FLORIDA KEYS NATIONAL MARINE SANCTUARY
Water Quality Protection Program Steering Committee Meeting

November 13, 2024

DRAFT MINUTES

Steering Committee Members Present
Wade Lehmann, US Environmental Protection Agency (EPA), Region 4 (Chair)
Kim Shugar, Florida Department of Environmental Protection (DEP) (Co-Chair)
Matthew Stout, Florida Keys National Marine Sanctuary (FKNMS)
Meagan Schrandt, National Park Service (NPS)
Greg Boling, Florida Keys National Wildlife Refuges Complex (FKNWR)
Yazmin Valdez, Florida Commerce - *Online*
Gil McRae, Florida Fish and Wildlife Conservation Commission (FWC)
Sue Heim, Key Largo Wastewater Treatment District (KLWTD)
Stephanie Faucett, Florida Keys Mosquito Control District (FKMCD)
Craig Cates, Monroe County Board of County Commissioners (MCBOCC) - *Online*
George Garrett, City of Marathon
Kelly Cox, FKNMS Sanctuary Advisory Council (SAC)
Sandy Walters, Eco Legacy Solutions, LLC (ELC)
Chris Bergh, Florida Keys Program, The Nature Conservancy (TNC)
Mimi Stafford, Citizen at Large
Patience Cohn, Marine Industries Association of South Florida (MIASF)

Summary of Resolutions

- Motion 1 (passed): Sandy Walters made the motion to approve the agenda with the proposed addition to discuss membership; Sue Heim seconded. The agenda was approved with the proposed change.
- Motion 2 (passed): Patience Cohn made the motion to approve the minutes; Chris Bergh seconded. The minutes passed with no objections.
- Motion 3 (passed): Sandy Walters made a motion to approve the resolution supporting the tidal connection project at Curry Hammock. Patience Cohn seconded the motion. Co-Chair Lehman called the question. Of the members present, four recused themselves from voting; the remaining ten voted in favor of the motion and the motion passed with no objections.

I. Introduction and Opening Remarks

Wade Lehmann, Ocean and Estuarine Section Chief, EPA Region 4, called the meeting to order at 9:10 am and welcomed everyone. Kim Shugar, Division of Ecosystem Assessment and Restoration (DEAR) Director, DEP, and Dr. Lehmann are the meeting co-chairs.

Dr. Lehmann introduced himself and gave the opening remarks on behalf of EPA. Thanks to the City of Marathon for providing the meeting space today. Steve Blackburn has been part of WQPP since 2008 for

EPA, including overseeing the grants for funding research and monitoring. He is retiring next month so this will be his last WQPP meeting. Beth Smith is with EPA and will take on some of Steve's portfolio. Recipients for the 2024 grants have been selected and are currently awaiting approval from the division. Recipients will be notified in January. Nearly $9M in grants will be awarded. EPA's new South Florida Program website is live at epa.gov/southflorida. This resource includes all grant information and a GIS map that depicts where those projects are located. The website also links to the main WQPP website.

Becky Allenbach, EPA added that EPA recently completed a 5-year sampling effort in the Everglades. Information about this project will also be published on the website, including data and reports that give a 30 year picture of the health of the Everglades.

Ms. Shugar gave the opening remarks on behalf of FDEP. DEP's DEAR oversees water quality monitoring, and develops and implements restoration plans.

Members of the WQPP Steering Committee introduced themselves. Management Committee and Technical Advisory Committee members in attendance were recognized.

Wade Lehmann, reviewed housekeeping information, including the hybrid meeting format and instructions for attendee participation and public comment. The presentations and materials associated with the meeting will be available at the Steering Committee page on the Water Quality Protection Program website http://ocean.floridamarine.org/FKNMS_WQPP/.

Agenda and Minutes
Mr. Lehmann reviewed the agenda and minutes from July 30, 2024 and requested edits or a vote to approve from the Steering Committee. Sue Heim requested to add an agenda item (to discuss FKAA representation on the Committee). Sandy Walters made the motion to approve the agenda with the proposed addition; Sue Heim seconded. The agenda was approved with the proposed change. Patience Cohn made the motion to approve the minutes; Chris Bergh seconded. The minutes passed with no objections.

II. WQPP Communications Subcommittee

Genevieve Schave, DEP, reminded attendees that a WQPP Communications Subcommittee was discussed and approved in July by the Steering Committee. Today's presentation is to provide a status update and revisit a few items for the committee's input. There are currently eight members on the subcommittee, including representatives from Monroe County, EPA, Florida Sea Grant, FWC, NOAA, KLWTD, Lower Keys Guides Association (LKGA), and Eco-Legacy Solutions.

The group had a virtual introductory meeting on October 3rd. In total, there were 11 attendees, including all members, Genevieve, and an FKNMS staff member who provided information to initiate an interpretive planning process. Members were introduced to interpretation as a discipline which, compared to environmental education, focuses on creating an emotional connection vs. flooding an audience with facts. A potential additional training in interpretation for this committee was discussed, as well as an in-person workshop to actually develop a communications and interpretive plan.

Roles and responsibilities for the subcommittee were reviewed. These are the same as what was discussed in July and include: participation in an initial water quality interpretive planning workshop facilitated by NOAA staff (the goal is to schedule this in person concurrent with the next Steering Committee meeting), participation in meetings and report out to the Steering Committee, coordinating communications and outreach related to water quality issues, creating shared messaging and products to amplify the work of

the WQPP, contributing to the Congressional Report (not to include writing content, but to assist with a template), and identifying a team lead, co-lead and secretary.

Deliverables were also reviewed: shared messaging about water quality, website updates, WQPP congressional report development and distribution, coordinating on other external products, and providing updates to the Steering Committee. The Steering Committee was asked for additional guidance relative to the purpose, responsibilities, and deliverables of the subcommittee.

Questions & Answers/Comments/Discussion:

- Sue Heim, KLWTD, suggested that the communications subcommittee convene to provide recommendations on these various questions. There is a concern about the expense associated with this group; there is no funding for this effort. The Public Information Officers (PIOs) on the committee felt that a focus on interpretation did not align with the PIO experience. There are also questions about the hierarchy within this group. This is a multi-agency committee; is one agency going to take the lead?
    - Genevieve Schave noted the desire to assign a chair and co-chair to provide leadership.
- Wade Lehmann, EPA, agreed that having a chair for the committee is a good idea; this would likely need to be self-selected.
- Gil McRae, FWC: This is a long time coming; agree with purpose and objectives. The WQPP is more low profile than it should be, so applaud this focus on communications. There is a lot going on in south Florida, and the one thing people understand is that everything is driven by water quality. The WQPP exists as part of FKNMS and is fundamental to the mission of FKNMS, yet it is underappreciated for its role in developing these long-term data sets we have for the sanctuary. The [EPA] website is a good idea with the map-based interface; we should get the word out. We also want to ensure people know about this multiagency group and the progress made over the years. Happy to help where he can.
- Chris Bergh, TNC: Recommendation to keep it simple. We have PIOs/agencies with communications mechanisms. If the objective is coordinating about messaging - consider what is the timely thing to message now. Focus on one thing at a time; don't make it super complex.
- Sandy Walters, ELC: Was at the first meeting of this group. I agree with keeping this simple. I was anticipating starting to establish a list of short term vs. long term things to accomplish, but that meeting did not get there. As a member of the WQPP since 2003, we started some effective, quick, easy things way back when - like having water quality month and giving presentations at local government meetings, etc. These were simple and straightforward. Request to set short term goals and schedules for certain communications activities. We don't need to do it all now and can have long term goals for more educational types of activities.
- Sue Heim, KLWTD: Asked for a status update on the Congressional Report. PIOs are ready for this, but need to have something to work on.
    - Wade Lehmann will provide an update at the end of this agenda item.
- Wade Lehmann, EPA: Agrees that continuous public education is a lift. No agencies have that kind of staff time. Consider a quarterly schedule and a long term schedule later. Focus on a pertinent subject related to water quality in the Keys on a quarterly basis. The subcommittee can help get that into the public sphere. Most agencies probably have capacity for this; if we can develop something to put out, we can all help to spread the word.
- Sue Heim, KLWTD: Want to know what the subcommittee's authorities are. For example, if we come up with a change to a website, an agency needs to control that. General messaging needs to be consistent so we say the same thing the same way over and over again. Request for guidance on the subcommittee's authority to set direction without that first being reviewed by the Steering Committee.

