

Project Summary

Coral Gables Waterway and Tributary Canals Water Quality Improvement Feasibility Assessment (Phase 1)

To: City of Coral Gables, Commissioners
From: Dr. Roland Samimy, Sr. Research Scientist, Coastal Systems Program, Univ. of Massachusetts-SMAST
Dr. Chris Keble, Biological Oceanographer, NOAA-AOML
Re: Summary of Proposed Restoration analysis of Water and Habitat Quality within Coral Gables, Florida waterways: land-based sources of nutrient pollution and resultant water quality, habitat and resource health for management and restoration.
Date: August 21, 2017

The Nutrient Enrichment Problem - The precious coastal systems throughout the State of Florida are widely acknowledged as over-enriched to varying degrees. In 2016, the extreme nitrogen and phosphorus over-enrichment in the St. Lucie River estuary in Martin County underscored in a dramatic manner how the health of the brackish canals and bays impacts millions of Florida residents and local economies. As a result of land-based nutrient over-enrichment to the St. Lucie River estuary, dense system wide algae blooms and water quality declines had significant negative impacts to tourism, marina activities and other common water based activities. Nutrient enrichment is the consequence of increasing development to support a growing population, without improved technologies to maintain the receiving waters that are so attractive to residents. The sources of this nutrient pollution are diverse, ranging from on-site septic system discharges, fertilizer use and runoff from impermeable surfaces. While water quality decline varies by estuary, the regional effects of nutrient over-loading spans the spectrum from lost resource use to socio-economic impacts, both having negative consequences to the culture, economy, and tax base of Florida's coastal communities such as the City of Coral Gables and Miami-Dade County more generally. Moreover, as long term sea level rise continues, with a possible increase in the rate of rise, the coastal groundwater system will respond, as will the controlled stormwater inflowing to the coastal canal systems such as is found throughout the City of Coral Gables. The practical consequence of these shifts is an increasing rate at which residential septic systems and stormwater drainages are compromised with associated consequences to public health, environment and local economies (decrease in property values / tax base) making land-based nutrient management even more critical.

Project Description - The initial steps of determining the proper management of the Coral Gables waterway system is to: (1) monitor the present water quality and assess the nutrient related health throughout this system, (2) link water quality to the spatial distribution and extent of land based nutrient sources, and (3) determine the need for practical management actions. If significant impairments are observed in these first steps (Phase 1), a second phase of data gathering would be needed to allow predictions of the effect of a variety of potential management alternatives on restoration of the waterways, thereby allowing for accurate planning and most efficient use of restoration funds. Over the past year a technical team was developed in partnership with NGO's, local schools, NOAA and the City of Coral Gables to collect the first-ever look at the nutrient related water quality of Coral Gables waterways. Samples were collected by trained volunteers on a monthly basis since October 2016. As this was a preliminary effort to gain initial insight and to develop the team, it was conducted at no cost to the City of Coral Gables. While the effort itself was highly successful, unfortunately, the results clearly document a poor level of nutrient related water quality in much of the waterway system, justifying the need for the proposed Phase 1 effort. The proposed assessment is designed to provide a detailed quantification of land-based nutrient loads at critical junctures throughout the brackish waterway/canal system and direct linkage to observed water quality conditions and associated key biological indicators of habitat impairment. In the short term, the assessment will allow planning towards restoration of canal system and receiving waters of Biscayne Bay via the most practical cost effective management options. Equally important, the results of this assessment of the Coral Gables waterway system is intended to link into the City of Coral Gables Sustainability Master Plan and assist the City of Coral Gables with nutrient management solutions and infrastructure planning

for adaptation to rising sea levels. Continuing sea level rise, and possible accelerated rise, in the decades to come will have a direct effect on: 1) the efficacy of the nearshore stormwater management infrastructure discharging directly to the canal system and 2) the functioning and failure rate of residential septic systems throughout large portions of the City of Coral Gables adjacent to the waterway and associated tributary canals. Given the decades long planning process for implementation of management solutions and municipal scale infrastructure improvement projects, the proposed assessment is a timely, critical and proactive first step for improving water quality in the canals of Coral Gables while also supporting critical planning to safeguard the City from the long term effects of sea level rise. This project is to be performed as a collaborative effort between scientists from multiple public and non-profit institutions with local presence in Miami and the City of Coral Gables specifically. The technical team is comprised of members from:

- National Oceanographic and Atmospheric Administration (NOAA), Atlantic Oceanographic and Meteorological Laboratory;
- Coastal Systems Program (CSP), within the University of Massachusetts-Dartmouth (UMD), School for Marine Science and Technology (Principal Investigator resident of Coral Gables);
- Florida Sea Grant, University of Florida / IFAS Extension, Miami-Dade County Parks and Recreation Department
- Assistance from Ransom-Everglades High School AP Environmental Science Classes.

The project is envisioned to be conducted over a 2 year period in order to capture the inter-annual variation in water quality within the canal system due to seasonally dependent precipitation/temperature conditions as well as tidal variations driven by changing lunar cycles. Upon completion of the project, the City of Coral Gables will be provided: (1) a detailed assessment of water quality and nutrient related health/impairment of the various segments comprising the waterway system and (2) land-use nutrient loads affecting the Coral Gables partitioned by the functional subwatersheds comprising the land area contributing to the waterway system. The linkage of the land based nutrient sources to the water/habitat quality allows prioritization of types of source reduction and the spatial distribution of source reduction to have the best cost/benefit. The project as a whole will serve as a pilot for assessing other canal systems discharging directly to Biscayne Bay (e.g. Snapper Creek Canal).

The investigation of the system will focus on areas that are dominated by brackish conditions (mix of salt and freshwater) down-gradient of SFWMD control structures. Water quality will be monitored at specific station locations (Figure 1) situated throughout the waterway/canal system and moored dissolved oxygen and chlorophyll-*a* sensors will be deployed at strategic locations (Figure 2). These data are then synthesized to quantify the degree of water quality and habitat health/impairment. All data collected will be processed and synthesized in a technical report summarizing the findings with recommendations for next steps that the City of Coral Gables to consider in its long term planning process for mitigating the effects of nutrient loading to the waterway systems as well as adapting to sea level rise. Specific management actions will be assessed for discussion with the City. A presentation will be provided to the City of Coral Gables as well as other pertinent stakeholders to explain the objectives behind the investigation as well as its conclusions and recommended next steps.

It should be noted the data and knowledge generated through this effort will be leveraged to obtain additional grant funding external to the City for Phase 2 involving further quantification of the nutrient dynamics of the system and the development of a numerical tool that the City can use in the future to test the effect of various management scenarios. The Phase 1 technical tasks of the proposed project are as follows:

Task 1) Defining Watershed / Sewershed and Completion of Land-use Analysis for Predicted Nutrient Loading	\$57,390
Task 2) Assessing Water quality in the Coral Gables Waterway and Tributary Canals	\$86,141
Task 3) Characterization of Dissolved Oxygen and Chlorophyll-a Conditions	\$95,675
<u>Task 4) Data Synthesis, Reporting, Presentation and Project Management</u>	<u>\$50,000</u>
Project Total Cost	\$289,206

