

Rookery Bay (RKB) National Estuarine Research Reserve (NERR) Nutrient Metadata
(January 2018 – December 2018)
Latest Update: May 20th, 2019

Note: This is a provisional metadata document; it has not been authenticated as of its download date. Contents of this document are subject to change throughout the QAQC process and it should not be considered a final record of data documentation until that process is complete. Contact the CDMO (cdmosupport@belle.baruch.sc.edu) or Reserve with any additional questions.

I. Dataset and Research Descriptors

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2) Research Objectives

The four primary System Wide Monitoring Program (SWMP) stations and a secondary SWMP station are located in estuaries affected by watersheds demonstrating different patterns of land-use. Their placement addresses priority resource management issues that are identified in the Reserve's management plan. Specifically, the data from these stations provide valuable information concerning the effects of land-use activities on the quantity, quality, and timing of freshwater inflow into the reserve. Each bay studied exhibits a pattern of altered freshwater inflow.

a) Monthly Grab Sampling Program – The principal objective of the monthly grab sampling is to determine spatial and temporal differences in water quality between sites representing different land-use patterns.

b) Diel Sampling Program – The principal objective of the diel sampling is to quantify temporal variability over a lunar tidal cycle and to determine the impact of tidal water exchange within Henderson Creek (a source of freshwater into the Rookery Bay proper waterbody).

3) Research Methods

a) Monthly Grab Sampling Program

Monthly grab samples were collected at all four primary SWMP water quality stations: Henderson Creek, Middle Blackwater River, Faka Union Bay, and Fakahatchee Bay. Beginning in October 2012, grab samples were also collected at Pumpkin Bay which was designated a Secondary SWMP Station by the CDMO in October of 2016. Duplicate grab samples were taken every month at each of the water quality stations following the National Estuarine Research Reserve System Nutrient and Chlorophyll Monitoring Program and Database Design SOP v1.8. Slack low tide was generally not considered for the grab sampling events due to the travel time between sites and the time constraints with the contracted laboratory. Rainfall conditions prior to grab sampling were generally not considered due to constraints with the contracted laboratory.

Sample bottles were pre-cleaned by the contracted laboratory following their Quality Assurance Management Plan (available by request). The bottle kits for each station were labeled with a unique sample identification number and chain of custody sheets were completed for tracking the samples during laboratory analysis and in the laboratory database. Tubing for the water sampling device (peristaltic pump), carboys (for deionized water), and filter holders were pre-cleaned using a Florida Department of Environmental Protection (FLDEP) decontamination procedure (FLDEP SOP FC1000/DEP-QAA-01/001) which involved: cleaning with phosphate-free soap, rinsing three times with tap water, soaking from 4 - 24 hours in a 10% hydrochloric acid bath, rinsing three times with deionized water, and drying for 24 hours. One to two days prior to field sampling, the filter holders were assembled with in-line filters (0.7 µm glass microfiber filters and 0.45 µm membrane filters).

At each water quality station, grab samples for dissolved nutrients were collected 0.5 meter below the surface (near surface grab) using a peristaltic pump. A filter holder attached to the peristaltic

pump tubing was used to filter for dissolved nutrients in the field. Nitrile gloves were worn through the entire process of sample collection and filtering. Unfiltered parameters included chlorophyll *a*, phaeophytin *a*, total phosphorous (TP), total Kjeldahl nitrogen (TKN), and total suspended solids (TSS). Filtered parameters included ammonium (NH₄), nitrite + nitrate (NO₂NO₃), nitrite (NO₂), and orthophosphate (PO₄). Chlorophyll *a*/ phaeophytin *a* and TSS sample bottles were rinsed three times with the sample water then filled to the shoulder, capped and immediately stored in a cooler with ice. The nitrite/ orthophosphate bottle was rinsed three times with filtered water and then filled with the filtrate, capped, and immediately stored in a cooler with ice. The sample bottles for ammonia, nitrite + nitrate, total Kjeldahl nitrogen, and total phosphorus contained sulfuric acid for preservation and therefore were not rinsed before adding the samples. All sample bottles were made of translucent high-density polyethylene (HDPE) with the exception of the chlorophyll *a*/ phaeophytin *a* bottle which was an opaque amber HDPE bottle. To avoid cross contamination, the peristaltic pump tubing was rinsed thoroughly with deionized water after each sampling and then rinsed thoroughly with sample water before sampling at each new station. New gloves and filters were used at each site. Additionally, an equipment blank using deionized water was performed at the end of each sampling event following all the same procedures. Samples were shipped overnight to the FLDEP lab in Tallahassee, FL.

Starting in January 2018, additional Chlorophyll *a* grab samples were collected at each site, using the same collection methods, in a different opaque amber HDPE bottles to compare the fluorometric and spectrophotometer method of analysis. The FLDEP lab reported the results for comparison purposes and the fluorometric data are available by request.

At each site physical/chemical water quality parameters were measured at the same depth as the nutrient samples were collected. A YSI EXO1 datasonde with hand held display were used to record the measurements. Recorded parameters included salinity (ppt), specific conductivity (mS/cm), temperature (°C), dissolved oxygen (% and mg/L), pH, and turbidity (NTU). Equipment calibration was done according to FLDEP SOP 001/01.

b) Diel Sampling Program

Monthly diel samples were collected at the depth of the water quality datasonde (0.25 meters above the bottom) every 2.5 hours over a lunar day (24hr:48 min) using an ISCO refrigerated auto-sampler (model 6712FR). The sampler was stationed at the Rookery Bay dock, approximately 100 meters from the water quality station. Prior to sampling, the polyethylene bottles used in the auto-sampler were washed following the same FLDEP decontamination procedure as described above in the grab sampling methods. A day before the sampling was to begin, the ISCO auto-sampler was set up and programmed. The siphon hose was rinsed with 900 ml ambient water prior to programming the auto-sampler. Sample bottles for the laboratory analysis were pre-cleaned by the contracted laboratory following their Quality Assurance Management Plan (available by request). Bottle kits for each sample interval (11) were labeled with a unique sample identification number and chain of custody sheets were completed for tracking the samples during laboratory analysis and in the laboratory database.

Sample filtration: Nitrile gloves were worn during sample processing. At Rookery Bay's laboratory, each polyethylene bottle containing 1000 ml of sample water was shaken to homogenize the sample. A peristaltic pump with a filter holder attached to the sampling tube was used to filter for dissolved nutrients. For dissolved phosphorus and nitrite, HDPE sample bottles were filled with the filtrate, capped, and immediately stored in a cooler with ice. For ammonium and nitrite + nitrate,

the HDPE sample bottles contained sulfuric acid for preservation and therefore were not rinsed before adding the filtrate, capped, and immediately stored in a cooler with ice. New filters were used for each sample. For the chlorophyll *a* samples, HDPE amber sample bottles were filled with at least 500 ml of unfiltered sample, capped, and immediately stored in a cooler with ice. Samples were shipped overnight to the FLDEP lab in Tallahassee, FL.

c) All Samples

Samples are placed on ice immediately after collection and kept on ice while shipped overnight to the FLDEP lab in Tallahassee, FL. Once at the lab, they are inventoried and placed in the appropriate refrigerator/freezer. Refrigerators range from 0 to 6.0°C and freezers from -30.0 to -5.0°C.

