review of the recommended priorities and approval of a final list, a phase-II facilitated planning process will be initiated to develop more detailed action plans relevant to those priorities. It is during phase-II that additional details regarding implementation steps, agency leads, budgets, and timelines may be developed.

Appendix 1. Working Group Participants

- Gus Rios, Florida Department of Environmental Protection, Management Committee
- Steven Blackburn, Environmental Protection Agency (EPA), Management Committee and TAC
- Karen Bohnsack, FKNMS, Management Committee
- Nancy Diersing, FKNMS, Management Committee Alternate
- Rhonda Haag, Monroe County Designee (on behalf of Roman Gastesi), Management Committee
    - Greg Corning, WOOD, Consultant to Monroe County
- John Hunt, Florida Fish and Wildlife Conservation Commission, Management Committee and TAC
- Shelly Krueger, Florida Sea Grant, Management Committee and TAC
- George Garrett, City of Marathon, Management Committee and TAC
- Nicholas Parr, Florida Department of Environmental Protection, TAC
- Alison Higgins, City of Key West, TAC
- Christopher Kavanagh, National Park Service – Everglades and Dry Tortugas, TAC
- Henry Briceño, Florida International University, TAC
- Jerry Ault, University of Miami, TAC
- Chris Bergh, The Nature Conservancy, TAC
- Michael Roberts, Monroe County, TAC
- Rene Price, Florida International University, TAC

Appendix 2. Prioritization Criteria and Framework

Criteria:

Each WQPP strategy was evaluated against the following criteria, based on a scale of Very High, High, Medium, or Low.

- **Water Quality Benefit**: Projected effectiveness in reducing water quality problems in FKNMS.
- **Potential WQPP Impact**: Likelihood that the WQPP can have a meaningful impact or serve as a key influencer on the issue or activity.
- **Level of Completion**: Degree to which the issue or activity has been or is currently being addressed.

Ranking Matrix:

Water Quality Benefits = Low

Level of Completion	<------Potential WQPP Impact------>			
	Very High	High	Medium	Low
Very High	Priority #4	Priority #4	Priority #4	Priority #4
High	Priority #3	Priority #4	Priority #4	Priority #4
Medium	Priority #3	Priority #3	Priority #4	Priority #4
Low	Priority #2	Priority #3	Priority #3	Priority #4

Water Quality Benefits = Medium

Level of Completion	<------Potential WQPP Impact------>			
	Very High	High	Medium	Low
Very High	Priority #3	Priority #4	Priority #4	Priority #4
High	Priority #3	Priority #3	Priority #4	Priority #4
Medium	Priority #2	Priority #3	Priority #3	Priority #4
Low	Priority #1	Priority #2	Priority #3	Priority #3

Water Quality Benefits = High

Level of Completion	<------Potential WQPP Impact------>			
	Very High	High	Medium	Low
Very High	Priority #3	Priority #3	Priority #4	Priority #4
High	Priority #2	Priority #3	Priority #3	Priority #4
Medium	Priority #1	Priority #2	Priority #3	Priority #3
Low	Priority #1	Priority #1	Priority #2	Priority #3

Water Quality Benefits = Very High

Level of Completion	<------Potential WQPP Impact------>			
	Very High	High	Medium	Low
Very High	Priority #2	Priority #3	Priority #3	Priority #4
High	Priority #1	Priority #2	Priority #3	Priority #3
Medium	Priority #1	Priority #1	Priority #2	Priority #3
Low	Priority #1	Priority #1	Priority #1	Priority #2

Appendix 3. Contributors to Keys' Water Quality Issues

The following issue areas were identified as the top contributors to Florida Keys' water quality issues during a facilitated multi-voting exercise:

1st: South Florida Regional External Influences

2nd – 5th (Tied):

- Farfield External Influences
- Local Wastewater
- Local Stormwater
- Tidal Flooding and Climate

6th: Sargassum and Organic Debris

7th – 8th (Tied):

- Canal Restoration
- Emerging Pollutants of Concern

9th: Marinas and Liveaboards

10th: Marine Debris

Other Issue Areas Noted:

- Mosquito Spraying
- Potential Offshore Drilling
- Coastal Acidification
- Atmospheric Inputs
- Vessel Discharges from Large Ships
- Harmful Algal Blooms*
- Coastal Overdevelopment*

*These issue areas were added after the fact, and were not included during the initial exercise to identify the top contributors to water quality decline in the Florida Keys.

