

Sapelo Island (SAP) NERR Nutrient Metadata

Months and year the documentation covers: January – December 2024

Latest Update: 5/29/2025

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@baruch.sc.edu) or reserve with any additional questions.

I. Data Set and Research Descriptors

1) Principal investigator(s) and contact persons –

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Dylan Bedortha was responsible for all sample collection, sample filtration, and data management for 2024.

2) Research objectives –

The nutrient monitoring program is designed upon spatial deployment across a wide variety of marsh types with differing fresh and marine water mixing. These differing dynamics allow scientists and researchers to select from both a variety of research sites as well as tailor research programs to specific tidal dynamics and utilize the Reserves' SWMP data acquisitions to the maximum extent. Additionally, from a long-term trend perspective the variety of marsh types and hydrology being monitored allows for a better understanding of the different effects of sea-level rise upon marsh type. Due to a lack of residential development and very low human activity within the watersheds of the sites on Sapelo Island, they serve as a proxy for reference conditions with the various marsh and associated hydrology types for the creeks and river stations. All of the sites selected at the Sapelo Island reserve have very little anthropogenic nutrient influences. The following brief descriptions are associated with each nutrient monitoring site on the island. For more detail, please refer to the site descriptors located under section (4) of this document and/or contact the Research Coordinator at the SAP NERR for detailed information of any/all sites.

Lower Duplin: Located at the mouth of the Duplin River with large, rapid and near-complete hydraulic exchange with Doboy Sound within each diurnal cycle. Typical of a high salinity, well mixed estuary site.

Hunt Dock: Located on the upper Duplin (approx. 5 miles upriver from Lower Duplin site) with relatively high hydraulic retention requiring an estimated 6-7 diurnal events to complete a total hydraulic exchange. Rainfall may drop salinity precipitously in the basin depending on tidal height, duration and volume of precipitation.

Cabretta Creek: Located on the eastern side of Sapelo Island with direct exchange with the Atlantic Ocean. Creek is typical of high salinity, high oceanic exchange and near complete hydraulic exchange with each diurnal event. Creek is extremely buffered from rainfall (event driven) fluctuations in salinity.

Dean Creek: Located on the southern end of Sapelo, this creek is the primary drainage of the inter-dune (located amid primary and secondary dune systems) meadow. This site is highly susceptible to very high salinity fluctuations associated with rainfall events on both seasonal and short-term, event driven scales. Tidal exchange is complete at each diurnal event and exchange water genesis is the Doboy Sound.

The Duplin River is a tidal basin with no freshwater influence within its headwaters apart from surficial aquifer weeping from the perched lens of water associated with Sapelo Island. This nutrient monitoring effort is tied into the Georgia Coastal Ecosystems, Long-Term Ecological Research (GCE-LTER) initiative and the University of Georgia Marine Extension Service water quality database whose collection and analysis of the water samples facilitates the database. This long-term data set is being developed to provide information on estuarine water mixing within the well-studied Duplin River basin in addition to providing a long-term characterization of water quality as related to nutrient loading within the Duplin River

- a) Monthly grab sampling program: This program's focus is to establish baseline nutrient levels and trends at each site and create a long-term data set that reflects these.
- b) Diel sampling program: This program's focus is to observe nutrient level variation as it relates to a lunar tidal cycle. Over the course of 24 hours, 13 samples are taken 2 hours apart.

3) Research methods –

a). Monthly grab sampling program

Grab samples are taken each month at four sites within the reserve. These are the same sites as the water quality monitoring program within SWMP; Lower Duplin (LD), Hunt Dock (HD), Dean Creek (DC), and Cabretta Creek (CA). Once a month, a bottom water sample is taken at each site, along with a duplicate taken sequentially. Sampling ideally happens around the same time each month but is tide-dependent and sometimes varies. These samples are taken using a Niskin-style sampling bottle. All grab samples are taken within 3 hours prior to that day's low tide. Tide charts from USHarbors.com at the location Old Tower, Sapelo Island, GA are used to determine low tide time. In addition to the water samples, the depth and time each sample was taken is recorded. The depth is measured to the closest half-meter and is determined by meter marks on the grab sampling bottle deployment rope. The grabs are taken approximately .5 meter off of the bottom to replicate water conditions experienced by the water quality sondes at each site. The grab samples are stored in dark Nalgene bottles to prevent sunlight altering them and immediately placed on ice inside of a cooler. Samples are taken back to the reserve lab to be filtered and frozen at -20°C. Filtering and freezing of samples occurs on the same day samples were taken.

