

**Reserve Name: Jobos Bay (JOB) NERR Nutrient Metadata**  
**Months and year the documentation covers: January-December 2017**  
**Latest Update: December 3, 2021**

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](mailto:cdmosupport@belle.baruch.sc.edu)) or Reserve with any additional questions.

## **I. Data Set and Research Descriptors**

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### **2) Research objectives –**

The main objective of this monitoring program is to understand the nutrient dynamics within Jobos Bay that may come from the watershed affecting the health of the estuary. Inorganic nutrients, particularly nitrogen and phosphorus are naturally found in mangrove and estuarine habitats. They can be significantly increased by human activities reaching the system through non-point source run-off or direct discharge. Eutrophication is defined as gradual accumulation of nutrients and organic biomass accompanied with an increase in photosynthesis and a decrease in the average depth of the water column caused by the accumulation of sediment.

#### **a) Monthly grab sampling program**

The objective of this study is to provide baseline information on inorganic nutrients and chlorophyll levels in the Jobos Bay estuary. It will also assess nutrients and chlorophyll levels in areas within the reserve that may be receiving impact from human activities from surroundings areas or may act as a habitat gradient in the Bay. In order to compare these with physical (abiotic) water quality parameters, monitoring sites were established at the four YSI's data-sonde stations.

Station number nine (9) was chosen as the impacted site, and collects water quality data in a site associated with runoff from littoral and basin mangrove areas. This lagoon has an average depth of 1.5 meters and its water regime is subject to high concentrations of tannin pigments associated with red mangroves. This station is characterized by a low water exchange due to a low circulation pattern. This sampling station is located in the most inland lagoon northeast of Mar Negro, closest to the thermoelectric power plant. It is subjected to runoff, which may include potential oil spill contamination from this industrial facility and agrochemicals from agricultural activities within the northern boundary of the Reserve. Information compiled from historical environmental documents, indicate that station nine (9) was used as a disposal site for residues of the previously operating sugar mill operation, and therefore might have high organic input into the sediments. Of all four water quality monitoring stations, this has the lowest dissolved oxygen values during the year. Benthic vegetation is scarce.

Station number ten (10), located in a mangrove lagoon area towards the southwestern section of Mar Negro is considered the reference or non-impacted site. This station is characterized by a low water exchange due to a low circulation pattern. This lagoon has an average depth of 2 meters and its water regime is subject to high concentrations of tannin pigments associated with red mangroves. Benthic vegetation is scarce.

Station number nineteen (19) is located in Jobos Bay surrounded by sea grass beds composed of *Thalassia testudinum*. This station is close to the power plant navigation channel, used by barges to bring oil and gas into the power plant pier. This area is exposed to barge standings and sediment re-suspension, and oil spills are always a threat.

Station number twenty (20) is located adjacent to Cayos Caribe reef system. Water currents coming from the reef platform may bring to this station an indication of water conditions behind the coral reef. These water currents are part of the main marine current coming from the eastern side of Jobos Bay that runs along the coast, coming in contact with sensitive areas like agricultural fields, a coal power plant, an oil refinery Phillips Core (shut down in 2005) and other industries.

See the Site Location and Character section for more information on the chosen sample sites.

#### **b) Diel sampling program**

The diel sampling program objective is to quantify the temporal variability of important nutrients and sediment loading in the water column as a function of tidal forcing.

### **3) Research methods –**

#### **a) Monthly Grab Sampling Program**

Monthly grab samples are taken at the four data-sonde stations. Grab samples are taken on the same day at or as near as possible to slack low tide conditions. Efforts are made to collect samples at approximately monthly intervals. Samples are not influenced by previous storm events. Grab samples are representative of the water mass sampled by the data-sonde. Because we have shallow and well-mixed water on our stations, two surface grab samples are collected that are representative of the data-sonde sampling area. Replicate (N=2) sample were collected by hand at an approximate depth of 30 cm.