Issue Area	Issue #	WQPP Strategy	Type of Activity	Relative Benefits	Relative WQPP Influence	Relative Level of Completion	Original Relative Priority	Included in Recommendation?
Local Stormwater	4	1. Design and build more effective stormwater projects, to include stricter stormwater management and project permitting.	Corrective Action	Very High	Very High	Medium	Priority 1	X
Local Stormwater	4	2. Support planning, development and implementation of the Monroe County Stormwater Master Plan. Develop best management practices for stormwater within Monroe County, including a consideration of better solutions to treat stormwater runoff in the Keys' environment. In addition to treatment options, prevention of stormwater via a reduction in impervious surfaces should also be considered.	Corrective Action	Very High	Very High	Medium	Priority 1	X
Tidal Flooding and Climate Change	5	2. Ensure wastewater and stormwater infrastructure is equipped to accommodate changing conditions associated with sea level rise and higher-intensity storms. Assess the ability of existing permitting requirements and facility designs to protect water quality, infrastructure and habitat under changing climate scenarios, and consider alternative design criteria for different types of facilities, levels of use, and/or areas. Identify and incorporate features to promote resilience, such as stormwater retention basins.	Corrective Action	Very High	High	Medium	Priority 1	X
General Activities	18	1. Ensure adequate staffing and support to effectively manage and advance the Water Quality Protection Program, as mandated by the FKNMSPA.	Other - WQPP	Very High	Very High	High	Priority 1	X
Local Wastewater	3	5. Research/monitor shallow injection wells to determine their impact on nearshore water quality. Test wastewater or other injectate for pollutants other than nutrients, including endocrine disruptors and other emerging pollutants of concern, salinity, viruses/bacteria, etc. Determine if injected effluent appears in the coastal waters and if so, identify where, what pollutants it still contains, and whether it causes local water quality degradation.	Research/ Special Studies	Very High	Very High	Low	Priority 1	X
Local Wastewater	3	6. Pending the results of the shallow injection well studies, consider pursuing additional corrective actions such as (a) the development of water quality standards or aquatic life criteria for endocrine disruptors or other contaminants of emerging concern, (b) investigating and/or implementing new wastewater treatment technologies to remove those contaminants, and (c) reducing the wastewater treatment plant capacity threshold for requiring deep well injection within the Keys and areas with similar porous geology (e.g., require deep injection wells, cased to a minimum depth of 2,100 feet, even if the design capacity of the wastewater treatment plant is less than 1 million gallons per day).	Corrective Action	Very High	Very High	Low	Priority 1	X
Monitoring/ Research Activities	19	4. Design a monitoring program to detect the effectiveness of corrective actions in improving water quality. While this may need to be project-specific, more general tools such as modeling or remote sensing could be developed to evaluate management actions (similar to Briceño's project with EPA in Biscayne Bay).	Monitoring	Very High	Very High	Medium	Priority 1	X
Monitoring/ Research Activities	19	3. Set up a Critical Monitoring Workshop to evaluate the existing water quality monitoring program, and recommend changes to answer priority questions or better inform management needs. This will require (a) an articulation of key management questions, (b) an evaluation as to whether those management needs can be fulfilled via mining existing data, a special study or region-wide monitoring, and (c) recommendations from the TAC on the design of special studies or changes to the region-wide monitoring program to effectively answer management questions.	Monitoring	Very High	Very High	Low	Priority 1	X
Monitoring/ Research Activities	19	2. Conduct alternative analyses or “mining” of the existing suite of water quality data to determine if water quality improvements, hotspot areas, or specific sources contributing to water quality degradation can be determined. Consider also incorporating other monitoring tools, such as satellite imagery, to provide additional information about regional trends.	Research/ Special Studies	High	Very High	Low	Priority 1	X
Local Stormwater	4	4. Provide education on stormwater issues and prevention, both to contractors and homeowners who may inadvertently contribute to stormwater pollution.	Public Education/ Outreach	High	High	Low	Priority 1	Replaced with 23-5
Emerging Pollutants of Concern	8	3. Incorporate emerging pollutants of concern into monitoring programs to determine the composition and concentration of pollutants in FKNMS waters.	Monitoring	High	Very High	Low	Priority 1	X
Local Wastewater	3	1. Implement Monroe County Wastewater Plan to achieve compliance with Section 403.086(10) F.S. Continue connecting package plants and septic tanks to central wastewater systems, including the Cudjoe Regional Wastewater Service Area.	Corrective Action	Very High	Very High	Very High	Priority 2	X
Canal Hydrology and Water Quality Restoration	7	1. Continue to support and implement the Monroe County Canal Master Plan and Canal Restoration Guidance Document to take steps toward restoring and improving water quality in residential canals, and reduce marine debris accumulation. Provide guidance to ensure maximum water quality benefits are achieved through canal restoration; assess options and funding sources to support operations and maintenance costs.	Corrective Action	Very High	Very High	Very High	Priority 2	X
Regulatory Activities	21	3. Support ongoing WQS development: Numeric Nutrient Criteria.	Corrective Action	Very High	High	High	Priority 2	