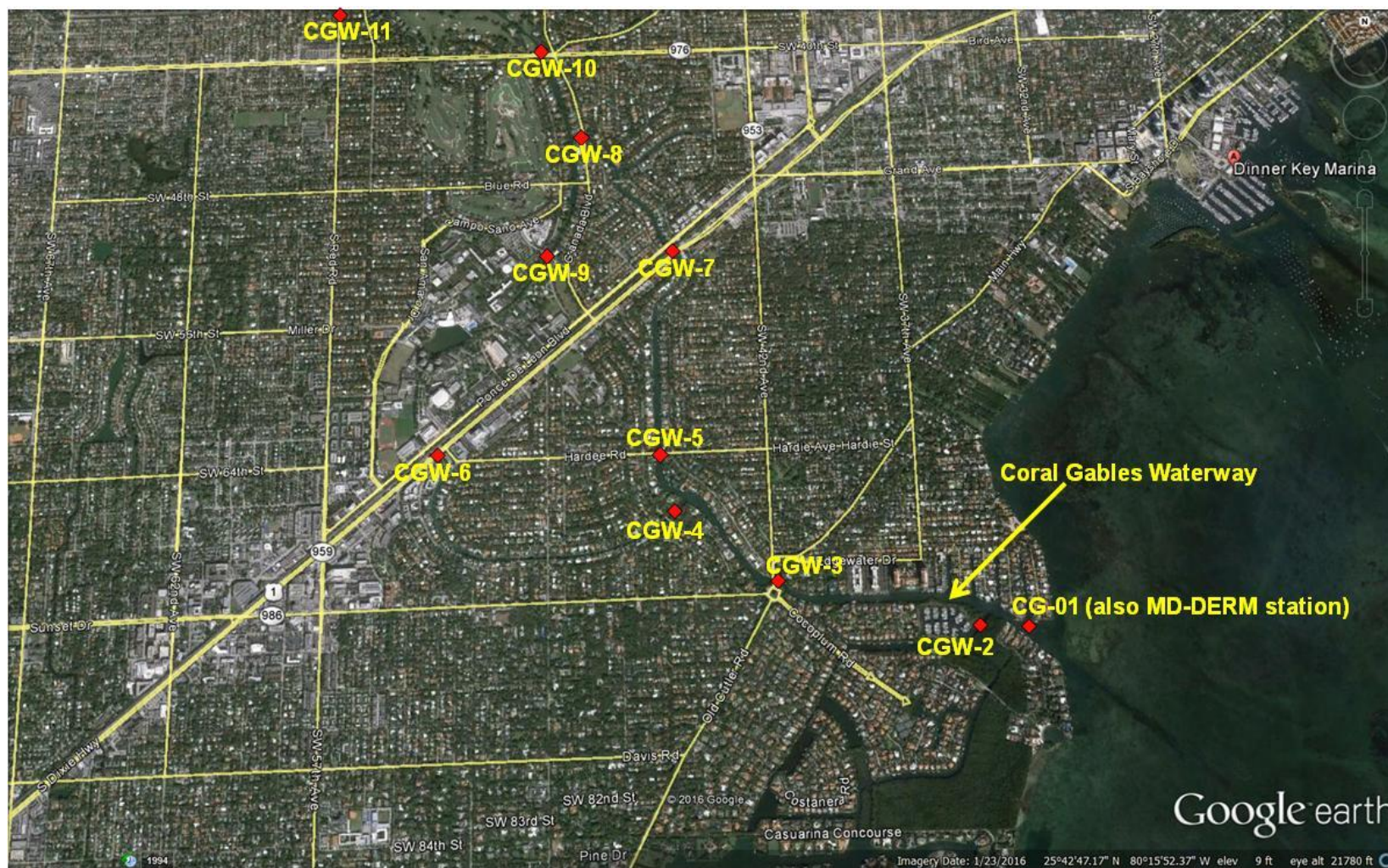


Figure 1. Proposed Water quality monitoring stations located in the main stem of the Coral Gables Waterway and associated tributary canals within the City of Coral Gables, FL. Canals discharge to Biscayne Bay at the mouth of the Coral Gables Waterway where a MD-DELM long term monitoring station is located (CG-01).