Grab samples are taken in duplicate (two separate samples collected in different bottles); this will result in a total of eight samples. All samples were collected in amber, Nalgene™ sample bottles that were previously acid washed (10%) rinsed (3x) with distilled-deionized water, dried and followed by rinsing (3x) with ambient water prior to collection of the sample. Samples were immediately placed on ice, in the dark and returned to the laboratory. All samples are filtered immediately after

collection using a vacuum pump. Membrane filters are used for nutrient samples and GF/F are used for Chlorophyll samples. All samples were immediately placed on ice again, in the dark and sent to the Virginia Institute of Marine Sciences (VIMS) laboratory next day shipment.

#### b) Diel Sampling Program

Diel samples are taken at long-term data-sonde station 9. Samples are collected over a full lunar cycle (24hr:48min) time period at 2 hours 11 minute intervals using an ISCO auto-sampler model 6712. Suction line is set to sample at 0.5 meters from the bottom, and is covered with a mesh to avoid clogging with organic debris. Efforts are made to collect samples at approximately monthly (30 days) intervals. Samples are not influenced by previous storm events; an antecedent dry period of 72 hours is desirable but may not be practical at all locations throughout the year. Sampling follows the following designs: samples are collected at a fixed depth from the bottom, generally 0.5 meters, and reflect the water mass sampled by the data-sonde. This device automatically samples 1000 ml of water every 2 hrs. A field blank consisting of DI water is placed in the bottle rack and left open during the diel sampling. All samples are pumped into polyethylene sample bottles that were previously acid washed (10%), rinsed (3x) with distilled-deionized water and dried. At the end of the 24 hr period, the 12 samples are kept in the dark and returned to the laboratory for immediate processing. All samples are filtered immediately after collection. The nutrient filtered samples are placed in 250 ml Nalgene bottles and the Chl-a filter in amber (empty) vials, then stored in a cooler (dark) on ice packs and sent to the Virginia Institute of Marine Sciences (VIMS) laboratory.

#### 3) Site location and character –

All Jobos Bay NERR historical nutrient/pigment monitoring stations:

| Station Code | SWMP Status | Station Name | Location                        | Active Dates         | Reason Decommissioned | Notes |
|--------------|-------------|--------------|---------------------------------|----------------------|-----------------------|-------|
| JOB09NUT     | P           | STATION 9    | 17°56'35.0" N<br>66°14'18.9" W  | 07/2002 -<br>current | NA                    | NA    |
| JOB10NUT     | P           | STATION 10   | 17°56'19.00 N,<br>66°15'27.85 W | 07/2002 -<br>current | NA                    | NA    |
| JOB19NUT     | P           | STATION 19   | 17°56'34.49"N,<br>66°13'43.77"W | 07/2002 -<br>current | NA                    | NA    |
| JOB20NUT     | P           | STATION 20   | 17°55'49.14"N,<br>66°12'41.30"W | 07/2002 -<br>current | NA                    | NA    |

The Jobos Bay National Estuarine Research Reserve (JB NERR) is located on the southern coastal plain of the island of Puerto Rico, a reserve within the West Indies geographical area. JB NERR is composed of two major areas: (1) Mar Negro, located on the western margin of the Bay, and (2) Cayos Caribe (a chain of 17 tear-shaped islets located to the southeast) and Cayos Barca (a chain of 7 tear-shaped islets located to the southwest boundaries), both with a back-reef system. The Mar Negro area comprises the bulk of the Reserve, and consists of mangrove forests and a complex system of lagoons and channels interspersed with salt and mud flats. Coral reefs and sea grass beds, with small beach deposits and upland areas fringe the Cayos Caribe and Cayos Barca mangrove islands. Few areas in the watershed drain directly to the bay. Rio Seco to the north-east of the bay is active only during heavy rain events during the wet season. A small creek, Quebrada Coqui, near JB NERR's pier to the north of the bay, drains into an extensive mangrove fringe forest in a laminar flow. During heavy rain events, Station 09 receives runoff water from the upland and finally, a diffuse flow of water reaches the bay from the local aquifer.