Issue Area	Issue #	WQPP Strategy	Type of Activity	Relative Benefits	Relative WQPP Influence	Relative Level of Completion	Original Relative Priority	Included in Recommendation?
Emerging Pollutants of Concern	8	2. Research emerging pollutants of concern to determine the magnitude of the problem posed by endocrine disruptors and other emerging pollutants.	Research/ Special Studies	High	High	Medium	Priority 2	X
Canal Hydrology and Water Quality Restoration	7	4. Educate canal residents on best practices for reducing water quality issues in canals.	Public Education/ Outreach	High	High	Medium	Priority 2	
Local Wastewater	3	4. Ensure centralized wastewater treatment systems are able to accept wastewater from non-municipal sources (e.g., marine sanitation devices and R/V blackwater), or update the collection systems as needed to accommodate that effluent.	Corrective Action	High	High	Medium	Priority 2	X
Data Management	20	1. Require all WQPP-generated data to meet applicable USEPA QA/QC requirements and all monitoring data to be submitted in a WIN-compatible format (especially data that would be used for regulatory purposes). These basic data management critera should be specified in all project contracts.	Other - WQPP	Medium	Very High	Medium	Priority 2	X
Education and Outreach	23	4. Provide a website or other mechanism for data to be available to the public, including all reports and other outputs from projects funded through the WQPP.	Public Education/ Outreach	Medium	Very High	Medium	Priority 2	X
Education and Outreach	23	1. Expand education and outreach efforts to inform the community about the WQPP and the activities it is working on. This should include print and digital media, and other novel approaches to reach people.	Public Education/ Outreach	Medium	Very High	Medium	Priority 2	
Emerging Pollutants of Concern	8	4. Educate the public on emerging pollutants, their potential impacts, and alternatives or solutions (e.g., include information on reef friendly sunscreens). Include messaging on human health impacts in addition to environmental impacts.	Public Education/ Outreach	Medium	High	Low	Priority 2	
South Florida Regional Influences	1	7. Organize a Florida Keys/Florida Bay/Biscayne Bay Science Conference to share and help develop consensus on the latest science, and determine updates necessary for the FKNMS Water Quality Action Plan.	Other - Collaboration	Medium	High	Low	Priority 2	
South Florida Regional Influences	1	1. Actively engage with the South Florida Ecosystem Restoration Task Force's efforts to restore the quantity, quality, timing and distribution of freshwater flow to the Everglades, Florida Bay, Biscayne Bay, and northern estuaries (Caloosahatchee and St. Lucie).	Other - Collaboration	Very High	Low	Medium	Priority 3	X
Local Wastewater	3	3. Ensure the sustainability and functionality of wastewater infrastructure. Monitor collection systems for proper performance and compliance. Iteratively review and adapt regulations and best management practices for wastewater infrastructure designs (vacuum sewers, gravity vs. low-pressure systems) and operations to ensure the systems are working properly and promote optimal functionality within the Keys environment.	Corrective Action	Very High	Medium	Very High	Priority 3	X
Marinas/ Liveaboards	9	2. Ensure adequate marine pumpout services and/or facilities to eliminate discharge of waste from vessels into FKNMS. Marinas should have and maintain their own pumpout facilities and assume responsibility for ensuring they have adequate pumpout capacity for the liveaboards that use that facility.	Corrective Action	Very High	High	Very High	Priority 3	X
South Florida Regional Influences	1	2. Pursue improvements to mainland wastewater infrastructure (closure of outfall pipes, upgrades to aging infrastructure, septic to sewer conversion, etc.). This may include coordination with local governments to develop resolutions and encourage timely and definitive action towards infrastructure improvements.	Corrective Action	Very High	Medium	Very High	Priority 3	X
Marinas/ Liveaboards	9	3. Conduct education and outreach to marina users to reduce marina pollution.	Public Education/ Outreach	High	High	Very High	Priority 3	
Tidal Flooding and Climate Change	5	3. Conduct a risk assessment to determine the vulnerability of water management infrastructure and land areas to tidal flooding and sea level rise, and the potential magnitude of associated water quality impacts. Identify the locations of properties of particular concern to water quality (e.g., previous dump sites), estimate when those areas would become at risk due to tidal flooding or sea level rise, and recommend the most effective management or remediation options based on a cost-benefit analysis (e.g., determine whether to remove hazardous materials from previous dump sites or to armor them to avoid erosion or minimize the likelihood of harmful substances being released into the environment).	Research/ Special Studies	High	Medium	High	Priority 3	
Canal Hydrology and Water Quality	7	3. Research the impact canals have on nearshore water quality to determine their relative contribution to water quality issues and the importance of continuing canal restoration efforts.	Research/ Special Studies	High	Very High	Very High	Priority 3	
Sargassum/ Organic Debris	6	1. Identify a suite of management options to successfully control and/or dispose of sargassum, including techniques for separating out plastic debris.	Corrective Action	High	High	Very High	Priority 3	X
Harmful Algal Blooms	16	1. Research the various types of harmful algal blooms (HABs) that affect the Keys' waters to determine the parameters that trigger different HAB events and the associated impacts of those blooms.	Research/ Special Studies	High	Medium	High	Priority 3	