4) Site Location and character

Lower Henderson Creek (rkblhwq):

Lat/Long (Decimal Degrees): 26.0257 N, 81.7332 W

The Lower Henderson site is located at the mouth of Henderson Creek. The “Lower Henderson” labeling is to clarify the site from other historical water quality stations. The sonde is affixed to a piling (manatee caution sign) located right of center (while facing downstream) of the creek channel, approximately 100 meters from RKB NERR’s boat dock. The monitoring site is approximately 5 km downstream of a four-lane highway (SR 951) that crosses Henderson Creek. The creek is 5.8 km long (mainstream linear dimension), has an average mid-channel depth of approximately 2 meters at MHW, and an average width of 239 meters. At the sampling site, the depth is 2 meters at MHW and the width is 600 meters. Tides at Lower Henderson Creek are mixed and range from 0.44 m to 1.91 m (average 1.25 m). Salinity at this site ranged from 10.9 to 38.4 ppt during the year. Creek bottom habitats are predominantly fine sand and there is no bottom vegetation. The dominant marsh vegetation near the sampling site is red mangrove. The dominant natural vegetation of the watershed is hydric pine and cypress.

Upland land use near the sampling site includes residential areas with septic systems. Watershed activities that potentially impact the site include non-point source pollution from road runoff, drift of mosquito control pesticides, runoff from upstream agricultural areas and leachate from nearby residential septic systems and a weir structure located at SR 41. The amount of water released from this weir can sometimes mask natural tidal salinity patterns. The historic Henderson Creek watershed was approximately 50% under State ownership and much of this protected area had intact cypress sloughs and other wetland vegetation. Canals and water use for agriculture and human consumption have altered the hydroperiod of this watershed. Consequently, the Henderson creek watershed may receive non-point source pollution runoff from a variety of sources.

Middle Blackwater River (rkmbwbq):

Lat/Long (Decimal Degrees): 25.9343 N, 81.5946 W

The Middle Blackwater sonde is located at the mouth of Blackwater river. The “Middle Blackwater” labeling is to clarify the site from other historical water quality stations. The sonde is affixed to navigational marker #17 within the river channel. The average depth at this marker

is approximately 2 meters at MHW. The tidal range for Middle Blackwater River varies between 0.05 and 1.90 meters (average 0.99 m). Salinity at this site ranged from 5.2 to 39.7 ppt during the year. Salinities fluctuate with the tides and watershed rainfall. The substrate within the channel is a mixture of sand and silt with oyster shell with some organic matter mixed in. Mature red mangrove forests dominate the banks of the river.

Upstream influences consist of the Collier-Seminole State Park boat basin and upstream agricultural fields adjacent to Blackwater River's main feeder canal (SR 41 canal). Nonpoint source pollution from agricultural operations and golf courses may affect this site. In addition, canals and roads built during the 1960's (Picayune Strand, formerly Southern Golden Gate Estates) may have caused significant disruptions to overland sheet-flow reducing the amounts of freshwater flowing to this estuary. Despite these alterations, the salinity fluctuations of this site suggest that seasonal fluctuations in salinity are more closely correlated to watershed rainfall patterns than salinities of estuaries with water control structures, such as Henderson Creek.

Faka Union Bay (rkbfuwq):

Lat/Long (Decimal Degrees): 25.9005 N, 81.5159 W

The Faka Union sonde is located at the mouth of the Faka Union Canal in the Faka Union Bay. The sonde is affixed to a manatee speed zone sign next to the main channel. The average depth at this site is approximately 2 meters at MHW. The tidal range for Faka Union Bay varies between 0.05 and 1.72 meters (average 0.82 m). Salinity at this site ranged from 0.5 to 39.0 ppt during the year. Salinities fluctuate daily with tides, seasonal rainfall, and management of upstream water control structures. The substrate within the channel is a mixture of sand and silt with some organic matter. Mature red mangrove forests and spoil islands dominate the banks of the canal and bay.

Upstream influences consist of the Port of the Islands development and marina. The watershed consists of an elaborate canal system (Picayune Strand, formerly Southern Golden Gate Estates) which has altered natural water drainage patterns into Faka Union Bay.

Fakahatchee Bay (rkbfbwq):

Lat/Long (Decimal Degrees): 25.8922 N, 81.4770 W

The Fakahatchee Bay sonde is located at the mouth of two rivers, Fakahatchee River and East River. The sonde is placed in a 4" PVC housing secured to a 6" PVC pipe jetted into the substrate. The average depth at MHW is approximately 1.0 meter. The tide range for Fakahatchee varies between 0.05 and 1.78 meters (average 0.79 m). Salinity at this site ranged from 8.3 to 40.1 ppt during the year. Salinities fluctuate daily with the tides and seasonal rainfall. The substrate within the channel is a mixture of sand, silt and some organic matter. Mature red mangrove forests dominate the banks of the rivers and bay. An oyster bar is located adjacent to the site.

Upstream there are minimal influences from the Picayune Strand State Forest with non-point source pollutants possible from the culverts under I-75 and US 41. Fakahatchee Strand State Preserve and Big Cypress National Park manage the headwaters of Fakahatchee Bay. Fakahatchee Bay's watershed is considered to be the least altered.

Pumpkin Bay (rkbpbwq):

Lat/Long (Decimal Degrees): 25.9141 N, 81.5404 W

The site is located at the mouth of the Pumpkin River. The tide range for Pumpkin Bay varies between 0.00 and 1.64 meters (average 0.67 m). Salinity at this site ranged from 12.9 to 39.9 ppt during the year. The bottom habitat is predominantly fine sand and there is no bottom vegetation. Mature red mangrove forests dominate the Pumpkin River and the bay. Upland land use is minimal with the main influence US 41 and the Picayune Strand State Forest canal system, which has diverted freshwater. Typically, this site does not receive enough freshwater inflow.

Station Code	SWMP Status	Station Name	Location	Active Dates	Reason Decommissioned	Notes
FB	P	Fakahatchee Bay	25.8922 81.477	01/01/2002 00:00 - current	NA	NA
FU	P	Faka Union Bay	25.9005 81.5159	01/01/2002 00:00 – current	NA	NA
LH	P	Lower Henderson Creek	26.0257 81.7332	01/01/2001 00:00 – current	NA	NA
MB	P	Middle Blackwater River	25.9343 81.5946	01/01/2000 00:00 – current	NA	NA
PB	S	Pumpkin Bay	25.9141 81.5404	07/06/2016 00:00 – current	NA	NA

5) Coded variable definitions

rkbhnut = Rookery Bay Lower Henderson nutrients (monthly grabs and diel sampling)

rkbmbnut = Rookery Bay Middle Blackwater nutrients (monthly grabs)

rkbfunut = Rookery Bay Faka Union nutrients (monthly grabs)

rkbfbnut = Rookery Bay Fakahatchee Bay nutrients (monthly grabs)

rkbpbnut = Rookery Bay Pumpkin Bay nutrients (monthly grabs, Secondary SWMP station)

Monitoring Codes:

monthly grab sample program = 1

monthly diel sample program = 2

Replicate grab samples were denoted as 1 for the first sample and 2 for the second sample at each station in the “Rep” column. Since 1 diel sample was collected every 2.5 hrs., the replicate number was always denoted as 1 in the “Rep” column.

6) Data Collection Period

The System-Wide Monitoring Program nutrient sampling began in January 2002 at all the primary SWMP sampling stations. Sampling began in October 2012 at the Secondary SWMP station, rkbpbnut. For 2016, the data collection period was from January to December.