**Station 9** is an impacted site and is located on the northeastern section of the Mar Negro component. This sampling station is associated with mangrove lagoon areas and receives runoff from mudflats, the thermoelectric power plant, and adjacent areas. The tidal range varies from 12 to 14 inches near the monitoring station. During 2017 the salinity at the vicinity of the monitoring station varied from 14.1 psu to 41.0 psu. The average depth at station 9 is 1.57 meters. The bottom is covered by a thick layer of thin sediments with a high content of organic material. *Microcoleus* sp. (blue-green algae), brown and green algae (*Caulerpa* sp.) are also present at this site, but a better assessment is needed. The station pole was located at 17° 56' 34.87" N and 66° 14' 18.64" W until 09/02/2010 12:00PM, then it was relocated to 17° 56' 35.0" N and 66° 14' 18.9" W approximately 65.0 meters from its original position. The relocation was due to sedimentation issues and the construction of a new telemetry station. Fresh water input to the station comes only from runoff and rain. This station has been the subject of several studies indicating the presence of relatively high levels of copper and pesticides compared to other stations.

#### Statistics for station 9 during 2017

|         | Temp | SpCond | Sal  | DO_pct | DO_mgl | Depth | pH  | Turb |
|---------|------|--------|------|--------|--------|-------|-----|------|
| Min     | 24.6 | 23.41  | 14.1 | 4.6    | 0.3    | 0.28  | 6.9 | 0    |
| Max     | 36.4 | 61.39  | 41.0 | 171.5  | 10.2   | 1.29  | 8.8 | 286  |
| Average | 29.5 | 54.68  | 36.1 | 64.7   | 4.0    | 0.61  | 7.8 | 8    |
| Std Dev | 1.7  | 3.69   | 2.7  | 31.0   | 1.9    | 0.13  | 0.2 | 18   |

**Station 10** is located in a mangrove lagoon not impacted directly by any upland or marine activities. It provides a reference for comparison of data obtained at other stations, especially to the station in Mar Negro lagoon. The tidal range varies from 12 to 14 inches. During 2017 the salinity at the vicinity of the monitoring station varies from 31.1 psu to 36.3 psu. The average depth at station 10 is 1.15 meters. The bottom is covered with a layer of fine sediments with organic material, followed by a layer of calcareous material mainly from shells and oysters. At this site, we can find sea grass (*Thalassia*), calcareous algae (*Halimeda* sp.), green algae (*Caulerpa* sp.) and brown algae (*Dictyota* sp.) among others. The station pole is located at 17° 56' 19.00 N, 66° 15' 27.85 W. Fresh water input to the station comes only from runoff and rain. There is not any direct source of fresh water.

#### Statistics for station 10 during 2017

|         | Temp | SpCond | Sal  | DO_pct | DO_mgl | Depth | pH  | Turb |
|---------|------|--------|------|--------|--------|-------|-----|------|
| Min     | 24.5 | 9.85   | 5.5  | 0.3    | 0.0    | 0.37  | 7.4 | 0    |
| Max     | 32.8 | 59.98  | 40.0 | 153.6  | 10.4   | 1.12  | 8.7 | 145  |
| Average | 29.1 | 52.52  | 34.5 | 81.7   | 5.2    | 0.65  | 7.9 | 2    |
| Std Dev | 1.6  | 6.52   | 4.7  | 21.7   | 1.3    | 0.09  | 0.2 | 8    |

**Station 19** is located on the western inner section of the bay at a distance of 233 meters from Cayo Colchones mangroves over sea grass beds (*Thalassia testudinum*). Tidal ranges in this area vary from 12 to 14 inches. During 2017 the salinity at the vicinity of the monitoring station varies from 15.6 psu to 37.9 psu. The average depth at this station is 1.5 meters. The YSI sonde is deployed at about 0.5 meters from the bottom. The bottom is of sandy composition. Sea grass, algae, echinoderms and other related organisms can be found in the area. The station pole is located at 17° 56' 34.49" N, 66° 13' 43.77" W. This station is close to the Power Plant navigation channel, used by barges to bring oil and gas into the Power Plant pier. This area is exposed to barge standings and sediment re-suspension. Oil spills are always a threat although the operation is under strict controls. There is no freshwater input to this area.