Once all samples have been collected and are back in the lab, each sample is filtered two different times.

The first filtration is used for chlorophyll and uses a glass microfiber filter (Whatman GF/F, diameter 47mm). 250 ml of well-mixed sample is poured into the filter tower with the filter in place and a beaker to collect the filtered sample underneath the filter. A Millipore pump is used to draw the sample through the filter into the beaker. A pressure of 40 kPa from the pump is maintained through this process. Once the sample has been completely drawn through the filter, the filter is removed from the tower and placed face side up in a prepared petri dish. The dish is immediately wrapped in foil and labeled with sample info and volume filtered. After each sample is filtered, the filter tower, the filter cap (where filter is placed), and the beaker that collects the filtered sample are all thoroughly rinsed with DI water before the next sample is filtered.

The second filtration is used for the other nutrients that are reported here. This filtration uses a nitrocellulose membrane with 0.8µm pore size filter made by Millipore. 150 ml of well-mixed sample is poured into the filter tower with the filter in place and a beaker to collect the filtered sample underneath the filter. A Millipore pump is used to draw the sample through the filter into the beaker. A pressure of 40 kPa from the pump is maintained through this process. Once the sample has been completely drawn through the filter, the filtered sample is poured into a prepared Nalgene sample bottle and closed tightly. The bottle is labeled with sample info and volume filtered. After each sample is filtered, the filter tower, the filter cap (where filter is placed), and the beaker that collects the filtered sample are all thoroughly rinsed with DI water before the next sample is filtered.

b). Diel sampling program

The diel sampling program takes place over 24 hours to ensure samples are taken during every period of the tidal cycle. The day prior to taking grab samples, the ISCO 6712 sampler is deployed at the Lower Duplin site. During warmer weather months (when daytime temperatures are expected to be above 75°F), the inside of the ISCO is filled with ice to keep the samples cool until collection. The ISCO is programmed to take one 1,000ml water sample every two hours over a 24-hour period. The first sample is taken sometime between two hours before and up to low tide and then every two hours until 13 samples are taken. Unlike the grab samples, the ISCO suction tube sits at a fixed depth near the surface of the water. The collection tube sits approximately 7.5ft below the water's surface. The ISCO is deployed on a floating dock to keep the depth consistent over all 13 samples. The day after the ISCO deployment, the ISCO is retrieved after taking the last grab samples of the day at the Lower Duplin site. The sampler is turned off, all sample bottles are capped, and the ISCO is brought back to the lab for filtering. The filtering protocol used for the grab samples is exactly the same as for the diel samples collected by the ISCO.

4) Site location and character –

Site name	Lower Duplin
Latitude and longitude	31°25'04.3"N 81°17'45.4"W
Tidal range (<i>meters</i>)	3 meters
Salinity range (<i>psu</i>)	15 – 35 psu
Type and amount of freshwater input	The Altamaha River drains into Doboy Sound which is the water body that influences the tidal fluctuation of the Duplin River. This site is close to the mouth of the Duplin River where it empties into Doboy Sound. Rainwater runoff also influences freshwater input.
Water depth (<i>meters, MLW</i>)	Estimated at 3 meters
Sonde distance from bottom (<i>meters</i>)	0.5 meters
Bottom habitat or type	Soft, muddy bottom. Site is located on part of the dock used by the ferry which makes multiple scheduled trips on/off the island daily.
Pollutants in area	None
Description of watershed	This site is located on the Marsh Landing Dock in the Duplin River on Sapelo Island and consists of a muddy bottom habitat. Water passing the dock during flood tide originates from the Doboy Sound. The Doboy Sound receives input from the Atlantic Ocean, and the freshwater Altamaha River via the Intra-Coastal Waterway. The water is pushed up