- Wade Lehmann, EPA: Having consistent material would be step 1. Then anyone can talk about it and have WQPP approval. How to authorize people to speak on our behalf?
    - Sue Heim: If needed, this can be an agenda item for the next meeting if there is no decision today.
- Chris Bergh, TNC: PIOs represent the agencies and can coordinate messages. The agencies will be the ones communicating vs. having a specific representative from the WQPP communicating. As a reminder, there are other related committees such as Florida's Coral Reef Resilience (FCRRP) communications committee that this group can coordinate with.
    - Genevieve Schave, DEP, has joined one meeting of the FCRRP. They are working on invasive species and public awareness documents. She will continue to join these meetings for awareness and ideas as we further develop this water quality communications subcommittee.
- Sue Heim, KLWTD: Believes the original intention was the congressional report and how to get this out. Believes this should be the primary focus.
- Chris Bergh, TNC: We are putting out $9M in grant funding and no one knows. It is important to make people aware of this, and why we are spending this money for our environment and economy.
- Gil McRae, FWC: These are the core components - the congressional report and funding for water quality. The communications group should focus on how to make the report more public friendly and promote it. Do not believe this focus would require any additional review from this committee.
- Chirs Bergh, TNC: As a reminder, we had a two-year timeline on this group. That's not to say it won't be reapproved, but we need to get to work and not make it too complicated to get some results.
- Becky Allenbach, EPA: EPA will do a press release to announce the $9M in grants awarded, encourage all the other agencies to pick that up and put it out. This can also be circulated in newsletters, etc.
- Patience Cohn, MIASF: From a private sector perspective, the government tends to get bogged down and move slowly. The MIASF newsletter was eliminated and everything is now on social media and has been well received. It's as simple as some photos and short text to say who sponsored this study and a link for more information about the study. This is easy and cheap to do.
- Wade Lehmann, EPA, recapped some proposed take aways:
    - Each member should work in their agency to identify the appropriate lines of communication to approve messages to go out. EPA is not local and will need to lean on local people for those local interest stories, photos for social media, etc.
    - Recommend everyone talking to their communications people to get their thoughts and buy in. Share those ideas directly with the subcommittee - let them know what agency reviews and approvals will look like.
- Wade Lehmann, EPA, provided a quick update on the congressional report: This document has passed from FKNMS to DEP to EPA. Beth Smith is making progress; it was too long and disjointed so they are working on trimming the content to something that is 20 pages. Data stuff will be moved to an appendix. This is necessary for the intended audience. The EPA Public Affairs Office has someone who can help design a template - we will move the report through that person then bring it back to the supporting agencies. The goal is to get this out in the first half of next year. Anything of this caliber will need to go through an internal process (which DEP and FKNMS will also have to do). Ideally we will have something clean and available in the next 4 months so we can start that process.
- Sue Heim, KLWTD, requested a discussion about the budget for the Communications Subcommittee on the next Steering Committee meeting agenda.

III. Water Quality Monitoring Program

Dr. Henry Briceño, FIU, provided an update on 29 years of water quality monitoring in FKNMS. This program was established in 1995 with a purpose of having long-term water quality monitoring data to understand long term trends and how things are changing in the Keys, and to see if remedial actions are having results (positive or not).

Dr. Briceño provided a regional overview of water movement in FKNMS. Circulation patterns bring water to FKNMS that comes from places outside of the Keys. The loop current brings water from the Gulf of Mexico, which first comes from northeast Brazil, through the Caribbean, and then into the Gulf of Mexico before it becomes the Florida Current and moves through the ocean side of FKNMS. This is a huge mass of water; this current moves more water than all the rivers of the world combined. This is the magnitude of what we face in the Keys. Besides that, we also have what comes from the Florida peninsula, the Everglades, etc. This includes pollutants from Miami and Biscayne Bay water; some water moves back south along the shore so pollutants from Miami can make it to the Dry Tortugas. This affects the coral reef. The loop current controls the water mass and it also controls rainfall patterns. Rainwater on the peninsula also controls freshwater coming from the Florida peninsula. This goes into Florida Bay and to the Florida Keys.

A diagram of hurricanes since 1851 shows Florida in the middle of hurricane tracks. We feel the effects of hurricanes annually and our system is used to it. The ecosystem impact from hurricanes takes 3-5 years to return to previous conditions water quality-wise; other changes last many years and may never go back to previous conditions. Mostly these are changes in the geomorphology/topography of the system. For example, we have had 19 major hurricanes in the Keys since this monitoring program began, and more named storms than that. Some were very significant. Irene affected Florida Bay, which affects the Keys. There was also Wilma and other storms in 2005, Irma in 2017, Ian in 2022, etc. We have not yet quantified Hurricane Milton (2024) impacts, but sampling is going on now. These are major controllers/drivers of water quality in our system. For example, after Irma, NOAA sampled around the southern part of the peninsula and provided specimens from the sanctuary for analysis at FIU. This included sucralose analysis, which is an indicator of human impact to our water. High nitrogen (N) and phosphorus (P) was also measured in the system. Concentrations up to 73 mg/L of sucralose were measured coming out of Biscayne Bay, and we see a gradient of sucralose from the Keys to offshore. This is how far human impact goes.

Dr. Briceño summarized the 29 years of the water quality monitoring program and trends. A budget cut in 2011 reduced the number of stations by 30%; now there are 112 stations, which is down from a total of 160 at the highest point. During this time, nearly 500k measurements have been taken. Long term trends include good news that dissolved oxygen (DO) concentrations have increased significantly sanctuary wide. We have had a decline in how much light goes to the bottom to generate photosynthesis in the biota (bad news), and water clarity in most of the halo zone. The attenuation coefficient (how much light is attenuated in the water column, Kd) is increasing, which means that less light is going to the bottom. This trend is seen in some areas along the islands, although a little more light is reaching the bottom in the Marquesas (good news). Total nitrogen (TN) has declined at the surface and bottom over the whole monitoring period. This is associated with a decline in total organic carbon (TOC) in the sanctuary and also Florida Bay, Biscayne Bay, and most estuaries in south Florida. This seems to be a regional phenomenon, maybe related to a decline in productivity in the coastal environment/marshes. Nitrate and ammonium (forms of inorganic nitrogen of which high concentrations indicate human pollution such as sewer, fertilizer/agricultural pollution) has declined significantly (good news). This could be a consequence of all the work done with sewer in the Keys. It's not as strong a signal as we would like to see and there are other counter phenomena, but this has consistently declined for years. TOC has decreased too. This is linked to nutrient concentrations and is associated with organic matter. Total

phosphorus (TP) has increased around the islands, mostly in the halo zone waters close to the Keys. When the water quality monitoring program began, the design was not intended to measure pollution, but rather to see how the ecosystem behaved and how healthy it was overall. We are now asking questions that we cannot answer because the program was not set up to measure those variables. Mostly in the Keys we have a problem with increasing concentrations of P. This is linked to a generalized increase in chlorophyll a (Chla), produced by organisms which feed on P.

South Florida has more data on water quality than many other places in the country. In 2013, this data was used to develop nutrient criteria based on subdivisions of water types identified in the Keys. A lot of data was needed to develop these criteria. While monitoring is boring, the data are also important to have when there are problems that need to be investigated. In 2005, EPA required that we had some type of level to compare monitoring data against - e.g., water quality targets. Data were reviewed to look at how many parameters went above or below levels derived from observations going on elsewhere in the Keys. Targets were established for Chla, Kd, dissolved inorganic nitrogen (DIN) and TP. A graph of compliance against the baseline vs. noncompliance over time was presented. Chla is not good, Kd is good throughout, DIN is improving, and P improved but is declining again. Reports that include this compliance information are available annually.

The halo zone is the area within 500m from shore. Water quality monitoring stations were established in the halo zone in 2011. There are a total of 10 stations, with 5 each on the oceanside and bayside. Within the halo zone, we see Chla and TP increasing across stations through time. These are the problems that we need to address. More monitoring is needed to better detect the pollution problem.

Key Questions Moving Forward:

- Are we measuring/sampling where we should be measuring/sampling?
    - Yes, but we have questions. There are major sources of pollutants and we need to reassess where we sample. It's been long enough and we have enough information that we can now come up with a more efficient sampling program. The old program should be maintained, but with a new dimension.
- Are we measuring/analyzing what we should be measuring/analyzing?
    - We cover the traditional monitoring species but there are emerging pollutants that we don't measure. Microbial communities should also be considered as we know these affect coral. These are options to improve the monitoring program.
- Are we measuring at the frequency we should be measuring?
    - No. There are high frequency natural phenomena that this program cannot detect. Quarterly sampling cannot go beyond seasonally driven variability. Things might be okay, then go to concentrations that may cause fish kills (for example a drop in DO due to nighttime declines). This monitoring program cannot capture such events.

Questions & Answers/Comments/Discussion:

- Gil McRae, FWC: With this long term data set we can address big picture issues. A fundamental question is local vs. regional vs. superregional sources affecting water quality. Locally, central sewer was implemented within this time period. Were any changes observed that are associated with that? Given this time series, do you have thoughts on local vs. regional vs. superregional sources relevant to nutrients in the Keys?
    - It will take a long time for the system to respond to sewering. Many years ago, Dr. Briceño was involved in a project that included weekly sampling in canals converted to sewer. No significant change in nutrients was observed after 3 years, although they did see improvements in fecal coliform and enterococci. We don't see these changes right away because we had septic for many years and that underground mess is still there, so we don't expect to see major changes right away. Compared to a place like Tampa, our

nutrient concentrations are low, but a little increase here will drive a significant change in the ecosystem.