**Statistics for station 19 during 2017**

|         | Temp | SpCond | Sal  | DO_pct | DO_mgl | Depth | pH  | Turb |
|---------|------|--------|------|--------|--------|-------|-----|------|
| Min     | 24.9 | 25.62  | 15.6 | 9.5    | 0.6    | 0.52  | 7.5 | 0    |
| Max     | 32.0 | 57.11  | 37.9 | 153.9  | 9.7    | 1.31  | 8.3 | 357  |
| Average | 28.6 | 53.67  | 35.3 | 99.1   | 6.3    | 0.75  | 8.0 | 2    |
| Std Dev | 1.4  | 2.82   | 2.1  | 16.1   | 1.0    | 0.09  | 0.1 | 7    |

**Station 20** is located in the inner eastern section at about 190 meters from the Cayos Caribe mangrove islets and at about 688 meters from the coral reef barrier. This station is the closest to Mar Caribe. It has a sandy bottom, with calcareous and coral fragments, sea grass (*Thalassia*) communities, echinoderms and other associated organisms. Tidal ranges in this area vary from 12 to 14 inches. During 2017 the salinity at the vicinity of the monitoring station varies from 28.3 psu to 37.6 psu. The average depth of the site is 1.3 meters. There is no surface freshwater input to this area. These waters are part of the main marine current coming from the eastern side of Jobos Bay that runs along the coast, getting in contact with sensitive areas like agricultural fields, a coal power plant, an oil refinery Phillips Core (shut down in 2005) and other industries. The station pole is located at 17° 55' 49.14" N, 66° 12' 41.30" W.

**Statistics for station 20 during 2017**

|         | Temp | SpCond | Sal  | DO_pct | DO_mgl | Depth | pH  | Turb |
|---------|------|--------|------|--------|--------|-------|-----|------|
| Min     | 24.6 | 44.10  | 28.3 | 50.5   | 3.3    | 0.03  | 7.5 | 0    |
| Max     | 32.1 | 56.61  | 37.6 | 151.4  | 9.6    | 1.35  | 8.7 | 725  |
| Average | 28.4 | 53.30  | 35.1 | 102.2  | 6.5    | 0.79  | 8.1 | 3    |
| Std Dev | 1.3  | 1.83   | 1.4  | 17.9   | 1.1    | 0.11  | 0.2 | 11   |

Data from stations 9, 10, 19 and 20 is being submitted to the CDMO. Eight sondes are permanently devoted to taking readings from these two sites, to assure continuous readings while sondes are taken out of the water for data upload and maintenance. This will avoid data gaps for the stations between sonde maintenance procedures. Due to errors in calibration, turbidity data in these files is considered inadequate. All monitoring is considered long term.

**5) Code variable definitions –**

Station Code Names:

job09nut – Station 9

job10nut – Station 10

job19nut – Station 19

job20nut – Station 20

Monitoring Programs:

Monthly grab sample program (1)

Diel grab sample program (2)

## 6) Data collection period –

### Diel:

| Site | Start Date/ Time | Stop Date/ Time  |
|------|------------------|------------------|
| 9    | 1/24/2017 10:00  | 1/25/2017 10:01  |
| 9    | 2/14/2017 10:00  | 2/15/2017 10:01  |
| 9    | 3/07/2017 09:00  | 3/08/2017 09:01  |
| 9    | 04/25/2017 10:00 | 04/26/2017 10:01 |
| 9    | 05/16/2017 10:00 | 05/17/2017 10:01 |
| 9    | 06/20/2017 10:00 | 06/21/2017 10:01 |

### Grab:

| Site | Start Date/ Time | Stop Date/ Time  |
|------|------------------|------------------|
| 9    | 1/25/2017 10:20  | 1/25/2017 10:21  |
| 9    | 2/15/2017 10:10  | 2/15/2017 10:11  |
| 9    | 3/08/2017 09:40  | 3/08/2017 09:41  |
| 9    | 04/26/2017 10:15 | 04/26/2017 10:16 |
| 9    | 05/17/2017 09:45 | 05/17/2017 09:46 |
| 9    | 06/21/2017 10:34 | 06/21/2017 10:35 |

| Site | Start Date/ Time | Stop Date/ Time  |
|------|------------------|------------------|
| 19   | 1/25/2017 09:25  | 1/25/2017 09:26  |
| 19   | 2/15/2017 09:54  | 2/15/2017 09:55  |
| 19   | 3/08/2017 10:25  | 3/08/2017 10:26  |
| 19   | 04/26/2017 10:59 | 04/26/2017 11:00 |
| 19   | 05/17/2017 08:45 | 05/17/2017 08:46 |
| 19   | 06/21/2017 09:20 | 06/21/2017 09:21 |