Monthly Grab Sampling

Station Code	Date Time Stamp (rep 1)	Date Time Stamp (rep 2)
rkblhnut	1/9/2018 8:13	1/9/2018 8:17
rkblhnut	2/7/2018 8:40	2/7/2018 8:45
rkblhnut	3/8/2018 12:57	3/8/2018 13:00
rkblhnut	4/4/2018 12:08	4/4/2018 12:14
rkblhnut	5/8/2018 7:20	5/8/2018 7:26
rkblhnut	6/5/2018 7:24	6/5/2018 7:29
rkblhnut	7/12/2018 11:30	7/12/2018 11:34
rkblhnut	8/7/2018 6:56	8/7/2018 7:03
rkblhnut	9/5/2018 7:20	9/5/2018 7:25
rkblhnut	10/3/2018 7:22	10/3/2018 7:26
rkblhnut	11/6/2018 8:40	11/6/2018 8:45
rkblhnut	12/4/2018 8:12	12/4/2018 8:16
rkbmbnut	1/9/2018 9:57	1/9/2018 10:03
rkbmbnut	2/7/2018 10:19	2/7/2018 10:25
rkbmbnut	3/8/2018 8:48	3/8/2018 8:52
rkbmbnut	4/4/2018 10:05	4/4/2018 10:11
rkbmbnut	5/8/2018 11:03	5/8/2018 11:06
rkbmbnut	6/5/2018 8:53	6/5/2018 8:56
rkbmbnut	7/12/2018 9:57	7/12/2018 10:01
rkbmbnut	8/7/2018 8:30	8/7/2018 8:34
rkbmbnut	9/5/2018 8:51	9/5/2018 8:55
rkbmbnut	10/3/2018 9:21	10/3/2018 9:26
rkbmbnut	11/6/2018 12:17	11/6/2018 12:23
rkbmbnut	12/4/2018 12:04	12/4/2018 12:09
rkbfunut	1/9/2018 11:22	1/9/2018 11:28
rkbfunut	2/7/2018 11:42	2/7/2018 11:49
rkbfunut	3/8/2018 10:04	3/8/2018 10:10
rkbfunut	4/4/2018 8:33	4/4/2018 8:40
rkbfunut	5/8/2018 9:34	5/8/2018 9:38
rkbfunut	6/5/2018 10:10	6/5/2018 10:15
rkbfunut	7/12/2018 8:28	7/12/2018 8:34
rkbfunut	8/7/2018 9:50	8/7/2018 9:55
rkbfunut	9/5/2018 10:05	9/5/2018 10:08
rkbfunut	10/3/2018 10:51	10/3/2018 10:54
rkbfunut	11/6/2018 11:10	11/6/2018 11:22

rkbfunut	12/4/2018 10:53	12/4/2018 10:58
rkbfbnut	1/9/2018 11:55	1/9/2018 12:03
rkbfbnut	2/7/2018 12:18	2/7/2018 12:22
rkbfbnut	3/8/2018 10:38	3/8/2018 10:42
rkbfbnut	4/4/2018 9:05	4/4/2018 9:13
rkbfbnut	5/8/2018 10:10	5/8/2018 10:18
rkbfbnut	6/5/2018 10:41	6/5/2018 10:46
rkbfbnut	7/12/2018 8:58	7/12/2018 9:02
rkbfbnut	8/7/2018 10:20	8/7/2018 10:24
rkbfbnut	9/5/2018 10:28	9/5/2018 10:32
rkbfbnut	10/3/2018 10:14	10/3/2018 10:19
rkbfbnut	11/6/2018 10:33	11/6/2018 10:38
rkbfbnut	12/4/2018 10:24	12/4/2018 10:28
rkbpbnut	1/9/2018 10:48	1/9/2018 10:54
rkbpbnut	2/7/2018 11:06	2/7/2018 11:10
rkbpbnut	3/8/2018 9:32	3/8/2018 9:37
rkbpbnut	4/4/2018 7:58	4/4/2018 8:04
rkbpbnut	5/8/2018 9:04	5/8/2018 9:09
rkbpbnut	6/5/2018 9:36	6/5/2018 9:40
rkbpbnut	7/12/2018 8:03	7/12/2018 8:07
rkbpbnut	8/7/2018 9:14	8/7/2018 9:18
rkbpbnut	9/5/2018 9:38	9/5/2018 9:42
rkbpbnut	10/3/2018 11:19	10/3/2018 11:23
rkbpbnut	11/6/2018 11:50	11/6/2018 11:55
rkbpbnut	12/4/2018 11:21	12/4/2018 11:25

Diel Sampling

Station Code	Date Time stamp (begin)	Date Time stamp (end)
rklhnut	1/16/18 8:00	1/17/18 9:00
rklhnut	2/14/18 9:30	2/15/18 10:30
rklhnut	3/14/18 8:00	3/15/18 9:00
rklhnut	4/10/18 4:00	4/11/18 5:00
rklhnut	5/14/18 7:30	5/15/18 8:30
rklhnut	6/12/18 6:30	6/13/18 7:30
rklhnut	7/17/18 6:00	7/18/18 7:00
rklhnut	8/15/18 9:00	8/16/18 10:00
rklhnut	9/10/2018 9:15	9/11/2018 10:15
rklhnut	10/23/2018 7:00	10/24/2018 8:00
rklhnut	11/13/2018 10:00	11/14/2018 11:00
rklhnut	12/11/2018 10:00	12/12/2018 11:00

7) Associated Researchers and Projects

As part of the SWMP, Rookery Bay NERR monitors 15-minute meteorological and water quality data which may be correlated with this nutrient/pigment dataset. The principal objective of these programs is to record long-term environmental data within Rookery Bay NERR in order to observe any changes or trends over time. The five water quality sites were also selected to represent various degrees of watershed hydrologic alteration. Both water quality and meteorological data are available at www.nerrsdata.org.

The nutrient data generated by Rookery Bay NERR are being used to analyze restoration targets established for the Picayune Strand Restoration Project (PSRP; formerly known as Southern Golden Gate Estates) which is a portion of the Comprehensive Everglades Restoration Plan (CERP). Additional datasets used in this analysis include a long-term fisheries survey (July 1998 to June 2013, October 2015 to the present), a shark demographics survey (May 2000 to the present), and an oyster reef/benthic crab survey (1999 to 2008). Florida DEP used the nutrient data to develop numeric nutrient criteria for the southwest region of Florida, which were approved by the Environmental Protection Agency.

8) Distribution

NOAA retains the right to analyze, synthesize and publish summaries of the NERRS System-wide Monitoring Program data. The NERRS retains the right to be fully credited for having collected and process the data. Following academic courtesy standards, the NERR site where the data were collected should be contacted and fully acknowledged in any subsequent publications in which any part of the data are used. The data set enclosed within this package/transmission is only as good as the quality assurance and quality control procedures outlined by the enclosed metadata reporting statement. The user bears all responsibility for its subsequent use/misuse in any further analyses or comparisons. The Federal government does not assume liability to the Recipient or third persons, nor will the Federal government reimburse or indemnify the Recipient for its liability due to any losses resulting in any way from the use of this data.

Requested citation format:

NOAA National Estuarine Research Reserve System (NERRS). System-wide Monitoring Program. Data accessed from the NOAA NERRS Centralized Data Management Office website: www.nerrsdata.org; accessed 12 October 2018.

NERR nutrient data and metadata can be obtained from the Research Coordinator at the individual NERR site (please see Principal investigators and contact persons), from the Data Manager at the Centralized Data Management Office (please see personnel directory under the general information link on the CDMO home page) and online at the CDMO home page www.nerrsdata.org. Data are available in comma separated version format.