Issue Area	Issue #	WQPP Strategy	Type of Activity	Relative Benefits	Relative WQPP Influence	Relative Level of Completion	Original Relative Priority	Included in Recommendation?
Coastal Overdevelopment	17	1. Work closely with the county on coastal projects to determine the impacts of coastal development on water quality and recommend best practices to reduce those impacts.	Other - Collaboration	High	Medium	Medium	Priority 3	
Farfield External Influences	2	1. Pursue improvements to watershed management practices in the Mississippi River Basin and a reduction of land-based pollution from coastal communities along the Gulf.	Corrective Action	Medium	Low	Low	Priority 3	
Local Wastewater	3	7. Develop a nearshore monitoring program to determine the impact of centralized, advanced wastewater treatment on nearshore water quality and resources.	Monitoring	Medium	High	High	Priority 3	
Sargassum/ Organic Debris	6	2. Research water quality impacts associated with accumulated sargassum or other organic debris on beaches and in nearshore waters to inform management decisions/strategies.	Research/ Special Studies	Medium	Medium	Medium	Priority 3	
Canal Hydrology and Water Quality Restoration	7	2. Establish an ordinance to prohibit dumping leaf litter, fish scraps, and other materials into canals, marinas and nearshore waters that result in degraded water quality.	Corrective Action	Medium	Medium	Low	Priority 3	
Data Management	20	2. Ensure all historical WQPP-generated monitoring data that has not been uploaded to WIN is added to that database in a timely manner.	Other - WQPP	Medium	High	High	Priority 3	X
Emerging Pollutants of Concern	8	1. Identify if emerging technology exists for reducing the input of these pollutants of concern into the environment from various sources (e.g., technologies to remove these compounds from wastewater or elsewhere). Such technologies could eventually be incorporated into best management practices across the various sources.	Corrective Action	Medium	Medium	Low	Priority 3	
South Florida Regional Influences	1	3. Conduct Florida Keys Tidal Restoration.	Corrective Action	Medium	Medium	Low	Priority 3	
Farfield External Influences	2	4. Coordinate with the Gulf of Mexico Alliance and other entities working across the Gulf of Mexico and Mississippi River Basin to encourage the use of best management practices to protect water quality.	Other - Collaboration	Medium	Low	Low	Priority 3	
Monitoring/ Research Activities	19	1. Continue to implement long-term water quality and ecological (coral/seagrass) monitoring. This may include changes to the monitoring design made as an outcome of the Critical Monitoring Workshop (19-3).	Monitoring	Medium	Very High	Very High	Priority 3	X