- George Garret, Marathon: Referencing the P increases in the halo zone, we are taking P out in the sewage system. Where is this coming from? Where is the problem? Is it pesticides and herbicides that persist in the system? There is an understanding that the rock does sequester P from the wastewater system.
    - There is a significant contribution from fertilizers and stormwater. There are more people and tourists in the Keys, which keeps increasing the P concentration above what we had. We do need to inject treated wastewater. [With shallow wells] injected water comes back to the surface right away. Dr. Briceño measured how fast water injected at 120' comes to the surface in Cudjoe Key, and found that the ground quickly returns things injected to the canals, beach, etc. We need to change our philosophy about how we deal with this. We must invest in this. Water quality is still okay, but if it continues to degrade, people won't want to come to the Keys.
    - Joe Boyer (colleague of Dr. Briceño's; via online comment) added that organic carbon and N are probably under superregional control while TP is mostly locally controlled.
- Chris Bergh, TNC: As a follow-on to the shallow well conversation, is there evidence of deep well injectate resurfacing? Reiterate Gil McRae's question about local vs. regional phosphorus? Is the ocean P-enriched over the historic baseline, is there something going on with the Everglades?
    - Big picture: We cannot change deforestation of the Amazon - sediments from there are transported here. Mississippi/Missouri river watershed activities come here too. We cannot control that. The loop current includes detachments that will bring freshwater all the way to the Dry Tortugas as a big unit where we see water quality decline offshore in the ocean with a reduced salinity. This is regional. There is a need to change how agriculture is done in the middle of the country and practices in the Amazon. Locally we can manage things with regulations, etc. A canal project in Islamorada showed water quality was improving as measured by changes in sucralose. We see less human-derived water going into canals (except one site). This is challenging because we cannot see sucralose and nutrient problems; it is up to all people to participate in actions to protect water quality.
    - Chris clarified: Is there more P in the ocean around us that is layering with our local contributions?
    - Everyone thinks more freshwater in Florida Bay will improve everything, although the data say no, not everywhere. In some places nutrient concentrations will increase - in some areas, the lower the salinity the higher the nutrient concentration. You cannot have one solution for all of the Everglades and Florida Bay. There is a need to manage where water goes. We are going to be impacted by Everglades restoration. More freshwater in Florida Bay is OK, but cannot be the same everywhere. Nutrients are similar - it doesn't need to be the same everywhere. This has to be looked at according to the water quality segments.
- Sue Heim, KLWTD: As far as future needs, what is the roadblock to meet needs - is it getting more funding, establishing more stations, something else?
    - We can still have a good monitoring program with a few less stations than we have now. Stations in the Dry Tortugas were removed because that was logistically challenging and expensive. We can look at the data to determine what stations are redundant, then you can reduce that way. Looking at stations geographically, we can consider what could be removed while still providing the same caliber of data. This is a statistics question.
- Wade Lehmann, EPA: EPA has just given funding for a Hypoxia Task Force for the Gulf of Mexico. Phosphorus concentrations in the Gulf are highest in the west. The Mississippi delta is a

big source. This will be looked at with the Task Force and EPA will be involved with a regional response.

Break

IV. Seagrass Monitoring Program

Dr. Johannes Krause, post-doc and research professor at FIU, reviewed 27 years of status and trends from the FKNMS seagrass monitoring program.

Status and trends of the benthic community. Originally, 30 sites were established in a near to offshore gradient that coincided with water quality monitoring stations. In 2012, a few additional sites were established in the halo zone, which increased the program to 40 total sites. Sampling methods are consistent with monitoring done in Florida Bay for the Florida Coastal Everglades Long Term Ecological Research (FCE LTER) project and in the Dry Tortugas for the National Park Service. All benthic community data was looked at and a cluster analysis done to define spatial patterns in benthic community compositions. In total, seven distinct community types were identified, as shown on the map. These include (1) dense *Thalassia testudinum* (Tt; turtle grass); (2) a mix of calcareous green algae and moderate Tt; (3) very patchy/low density Tt seagrass with a lot of sand, which is primarily seen offshore; (4) a mix of calcareous green algae and sparse Tt; (5) dense *Syringodum filiforme* (Sf; manatee grass) meadows predominantly in the backcountry/sluiceway; (6) *Holodule wrightii* (Hw; shoal grass) dominated meadows found in the halo zone and shallow parts of Florida Bay; and finally (7) a few monitoring sites are in coral/sponge dominated areas in the Dry Tortugas.

Environmental covariants associated with these different types of communities were assessed. Overall, Sf and Hw occur with high N and P; and high DIN is also associated with Hw meadows. Patchy Tt and sand is at deep sites with low relative N availability and more relative P as determined by N:P ratios. This framework can be used to look at how sites change over time. At each monitoring station, for each year, the community is determined. Have found that overall those community types are pretty stable over time, although some changes are observed. The most stable communities over time are the dense Sf meadows in the backcountry (not much change has been observed here in 25+ years). Some communities shift around a little, mostly with a switch from calcareous green algae to Tt and back in the nearshore (these are the least stable communities). Some seagrass communities inshore and in the halo zone have experienced stage shifts from Tt to Hw-dominated. This is an indication of changing water quality impacting the ecology of benthic communities. Some offshore sites have suddenly lost seagrass cover; something happened at these stations with moving sand to cause this patchiness. Nutrient enrichment causes inshore seagrass communities to change. Dr. Krause showed some example sites where Tt density crashes while Hw density increases. This correlates with an increase in TP concentrations. DIN also increased at these sites. While this is correlative, this is happening at the same time and is an indication of conditions at these sites. Offshore sites where moving sand buries seagrass meadows coincides with hurricanes coming through. Dr. Krause showed seagrass density at various sites relative to the timing of Hurricanes Georges, Katrina and Irma. We see crashes in Tt populations associated with those events. Changes in seagrass meadows are part of a hurricane impacted system. Over time, at these sites we can only measure loss; we do not have monitoring sites where sand was that would detect where seagrass may be coming back. Seagrass populations do recover, but it takes longer than the periodicity of the hurricanes.

To summarize the benthic community status and trends: Overall, communities in FKNMS are stable over 25 years; spatial patterns in nutrient conditions drive the benthic community composition; nutrient enrichment in nearshore waters are associated with shifts to Hw meadows; catastrophic, lasting loss in seagrass has only been observed after major hurricanes, however there is no data if this is a net loss. Long

term monitoring is needed to track recovery dynamics and the resilience of south Florida seagrass meadows.

Climate variability analysis. In the previous talk, Dr. Briceño talked about TN and TP trends through time. There is also interannual variability/oscillations in these trends. Time series of seagrass abundance in different areas of FKNMS (offshore, nearshore, halo, backcountry/sluiceway, etc.) were shown. What is apparent is that seagrass density across the whole system oscillates between high and low. N and P availability also oscillates where there is relatively more N or P available. Seagrass and water nutrients have a similar pattern. Climate indices also oscillate in a similar way, including: rainfall, the Atlantic Multi-decadal Oscillation (AMO), and the Southern Oscillation Index (SOI) which tracks El Niño and La Niña climate patterns. Seagrass takes up nutrients for growth. In FKNMS, there is a steep gradient of nutrient availability. Phosphorus is limited in Florida Bay, and moving from the Gulf and towards the reef, seagrasses are less P-limited. The reef is more N-limited. More rainfall is associated with El Niño years, and more rainfall results in more N relative to P in the system. In other words, there is a higher N:P in high rainfall years, which may be due to the effects of freshwater on upwelling of nutrient rich waters and/or increased terrestrial runoff.

As we've seen, seagrass cover changes in relation to different water quality parameters. Where there is more N available, offshore seagrasses have higher cover in FKNMS. The opposite is true for Florida Bay and inshore sites; they do worse with more N and have more cover in years with greater P availability, although this trend is not statistically significant. There are also patterns with temperature and Chla; seagrasses tend to decline with more Chla due to less light availability. Seagrasses also do "worse" with higher temperatures, but this is quarterly sampling so these data are highly variable depending on the time when sampling occurred. Overall, climate drivers change relative nutrient availability which affects seagrasses depending on where those seagrasses are. In years where N is less available, lush seagrasses return. These effects on seagrass cover are not permanent; rather seagrasses show resilience to these pulse signals; with changing conditions seagrass can return to its previous state. This is different from the press-type stressors where increasing P changes the benthic community over time.

Modular monitoring supports science. This monitoring program provides a platform to support additional scientific research. The co-located water quality and seagrass monitoring over nearly 30 years provides a wealth of data and is a unique and good backdrop to ask scientific questions about other things. For example, fish communities can be analyzed compared to trends in seagrass changes and patchiness. There is also other associated research on *Syringodium* (Sf) reproduction and seed banks (looking to see if this species can be used for seed-based restoration), carbon sequestration, etc. Over 100 species have been recorded using seagrass meadows and sediment cores have been collected and dated to understand carbon, N, and P sequestration over time in these meadows. Integrating this into the monitoring helps to interpret data because we know more about the ecological history of the site and where it sits relative to the rest of the system. This is a unique long term data set with good temporal and spatial distribution. The co-location with water quality data is also unique to this area of the world and helps with data interpretation.

Questions & Answers/Comments/Discussion:

- Wade Lehmann, EPA: Regarding nutrient limitations, there are players other than N and P? Do we have known iron limitations with seagrasses? As Everglades restoration begins to increase flows, it's interesting to know what else comes out and if DOC, iron or other things we don't usually measure may impact seagrasses.
    - Iron plays a role but we don't have great data. Seagrass is often about sediment and how much is available there. There are some studies in Florida Bay on this, but none in FKNMS.

    - Wade added that looking at iron in Florida Bay would be crucial; it's likely less of a problem in the sanctuary. Iron helps seagrass if there is more of it.
- Patience Cohn, MIASF, inquired about the new invasive seagrass found in Biscayne Bay from the Red Sea. Are we at risk of getting this in the Keys? Is this a bad thing for the Keys?
    - The seagrass is *Halophila stipulacea*; it is from the Red Sea and invasive in the Caribbean. It grows where natives do not grow, but also replaces natives in some areas. Studies are ongoing to understand how this species affects carbon storage and other ecosystem services, as well as populations of herbivores, fish, etc. The potential impact is still to be determined. This was found in a marina in Biscayne Bay, which may point to how it got here and where to look. This monitoring program does not have sites in the marinas, so a different sampling effort would be needed to look at places that are not vegetated by native seagrasses because they are murky or too deep. It will be interesting to determine if this is a positive that brings new ecosystem services or a negative that destroys native communities.
- Gil McRae, FWC: Under drought conditions we've experienced hypersaline conditions and seagrass die-offs in Florida Bay. Why isn't this reflected in the time series?
    - Monitoring sites are not in areas where there were die-offs from salinity (that was monitored by other programs). We miss what happens in Florida Bay. Variability in salinity in FKNMS is very small, and we don't see the salinity effect in near or offshore sites.