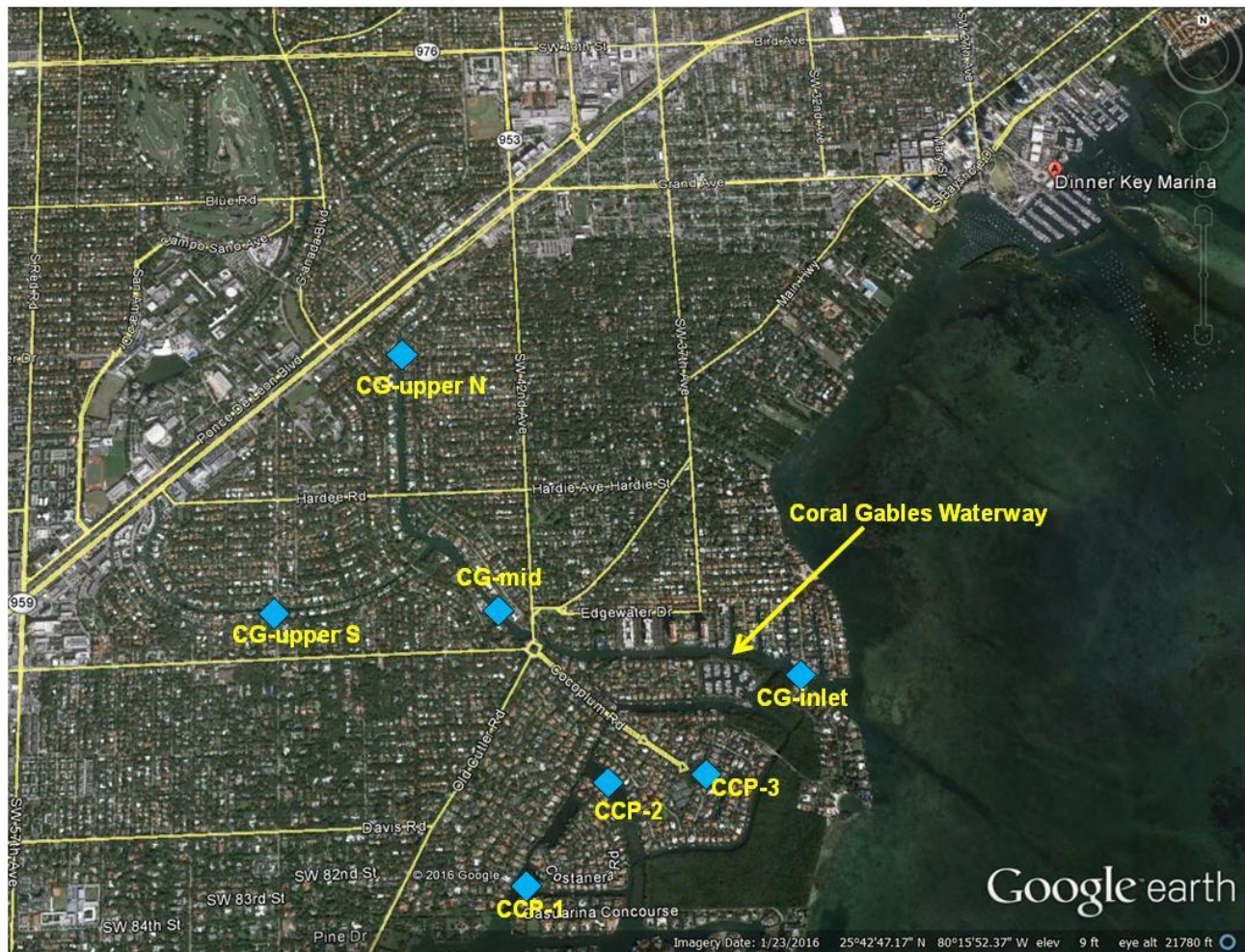


Figure 2. Proposed dissolved oxygen / chlorophyll mooring deployment locations in the main stem of the Coral Gables Waterway and associated tributary canals within the City of Coral Gables, FL. Stations CCP-1,2,3 are located in the tributary canals of the Cocoplum community which discharge to the Coral Gables Waterway and ultimately Biscayne Bay.