### Grab

### (CONT):

| Site | Start Date/ Time | Stop Date/ Time  |
|------|------------------|------------------|
| 10   | 1/25/2017 09:45  | 1/25/2017 09:46  |
| 10   | 2/15/2017 10:32  | 2/15/2017 10:33  |
| 10   | 3/08/2017 09:16  | 3/08/2017 09:17  |
| 10   | 04/26/2017 10:35 | 04/26/2017 10:36 |
| 10   | 05/17/2017 09:05 | 05/17/2017 09:06 |
| 10   | 06/21/2017 10:02 | 06/21/2017 10:03 |

| Site | Start Date/ Time | Stop Date/ Time  |
|------|------------------|------------------|
| 20   | 1/25/2017 09:10  | 1/25/2017 09:11  |
| 20   | 2/15/2017 11:10  | 2/15/2017 11:11  |
| 20   | 3/08/2017 08:50  | 3/08/2017 08:51  |
| 20   | 04/26/2017 09:15 | 04/26/2017 09:16 |
| 20   | 05/17/2017 08:30 | 05/17/2017 08:31 |
| 20   | 06/21/2017 09:05 | 06/21/2017 09:06 |

## 7) Associated researchers and projects–

As part of the SWMP long-term monitoring program, JBNERR also monitors 15-minute meteorological and water quality data which may be correlated with this nutrient/pigment dataset. These data are available at [www.nerrsdata.org](http://www.nerrsdata.org).

The JBNERR water quality monitoring data has been incorporated into the Puerto Rico Environmental Quality Board (EQB) Integrated Report 303(d)/305(b) of the Federal Clean Water Act. This document consists of a water quality inventory and list of impaired waters and it's used by the Environmental Protection Agency (EPA) to inform Congress of the progress made at the national level towards the achievement of the statutory water quality goals and purposes established by the Federal Clean Water Act.

## 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](http://www.nerrsdata.org); *accessed* 12 October 2016.

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](http://www.nerrsdata.org). Data are available in comma separated version format.

## II. Physical Structure Descriptors

### 9) Entry verification –

Samples are pre-processed at JBNERR laboratory. This consists of filtration of samples and storing in a cooler with ice-packs for overnight delivery to VIMS. Analysis results were sent from the VIMS Laboratory in digital and hardcopy format.

Files consisted of sampling station ID, date, replicate number, and parameter values expressed in unit concentrations. Nutrients results are reported by VIMS in mg/L and pigments in ug/L. The CDMO rounding macro is applied to the data after unit conversion calculations. Data are double-checked to insure correct data transfer.

Data is reported with the number of decimal places that conserves the laboratory number of significant figures, i.e., four decimal places for all nutrients and two decimals for CHLA, PHEA.

SWMP technician, Enid Malave, entered and double-checked 2017 sampling dates, locations, times, field parameters, and replicates from the original field data. Missing data are verified through inspection of field logs, inserted into the data files, and denoted by a blank space. VIMS laboratory reports any value below the MDL as the <MDL value, ie. <0.0002 for NO<sub>2</sub>. When entering those values below the method detection limit (MDL) the CDMO macro inserts the MDL value. All data is processed by CDMO Nutrient QAQC Excel macro described below.