V. Coral Reef Evaluation and Monitoring Program

Rob Ruzicka provided an update on the Coral Reef Evaluation and Monitoring Project (CREMP), including a review of status and trends since 1996. What we've learned over almost 30 years is remarkable; although mostly it is bad news. There are some silver linings to speak of too.

This is the 29th year of sampling for CREMP, although the 2024 dataset is still under analysis. This presentation will discuss 28 years of data, through the 2023 sampling year. Overall, the program has documented 51 coral species, and almost 500k photos have been taken to do point count analysis going back to 1996. Just under a 60% loss in coral cover has been documented since 1996. In 2011 after the Battelle audit of the monitoring programs; this program was updated to incorporate demographic surveys to do population-level assessments. This was essential to help understand losses due to stony coral tissue loss disease (SCTLD) and also to help estimate what we need to restore in the Florida Keys. Nearly 136k corals have been counted across these repeat transects since they were established in 2011, and nearly 6 million points have been counted to determine coral percent cover. Each year it takes ~30 days to complete the surveys in water. The spatial framework for this program includes 40 fixed sites, stratified from nearshore to offshore. There are also legacy hardbottom sites that were discontinued due to low coral cover, although temperature logger data is still collected at those locations, which was important to monitor temperature events. Those hardbottom sites were replaced with additional patch reef sites. Forereef sites are stratified to include deep and shallow. The program also monitors some backcountry sites, although those are analyzed separately. Mr. Ruzicka reviewed the program's methods and surveys. As noted, this was expanded from just monitoring percent cover to include demographic surveys. Each site has 4 stations that have camera surveys and coral demographics surveys. Twenty sites also have octocoral demographic surveys and 11 sites have *Xestospongia muta* surveys (this is another taxa to monitor health at the reef). Temperature loggers are deployed at 45 sites, including the legacy hardbottom sites.

Mr. Ruzicka presented a graph of long-term benthic taxa trends in the Florida Keys, where the y-axis shows percent cover and the x-axis is time. The addition of patch reef sites is the reason for coral cover increase in ~2011 (this is an artifact of changing the sampling locations). Four major taxa are represented,

including stony coral, soft coral, macroalgae, and porifera. Looking through time, we see a large decline in stony corals associated with the 1997-1998 El Niño event. There had been bleaching events before, but this was a major shock to the system. There was another bleaching event in 2005 which initiated the Disturbance Response Monitoring (DRM) program, and another El Niño and stony coral decline in 2014-2015. Besides hot water events, we also have cold water events, including in 2010 which had a major impact on corals, especially the reef building *Orbicella* species. Overall, thermal stress has been a major factor in changes to community composition.

There are also disease events, including one that overlapped with the 1997-1998 thermal stress event that involved white diseases on the acroporids. This was a major contributor to acroporid loss in the Keys. Disease was also seen in 2003-2004 on large boulder and brain corals. Then there was the SCTLD related decline from 2016-2020. After 2020, we see a plateau; this is when we believe the worst of the epidemic stage ended (>5% corals with lesions).

Hurricanes are another stressor. Irma was a major one, but it is hard to tease apart the effects of this and SCLTD. However, we see impacts to octocoral and sponge communities associated with hurricanes too. Octocorals got ripped up from the substrate. In 2005, you also see a hurricane signal in this data, with lower macroalgae levels which is a good thing. Hurricanes that year scoured the reef and created space for recruitment for coral, octocorals, and sponges. Overall a 58.1 % decline in coral cover is represented on this graphic. It also shows an increase in octocorals which have bounced back from various stressors because they can recruit quickly and have massive recruitment pulses. Sponges have bounced back too. The big problem is the increase in macroalgae through time. Irma helped reduce it but it is still persisting at a level that is greater than the other benthic taxa groups. This may be attributed to water quality factors, including more N for them to take up and proliferate after disturbances. More macroalgae results in less spaces for coral settlement and growth.

SCTLD fundamentally changed the reef composition in Florida. Many corals outside the *Acropora* community that were more resistant to thermal stress and were less affected by previous diseases fell during SCTLD. Mr. Ruzicka presented a series of graphs where the y-axis represents the number of colonies aggregated across the 9 most vulnerable coral species (left) and the percent prevalence (right), and the x-axis is time. Many of the most vulnerable were framework building species; including large, very old corals that died in a short period of time (weeks to months). Comparing these graphs between the upper, middle, and lower Keys and the Dry Tortugas shows how this disease moved down the reef tract, against the prevailing current patterns. Disease prevalence got up to 20-30% in the upper and middle Keys (depending on when surveys were completed), and up to 40% prevalence in the Dry Tortugas. SCTLD often resulted in 100% coral mortality; this level of prevalence is massive compared to what has been seen in other disease outbreaks. We now believe this event has concluded as less than 1% infection was recorded in the Dry Tortugas during the 2024 surveys. It is now part of the background prevalence of disease that we normally find on corals during monitoring.

The 9 most vulnerable species included maze corals, brain storals, and star corals. Looking at the number of colonies over time from 2014-2023, we can see a pattern of decline - including the loss of all of some species within stations at a point of time. Some new recruitment is also seen for some species. Looking at three species: *Colpophyllia natans* (CNAT), *Montastraea cavernosa* (MCAV), and *Orbicella* species, we can see that these are the principal architects of the reef back to 1996, and that they have experienced a large decline. These have been vulnerable to thermal events, disease, etc., and this is death by a thousand cuts. CNAT survived other events, but was heavily impacted by SCTLD and now has very low coral cover. We have seen small recruits, but it will take decades for this species to come back. The community composition is also changing; the predominant “weedy” species are increasing or staying level in abundance (*Siderastrea siderea* [SSID], *Porites astreoides* [PAST], and *Stephanocoenia intersepta* [SINT]). We did see a decline in SSID in the data, but it has bounced back. These can be large framework

builders, but there are also a lot of small colonies. PAST/SINT were less affected by SCTLD; they have held their ground and are staying steady to maintain coral cover on the reef. Mr. Ruzicka also reviewed octocoral abundance across 5 species (*Antillogorgia americana* [AAME], *Antillogorgia bipinnata* [ABIP], *Eunicea flexuosa* [EFLE], *Gorgonia ventalina* [GVEN], and *Pseudoplexaura porosa* [PPOR]). These held steady, declined after Irma, but then bounced back following that event, as evidenced by new recruitment. In 2023 we saw declines from thermal stress (although some surveys were done before the thermal event, so these data are somewhat murky).

As far as the 2023 bleaching/thermal stress event, NOAA Coral Reef Watch products show how hot the water got and how early. An Alert Level 1 predated normal thermal stress by a month. The scale has since been revised to add Alert Levels 3, 4, 5 based on degree heating weeks, which is what the reef experienced in 2023. There was extensive bleaching during this event. In collaboration with DRM, CREMP sites were resurveyed in the winter after bleaching, and temporary markers were set up at DRM sites so that repeat transects could be monitored to assess before/after effects. In total 60 sites were resurveyed (37 DRM/23 CREMP), totalling 81 coral transects (some markers were lost/displaced); 38 octocoral transects were completed, and temperature data from 25 CRMP sites were analyzed to see how hot it got. A temperature of 30.5°C is the bleaching threshold, and 32° is a direct mortality threshold where corals bypass bleaching and start to die/have tissue slough off. Looking at mean temperatures from the loggers through time, one can see how much hotter it was in 2023 compared to previous thermal events. In 2023, we saw 7x the number of days above the coral mortality threshold than seen previously. There was a drought on the west coast of Florida which helped increase temperatures. Looking regionally (between Biscayne and the lower Keys) and by habitat (across the shelf from inshore to the forereef) one can see how hot it was, especially in the Keys and in the inshore and mid-channel reefs. To determine the impact of this event, a before and after analysis was done to compare density (# of corals/transect) and live tissue area (using height and diameter to estimate surface area). Total abundance decreased by 21% in all areas of the upper, middle and lower Keys from 2023 and 2024. The same pattern is observed across habitats. For octocorals, total colony abundance and total sum of heights (a metric of canopy) were measured. We did not find significant declines in the lower keys, but we did see significant declines in the upper and middle Keys in both metrics, especially in nearshore/patch reefs. This was a devastating event for these taxa in the Keys.

Finally, Mr. Ruzicka reviewed the status of iconic corals on Florida's Coral Reef (FCR), including *Acropora* spp. and other Endangered Species Act species. Acropora was very vulnerable to the thermal stress event, as demonstrated by photos showing declines in an *Acropora palmata* (APAL) patch in the Dry Tortugas from 2022, 2023 to 2024. The Dry Tortugas experienced extreme temperatures similar to the Keys. This was otherwise a big stand of APAL that was doing well since 2004. Now this site is bioeroding. There are now no wild APAL west or southwest of the upper Keys; everything in the middle Keys, lower Keys, and Dry Tortugas was lost during this event. There are a few survivors in the upper Keys, it is estimated that there are ~30 colonies that are reproductively active. Mr. Ruzicka showed another series of photos from Molasses Reef in Key Largo from 2009, 2015, 2020, and 2024. Again, you can see a huge patch of APAL that has disappeared. Irma displaced a lot of *Acropora* that was at the top of the spur; what survived did not fare well in the 2023 bleaching event. Admiral reef is an *Orbacella* site with over 40% coral cover that is inshore of Molasses. From 2007 to 2014 we saw a loss of coral cover due to the winter 2010 mortality event. In 2021, we see how octocorals colonizef bare coral heads. In 2024 the site looks a lot different due to Hurricane Irma - as skeletons bioerode, there is no platform left for other corals to move in and colonize.