II. Physical Structure Descriptors

9) Entry Verification

The analytical results (electronic files) were provided monthly from the contracted laboratory to Nick Roach, Nutrient Technician and Julie Drevenkar, SWMP Manager. Upon receiving the results, Nick/ Julie reviewed the data for errors. Nick/ Julie were responsible for compilation and QA/QC of the final data set according to chapter 10 of the Centralized Data Management Office (CDMO)

NERR SWMP Data Management Manual v 6.6. The data reported from the lab were in the required units making it unnecessary to convert the data prior to entering it into Microsoft Excel.

Nutrient data are entered into a Microsoft Excel worksheet and processed using the NutrientQAQC Excel macro. The NutrientQAQC macro sets up the data worksheet, metadata worksheets, and MDL worksheet; adds chosen parameters and facilitates data entry; allows the user to set the number of significant figures to be reported for each parameter and rounds using banker's rounding rules; allows the user to input MDL values and then automatically flags/codes measured values below MDL and inserts the MDL; calculates parameters chosen by the user and automatically flags/codes for component values below MDL, negative calculated values, and missing data; allows the user to apply QAQC flags and codes to the data; produces summary statistics; graphs selected parameters for review; and exports the resulting data file to the CDMO for tertiary QAQC and assimilation into the CDMO's authoritative online database.

10) Parameter Titles and Variable Names by Category

Required NOAA/NERRS System-wide Monitoring Program water quality parameters are denoted by an asterisk "**".

Data Category	Parameter	Variable Name	Units of Measure
Phosphorus and Nitrogen:			
	*Orthophosphate, Filtered	PO4F	mg/L as P
	Total Phosphorus	TP	mg/L as P
	*Ammonium, Filtered	NH4F	mg/L as N
	*Nitrite, Filtered	NO2F	mg/L as N
	*Nitrate, Filtered	NO3F	mg/L as N
	*Nitrite + Nitrate, Filtered	NO23F	mg/L as N
	Dissolved Inorganic Nitrogen	DIN	mg/L as N
	Total Kjeldahl Nitrogen	TKN	mg/L as N
	Total Organic Nitrogen	TON	mg/L as N
Chemical Composition:			
	Total Suspended Solids	TSS	mg/L
Plant Pigments:			
	*Chlorophyll <i>a</i>	CHLA_N	µg/L
	Phaeophytin	PHEA	µg/L
Field Parameters (grabs only):			
	Water Temperature	WTEM_N	°C
	Specific Conductance	SCON_N	mS/cm
	Salinity	SALT_N	ppt
	Dissolved Oxygen	DO_N	mg/L
	%Dissolved Oxygen Saturation	DO_S_N	%
	pH	PH_N	pH units
	Turbidity	TURB_N	NTU/FNU

Notes:

1. Time is coded based on a 2400 clock and is referenced to Standard Time.

2. Reserves have the option of measuring either NO₂ and NO₃ or they may substitute NO₃ for individual analyses if they can show that NO₂ is a minor component relative to NO₃.

11) Measured or Calculated Laboratory Parameters

a) Parameters Measured Directly

Phosphorus species:	PO ₄ F, TP
Nitrogen species:	NH ₄ F, NO ₂ F, NO ₃ F, TKN
Chemical Composition:	TSS
Plant Pigments:	CHLA and PHEA

b) Calculated Parameters

DIN:	NO ₃ F + NH ₄ F
TN:	TKN + NO ₂ F
TON:	TKN – NH ₄ F

12) Limits of Detection

Method Detection Limits (MDL), the lowest concentration of a parameter that an analytical procedure can reliably detect, were established by the Florida Department of Environmental Protection (FLDEP) Laboratory. MDLs were determined using the U.S. Environmental Protection Agency MDL procedure found in Title 40 Code of Federal Regulations Part 136 (40 CFR 136, Appendix B, revision 2.0). Once the MDL was established using this method, verification was done prior to use. Verification included analyzing a known standard at 2-3 times the calculated MDL. Additionally, various checks and balances were used to ensure suitability of the MDL. Every quarter the labs employed verification checks on all MDLs. If the verification checks met the lab's acceptance criteria then the MDL remained unchanged. The MDL for all parameters were determined by the FLDEP Laboratory.

a) FLDEP laboratory MDL determination:

MDLs are set such that the risk of reporting a false positive is less than 1%. MDLs are determined using the method specified in the Federal Register, 40 CFR Part 136 Appendix B, revision 2.0. MDL determinations use both LCSs prepared near the estimated detection and method blanks to estimate methodological noise. Where the possibility exists for significant systematic bias from sample preparation and handling or from the analytical determinative step (typically inorganic analyses), bias is taken into account when calculating detection limits. Published MDLs may be set higher than experimentally determined MDLs to (1) avoid observed positive interferences from matrix effects or common reagent contaminants or (2) for reporting convenience (i.e., to group common compounds with similar but slightly different experimentally determined MDLs). MDLs are determined in a suitable analyte-free matrix when possible. For certain analytes and matrices, no suitable, analyte-free matrix may be available. In those cases, MDLs are determined in the absence of any matrix, but in the presence of all preparatory reagents carried through the full preparatory and determinative steps. LOD verification procedures may be found in SOP LB-031, Limit of Detection Verification. (From page 42 of FLDEP Laboratory Quality Manual 2019 located at: http://publicfiles.dep.state.fl.us/dear/labs/lab_qualitymanual_19.pdf)

2018 MDLs

Parameter	Variable	MDL	Approved
Orthophosphate	PO ₄ F	0.004 mg/L	01/01/18-12/31/18

Ammonium	NH4F	0.002 mg/L	01/01/18-12/31/18
Nitrite	NO2F	0.002 mg/L	01/01/18-12/31/18
Nitrite +Nitrate	NO23F	0.004 mg/L	01/01/18-12/31/18
Chlorophyll <i>a</i>	CHLA	0.55 µg/L	01/01/18-12/31/18
Phaeophytin	PHEA	0.4 µg/L	01/01/18-09/30/18
Phaeophytin	PHEA	0.6 µg/L	10/01/18-12/31/18

Kjeldahl Nitrogen	TKN	0.08 mg/L	01/01/18-12/31/18
Total Phosphorus	TP	0.002 mg/L	01/01/18-12/31/18
*Total Suspended Solids	TSS	2 mg/L	01/01/18-12/31/18

*MDL for Total Suspended Solids is 3 when conductivity is > 15,000 µmhos/cm.

FLDEP MDLs for the chlorophyll suite of components may change by station and month based on the need to dilute samples during processing. The base MDL listed in the FLDEP SOP is based on the maximum filtration volume and minimum extract volume and will therefore be the lowest MDL. This MDL was last verified by the FLDEP laboratory 9/28/2018 (as presented in version BB-029-2.5 of the FLDEP SOP for *Spectrophotometric Determination of Corrected and Uncorrected Chlorophyll a and Phaeophytin*, available here:

<https://fldeploc.dep.state.fl.us/sop/sop3.asp?sect=BIOLOGY&cat=CHLOROPHYLL-BOD-SEDIMENT+GRAIN+SIZE&A1=Submit>).

The sample MDL is calculated based on the number of times a sample must be diluted. For example, if a CHL_A sample must be diluted to twice its volume, the base MDL of 0.55 ug/L is multiplied by a dilution factor of two (0.55 ug/L x 2) thus resulting in an MDL of 1.10 ug/L. For samples that fall below the MDL and their MDL is greater than the base MDL, individual sample MDLs are listed in the table below. These data have been flagged and coded as -4 SBL in the dataset. A table of these instances can be found in the "Other Remarks/Notes" section of this metadata document.