Sargassum/ Organic Debris	6	3. Develop guidelines and educate homeowners on the proper ways to control or dispose of sargassum (e.g., it cannot be added to yard waste refuse because of its salt content).	Public Education/ Outreach	Low	Medium	Low	Priority 3	
Education and Outreach	23	2. Reestablish the WQPP Outreach Subcommittee, or develop a more informal Education and Outreach Working Group to develop and implement a water quality communications plan (note: one was created in the past).	Public Education/ Outreach	Low	High	Low	Priority 3	
Education and Outreach	23	3. Identify and implement additional opportunities to engage with stakeholders on water quality issues.	Public Education/ Outreach	Low	High	Medium	Priority 3	
Habitat Protection/ Restoration	22	2. Conduct sponge restoration in nearshore shallow waters.	Corrective Action	Medium	High	Medium	Priority 3	
Local Wastewater	3	2. As part of implementing the Monroe County Wastewater Plan, connect Cross Key and other remaining remote areas to decentralized Advanced Wastewater Treatment or Best Available Technology treatment standards.	Corrective Action	High	Medium	Very High	Priority 4	X
Marinas/ Liveaboards	9	1. Strengthen regulations to reduce marine and boater pollution.	Corrective Action	High	Medium	Very High	Priority 4	
Habitat Protection/ Restoration	22	1. Restore reefs after Stony Coral Tissue Loss Disease.	Corrective Action	Medium	Low	High	Priority 4	
South Florida Regional Influences	1	4. Research the effects of inputs from mainland south Florida and Florida Bay on Florida Keys National Marine Sanctuary resources.	Research/ Special Studies	Medium	Medium	High	Priority 4	
South Florida Regional Influences	1	8. Create a forecasting tool to assist water management agencies in adapting operations to prevent ecological collapse in Florida Bay (e.g., similar to NOAA Coral Reef Watch/Degree Heating Weeks/Alerts to determine bleaching risk on the reef, this would look at rainfall, water inputs from the Everglades, real time salinity, surface temperature, etc.	Research/ Special Studies	Medium	Low	High	Priority 4	
Regulatory Activities	21	2. Support ongoing WQS development: Turbidity standard.	Corrective Action	Medium	Low	Very High	Priority 4	
South Florida Regional Influences	1	5. Research potential impacts of hypersaline cooling canal waters from Turkey Point on Biscayne Bay, include Card Sound, Barnes Sound, and Manatee Bay.	Research/ Special Studies	Low	Low	Medium	Priority 4	
South Florida Regional Influences	1	6. Conduct public education and outreach on the connectivity between the Keys and water quality issues and pollution sources from mainland south Florida. Establish informed support for corrective actions and voluntary compliance by including information on actions individuals in the community can take to encourage regional water quality improvements.	Public Education/ Outreach	Low	Medium	Medium	Priority 4	