CREMP provides important reference sites for Mission: Iconic Reefs to evaluate restoration success. This is a backbone for collaborative research that is being done. We need this information to understand before and after changes. While other programs are a random stratified design, when put together with CREMP

we can extrapolate patterns/trends across the reef. As a result, we can estimate a loss of 60 million colonies due to SCTLD when we look at these combined data.

Questions & Answers/Comments/Discussion:

- Wade Lehmann, EPA, iterated the importance of CREMP to also track the spread of SCTLD as it moved from Miami down through the Keys.
- Johannes. Krause, FIU, asked about the Dry Tortugas monitoring. Are any effects from Hurricane Ian obvious? Their data show that seagrass systems were impacted.
    - Good question; SCTLD was also a confounding factor in 2022 so it's hard to disentangle the effects from these different disturbances in terms of percent cover and abundance. With Irma in the Keys we saw huge corals topple near the area where they eye hit, so we know that these events do result in some loss. However, determining what percentage or the relative contribution is difficult.
- Chirs Bergh, TNC: How is this funded?
    - CREMP is mostly funded by EPA. There has been a mix of funding recently that has helped the CREMP effort with more staff and a partnership with DRM. The FWC Coral Program does a lot more than just CREMP, including DRM, research projects and other surveys. They have received Irma disaster grant funds to assist with propagation, restoration, and SCTLD recovery, and some of those funds helped to do additional CREMP surveys as well. TNC helped fund post-bleaching surveys and they also received money from the legislature to help with monitoring. The level of work going on now exceeds the funding that EPA has historically provided to CREMP; we are very fortunate to have additional funding to do extra work.
    - Chris reiterated that the data is extremely valuable to draw robust conclusions that support management decision making. The TNC money was a pass through from NOAA CRCP.
- Rob Ruzicka referenced the Battelle Report review and recommendations for the monitoring programs. We would be open to a new review. *Acropora* is functionally extinct along FCR and will not return naturally without restoration intervention. The same is true for *Dendrogyra cylindrus* (DCYL); without restoration it will not come back naturally. CNAT may be in a similar situation. It was the Battelle audit that spurred the demographic surveys that gave us this important information. It also helps us understand how much we need to restore - e.g., to set targets to grow corals, create space for restoration, quantify funding needs, etc. We would not have population level information without that assessment.

New Topic Addition to the Agenda: Steering Committee Membership

Sue Heim, KLWTD, requested time to discuss Steering Committee membership, which we have spoken about in previous meetings. It is important to have FKAA at the table as they are in the sewer business. Ms. Heim suggested an action item to pursue new membership from FKAA, and would be open to including other agencies as well.

Questions & Answers/Comments/Discussion:

- Wade Lehmann, EPA: An FKAA seat exists on the Steering Committee per the Bylaws. We need to make a decision to move the existing person out and request a new representative that would be willing and able to sit on the WQPP. We can reach out to FKAA, bring this request to their attention and ask them to designate a member on the WQPP.
- Karen Bohnsack, FKNMS, offered to provide some background information to help in making an ask for a new FKAA representative on the Steering Committee.

- Wade Lehmann, EPA: We need to make a similar ask of USACE. Unless other options come forward first, we will work with EPA leadership to write a letter to the Colonel in Jacksonville District to ask for USACE participation.
- Steve Blackburn, EPA, clarified that, beyond the Bylaws, FKAA is named as a member of the Steering Committee in the legislation that created the WQPP (the Florida Keys National Marine Sanctuary and Protection Act).

Lunch

VI. Special Study Project Update: Trends in Florida Keys Water Quality and linkages to Synechococcus and Sargassum Blooms

Dr. Brian Barnes provided an overview of an ongoing special study project, which is looking at trends in Florida Keys water quality and linkages to *Synechococcus* and *Sargassum* blooms. This was funded by EPA and builds on previous work done by NASA and NOAA; there are a lot of collaborators on this project.

Today we will discuss *Synechococcus* cyanobacteria, which form blooms in Florida Bay that sometimes come south and impact the Keys. We will also discuss *Sargassum*, a floating macroalgae that affects the south/ocean side of the Keys. We care about water quality in the Keys because it impacts the things that live on the bottom and the organisms that live in them (such as invertebrates, fish, etc.); water quality is also tied to tourism and the economy in the Keys. Water quality monitoring is critical and that is part of this project. A ton of water quality data has been collected in the Keys over the years, and given this huge resource of in situ data, you might wonder why satellite oceanographers are also working on this issue. In situ data collection is a huge effort and that data are very valuable. Satellite data is not a replacement for this, but is a complement to help fill in the data gaps. While in-situ data is collected at a month-to month frequency at relatively few locations, satellites can provide daily or even multiple times a day views of the entire Keys region. These satellite data products are available to resource managers to assist in assessing water quality in Florida Bay. Today's talk will show where you can access the data; will also discuss goals and objectives of this project.

Processing framework: As satellites pass overhead, they look down and are measuring things coming off the water. This information is transmitted to a ground station at NASA, USGS, etc. who then host the data online. We have automatic routines to download data and process them into products that are relevant for resource managers - for example, converting them to something useful towards water quality monitoring in a region, then make them available online. This is near real time data that is available within several hours of a satellite pass.

Satellite data are hosted on a web portal available here: https://optics.marine.usf.edu. The portal has a Satellite Data Products menu, from which you can select Clickable Maps, then zoom into an area of interest. In this case, we select the Gulf of Mexico/ Western Caribbean, then can go even closer to the Florida Keys region. Once in the Florida Keys region, there is a repository page for all satellite data collected in the last 25 years in this region. There is also a smaller box that covers Florida Bay, which is another area of interest to water quality in the Keys.

Looking closer at the data repository for the Florida Keys, everyday there are many satellite overpasses with multiple products derived from each. On the left, one can select a date on the calendar to access data for that day. Each satellite overpass is represented by a different tab, so if a satellite went over the keys to collect data 7 times, you'd see 7 tabs. There are many products available, and a variety of things you can visualize from satellite data, such as true color picture, sea surface temperature, chlorophyll composition, etc. You can also pull data into Google Earth to overlay current vectors and other useful tools.

Dr. Barnes pulled up an example of the true color composite for 11/12/2024 from one satellite overpass. As seen in the image, there is a lot of cloud coverage which is not good for satellite ocean color as you cannot see what water does under the clouds. Even so, to the left in this image, you can see a pea colored plume of water, which is an active *Synechococcus* bloom. Rather than trying to find the extent of the bloom from this image, we can look at other products, such as the cyano chlorophyll concentration product, which better shows the location of that bloom. This helps quantify the concentration of Chla in the bloom. This data can also be animated over space and time. Showing a bloom from 2013, you can watch how this progresses over images captured a couple days apart. The plume starts in Florida Bay, takes a south to southwesterly track, then terminates. You can also look at data in a temporal context, such as looking at seasonality across multiple events. Looking at the size of the bloom across time (various years), we see blooms in Florida Bay from September to January, usually peaking in November. We also see a lot of interannual variability. For example, the bloom in 2022 started earlier and lasted longer than other years.

Taking this one step further, we can also investigate where these blooms come from. Satellite products they develop and provide can pinpoint upstream locations, and with more investigation we may be able to understand the causes of these blooms. For example, there are structures north of the blooms that are opened and closed, so the blooms may be seeded from that and then make their way into Florida Bay. If you look at higher resolution data, you can actually see pulses of organic matter coming from these areas where water is being moved (e.g., Garfield Bight). Looking again at coarse resolution Chla products, we can see a nutrient pulse on this day, but also a substantial bloom in North Garfield Bight. Looking into other lakes, we also see blooms occurring there. Thus, it is likely that nutrients are being seeded from the lakes to the north. This can be further investigated with more information from satellite data.

Very fine scale/high resolution satellite data products are also available online. We don't have everyday passes from multiple satellites, but every 5 days there is one overpass with the same products. What these data lack in temporal resolution is made up with a higher spatial resolution. Dr. Barnes showed a sample image with much finer definition. These also have more noise, and efforts are underway to improve this, but these data still allow you to see the bloom from initiation to the locations in Florida Bay. The general pattern for *Synechococcus* blooms in September to January, and we are working to trace these back to their source into the Intermittent Closed-Open Lakes and Lagoons (ICOLLs) in northern Florida Bay. Daily maps are available from multiple sensors to anyone who needs them. Feedback would be accepted if something is not working or if a different product would be useful.

Switching to *Sargassum.* This is a historic ecosystem in the Gulf of Mexico and Sargasso Sea which was named for this species. Invertebrates, reptiles, fish, etc. are all communities that live in this important habitat. In recent years, we have seen huge inundations that can smother coastal ecosystems with devastating impacts. Looking at historical vs. current maps, there is a Great Atlantic *Sargassum* Belt that stretches from Africa to the Gulf of Mexico and around to the Florida Keys. This is a huge aggregation that is novel and doesn't have a historical analog. This can be measured from space, and satellites are needed to capture its size and extent. *Sargassum* is patchy, so coarse resolution sensors can detect it in small scales. There is also patchiness in coastal inundation, which means that a wide swath of area must be covered to detect it, and satellites are a main tool to do that over this spatial scale. Satellite data is available from the *Sargassum* Watch System (https://optics.marine.usf.edu/projects/SaWS.html). This data can be used to see the progression of the bloom which starts in eastern Africa in November, moves west over the spring and summer and expands/becomes more abundant which can impact the Keys. The bloom tends to die back in the fall when the *Sargassum* returns to its original seed population off the west coast of Africa. The website has a basemap and similar landing page for *Sargassum*-based satellite information. Here, one can zoom in on individual regions and can look at the Gulf of Mexico and Keys based products. They have a *Sargassum* Watch bulletin issued once per month which looks at conditions

and makes broad predictions about what will happen in the future (e.g., if we may see impacts in the Keys over the next month or two). This is somewhat helpful, but not perfect given the patchiness and the scale needed for response. For example, the scale is too coarse to prepare for *Sargassum* cleanup at a specific beach. Anyone can be added to this bulletin email list for this regional forecast. Contact Brian Barnes (bbarnes4@usf.edu).