13) Laboratory Methods

Chemical and biological analysis was performed by Florida Department of Environmental Protection Laboratory. FLDEP SOP hold times are as follows:

NH4F, Ammonia	Cool, ≤6 °C, H2SO4 to pH<2	28 days
NO2F, Nitrite	Cool, ≤6 °C	48 hours
NO23F, Nitrate-Nitrite	Cool, ≤6 °C, H2SO4 to pH<2	28 days
TP, Total Phosphorous	Cool, ≤6 °C, H2SO4 to pH<2	28 days
TKN, Total Kjeldahl Nitrogen	Cool, ≤6 °C, H2SO4 to pH<2	28 days
TON, Total Organic Nitrogen	Cool, ≤6 °C, H2SO4 to pH<2	28 days
PO4F, Orthophosphate	Cool, to ≤6 °C	Filter w/in 15 minutes; Analyze w/in 48 hours
TSS, Total Suspended Solids	Cool, to ≤6 °C	7 days

*Note that hold times INCLUDE time spent in transport and held at the laboratory.

a) Parameter: PO₄F

EPA or other Reference Method: EPA 365.1

Method Reference: Standard Methods for Examination of Water and Wastewater, 20th ed.

Method Description: Ammonium molybdate and antimony potassium tartrate react in an acid medium with dilute solutions of phosphorus to form an antimony-phosphomolybdate complex. This complex is reduced to an intensely blue-colored complex by ascorbic acid. The color is proportional to the phosphorus concentration and is measured with a rapid flow autoanalyzer.

Preservation Method: Samples were filtered in the field and stored at 4 °C until analysis.

b) Parameter: TP

EPA or other Reference Method: EPA 365.1

Method Reference: Standard Methods for Examination of Water and Wastewater, 20th ed.

Method Description: Ammonium molybdate and antimony potassium tartrate react in an acid medium with dilute solutions of phosphorus to form an antimony-phosphomolybdate complex. All of the phosphorus present in the sample regardless of forms is measured by the persulfate digestion procedure.

Preservation Method: Samples were preserved with H₂SO₄ and stored at 4 °C until analysis.

c) Parameter: NH₄F

EPA or other Reference Method: EPA 350.1 Rev. 2.0 (1993) (no distillation)

Method Reference: Methods for Chemical Analysis of Water and Wastes

Method Description: Alkaline phenol and hypochlorite react with ammonia to form indophenol blue that is proportional to the ammonia concentration. The blue color formed is intensified with sodium nitroprusside. The color's absorbance is directly proportional to analyte concentration and is measured with a rapid flow autoanalyzer.

Preservation Method: Samples were preserved with H₂SO₄ and stored at 4 °C until analysis.

d) Parameter: NO₂F

EPA or other Reference Method: EPA 353.2

Method Description: A filtered sample is passed through a column containing granulated copper-cadmium to reduce nitrate to nitrite. The nitrite (that was originally present plus reduced nitrate) is determined by diazotizing with sulfanilamide and coupling with N-(1-naphthyl)-ethylenediamine dihydrochloride to form a highly colored azo dye, which is measured colorimetrically with a rapid flow autoanalyzer

Preservation Method: Samples were filtered in the field and stored at 4 °C until analysis.

e) Parameter: NO₃F

EPA or other Reference Method: EPA 353.2

Reference Method: Methods for Chemical Analysis of Water and Wastes

Method Description: A filtered sample is passed through a column containing granulated copper-cadmium to reduce nitrate to nitrite. The nitrite (that was originally present plus reduced nitrate) is determined by diazotizing with sulfanilamide and coupling with N-(1-naphthyl)-ethylenediamine dihydrochloride to form a highly colored azo dye, which is measured colorimetrically with a rapid flow autoanalyzer

Preservation Method: Samples were preserved with H₂SO₄ and stored at 4 °C until analysis.

f) Parameter: TKN

EPA or other Reference Method: EPA 351.2

Reference Method: Methods for Chemical Analysis of Water and Wastes

Method Description: A filtered sample is passed through a column containing granulated copper-cadmium to reduce nitrate to nitrite. The nitrite (that was originally present plus reduced nitrate) is determined by diazotizing with sulfanilamide and coupling with N-(1-naphthyl)-ethylenediamine dihydrochloride to form a highly colored azo dye, which is measured colorimetrically with a rapid flow autoanalyzer.

Preservation Method: Samples were preserved with H₂SO₄ and stored at 4 °C until analysis.

g) Parameter: TSS

EPA or other Reference Method: Standard Methods 2540 D-97

Method Description: A well-mixed sample is filtered through a pre-weighed glass fiber filter. The filter and any residue are then dried to a constant weight at 103-105 °C. The filter is cooled in a desiccator, weighed and the result used to compute the TSS of the sample.

Preservation Method: Samples were stored at 4 °C until analysis.

h) Parameter: CHLA and PHEA

EPA or other Reference Method: SM 10200 H and EPA 446.0

Method Reference: Standard Methods for the Examination of Water and Wastewater, 20th Edition

Method Description: An extractive spectrophotometric technique was used to determine chlorophyll *a* concentrations. Samples were filtered immediately at the laboratory. Filters were placed in a tissue grinder with 2-3 ml of 90% aqueous acetone. Extracts steeped for at least 2 hours at 4 °C in the dark. Extracts were analyzed using a UV/VIS Spectrophotometer.

Preservation Method: Stored at 4 °C and filtered at the lab upon arrival.

h) Parameter: CHLA_FL

EPA or other Reference Method: EPA 445.0

Method Reference: Standard Methods for the Examination of Water and Wastewater, 20th Edition

Method Description: An extractive spectrophotometric technique was used to determine chlorophyll *a* concentrations. Samples were filtered immediately at the laboratory. Filters were placed in a tissue grinder with 2-3 ml of 90% aqueous acetone. Extracts steeped for at least 2 hours at 4 °C in the dark. Extracts were analyzed using a Fluorometer.

Preservation Method: Stored at 4 °C and filtered at the lab upon arrival.

14) Field and Laboratory QAQC programs

Based on Collier County Pollution Control and Prevention Department (CCPCP) Laboratory's Quality Assurance Management Plan version 04-02-08 (available by request) and FLDEP SOP 5361 QAQC manual and FLDEP Quality Manual (available by request).

a) Precision: is defined as the agreement or closeness of two or more results.

i) **Field Variability** – Duplicates (successive grabs at each station) were taken every month at each station.

- ii) **Laboratory variability** – The RPD for matrix duplicates was measured either by the instrument or the analyst. When the average value of the concentration was above the PQL then the RPD must be no more than 20 % in order to be acceptable.
- iii) **Inter-organizational splits** – The laboratory participates in external audit programs including split sample analysis with both public and private laboratories.

b) Accuracy: is defined as the agreement between the analytical results and the known concentration.

- i) **Sample spikes**- A representative sample was spiked with known quantities (preferably approximately 2 to 10 times the practical quantitation limit (PQL)) of the analyte before processing. Percent recoveries were calculated for the added analyte. Matrix spike recoveries were indicators of sample matrix interference and contamination. The confidence range was set at $\pm 15\%$ for water matrices.
- ii) **Standard reference material analysis** - Standard curves were checked against certified or other independently prepared standards during each analytical run. Control standards were analyzed at least every 20 samples. The correlation coefficient for a standard curve should be 0.995 or greater and the recovery for each calibrant above the PQL should be $\pm 10\%$.
- iii) **Cross calibration exercised** – The laboratory participates in a number of Performance Testing (PT) studies and interlaboratory comparison studies every year. They include PT studies that are required as part of our lab's NELAC certification and others such as those conducted by the USGS. The results from these studies are posted at <http://depnet/burlabs/ptinfo.htm>. In addition, our nutrients group also participates in two round robins conducted by the Regional Ambient Monitoring Program (RAMP).

c) Other QAQC methods: Field equipment blanks were taken every monthly grab sampling event to indicate any potential contamination problems during sampling.