	the river or up smaller tidal creeks and some is pushed onto the marsh surface by the flood tide and recedes into the main channel during ebb tide. Primary freshwater input consists of rainwater runoff. The Marsh Landing dock is used as the main dock to the island where the ferry makes several daily runs. Small boats also dock here occasionally. The surrounding area vegetation is dominated by salt marsh with <i>Spartina</i> being the predominant flora.
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Site name	Hunt Dock
Latitude and longitude	31°28'43.3"N 81°16'23.2"W
Tidal range (<i>meters</i>)	3 meters
Salinity range (<i>psu</i>)	10 – 30 psu
Type and amount of freshwater input	The Altamaha River drains into Doboy Sound which is the water body that influences the tidal fluctuation of the Duplin River. This site is approximately 5 miles up river from the mouth of the Duplin River where it empties into Doboy Sound, so input from the Altamaha is very minimal. Rainwater runoff is the primary input at this site.
Water depth (<i>meters, MLW</i>)	Estimated at 2 meters.
Sonde distance from bottom (<i>meters</i>)	0.5 meters
Bottom habitat or type	Soft, muddy bottom with some oyster reefs towards the shore.
Pollutants in area	none
Description of watershed	This site is located on the Duplin River, off of Moses Hammock, which is separated from Sapelo Island by a small tidal channel. The primary runoff at the site is from tidal creeks flowing through <i>Spartina</i> marsh and through the mud. Bottom habitat at this site includes soft mud and some oyster bed building along the shoreline with an average tidal range of 3 meters and a salinity range of 5-35 ppt with normal levels falling between 20-30 ppt. Primary freshwater input consists of rainwater runoff.

Site name	Dean Creek
Latitude and longitude	31°23'41.2"N 81°16'11.5"W
Tidal range (<i>meters</i>)	2.5 meters
Salinity range (<i>psu</i>)	15 – 32 psu
Type and amount of freshwater input	Dean Creek is a small tidal basin fed from the waters of Doboy Sound, which is located on Sapelo Island's south end. Primary freshwater input is from rainfall.
Water depth (<i>meters, MLW</i>)	Estimated at 0.35 meters
Sonde distance from bottom (<i>meters</i>)	0.5 meters

Bottom habitat or type	Soft, muddy bottom with interspersed oyster reefs along banks.
Pollutants in area	none
Description of watershed	The site is located on a small metal bridge spanning Dean Creek, in close proximity to the adjacent Nannygoat Beach causeway. Dean Creek is a small tidal basin fed from the waters of Doboy Sound, which is located on Sapelo Island's south end. The small creek feeds approximately 150 acres of <i>Spartina alterniflora</i> dominated salt marsh, which is interspersed with small 0.5-1 acre hammocks and salt pans. Fringe community components range from Loblolly pine forests with a sub-canopy of Yaupon holly to Wax myrtle and Sable Palm. Salinity at this site is especially influenced by rainfall due to its shallow depth.

Site name	Cabretta Creek
Latitude and longitude	31°26'19.2"N 81°14'19.5"W
Tidal range (<i>meters</i>)	3 meters
Salinity range (<i>psu</i>)	20 – 35 psu
Type and amount of freshwater input	The primary freshwater input at this site is rainwater. This site receives tidal influence from the Atlantic Ocean.
Water depth (<i>meters, MLW</i>)	Estimated at 2.5 meters
Sonde distance from bottom (<i>meters</i>)	0.5 meters
Bottom habitat or type	Soft, muddy bottom with oyster reefs on banks.
Pollutants in area	none
Description of watershed	The station is located on a small (one-lane), wooden roadway bridge spanning Cabretta creek located on the island's extreme eastern side, bordering the Atlantic Ocean. The creek is fed directly from waters of the Atlantic Ocean. Adjacent to the site is extensive, intertidal, bank stabilization (armoring) in the form of woven rip-rap fencing and granite rocks. This manipulation is slowly becoming stabilized via oyster reef community colonization. The adjacent marshes are dominated by <i>Spartina alterniflora</i> with occasional <i>Juncus roemerianus</i> in the nearby fringe community habitat. The creek has very little adjacent uplands due to: 1) the low elevational gradient and 2) the area's geologically recent accretion genesis (Holocene) resulting in sandy soils; of which neither conditions allow for extensive floral colonization or stabilization.