Higher spatial resolution data changes the game for sargassum inundation predictions. Dr. Barnes showed a comparison between higher resolution images and the coarse resolution sensor that is used for the monthly bulletin. Notably, one will see blacked out areas around the Keys because the satellite cannot get data within 10km from land; the algorithms and data are not sufficient here. There are alternate high resolution data sets that provide coverage much closer to land and with much more definition. This contains information in more nearshore areas which is where there are land-based *Sargassum* impacts. High resolution *Sargassum* detection can be incorporated into hydrodynamic models and include tracers to forecast future movement where those blooms will go over the next few days. With this system, NOAA will be able to provide real time alerts for specific beaches that are at risk of an inundation event.

Sargassum inundations include a lot of biomass that can smother the coastal ecosystem. This can also create a *Sargassum* brown tide where the decaying organic matter results in increased nutrients, turbidity, hypoxia and anoxia in nearshore waters. One of Dr. Barnes' collaborators is measuring how far the impacts of these brown tide events from larger inundation events extend into the halo zone. This work is ongoing. Sargassum in the Keys is patchy, but April through September is the most likely time for impacts. A lot of maps are currently available and work is ongoing to provide higher resolution data, maps, and alert systems.

Questions & Answers/Comments/Discussion:

- N/A

VII. Special Study Project Update: Monitoring Water Quality in the Florida Keys Halo Zone

Dr. Sinigalliano introduced himself as a collaborator on this project, which is a new project funded by EPA. Dr. Erique Montes is the Principal Investigator (PI) and Dr. MaryBeth Gidley is another co-PI. This project is a chemical, genetic, and spaceborne characterization of nutrient and microbial water quality in the nearshore halo zone of the Florida Keys, and is trying to link that to broader regional water quality on the reef tract.

This project has 4 main objectives: (1) Resolve linkages between water quality and the microbiome, from the open ocean to the nearshore (within 25 m of coast); (2) Characterize spatial and temporal patterns in water quality, microbial assemblages, and lower tropic level biodiversity in the region; (3) Identify hotspots of poor water quality conditions suitable for exposure to pathogenic bacteria; and (4) examine relationships between water quality, microbiome, plankton diversity and benthic habitat health indicators.

This project is part of NOAAs Integrated Ecosystem Assessment program and combines that with the Molecular Biology program to support better Ecosystem-Based Management (EBM) and decision making. The project will be integrated with the long-term environmental assessment programs that have been going on since the 90s, including the Marine Biodiversity Observation Network and South Florida Ecosystem Restoration (SFER) data collection efforts, which collect a variety of data to understand environmental changes and responses to support EBM. This project will piggyback on oceanographic cruises undertaken by the SFER program, which occur ~every 6 weeks on the RV Walton Smith and include data collection along a series of transects at sentinel reef sites across the Florida Keys and southwest Florida coast. Data collected include conductivity, temperature, and depth (CTD) profiles, physical measurements, flow thru imaging of microscopic communities, screening for microbial

diversity/populations, etc. This is also integrated with satellite imaging to make connections with biodiversity, plankton/Chla, etc. This program, however, is primarily offshore and does not have a nearshore component; the closest to shore the sampling currently takes place is 1.5 km from the shoreline.

From the EPA grant opportunity, there was an interest in additional assessment of the very nearshore areas within 500 m of the shoreline. There have been other studies in this area, including genetic studies and microbial source tracking, but those were short-term snapshots in time; there has not been a sustained longer-term study conducted to link inshore and offshore water quality, so this project is filling a gap by providing a nearshore component to the long-term offshore data sets. Over two years, small boats will be launched from the RV Walton Smith to sample 4 nearshore transects with a focus on areas with established sentinel reef sites, including Key Biscayne to Emerald Reef, Key Largo to Grecian Rocks, Marathon to Sombrero Reef, and Key West to Eastern Dry Rocks. These were chosen from the 8 existing transects the ship uses to focus on more highly populated areas that are believed to be larger exporters of land-based sources of pollution (LBSP). The transects will be sampled at increments from shore (25m, 50m, 100m, 250m and 500m), with sampling taking place at the same time that the existing offshore/reef transects are being sampled.

This study will address the following questions: (1) What is the extent and impact of LBSP to the Florida Keys halo zone? (2) Is there a common source of LBSP along the Keys? (3) Can microbial source tracking (MST) and other molecular sequencing help detect LBSP impacts and transport patterns to the reefs? (4) How does water quality within the halo zone vary between different regions of the Keys and seasons? (5) Can we find reasonable 'end points' of LBSP vs. regional water quality impacts to inform water quality targets and management?

A number of parameters will be measured from small boats, the RV Walton Smith, and nutrients and molecular sequencing for microbial contaminants will be analyzed in the NOAA AOML lab for molecular microbiology. CTD casts will include collection of surface and bottom water from reef sites. The study will look for markers specific to enterococci as well as for specific markers from humans, birds, dogs (a terrestrial runoff signal), and various pathogens. Environmental DNA (eDNA) will be sequenced for bacterial populations and to determine algal populations. Sequencing can be used to characterize population diversity but also source tracking to compare input waters nearshore to receiving waters. Satellite imagery will also be incorporated and will provide a better look at connectivity and transport patterns. Unlike traditional regulatory live culture work which has no source tracking capability, extraction of eDNA allows multiple parameters to be analyzed at same time, and can be reanalyzed over and over.

Dr. Sinigalliano provided examples for how these techniques have been used in the past. For example, AOML is involved in monitoring the Port Everglades dredge project to look at water quality impacts; they have conducted source tracking studies in Biscayne Bay, including an EPA funded project through Miami Waterkeeper in northern Biscayne Bay to do microbial source tracking. From this they have found human fecal contamination from hotspots such as the Miami River. NOAA CRCP funded a similar study to look more closely at middle and southern Biscayne Bay to identify inputs from the Bay to the reef tract via Government Cut. They are also looking at the treated wastewater outfalls which also contribute to human wastewater markers. These bacteria are dead but still have genetic information that can be analyzed. This is a major input source for a lot of contamination/exposure from Emerald Reef along the Florida Reef Tract, including influences to the south.

Another example was the MST of the Little Venice canal during septic to sewer upgrades. As sewering was completed in this area, levels of human markers did go down in the restored canals, while the control canal had high and variable human markers. This is an example of seeing some of the benefits of the sewering process. It took time for levels to go down as more sewers were installed. There are other

studies along beaches, including in the Keys, where human markers were found. The combination of human markers and staph suggests that it is related to bather density. This is a significant contaminant source into recreational waters as well.

Modeling can be integrated with water sampling and satellite data to track particulates and look at flows. Backward and forward flow monitoring can be used to look at how water masses impact sites and where the water sampled came from. Backcasting can show sources of water from the north coming down to the sites in the transects. Forward casting can be used to see where contaminants are potentially going and what sites will be exposed and impacted.

Questions & Answers/Comments/Discussion:

- Chris Bergh, TNC, referenced the notion that dead bacteria can still transfer genes; can you elaborate on this?
    - Free DNA can be picked up by background microbial populations. Can have conjugation or natural transformation (where they pick up free floating DNA and incorporate into the cell). Once in the cell, they can recombine that DNA into their own genome. This is a way for antibiotic resistance or pathogenicity marker genes to pass on. This could potentially pass on some new ability to a native microbial population. This is not as dangerous as a live pathogen, but is still not a great thing. Most of the bacteria coming from the outfalls are dead, and free DNA degrades rapidly. Where there is untreated wastewater, those are live bacteria. So there is genetic transfer potential, but associated pathogens from the contamination could be alive and viable. This may be where SCTLD came from - patterns of spread suggests this may have come from Biscayne Bay outputs although the source has not been confirmed. We know that these things can also be associated with viral outputs (which are associated with human fecal outputs). Hepatitis strains can impact corals, sea turtles, dolphins etc. Overall, the more you can limit LBSP the better. This is a way to track potential exposures.
- Chris Bergh asked for more information about Miami River and other contributors to LBSP in the watershed.
    - The Miami River is the primary output source measured over the past 3-4 years. Arch Creek and Little River are also contributors. We are working with Miami Dade County on a project to track Miami River and do finer scale detection of localized sources that contribute to this. This will help find hotspots contributing to the Miami River to guide management actions. There is also a septic to sewer effort in Miami.
- Mimi Stafford, Citizen at Large, requested clarification about the recombination of DNA. Is this virus and bacteria?
    - Yes. Depending on the organism you're talking about, some have mechanisms to grab DNA from the environment. They have binding proteins on their surface that they use to pull DNA through the cell membrane to recombine into their own chromosome. Some bacteria may select certain types of DNA. It's a broad characteristic, but how it plays out depends on the organism. Horizontal gene transfer is a common phenomenon in the environment.
- Wade Lehman, EPA: Live bacteria are even worse so it is important to make sure treatment is working.

VIII. Curry Hammock Tidal Restoration Project

Dr. Nick Parr reminded the Steering Committee that he gave a presentation on this project at the last meeting, at which point they had about 60% completion of the design plans. They are working towards 90% design and hope to be shovel ready with permits in place by July 1st. While the design was funded

via the EPA grant, DEP is now seeking $12M - $13M to complete the actual work. This is an expensive project, which was known going into it.