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 nutrient parameters are denoted by an asterisk “\*”.

| Data Category                   | Parameter                    | Variable Name | Units of Measure |
|---------------------------------|------------------------------|---------------|------------------|
| <b>Phosphorus and Nitrogen:</b> | *Orthophosphate              | PO4F          | 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        |
| <b>Plant Pigments:</b>          | *Chlorophyll a               | CHLA_N        | µg/L             |
|                                 | Phaeophytin                  | PHEA          | µg/L             |

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 NO23 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

Nitrogen species: NH4F, NO2F, NO23F  
 Phosphorus species: PO4F  
 Other: CHLA\_N, PHEA

##### b) Calculated parameters

NO3F NO23F-NO2F  
 DIN NO23F+NH4F

#### 12) Limits of detection –

Example: Method Detection Limits (MDL), the lowest concentration of a parameter that an analytical procedure can reliably detect, have been established by the VIMS Nutrient Analytical Laboratory. The MDL is determined as 3 times the standard deviation of a minimum of 7 replicates of a single low concentration sample. These values are reviewed and revised periodically.



| Parameter | Start Date | End Date | MDL         | Revisited |
|-----------|------------|----------|-------------|-----------|
| PO4F      | 1/01/17    | 06/30/17 | 0.0020 mg/L | 5/11/2017 |
| NH4F      | 1/01/17    | 06/30/17 | 0.0056 mg/L | 5/11/2017 |
| NO2F      | 1/01/17    | 06/30/17 | 0.0016 mg/L | 5/11/2017 |
| NO23F     | 1/01/17    | 06/30/17 | 0.0047mg/L  | 5/11/2017 |
| CHLA_N    | 1/01/17    | 06/30/17 | 0.10 µg/L   | 5/11/2017 |
| PHEA      | 1/01/17    | 06/30/17 | 0.10 µg/L   | 5/11/2017 |

### 13) Laboratory methods –

#### i) Parameter: NH4F

##### VIMS Laboratory Method:

EPA or other Reference Method: SM 4500-NH3 H-1997

Reference: Standard Methods for the Analysis of Water and Wastes, 21st Ed. 2005. 4500-NH3 H. Nitrogen (Ammonia) by Flow Injection Analysis.

US.EPA 1974. Methods for Chemical Analysis of Water and Wastes pp.168-174

Method Descriptor: Samples were filtered with a 0.45 µm membrane filter.

Preservation Method: Samples are stored at 4°C up to 24 hours, followed by freezing @ 20°C.

##### Summary of Method:

Automated Continuous flow, segmented stream, no bubble gating. Dual wavelength detection and matrix correction.

##### Chemistry:

Alkaline phenol and hypo chlorite react with ammonia to form indophenols blue that is proportional to the ammonia concentration. The blue color formed is intensified with sodium nitroprusside.

Reaction is heat catalyzed at 37°C. The range is 0.001-2.0 mg/L.

##### Interferences:

Alkalinity over 500 mg/L

Acidity over 100 mg/L

Ca and Mg ions will precipitate unless complexed

Color intensity is pH dependent

#### ii) Parameter: NO2F

##### VIMS Laboratory Method:

EPA or other Reference Method: SM 4500 NO3-F-2000

Method Reference: Standard Methods for the Analysis of Water and Wastes, 21st Ed. 2005. 4500-NO3 F. Nitrogen (Nitrite) by Flow Injection Analysis.

US.EPA 1994. USEPA 600/R-97/072. Method 353.4

Method Descriptor: Samples were filtered with a 0.45 µm membrane filter.

Preservation Method: Samples are stored at 4°C up to 24 hours, followed by freezing @ 20°C.

##### Summary of Method:

Automated continuous flow, segmented stream, no bubble gating. Dual wavelength detection and matrix correction.

##### Chemistry:

An adaptation of the diazotization method. Under acidic conditions, nitrite ion reacts with sulfanilamide to yield a diazole compound, which couples with N-1 naphthylenediamine

dihydrochloride to form a soluble dye, which is measured colorimetrically. The range is 0.001 to 0.050 mg/L.

**Interferences:**

NCl<sub>3</sub> false positive

These metal ions cause precipitation at high concentrations:

Sb +3, Au +3, Bi +3, Fe +3, Pb +2, Hg +2, Ag +, PtCl<sub>6</sub>-2, VO<sub>3</sub>-2

Cupric ion may catalyze decomposition of diazole compound.