15) QAQC flag definitions

QAQC flags provide documentation of the data and are applied to individual data points by insertion into the parameter's associated flag column (header preceded by an F_). QAQC flags are applied to the nutrient data during secondary QAQC to indicate data that are out of sensor range low (-4), rejected due to QAQC checks (-3), missing (-2), optional and were not collected (-1), suspect (1), and that have been corrected (5). All remaining data are flagged as having passed initial QAQC checks (0) when the data are uploaded and assimilated into the CDMO ODIS as provisional plus data. The historical data flag (4) is used to indicate data that were submitted to the CDMO prior to the initiation of secondary QAQC flags and codes (and the use of the automated primary QAQC system for WQ and MET data). This flag is only present in historical data that are exported from the CDMO ODIS.

-4	Outside Low Sensor Range
-3	Data Rejected due to QAQC
-2	Missing Data
-1	Optional SWMP Supported Parameter
0	Data Passed Initial QAQC Checks
1	Suspect Data
4	Historical Data: Pre-Auto QAQC

16) QAQC code definitions

QAQC codes are used in conjunction with QAQC flags to provide further documentation of the data and are also applied by insertion into the associated flag column. There are three (3) different code categories, general, sensor, and comment. General errors document general problems with the sample or sample collection, sensor errors document common sensor or parameter specific problems, and comment codes are used to further document conditions or a problem with the data. Only one general or sensor error and one comment code can be applied to a particular data point. However, a record flag column (F_Record) in the nutrient data allows multiple comment codes to be applied to the entire data record.

General errors

GCM	Calculated value could not be determined due to missing data
GCR	Calculated value could not be determined due to rejected data
GDM	Data missing or sample never collected
GQD	Data rejected due to QA/QC checks
GQS	Data suspect due to QA/QC checks
GSM	See metadata

Sensor errors

SBL	Value below minimum limit of method detection
SCB	Calculated value could not be determined due to a below MDL component
SCC	Calculation with this component resulted in a negative value
SNV	Calculated value is negative
SRD	Replicate values differ substantially
SUL	Value above upper limit of method detection

Parameter Comments

CAB	Algal bloom
CDR	Sample diluted and rerun
CHB	Sample held beyond specified holding time
CIP	Ice present in sample vicinity
CIF	Flotsam present in sample vicinity
CLE	Sample collected later/earlier than scheduled
CRE	Significant rain event
CSM	See metadata
CUS	Lab analysis from unpreserved sample

Record comments

CAB	Algal bloom
CHB	Sample held beyond specified holding time
CIP	Ice present in sample vicinity

CIF	Flotsam present in sample vicinity
CLE	Sample collected later/earlier than scheduled
CRE	Significant rain event
CSM	See metadata
CUS	Lab analysis from unpreserved sample
<i>Cloud cover</i>	
CCL	clear (0-10%)
CSP	scattered to partly cloudy (10-50%)
CPB	partly to broken (50-90%)
COC	overcast (>90%)
CFY	foggy
CHY	hazy
CCC	cloud (no percentage)
<i>Precipitation</i>	
PNP	none
PDR	drizzle
PLR	light rain
PHR	heavy rain
PSQ	squally
PFQ	frozen precipitation (sleet/snow/freezing rain)
PSR	mixed rain and snow
<i>Tide stage</i>	
TSE	ebb tide
TSF	flood tide
TSH	high tide
TSL	low tide
<i>Wave height</i>	
WH0	0 to <0.1 meters
WH1	0.1 to 0.3 meters
WH2	0.3 to 0.6 meters
WH3	0.6 to > 1.0 meters
WH4	1.0 to 1.3 meters
WH5	1.3 or greater meters
<i>Wind direction</i>	
N	from the north
NNE	from the north northeast
NE	from the northeast
ENE	from the east northeast
E	from the east
ESE	from the east southeast
SE	from the southeast
SSE	from the south southeast

S	from the south
SSW	from the south southwest
SW	from the southwest
WSW	from the west southwest
W	from the west
WNW	from the west northwest
NW	from the northwest
NNW	from the north northwest
<i>Wind speed</i>	
WS0	0 to 1 knot
WS1	> 1 to 10 knots
WS2	> 10 to 20 knots
WS3	> 20 to 30 knots
WS4	> 30 to 40 knots
WS5	> 40 knots

17) Other remarks/notes

Data may be missing due to problems with sample collection or processing. Laboratories in the NERRS System submit data that are censored at a lower detection rate limit, called the Method Detection Limit or MDL. MDLs for specific parameters are listed in the Laboratory Methods and Detection Limits Section (Section II, Part 12) of this document. Concentrations that are less than this limit are censored with the use of a QAQC flag and code, and the reported value is the method detection limit itself rather than a measured value. For example, if the measured concentration of NO₂3F was 0.0005 mg/l as N (MDL=0.0008), the reported value would be 0.0008 and would be flagged as out of sensor range low (-4) and coded SBL. In addition, if any of the components used to calculate a variable are below the MDL, the calculated variable is removed and flagged/coded -4 SCB. If a calculated value is negative, it is rejected and all measured components are marked suspect. If additional information on MDL's or missing, suspect, or rejected data is needed, contact the Research Coordinator at the Reserve submitting the data.

Note: The coding of MDL values in the NERRS SWMP dataset were changed in November of 2011. Previously, below MDL data from 2007-2010 were also flagged/coded, but either reported as the measured value or a blank cell. Any 2007-2011 nutrient/pigment data downloaded from the CDMO prior to November of 2011 will reflect this difference.

Sample hold dates for 2018: Samples are held at 4°C by the FLDEP Laboratory. NERRS SOP allows nutrient samples to be held for up to 24 hours at 4°C (CHLA for 30) or 28 days at 4°C with acidification, plus up to 5 days for collecting, processing, and shipping samples. Samples held beyond that time period are flagged suspect and coded CHB. The dates recorded in the table below are the longest hold date that the FLDEP Laboratory analyzed each parameter.