All SAP NERR historical nutrient/pigment monitoring stations:

Station Code	SWMP Status	Station Name	Location	Active Dates	Reason Decommissioned	Notes
CA	P	Cabretta Creek	31°26'19.2"N 81°14'19.5"W	–04/2004 - current	NA	NA

DC	P	Dean Creek	31°23'41.2"N 81°16'11.5"W	05/2004 - current	NA	NA
HD	P	Hunt Dock	31°28'43.3"N 81°16'23.2"W	07/1999 - current	NA	NA
LD	P	Lower Duplin	31°25'04.3"N 81°17'45.4"W	01/1999 - current	NA	NA
ML	S (retired)	Marsh Landing	31° 25' 04.23" N, 81° 17' 46.30" W	05/1995 – 12/1998	Site character	Near surface deployment and the fouling with such a setup was too severe to harvest reliable data.
FL	S (retired)	Flume Dock	31° 28' 53.85"N 81° 16' 12.37"W	01/1995 – 12/1998	NA	NA

5) Coded variable definitions –

SAP = Reserve Code

NUT = Data Code (nutrient)

LD = Lower Duplin

HD = Hunt Dock

DC = Dean Creek

CA = Cabretta Creek

Sampling Site Codes

sapldnut = Sapelo Island nutrient data for Lower Duplin site

saphdnut = Sapelo Island nutrient data for Hunt Dock site

sapdcnut = Sapelo Island nutrient data for Dean Creek site

sapcanut = Sapelo Island nutrient data for Cabretta Creek site

The monitoring codes are set as “1” to indicate grab samples and “2” to indicate diel samples. Replicates are also given specific codes. Grab samples in which duplicate field samples are taken utilize a “1” for the first sample and a “2” for the second sample under the “Rep” column in the data. Subsequent lab splits of each field replicate are labeled with an “S”. Diel samples are always labeled with a “1” for the first lab replicate and an “S” for the second lab replicate. Only one actual sample is taken at each interval with the ISCO sampler. No lab splits were used in 2024’s nutrient sampling data.

6) Data collection period –

All times reported in Eastern Standard Time (EST).

Diel Sampling				
Location	Start Date	Start Time	End Date	End Time
LD	01/07/2024 (low tide @ 11:00)	9:00	01/08/2025	9:00
LD	02/19/2024 (low tide @ 11:00)	9:00	02/20/2024	9:00
LD	03/07/2024 (low tide @ 11:58)	10:00	03/08/2024	10:00
LD	04/18/2024 (low tide @ 10:42)	10:30	04/19/2024	10:30
LD	05/20/2024 (low tide @ 12:00)	10:00	05/21/2024	10:00
LD	06/19/2024 (low tide @ 12:00)	10:00	06/20/2024	10:00
LD	07/17/2024 (low tide @ 10:32)	9:30	07/18/2024	9:30
LD	08/15/2024 (low tide @ 10:00)	9:00	8/16/2024	9:00
LD	09/16/2024 (low tide @ 12:33)	11:30	09/17/2024	11:30
LD	10/28/2024 (low tide @ 11:29)	10:30	10/29/2024	10:30
LD	11/13/2024 (low tide @ 12:00)	11:00	11/14/2024	11:00
LD	12/12/2024 (low tide @ 11:45)	10:45	12/13/2024	10:45