**iii) Parameter: NO<sub>x</sub> F**

**VIMS Laboratory Method:**

EPA or other Reference Method: SM 4500 NO<sub>3</sub>-F-2000

Method Reference: Standard Methods for the Analysis of Water and Wastes, 21st Ed. 2005. 4500-NO<sub>3</sub> F, Nitrogen (Nitrate) Automated Cadmium Reduction Method; US.EPA 1994. USEPA 600/R-97/072. Method 353.4

Method Descriptor: Samples were filtered with a 0.45 µm membrane filter.

Preservation Method: Samples are stored at 4°C up to 24 hours, followed by freezing @ -20°C.

**Summary of Method:**

Automated continuous flow, segmented stream, no bubble gating. Dual wavelength detection and matrix correction.

**Chemistry:**

Nitrate is reduced to nitrite by a copper/cadmium reductor column. The nitrite ion then reacts with sulfanilamide to form diazole compound. This compound then couples with n-1-naphthylenediamine dihydrochloride to form a reddish/purple azo dye. The color development chemistry is the same as that used in nitrite, Method #5. Range is 0-1.2 mg/L.

**Interferences:**

High concentrations of Fe, Cu (>10 mg/L)

Oil and Grease will coat Cd column

Residual Chlorine oxidizes Cd column

Sulfates will consume Cd column in the formation of S<sup>-2</sup>

**iv) Parameter: PO<sub>4</sub>F**

**VIMS Laboratory Method:**

EPA or other Reference Method: SM 4500-P F-2011

Method Reference: Standard Methods for the Analysis of Water and Wastes, 21st Ed. 2005. 4500-P F. Phosphorus by Flow Injection Analysis; US.EPA 1994. USEPA 600/R-97/072. Method 365.5

Method Descriptor: Samples were filtered with a 0.45 µm membrane filter.

Preservation Method: Samples are stored at 4°C up to 24 hours, followed by freezing @ -20°C.

**Summary of Method:**

Automated continuous flow, segmented stream, no bubble gating. Dual wavelength detection and matrix correction.

**Chemistry:**

Ammonium molybdate and antimony potassium tartrate react in a sulfuric acid environment to form an antimony-phospho-molybdo complex, which is reduced to a blue colored complex by ascorbic acid. Reaction is heat catalyzed at 40 °C. Range is 1-50 ppb.

**Interferences:**

Fe +3 at concentrations greater than 50 mg/L

SiO<sub>2</sub> at conc.>10mg/L positive interference- not naturally present

Hydrogen sulfide  
Mercuric Chloride (used as preservative by some)

**v) Parameter: CHLA\_N and PHA**

**VIMS Laboratory Method:**

EPA or other Reference Method: EPA 445 REV 1.2

Method Reference: US.EPA 1997. USEPA 600/R-97/072. Method 445.0

Method Descriptor: Samples were filtered with a 0.47 µm membrane filter, placed dry in an amber vial and stored with ice packs. They were kept in the dark and extracted at VIMS using 90% acetone.

Preservation Method: Samples are stored at 4°C up to 24 hours, followed by freezing @ -20°C.

**Summary of Method:**

The method for determining Chlorophyll-a is using Fluorometry with a Turner Design fluorometer. The method used requires filtering a known quantity of water through a glass fiber filter. This filter is later ground with a tissue grinder made of Teflon/glass. Approximately 2-3 mL's of 90% acetone are added to the filter before grinding. Acetone is also used to wash the filter in to a 17 x 150 test tube with tight fitting cap. The sample is steeped at least 2 hours and not exceeding 24 hours at 4°C, in the dark. The samples are centrifuged and read on the Turner fluorometer. If pheophytin measurements are desired, the sample is acidified and read again.

**14) Field and Laboratory QAQC programs –**

**a) Precision**

**i) Field variability**

Two successive true replicate grab samples are collected for the monthly grab samples at each of the four stations ensuring that replicate samples are collected at the same depth. They are collected successively by hand within the same minute.

**ii) Laboratory variability** –10% of samples are replicated and RPD should not exceed 20% except in specific circumstances which are defined

**iii) Inter-organizational splits** –None

**b) Accuracy**

**i) Sample spikes**

The VIMS Analytical Service Center for Nutrients analyzes a matrix spike once for every ten samples Standard reference material analysis – This will result from samples sent out from EPA to each lab. 10% of samples are spiked acceptable range is 80-120% recovery except in specific circumstances which are defined.