As a brief reminder, the purpose of this project is to restore two tidal connections in Marathon that were closed during the construction of Flagler's railroad. This severed connection has caused continued degraded water quality conditions in these areas over the past century. This also exacerbates storm surge situations, which contributes to beach erosion too. The project will include the installation of 10x10' box culverts at the two sites.

Last year, DEP applied for a NOAA habitat restoration grant from BIL funding. While DEP did not get the grant, they did get good feedback in support of the project, but needed to see more of the design in place. With additional designs and baseline data, DEP hopes they will be successful in their next grant application, and are hoping for support from the WQPP towards that effort. It was acknowledged that some on the Steering Committee may need to abstain from any vote of support

George Garrett, City of Marathon, introduced text for a resolution to support his project. That read as follows:

A Resolution of the Florida Keys National Marine Sanctuary Water Quality Protection Program Steering Committee in support of the Curry Hammock Tidal Restoration project in Marathon, Florida.

The Water Quality Protection Program (WQPP) Steering Committee for the Florida Keys National Marine Sanctuary would like to express our support for the ongoing efforts by the Florida Department of Environmental Protection (DEP) to restore the two historical tidal connections in Curry Hammock State Park. The design and baseline environmental monitoring for this site has been funded by both DEP and the Environmental Protection Agency with the 100% design plans and all permits expected to be received by July 2025.

During the construction of the Florida Overseas Railroad in the early 20th century, several tidal connections between Florida Bay/the Gulf of Mexico and the Atlantic Ocean were filled-in in lieu of building additional bridges. These lost tidal connections have had negative impacts on the water quality, creating areas of stagnant water where tidal flushing is no longer occurring. In addition to degrading water quality, these blockages create impediments to hurricane storm surges and cause additional damage to the infrastructure in the area.

During the most recent priority setting exercise, restoring tidal connections was an identified priority of the WQPP. In addition to this project addressing one of the most prominent and detrimental blocked connections in the Florida Keys, it will also serve as a demonstration project for other potential tidal restoration sites along the Overseas Highway and potentially in other parts of the country.

Questions & Answers/Comments/Discussion:

- George Garrett, Marathon: This is part of the original CERP plan but was not funded in that way. Pleased to see this happening. There is one example of this type of project in Marathon at Pull `N Be Damned Creek near Sadowski Causeway. As far as hurricanes, this helps reduce overwash of the roadways and thus also has a public safety perspective. There was controversy about this Pull `N Be Damned Creek bringing terrible water from other areas, but the evidence has shown that this was successful. Following this project, there may be other sites to consider too.
    - Nick added that this project entails two of the four tidal connections originally proposed by CERP. There are other areas in the lower Keys that could benefit, like Shark Key by the boat ramp.

Motion (passed)
Sandy Walters made a motion to approve the resolution as written. Patience Cohn seconded the motion. Co-Chair Lehman called the question. Of the members present, four recused themselves from voting; the remaining ten voted in favor of the motion. The motion passed with no objections.

Break

IX. Florida Keys Reasonable Assurance Document Update

Ken Weaver, DEP, provided an update on the Florida Keys Reasonable Assurance Document (FKRAD), also known as the Reasonable Assurance Plan (RAP). A RAP is a stakeholder-led plan that replaces the state-driven Total Maximum Daily Load (TMDL) and Basin Management Action Plan (BMAP) processes. In a RAP, stakeholders take on the elements that are usually required in these other plans to get ahead of the state-led regulatory processes. These are allowed under EPA Clean Water Act (CWA) regulations and 403.067, Florida Statutes, which gives DEP authority to do TMDLs and BMAPs. As part of the RAP, stakeholders agree to implement pollution control projects and policies to ensure that water quality will be restored within a period of time.

When the State and EPA approve a RAP, it is listed on the 303(d) list of impaired waters until the waterbody meets water quality standards. This is an accounting category vs. category 5 where waterbodies are prioritized for TMDL. After RAP projects are implemented and water is attaining standards, that waterbody becomes category 2b, which again helps with record keeping to account for the RAP having been there. The goal of a RAP is to move to 2b.

Mr. Weaver provided a brief history of water quality regulations in the Keys. In 1985, the Keys were established as an Outstanding Florida Water (OFW) which is part of the antidegradation policy that is implemented via permitting processes. In 1998, the Keys were identified as impaired/ not meeting standards for nutrients. The standards were narrative at the time, which included algal overgrowth, loss of seagrass, etc. After this, stakeholders started working on a RAP to come up with targets and projects. In 2008 the state approved a RAP to focus on water quality improvements in the halo zone. In 2011, the RAP was first assessed and updated. At that time, 68 projects were completed with others on the way. In addition to the 1998 listing, more data was collected and dissolved oxygen (DO) was identified as impaired in the canals. There are no targets for DO, but DO condition is reported in RAP updates and projects are underway to address that. In 2011, DEP adopted numeric nutrient criteria (NNC) for areas of the Keys (in segments of water outside the 500m halo zone). NNC were identified outside the halo zone because the RAP was already in place to address waters within the halo zone. The NNC includes TN, TP and Chla, and the rule became effective in 2014. Another RAP update was completed in 2018; at that time 100 restoration projects were completed, and it was determined that more monitoring was needed to assess water quality in the nearshore waters (within the halo zone and at the edge of the zone). In 2019 a cooperative agreement with Monroe County was implemented to do more monitoring. During the 2022 RAP update, 121 restoration projects had been completed and additional monitoring was reported. Some segments were not attaining TN targets, so monitoring was continued.

Currently DEP is working on a 2024 RAP update, which is expected to be out by the end of the year or early 2025. Components of the RAP are similar to TMDLs/BMAPs. Stakeholders implement pollution control mechanisms (such as capital projects, moving off of septic, etc.) and policy changes to return nearshore waters to the water quality targets. Targets were developed for modeled quads, based on an "insignificant increase above natural conditions within 500 m of the shoreline." It also includes monitoring to assess progress in the halo zone. The RAP goal was to achieve water quality targets by 2020. We are past that, but still working on it. The final part of the RAP is to report on progress.

Model quads include 20 individual segments from Key West to Key Largo; there are 10 regions which each have two quads - one north and one south of the islands. The width of the segments varies, but all have the same set distance from shore; a range from 100 m to 12,100 m offshore. Nutrient Targets were set via modelled natural conditions with a flushing model applied to estimate dilution by distance to shore. Mr. Weaver presented a graph showing this model for TP, including the distance from shore where it can no longer be determined if the nutrient sources are nearfield or farfield (represented by the blue line); this is the mixing point where nutrient load origins are no longer discernable. The black curve is the model-estimated natural background condition. The targets are set as "insignificant" increases above the natural condition at the 500 m mark. Those targets apply to the edge of the halo zone (at 500 m) and include 10 µg/l above background TN, and 2 µg/l above background TP. For conditions in the halo zone to be compared to RAP targets, one would look at where on the curve those data fall based on where they are collected (e.g., if measuring at 100m from shore, compare that to the target at that distance). The model results provide targets for each quad, based on the natural background in that area. For TP, targets range from 7 to 13 µg/l; TN targets range from 124 to 766 µg/l .

In 2018 it was determined that the RAP needed more monitoring at the 500 m mark. DEP and Monroe County implemented a 2-year monitoring program to collect data in each quad to assess the targets (this included quarterly sampling at 65 stations from August 2018 - March 2021). This monitoring found that TP was meeting targets in all 20 segments over both years (2019/2020). In some cases, this was met by a large margin. For TN, it was more complicated. Most quads did meet the targets, but 5 did not meet targets in at least one year, including segments in Boca Chica (2N), Saddlebunch (3N and 3S), Layton (7S), and Ocean Reef (10N).

During the 2022 RAP update it was determined that more monitoring was still needed, especially for the 5 plots not meeting the TN water quality target. Staff from DEP's Aquatic Preserves initiated quarterly monitoring at six stations in these quads in 2022. Sampling at Ocean Reef (quad 10N) was discontinued in 2024 due to logistical challenges and because that quad was meeting the target based on the two additional years of sampling. TP data was also collected at these sites, and all remained below the targets. Some quads continue to exceed their TN targets. The 2024 results so far only include a half year of sampling, so the hope is that those numbers will come down with additional data. Those data will be reported in the 2024 RAP update.

DEP is currently working on the 2024 RAP update. In May they reached out to the stakeholders in the RAP for updates on what projects have been completed or what new projects have been identified. Data was obtained from entities such as the City of Key West, Village of Islamorada, FKAA, etc. Monroe County also provided an inventory of canal restoration projects relevant to the DO impairments. The RAP will hopefully be publicly available by early 2025. DEP also asked for information on onsite sewage treatment and disposal systems (OSTDS) in an attempt to identify where nutrients are coming from. Those OSTDS counts were provided based on the 2023 Area of Critical State Concern (ACSC) annual report. There are at least 969 known OSTDS that have not been connected across Monroe and the municipalities. In some areas, these exist because connections are cost prohibitive or logistically impossible. Florida Statute allows this to happen, but owners are required to upgrade to an enhanced nutrient removal system to address nutrients, primarily nitrogen. Monroe County has reported to code compliance those properties that refuse to connect. All new units are required to connect to the central sewer. Continued halo zone monitoring is needed before DEP can move the Keys out of the assessment Category 4b (due to those 4 segments not attaining targets). DEP is coordinating with stakeholders on continued monitoring of TN and TP in, at a minimum, the non-attaining quads.