Grab Sampling								
Date	LD1	LD2	HD1	HD2	CA1	CA2	DC1	DC2
01/08/2024 (low tide @ 12:00)	11:25	11:30	10:50	10:55	10:30	10:35	9:55	10:00
02/20/2024 (low tide @ 11:54)	11:40	11:45	11:15	11:20	10:50	10:55	10:15	10:20
03/08/2024 (low tide @ 12:51)	11:35	11:40	11:05	11:10	10:35	10:40	10:05	10:10
04/19/2024 (low tide @ 11:26)	10:30	10:35	9:55	10:00	9:25	9:30	8:40	8:45
05/21/2024 (low tide @ 12:38)	11:05	11:10	10:40	10:45	10:10	10:15	9:40	9:45
06/20/2024 (low tide @ 12:47)	11:10	11:15	10:45	10:50	10:20	10:25	9:50	9:55
07/18/2024 (low tide @ 11:26)	9:55	10:00	9:30	9:35	9:10	9:15	8:40	8:45
08/16/2024 (low tide @ 11:00)	10:15	10:20	9:50	9:55	9:25	9:30	8:30	8:35
09/17/2024 (low tide @ 13:29)	11:30	11:35	11:05	11:10	10:40	10:45	10:05	10:10
10/29/2024 (low tide @ 12:15)	10:35	10:40	10:10	10:15	9:45	9:50	9:15	9:20
11/14/2024 (low tide @ 12:56)	11:25	11:30	10:55	11:00	10:30	10:35	9:55	10:00
12/13/2024 (low tide @ 12:42)	11:15	11:20	10:50	10:55	10:20	10:25	9:45	9:50

The site codes in this table refer to which site was sampled at the given times. For example, CA1 is the first grab sample at Cabretta Creek and CA2 is the duplicate sample taken at Cabretta Creek.

7) Associated researchers and projects–

As part of the SWMP long-term monitoring program, SAP NERR 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.

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 processed 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 2024.

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 –

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.

Dylan Bedortha is responsible for all data collection in 2024, as well as the entry of all data into the NutrientQAQC macro, applying flags to data, entering MDLs and significant figures, etc.

As data is returned to SAP NERR from the VIMS analytical lab, it is saved and compiled by year in the nutrient files maintained by the reserve. The lab returns two separate documents for each month's samples. One is an Excel sheet with raw data results from the analysis. The other is a pdf with a sample-by-sample breakdown of nutrient values, detection limits, and dates of analysis. Once all the data from a given year is received and verified, it is all at once entered into the Nutrient QAQC macro and the macro steps are followed. The raw data results Excels received from the analytical lab are used to populate the Nutrient QAQC macro. These raw data Excels are also submitted to the CDMO. Summary statistics and graphs of different parameters provided by the macro, as well as field notes from sampling help determine any additional QAQC flags that need to be applied to the data. The year's filed notes are also compiled and added to the metadata document.

Nutrient values are returned from VIMS in the correct units of measurement, so no conversion is needed.

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
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Phosphorus and Nitrogen:

*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

Plant Pigments:

*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 –

Parameter	Start Date	End Date	MDL	Revisited
NH ₄	1/1/2024	12/31/2024	0.0062 mg/L	January 2024
NO ₂₃	1/1/2024	12/31/2024	0.0055 mg/L	January 2024
NO ₂	1/1/2024	12/31/2024	0.0016 mg/L	January 2024
PO ₄	1/1/2024	12/31/2024	0.0016 mg/L	January 2024
CHLA_N	1/1/2024	12/31/2024	0.50 µg/L	January 2024
PHEA	1/1/2024	12/31/2024	0.50 µg/L	January 2024

MDLs are verified annually, every January. If MDLs are at or less than the reported, they aren’t changed. The following excerpt explains the analytical lab’s protocol for determining MDLs.

Excerpt from VIMS Analytical Service Center Quality Manual:

15.5.7.1 LODs (limit of detection) will be determined by the protocol in the mandated test method or applicable regulation. For chemistry testing, where applicable, procedure EPA 821-R-16-006, December 2016 Revision 2 will be used and verified on an annual basis.

15.5.7.2 MDLs for each analyte not applicable to the above LOD determination, are determined using the “Federal Register” (Appendix B) 131:4357. This evaluation is made yearly from a sample obtained from the Chesapeake Bay

at low concentrations, or alternatively, a standard made up in synthetic seawater may be acceptable. The standard should be made at a concentration of 1-5 times the expected MDL.