**ii) Cross calibration exercises** – *None*

**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
- 5 Corrected Data

## 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 NO<sub>3</sub>F 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 way below MDL values are handled in the NERRS SWMP dataset was 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.

**Missing Data:**

15-Feb-17 Lab# 17-057-018 Grab Sample Station 10 data (1) at 10:33am. Sample Bottle cracked and empty. Flagged (1) GDM

Sampling did not occur from July to December 2107 due to administrative issues related to laboratory contract.

**Date of sampling and date of sampling for each parameter**

| Collect_Date     | Date of lab analysis |           |           |                 |                 |                   |
|------------------|----------------------|-----------|-----------|-----------------|-----------------|-------------------|
|                  | CHLA                 | PHEO      | NH3       | NO <sub>x</sub> | NO <sub>2</sub> | O-PO <sub>4</sub> |
| 24-25 Jan 2017   | 6/1/2017             | 6/1/2017  | 6/22/2017 | 6/22/2017       | 6/22/2017       | 6/22/2017         |
| 14-15 Feb 2017   | 6/14/2017            | 6/14/2017 | 6/23/2017 | 6/23/2017       | 6/23/2017       | 6/23/2017         |
| 07-08 March 2017 | 6/21/2017            | 6/21/2017 | 6/28/2017 | 6/28/2017       | 6/28/2017       | 6/28/2017         |
| 25-26 April 2017 | 7/11/2017            | 7/11/2017 | 7/11/2017 | 7/11/2017       | 7/11/2017       | 7/11/2017         |
| 16-17 May 2017   | 6/6/2017             | 6/6/2017  | 6/9/2017  | 6/9/2017        | 6/9/2017        | 6/9/2017          |
| 20-21 June 2017  | 7/11/2017            | 7/11/2017 | 7/19/2017 | 7/19/2017       | 7/19/2017       | 7/19/2017         |

**Rain Event:**

| <b>Date</b> | <b>Precipitation (mm)</b> | <b>Event associated with</b> |
|-------------|---------------------------|------------------------------|
| 01/11/2017  | 1.8                       |                              |
| 01/25/2017  | 2.5                       |                              |
| 02/06/2017  | 2.8                       |                              |
| 02/24/2017  | 2.8                       |                              |
| 03/02/2017  | 2.0                       |                              |
| 03/13/2017  | 0.51                      |                              |
| 03/16/2017  | 0.80                      |                              |
| 03/22/2017  | 12.45                     |                              |
| 03/23/2017  | 12.19                     |                              |
| 03/24/2017  | 12.19                     |                              |
| 03/25/2017  | 18.80                     |                              |
| 03/26/2017  | 3.81                      |                              |
| 03/27/2017  | 0.25                      |                              |
| 04/10/2017  | 4.1                       |                              |
| 04/26/2017  | 4.3                       |                              |
| 04/28/2017  | 21.6                      |                              |
| 04/29/2017  | 7.4                       |                              |
| 04/30/2017  | 1.3                       |                              |
| 05/01/2017  | 23.4                      |                              |
| 05/08/2017  | 0.30                      |                              |
| 05/09/2017  | 5.3                       |                              |
| 05/11/2017  | 21.8                      |                              |
| 05/13/2017  | 0.30                      |                              |
| 05/29/2017  | 6.1                       |                              |
| 05/30/2017  | 0.5                       |                              |
| 05/31/2017  | 4.8                       |                              |
| 06/02/2017  | 0.30                      |                              |
| 06/03/2017  | 0.50                      |                              |
| 06/11/2017  | 3.8                       |                              |
| 06/12/2017  | 0.50                      |                              |
| 06/15/2017  | 1.8                       |                              |
| 06/17/2017  | 0.50                      |                              |
| 06/19/2017  | 5.6                       |                              |
| 06/21/2017  | 6.5                       |                              |
| 06/24/2017  | 4.3                       |                              |
| 06/25/2017  | 16.8                      |                              |