Conclusions: All segments meet TP targets, four segments do not meet TN targets, and some canals remain impaired for DO. Effort is still underway to identify and implement improvements and canal

restoration projects, including ensuring OSTDS remediation requirements are obtained. Continued monitoring is also needed at the 500 m quad boundary.

Questions & Answers/Comments/Discussion:

- N/A

X. USACE Small Projects Division Updates: Water Quality Improvement Program and Other Capabilities

Rick Butler, Small Project Program (SPP) Manager/Jacksonville District, introduced himself and the others present from the team, and provided an overview of the USACE small project programs that provide cost share to resolve issues with navigation, erosion, ecosystem restoration, and flood control. These include the Continuing Authorities Program (CAP), Planning Assistance to States (PAS) and Flood Plain Management Services (FPMS). The local governments/municipalities are non-federal sponsors (NFS) that would work with USACE on these issues. While USACE also has responsibility over large, multi-billion dollar water resource programs, that is handled elsewhere in the agency. Today the focus is on smaller programs that can assist where municipalities may not have resources to address problems related to erosion, water supply, etc.

Mr. Butler shared a decision tree to determine what types of activities would qualify for assistance via the Small Project Program. There are specific criteria that must be met, as well as other considerations such as whether the municipality wants technical/planning guidance or construction assistance. There are different cost shares associated with planning only vs. planning and construction.

The Continuing Authorities Program (CAP) includes nine legislative authorities under which USACE can plan, design and implement various water resources projects without additional congressional authorization. Relevant to the Keys, these include projects related to flooding, erosion, ecosystem restoration and navigation. The purpose is to plan and implement projects of limited size, cost, scope and complexity. CAP is broken into 2 phases: The feasibility phase (up to 3 years) the the design and implementation phase. There is a $10M federal funding limit for most CAP projects (there are some exceptions). Most CAP authorities include a 50/50 cost share for the feasibility phase, with the first $100k covered by federal funding. Implementation and design cost share varies by authority. Any project larger than ~ $15M with the cost share would exceed SPP capability/authorities.

Mr. Butler presented a diagram showing the nine CAP authorities. The decision tree helps guide users through what is the appropriate one. A NFS would then sit down with USACE to review the checklist for those authorities. CAP authorities can also be identified based on the type of problem to be addressed - e.g., erosion, aquatic ecosystem restoration. The Keys are unique, so not all 9 authorities may apply - but some do. The feasibility vs. implementation cost share depends on the authority to be utilized; each varies and these were presented in a table. The CAP process was also presented as a map showing the progression from the feasibility to the design and implementation phase. SAD entails working within the division to secure funding (first $100k in the feasibility phase is federal, then a 50/50 split after that). This feasibility process ends in a decision document and from there a partnership agreement with the NFS is needed to move into the design and implementation phase. This can take 3-5 years depending on the process.

A few example CAP projects were shown, including an ecosystem restoration project in the St. Lucie River, which is in the feasibility phase and ongoing. This project is looking at improving hydrologic connectivity in the watershed. A second example is a project currently under construction in Lake Worth Lagoon. This project will create a chain of three islands with oyster reefs and seagrass. Each type of project is specific to that area and based on local NFS needs. A third example deals with emergency

erosion (Section 14) at St. Francis Barracks; which could also apply in the Keys after a hurricane. This may include weepholes for groundwater discharge, fortifying storm banks, etc. This project timeline is 3-5 years for feasibility and constructions. Again, these are small and relatively short projects (<$15M and 5 years); they are supposed to be quick and efficient to solve a problem.

Technical Assistance (Remaining Items Program) applies to planning guidance only. This leverages USACE technical expertise to solve a problem. Technical assistance includes Planning Assistance to States (PAS), which covers "all things water," and the Flood Plain Management Services (FPMS) which covers "all things flooding." Often FPMS depends on the municipality and their resources (this is 100% federal cost. vs. PAS which is 50/50. The appropriate program is situational and will be decided in coordination with USACE. Technical assistance outputs (report, white paper, etc.) can be used by the municipality to access non-USACE grant funding to solve the problem.

Mr. Butler provided an overview of PAS, including sponsorship eligibility, the type of work covered, funding structure and timeline. PAS may result in studies or reports related to GIS mapping, wetland evaluation, land use assessments, etc. The cost share is 50/50 and the timeline is approximately 12-18 months. FPMS was also reviewed; unlike PAS this is 100% federally funded. Assistance may entail general planning or technical guidance, guides, pamphlets, or supporting studies related to topics such as floodplain delineation, stormwater management, hydrologic transport modeling, etc. FPMS is usually $300k down; with a timeline up to 24 months. PAS can be a lot more than $300k because of the cost share with a NFS.

Within FPMS, if something needs to be addressed interagency, USACE can also support this via the "Silver Jackets." Silver Jacket projects are led by the state, facilitated by USACE, and use expertise from other state, federal, local agencies and non-profits to develop collaborative solutions to flood risk priorities. This is the time of year to identify issues because project submission is in the spring. There are traditional products and non-traditional interagency approaches. Google "Silver Jackets Florida" for more information on products from this type of technical assistance. This is a unique way to address issues and projects.

Mr. Butler shared a number of examples of Technical Assistance from across the United States.. Examples are helpful to understand what is out there; there may be similarities between the Keys and other island communities such as Guam, Puerto Rico, USVI, Hawaii etc.

Finally, Mr. Butler reviewed the process to determine if a specific problem could be addressed by CAP, PAS, or FPMS. Step 1 is to request an initial collaboration meeting with the SPP. Step 2 is to attend the collaboration meeting. This meeting will include a review of the checklists to see which authority best fits the problem to be efficient and provide best guidance. Once an authority is identified, the SPP will send a template Letter of Intent. Step 3 is to use the template letter to document the location and nature of the problem, and submit the request for assistance. This request goes to the SPP Manager, who will then see if there is a federal interest.

Questions & Answers/Comments/Discussion:

- Chris Bergh, TNC: With CAP projects, can you combine authorities?
    - No, you need to pick one or the other. They select the one authority that has the best potential to succeed. USACE has had a lot of success addressing issues in Puerto Rico and USVI with the SPP.
- Wade Lehmann added that the WQPP includes municipal representation; there is an interest in keeping up to date on USACE opportunities and collaboration in the Keys. .

XI. Public Comment

Nancy Diersing, Resident of the Florida Keys
When the Florida Keys Water Quality Improvement Program funds came up for discussion during the last meeting, there was discussion about whether Monroe County would be a stakeholder at the table. Monroe County should be included. As someone who lives in unincorporated Monroe, I wanted to make sure that point gets made.

XII. Steering Committee Member Updates

Gil McRae, Florida Fish and Wildlife Conservation Commission
We are moving into the season where last year we had spinning fish and sawfish mortality. We are as ready as we can be to coordinate among partners on potential response activities (including Bonefish and Tarpon Trust, DEP, FWC, the Lower Keys Guides Association, etc.). Please report anything unusual to FWC's Fish Kill Hotline, this will be where they collect reports and organize a response. Hopefully we won't need it.

Chris Bergh, The Nature Conservancy
TNC released a report that provides guidance on site selection for coral restoration to have the biggest ecological impact for the entirety of Florida's Coral Reef. This effort was funded by CRCP, as requested by DEP, FWC, NOAA, and NPS. High resolution connectivity modeling suggests where coral larvae may go for some key species. There is also an effort to work with the Southeast Florida Coral Reef Initiative (SEFCRI) in the Kristin Jacobs Ecosystem Conservation Area to look at the more specific tier of selecting restoration sites to meet multiple objectives.

I'd also like to acknowledge Steve Blackburn; he has done Yeoman's Work for the WQPP. As defined, this means difficult, valuable, high-quality work especially in support of a team. Thank you, we will miss you.

Patience Cohn, Marine Industries Association of South Florida
The Ocean Exchange awarded money for innovation in the environment. Most presentations were water quality related and three award winners will be startups and do great things.

Meagan Schrandt, Everglades National Park
ENP is monitoring the algae blooms in Florida Bay via hydrology and nutrient cycling stations bimonthly. There are also a few data analysis projects going on that are trying to figure out the mechanisms behind these blooms and what is causing them. Also, the hydrology stations are being reviewed to ensure they don't have redundant monitoring. Some sites will be decommissioned where there is high redundancy. These will go offline in the near future.

George Garrett, City of Marathon
Acknowledged Steve Blackburn's work. The City of Marathon is in the process of developing a deep injection well (DIW). The work done concluded this should sited at one of two locations: Crawl Key with the reverse osmosis (RO) plant or at Cocoplum. This will end up at Cocoplum because FKAA is in full swing to develop RO and it would take longer to get permits for the other site. The city is working to get funding for this project and on the engineering for collection, processing and disposal. They are also dealing with a lawsuit, and it's been difficult to get a permit from DEP to do expansion, possibly because the agency is now worried about permitting associated with shallow injection well (SIW) issues. The City of Marathon will collect the flow from the current 5 SIWs to one place and put it down a DIW. They are working through permitting issues.

Steve Blackburn, Environmental Protection Agency

Acknowledged that it is bittersweet to retire. It has been wonderful to work with this group in the Keys. Has seen a lot of good effort here - removing 30k septic tanks, working through limestone in a vertically challenged place, clean marinas, canals, no discharge zone, the monitoring programs, etc. The work has been incredible. It's been amazing to see the accomplishments and it's important to get the communications strategy out! There is more work to do.

Meeting Wrap-Up and Adjourn
Wade Lehmann thanked everyone for participating in the meeting and reviewed accomplishments and next steps. The next meeting will be held in March in Marathon, although the exact date is still to be determined. Additional input is requested from the Steering Committee as to their availability. The date should be selected soon.

The meeting adjourned at 4:15pm.