Sample Descriptor	Date Analyzed					
	PO4F	NH4	NO2	NO3	CHLA_N, PHEA	Fluoristic CHLA
01/09/2018 grab samples	1/11/2018	1/18/2018	1/11/2018	1/16/2018	1/22/2018	1/31/2018
01/16-01/17/2018 diel samples	1/18/2018	1/26/2018	1/18/2018	1/23/2018	1/24/2018	
02/07/2018 grab samples	2/8/2018	2/12/2018	2/8/2018	2/16/2018	2/19/2018	2/21/2018
02/14-02/15/2018 diel samples	2/16/2018	2/27/2018	2/16/2018	2/22/2018	2/28/2018	
03/08/2018 grab samples	3/9/2018	3/15/2018	3/9/2018	3/13/2018	3/15/2018	3/19/2018
03/14-03/15/2018 diel samples	3/16/2018	3/26/2018	3/16/2018	3/21/2018	3/21/2018	
04/04/2018 grab samples	4/5/2018	4/13/2018	4/5/2018	4/13/2018	4/12/2018	4/11/2018
04/10-04/11/2018 diel samples	4/12/2018	4/13/2018	4/12/2018	4/13/2018	4/18/2018	
05/08/2018 grab samples	5/9/2018	5/14/2018	5/9/2018	5/11/2018	5/17/2018	5/17/2018
05/14-05/15/2018 diel samples	5/16/2018	5/15/2018	5/16/2018	5/21/2018	5/24/2018	
06/05/2018 grab samples	6/6/2018	6/15/2018	6/6/2018	6/7/2018	6/13/2018	6/18/2018
06/12-06/13/2018 diel samples	6/14/2018	6/21/2018	6/14/2018	6/15/2018	6/21/2018	
07/12/2018 grab samples	7/13/2018	7/20/2018	7/13/2018	7/16/2018	7/18/2018	7/18/2018
07/17-07/18/2018 diel samples	7/19/2018	7/24/2018	7/19/2018	7/20/2018	7/24/2018	
08/07/2018 grab samples	8/8/2018	8/14/2018	8/8/2018	8/13/2018	8/16/2018	8/10/2018
08/15-08/16/2018 diel samples	8/17/2018	8/23/2018	8/17/2018	8/20/2018	8/29/2018	
09/05/2018 grab samples	9/6/2018	9/7/2018	9/6/2018	9/12/2018	9/17/2018	9/26/2018
09/10-09/11/2018 diel samples	9/12/2018	9/17/2018	9/12/2018	9/17/2018	9/20/2018	
10/03/2018 grab samples	10/4/2018	10/19/2018	10/4/2018	10/5/2018	10/22/2018	10/25/2018
10/23-10/24/2018 diel samples	10/25/2018	11/6/2018	10/25/2018	11/5/2018	11/8/2018	
11/06/2018 grab samples	11/7/2018	11/13/2018	11/7/2018	11/15/2018	11/26/2018	11/20/2018
11/13-11/14/2018 diel samples	11/15/2018	11/19/2018	11/15/2018	11/27/2018	11/30/2018	
12/04/2018 grab samples	12/5/2018	12/6/2018	12/5/2018	12/6/2018	12/17/2018	12/19/2018
12/11-12/12/2018 diel samples	12/14/2018	12/18/2018	12/14/2018	12/18/2018	1/2/2019	

Monthly QAQC Code explanations:

January

For the 01/09/2018 grab samples, OP, NO2 from 08:13 through 10:48, CHLA from 08:13 through 11:28, and PHEA from 08:13 through 11:28, were Q-qualified, “sample held beyond normal holding time” by the lab due to the samples arriving a day later than expected, but all samples were within the CDMO’s hold time criteria.

The TSS grab sample taken at 01/09/2018 11:55 and 12:03 were A-qualified, “Value reported is the mean of two or more determinations.”

March

The TSS grab sample taken at 03/08/2018 13:00 was A-qualified, “Value reported is the mean of two or more determinations.”

April

For the 04/04/2018 grab samples, a cooler with the 08:40, 09:05, 09:13 and 12:14 samples were delivered 5 days late thus the samples were not analyzed.

The TSS grab sample taken at 04/04/2018 12:08 was A-qualified, "Value reported is the mean of two or more determinations."

The CHLA diel sample taken at 04/10/2018 16:30 was A- qualified, "Value reported is the mean of two or more determinations."

May

The CHLA grab sample taken at 05/08/2018 09:34 was A- qualified, "Value reported is the mean of two or more determinations."

June

The NO₂ grab sample taken at 06/05/2018 08:53 and 10:41 were J-qualified, "Estimated value and/or the analysis did not meet established quality control criteria."

The CHLA grab sample taken at 06/05/2018 08:53 was A-qualified, "Value reported is the mean of two or more determinations."

July

For the 07/12/2018 grab samples, the field data was not recorded because the sonde was left at the lab.

August

The CHLA, PHEA and TSS grab samples taken at 08/07/2018 10:24 were A- qualified, "Value reported is the mean of two or more determinations."

September

The TSS grab sample taken at 09/05/2018 10:28 was A-qualified, "Value reported is the mean of two or more determinations."

The CHLA diel sample taken at 09/11/2018 10:15 was A-qualified, "Value reported is the mean of two or more determinations."

October

For the 10/03/2018 grab samples, the LH turbidity field reading was inadvertently not recorded.

The CHLA grab sample taken at 10/03/2018 10:51 was A-qualified, "Value reported is the mean of two or more determinations."

For the 10/23/2018 14:30 diel sample OP was Q-qualified, "sample held beyond normal holding time" by the lab, but the sample was within the CDMO's hold time criteria.

The TSS grab samples taken at 10/03/2018 11:19 and 11:23 were A-qualified, "Value reported is the mean of two or more determinations."

November

For the 11/13/2018 and 11/14/2018 diel samples, the ISCO sampler did not collect the 17:30, 20:00, 22:30, 06:00, and 08:30 samples.

The CHLA and PHEA grab samples taken at 11/06/2018 10:33 were A-qualified, "Value reported is the mean of two or more determinations."

The CHLA diel sample taken at 11/13/2018 10:00 was A-qualified, "Value reported is the mean of two or more determinations."

The TSS grab sample taken at 11/06/2018 11:50 was A-qualified, "Value reported is the mean of two or more determinations."

December

For the 12/04/2018 grab samples, the NO₂ readings were significantly higher than the rest of the year. The cause for the higher readings is unknown.

For the 12/12/2018 diel samples, OP 03:30 through 11:00, NO₂ from 03:30 through 11:00, CHLA from 03:30 through 08:30, and PHEA from 03:30 through 08:30, were Q-qualified, "sample held beyond normal holding time" by the lab due to the samples arriving late, but all samples were within the CDMO's hold time criteria.

The CHLA grab sample taken at 12/04/2018 11:21 was A-qualified, "Value reported is the mean of two or more determinations."

Monthly MDL Changes: Due to the need for sample dilution by the lab for the sample to be analyzed, some chlorophyll *a*, pheaphtin *a*, nitrite+nitrate, and TSS MDLs are elevated. Some values are flagged as below sensor limits <-4> [SBL] while the value reported is higher than the normal MDL. These samples are as follows:

January

The TSS grab sample taken at 01/09/2018 08:13 has an MDL of 3 mg/L.

The TSS grab sample taken at 01/09/2018 08:17 has an MDL of 3 mg/L.

The TSS grab sample taken at 01/09/2018 10:48 has an MDL of 3 mg/L.

The TSS grab sample taken at 01/09/2018 11:28 has an MDL of 3 mg/L.

The PHEA diel sample taken at 01/16/2018 08:00 has an MDL of 0.89 ug/L.

The PHEA diel sample taken at 01/16/2018 23:00 has an MDL of 0.44 ug/L.

The CHLA diel sample taken at 01/17/2018 01:30 has an MDL of 1.40 ug/L.

The PHEA diel sample taken at 01/17/2018 01:30 has an MDL of 1.00 ug/L.

The PHEA diel sample taken at 01/17/2018 06:30 has an MDL of 0.44 ug/L.

March

The PHEA diel sample taken at 03/14/2018 13:00 has an MDL of 0.89 ug/L.

May

The PHEA grab sample taken at 05/08/2018 10:18 has an MDL of 0.45 ug/L.

June

The TSS grab sample taken at 06/05/2018 10:41 has an MDL of 3 mg/L.

The TSS grab sample taken at 06/05/2018 10:46 has an MDL of 3 mg/L.

The PHEA diel sample taken at 06/12/2018 14:00 has an MDL of 0.89 ug/L.

July

The TSS grab sample taken at 07/12/2018 09:02 has an MDL of 3 mg/L.

The PHEA grab sample taken at 07/12/2018 11:34 has an MDL of 0.60 ug/L.

September

The TSS grab sample taken at 09/05/2018 07:20 has an MDL of 3 mg/L.