15.5.7.2.1 The sample is filtered in-house as required into separate pre-cleaned containers for specific parameters.

15.5.7.2.2 Filter particulates onto appropriate filters.

15.5.7.2.3 Analyze all replicates. The first 7 replicates of each will be used for the MDL determination.

15.5.7.2.4 To determine the MDL for an analyte, first calculate the standard deviation from the seven results. The standard deviations then multiplied by the “student t” value (3.113 or rounded to 3 for seven replicates).

13) Laboratory methods –

a) **Parameter: NH₄F**

VIMS Laboratory Method: SA156-350.1

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

Method Reference:

Method Descriptor: A Skalar SANplus Continuous Flow Analyzer SA1050 Autosampler is used to analyze this parameter.

Preservation Method: Samples are filtered at the reserve on the day they are collected. Once filtered, all samples are stored in acid washed bottles provided by the VIMS lab and frozen at -20°C in the reserve lab freezer. Samples are frozen at least overnight and sometimes longer depending on sampling date and when the samples are shipped for analysis. Samples are held in the reserve freezer until shipment for analyzation. The frozen samples are packed into a cooler with frozen ice packs and plenty of packing material (reusable paper and/or pieces of foam) to limit movement while in transit. Once packed and secured, the samples are shipped overnight via UPS to ensure VIMS receives them while they are still frozen. When samples are received by VIMS, the following excerpt explains their process of preservation and holding of samples:

17.4.2 The method of preservation for filtered water is freezing at -20°C (+/- 2.0°C) and analyzed within 28 days....Chlorophyll-a filters should be immediately wrapped in foil, labeled and frozen at -20°C (+/- 2.0°C) with analysis within 28 days.

b) **Parameter: NO₂F**

VIMS Laboratory Method: SA467-353.2

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

Method Reference:

Method Descriptor: A Skalar SANplus Continuous Flow Analyzer SA1050 Autosampler is used to analyze this parameter.

Preservation Method: Samples are filtered at the reserve on the day they are collected. Once filtered, all samples are stored in acid washed bottles provided by the VIMS lab and frozen at -20°C in the reserve lab freezer. Samples are frozen at least overnight and sometimes longer depending on sampling date and when the samples are shipped for analysis. Samples are held in the reserve freezer until shipment for analyzation. The frozen samples are packed into a cooler with frozen ice packs and plenty of packing material (reusable paper and/or pieces of foam) to limit movement while in transit. Once packed and secured, the samples are shipped overnight via UPS to ensure VIMS receives them while they are still frozen. When samples are received by VIMS, the following excerpt explains their process of preservation and holding of samples:

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c) **Parameter: PO₄**

VIMS Laboratory Method: SA503-365.1

EPA or other Reference Method: SM 4500-P F

Method Reference:

Method Descriptor: A Skalar SANplus Continuous Flow Analyzer SA1050 Autosampler is used to analyze this parameter.

Preservation Method: Samples are filtered at the reserve on the day they are collected. Once filtered, all samples are stored in acid washed bottles provided by the VIMS lab and frozen at -20°C in the reserve lab freezer. Samples are frozen at least overnight and sometimes longer depending on sampling date and when the samples are shipped for analysis. Samples are held in the reserve freezer until shipment for analyzation. The frozen samples are packed into a cooler with frozen ice packs and plenty of packing material (reusable paper and/or pieces of foam) to limit movement while in transit. Once packed and secured, the samples are shipped overnight via UPS to ensure VIMS receives them while they are still frozen. When samples are received by VIMS, the following excerpt explains their process of preservation and holding of samples:

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d) Parameter: CHLA_N

VIMS Laboratory Method: Turner Designs Trilogy Laboratory Benchtop Fluorometer

EPA or other Reference Method: EPA 445.0 Rev 1.2

Method Reference:

Method Descriptor: A Turner Designs Trilogy Laboratory Benchtop Fluorometer is used to analyze this parameter. The acetone extraction method is used to extract the chlorophyll over 2-24 hours and a fluorometer is used to obtain readings, which are calculated into a final result.