Issue Area	Issue #	WQPP Strategy	Type of Activity	Relative Benefits	Relative WQPP Influence	Relative Level of Completion	Original Relative Priority	Included in Recommendation?
Tidal Flooding and Climate Change	5	4. Research the potential impacts of habitat loss due to sea level rise on Keys' water quality (e.g., as rising sea levels kill freshwater marshes and cause peat collapse, does that oxidize and become dissolved organic matter that clouds the water and will eventually be transported into Florida Bay and onto the reef? What overall impact might this have on WQ?).	Research/ Special Studies	Low	Low	High	Priority 4	
Mosquito Spraying	11	3. Review existing science on mosquito spraying and attempt to come to a conclusion as to the threat posed by this activity. This should include a review of the ways that mosquito control has reduced or changed their use of insecticides and other control techniques.	Research/ Special Studies	Low	Medium	High	Priority 4	
Farfield External Influences	2	2. Research the connection between, and the effects of, inputs from farfield external sources (greater Mississippi watershed and Gulf of Mexico) on Florida Keys National Marine Sanctuary resources.	Research/ Special Studies	Low	Low	Low	Priority 4	
Local Stormwater	4	3. Establish a community water basin stewardship program (similar to Bay Keeper or River Keeper), to provide educational information to the community and resource users. This could include boaters operating within canals to provide education to waterfront homeowners.	Public Education/ Outreach	Low	Medium	Medium	Priority 4	
Regulatory Activities	21	4. Develop additional Keys mooring fields (Monroe County 2014 mooring field feasibility study).	Corrective Action	Low	Low	Very High	Priority 4	
Tidal Flooding and Climate Change	5	1. Educate the community on the risks climate change poses to the Keys and local water quality, as well as solutions or intervention opportunities (including adaptation and mitigation strategies). All information should be translated into lay terms, and novel approaches and different media should be incorporated to more effectively reach people (e.g., videos vs. books). Step 1: Consolidate information Step 2: Design communications pieces.	Public Education/ Outreach	Low	Low	High	Priority 4	
Mosquito Spraying	11	2. Research the resource impacts associated with mosquito control, including new mosquito control technologies/techniques.	Research/ Special Studies	Low	Low	Very High	Priority 4	
Farfield External Influences	2	3. Conduct public education and outreach on the connectivity between the Keys and water quality issues and pollution sources from farfield external sources (Mississippi watershed and Gulf of Mexico). Establish informed support for corrective action by including information on actions individuals in the community can take to encourage water quality improvements across the greater Mississippi watershed.	Public Education/ Outreach	Low	Low	Low	Priority 4	
Tidal Flooding and Climate Change	5	5. Research the biological and chemical changes associated with warming waters.	Research/ Special Studies	Low	Low	High	Priority 4	
Mosquito Spraying	11	1. Reduce aerial spraying within the Sanctuary.	Corrective Action	Low	Low	Very High	Priority 4	
Regulatory Activities	21	1. Establish biocriteria for corals.	Corrective Action	Low	Low	Medium	Priority 4	
Harmful Algal Blooms	16	2. Conduct education and outreach on the triggers of various HABs, the potential consequences, and actions that can be taken to avoid or remediate blooms.	Public Education/ Outreach	Low	Low	Medium	Priority 4	
Marine Debris	10	1. Prevent accumulation of man-made/plastic marine debris in enclosed water bodies and along shorelines.	Corrective Action				Not Ranked	
Marine Debris	10	2. Research the water quality impacts associated with accumulated man-made/plastic marine debris.	Public Education/ Outreach				Not Ranked	
Education and Outreach	23	5. Expand education and outreach efforts to inform the community about water quality in FKNMS, including the top contributors to water quality decline, strategies to remediate those issues, and opportunities for agency and individual action to support water quality improvements.	Public Education/ Outreach				Not Ranked	X
Offshore Drilling	12	N/A						
Coastal Acidification	13	N/A						
Atmospheric Inputs	14	N/A						
Vessel Discharges from Large Ships	15	N/A						