The TSS grab sample taken at 09/05/2018 07:25 has an MDL of 3 mg/L.

October

The TSS grab sample taken at 10/03/2018 07:26 has an MDL of 3 mg/L.

The PHEA diel sample taken at 10/24/2018 05:30 has an MDL of 1.20 ug/L.

November

The PHEA diel sample taken at 11/14/2018 01:00 has an MDL of 1.20 ug/L.

2018 weather conditions based on Big Cypress Basin (BCB) Hydrologic Reports:

January: In January, the Big Cypress Basin [BCB] continued to experience the dry weather trends which characterized the final months of 2017. Rainfall totals for the month remained sub-par, even as incoming frontal systems brought some episodic colder temperatures over southwest Florida. Rainfall across the BCB was insufficient to top the historical norm last month. The recorded Basin-wide average was 0.87 inches. This tally was 57% below the Basin's monthly historic weighted average, typically 2.04 inches for January. From a historic perspective, precipitation received last month was also far less than in 2016, when the Basin registered a record of 10.6 inches.

February: Rainfall across the BCB was once again below average in February. This continues the dry weather trend which has characterized the winter months thus far. Rainfall across all BCB localities remained scant last month, recording a Basin-wide average of 0.23 inches. This represents a significant rainfall deficit (-88%) for February, and compounds the dry conditions already being experienced by the Basin since the beginning of the year. From a historic perspective however, this past month was not the driest on record, this distinction goes to February 2000, which barely received 0.1 inches. The highest February precipitation during that record period occurred in 1998, when the Basin registered 5.5 inches.

March: The rainfall received across BCB was a modest improvement over the dry conditions in February, although not sufficiently significant to alter the overall trends experienced so far this year. Incoming frontal systems, normally the predominant wet-weather pattern in winter, remained generally unproductive over the BCB. Rainfall across all BCB localities remained sub-par, registering a Basin-wide average of 1.26 inches, far less than the 2.14 inches typically expected. The deficit in March once again highlights the ongoing dry weather patterns experienced since January. Thus far the 2018 cumulative rainfall total is 2.36 inches, well below the BCB historical average, normally about 6.12 inches by this time of year. Viewed from a historical perspective, spanning from 1990 to present, this past month was

only moderately dry. Based on BCB records for the month of March 2004 was the driest, registering a scant 0.2 inches, while the wettest occurred in 2010 which recorded a Basin-wide average of 6.3 inches.

April: Weather patterns across the BCB were somewhat more encouraging in terms of rainfall last month. Although precipitation was still insufficient to top the historical average, rainfall amounts generated by incoming frontal systems registered a modest improvement over March. Rainfall across all BCB localities registered a Basin-wide average of 1.78 inches, still below the historical average of 2.43 inches. This deficit highlights the continued dry weather trend which has held sway since January. Thus far, the 2018 BCB cumulative rainfall totals 4.06 inches, well below the Basin's historical average, normally about 8.47 inches by this time of year. A comparative review of BCB archives, 1990 to present, indicates that rainfall amounts last month were historically in low range, albeit moderately so. These records indicate that April 1998 was the driest, registering a scant 0.3 inches, while April 2010 was by far the wettest, with a record Basin-wide average of 6.2 inches.

May: May is normally a transitional month coinciding with the start of wet season. For most of south Florida, including the BCB, the timeline of weather changes can hardly be better described. By mid-month the onset of significant rainfall events, including Subtropical Storm ALBERTO, the first named storm of the 2018 season, abruptly ended the prolonged drought which had held sway since January, and by month's end the Basin had received rain in record amounts. The change in weather patterns resulted in a Basin-wide average rainfall of 9.10 inches, pushing well beyond the historical norms, typically 3.63 inches. As a result, the Basin's 2018 cumulative rainfall totals are now considerably improved. This tally now tops 13.23 inches, clearly in excess of the historical average, which is typically 12.11 inches by this time of year. Occurrence of such high rainfall in May is unusual, and review of the BCB archives indicates that totals were indeed record-setting, the highest in 28 years.

June: In June, wet season conditions continued to develop across the BCB, albeit with diminished intensity compared to the previous month. As is typical for this time of year, precipitation received was mostly from a daily pattern of scattered afternoon and early evening thunderstorms. Rainfall for June, normally one of the wettest months of the season, was significant but still fell short of the Basin's historical average. The sea breeze weather patterns in June were sufficient to generate significant rainfall across the Basin. Basin-wide rainfall averaged 7.03 inches. However significant, this total did not best the normal BCB average of 9.59 inches. Reviewed in historical context, June's tally was solid but certainly well below last year's total, when the Basin averaged a whopping 21.3 inches of rainfall. By the end of June, the accumulated precipitation for 2018 had yet to match the Basin's historical average. The January through June rainfall total is now close, up to 20.3 inches but still less than the 21.7 inches normally expected by this time of year.

July: Weather conditions throughout July were drier than normal across the BCB. Absent any significant tropical activity impacting the area, the characteristic pattern of afternoon and early evening thunderstorms were consistent for this time of year. By month's end, the basin-wide monthly rainfall fell short of the Basin's historical average. For the second consecutive month, rainfall across the BCB remained below the Basin's historic average. The July recorded basin-wide average rainfall was 7.16 inches. This tally was 1.4 inches below the monthly historic weighted average, which is 8.55 inches in July or 84% of the historic monthly total. By the end of July, the accumulated precipitation for 2018 measured 27.42 inches, which is 2.82 inches less than the 30.25 inches normally expected by this time of year.

August: No report.

September: September continued the below average rainfall trend for the BCB. Tropical Storm Gordon formed near the Florida Keys and came through the BCB during the Labor Day holiday. Gordon did not have a large impact on the BCB and did not provide enough widespread precipitation to offset this year's rainfall deficit. For the fourth consecutive month, rainfall across the BCB remained below the Basin's historic average. The September recorded basin-wide average rainfall was 7.67 inches. This tally was 1.14 inches below the monthly historic weighted average, which is 8.81 inches in September or 87% of the historic monthly total. By the end of September, the average accumulated precipitation for 2018 measured 43.82 inches, which is 4.71 inches less than the 48.53 inches normally expected by this time of year.

October: Below average rainfall continued through October as it has since June. October signaled the start of the dry season as average rainfall dropped significantly from September. The basin-wide monthly average was 2.05 inches, which is only 59% of the normal 3.47 inches typically collected. By the end of October, the average accumulated precipitation for 2018 measured 46.03 inches, which is 5.97 inches less than the 52.00 inches normally expected by this time of year.

November: November finally broke the below average rainfall trend that began in June, although rainfall was just above historical averages for the basin. The rainfall that did occur came from cold fronts crossing the region from the northwest. November was a fairly typical dry season month in terms of rainfall but was above average. The basin-wide monthly average was 2.10 inches, which is 121% of the normal 1.73 inches typically collected. By the end of November, the average accumulated precipitation for 2018 measured 47.91 inches, which is 5.82 inches less than the 53.73 inches normally expected by this time of year.

December: December rainfall was just about average for the Basin. The rainfall that did occur was focused around approaching cold fronts. The majority of rain fell from one frontal system just before the Christmas holiday, which was forecasted to be a much larger event. December was a very typical dry season month in terms of rainfall and was almost right at the historical average. The basin-wide monthly average was 1.43 inches, which is 93% of the normal 1.53 inches typically collected. By the end of December, the average accumulated precipitation for 2018 measured 49.34 inches, which is 5.91 inches less than the 55.25 inches normally expected for the calendar year.

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