Preservation Method: Samples are filtered at the reserve on the day they are collected. Once filtered, all filters are immediately placed in labeled petri dishes, wrapped in foil which is also labeled, and frozen at -20°C in the reserve lab freezer. Samples are frozen at least overnight and sometimes longer depending on sampling date and when the samples are shipped for analysis. Samples are held in the reserve freezer sealed in a Ziploc bag until shipment for analyzation. The frozen samples are packed into a cooler with frozen ice packs and plenty of packing material (reusable paper and/or pieces of foam) to limit movement while in transit. Once packed and secured, the samples are shipped overnight via UPS to ensure VIMS receives them while they are still frozen. When samples are received by VIMS, the following excerpt explains their process of preservation and holding of samples:

17.4.2 The method of preservation for filtered water is freezing at -20°C (+/- 2.0°C) and analyzed within 28 days....Chlorophyll-a filters should be immediately wrapped in foil, labeled and frozen at -20°C (+/- 2.0°C) with analysis within 28 days.

e) Parameter: PHEA

VIMS Laboratory Method: Turner Designs Trilogy Laboratory Benchtop Fluorometer

EPA or other Reference Method: EPA 445.0 Rev 1.2

Method Reference:

Method Descriptor: A Turner Designs Trilogy Laboratory Benchtop Fluorometer is used to analyze this parameter.

Preservation Method: Samples are filtered at the reserve on the day they are collected. Once filtered, all filters are immediately placed in labeled petri dishes, wrapped in foil which is also labeled, and frozen at -20°C in the reserve lab freezer. Samples are frozen at least overnight and sometimes longer depending on sampling date and when the samples are shipped for analysis. Samples are held in the reserve freezer sealed in a Ziploc bag until shipment for analyzation. The frozen samples are packed into a cooler with frozen ice packs and plenty of packing material (reusable paper and/or pieces of foam) to limit movement while in transit. Once packed and secured, the samples are shipped overnight via UPS to ensure VIMS receives them

while they are still frozen. When samples are received by VIMS, the following excerpt explains their process of preservation and holding of samples:

17.4.2 The method of preservation for filtered water is freezing at -20°C (+/- 2.0°C) and analyzed within 28 days....Chlorophyll-a filters should be immediately wrapped in foil, labeled and frozen at -20°C (+/- 2.0°C) with analysis within 28 days.

14) Field and Laboratory QAQC programs –

a) Precision

- i) **Field variability** –. Field replicates are taken for every grab sample, at every site, every month. The first grab sample is taken, and the sample is emptied. Then a successive grab sample is taken at the same depth within five minutes of the first. The Niskin sampler and sample bottles are rinsed with ambient water prior to collection.
- ii) **Laboratory variability** –. 15.5.9.4 Analytical precision is the degree to which an analytical result can be reproduced. This can be determined by running 10-20% of samples in duplicate. Sediment samples are to be run in duplicate for 10% of the samples since we may not have the ability to spike a sediment.
15.5.9.5 Relative percent difference = (absolute difference of the two values) ÷ (average of the replicate) x 100

Inter-organizational splits – All samples from SAP NERR were analyzed by the VIMS Analytical Service Center lab.

b) Accuracy

- i) **Sample spikes** – List the % recovery of field and laboratory samples (% recovery should be 100% under ideal conditions) – cannot be done on samples analyzed directly from filters. 15.5.9.2 Spiking a known amount of analyte into the sample itself will also allow us to measure accuracy. A small amount of high concentration standard is introduced into a sample aliquot. The spike is then carried through the entire procedure and % recovery is determined. Low spike recovery may indicate a methods problem or error or may also indicate matrix problems. % recovery = spike recovered ÷ spike true value (sample+addition) x 100. 10% of sample analyzed should be spiked for accuracy on samples which can be spiked.
- ii) **Standard reference material analysis** –16.4 To ensure accurate and precise measurements, the laboratory uses reference materials that are traceable to a national standard of measurement where commercially available, such as NIST, NELAC, or are traceable to certified reference materials. The laboratory retains the Certificates of Reference Materials to demonstrate traceability.
- iii) **Cross calibration exercises** -. SAP NERR does not participate in any cross calibration exercises.

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

Cloud cover

CCL	clear (0-10%)
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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 NERR 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 NO₃F 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.

3/8/24 ISCO battery died, missing samples 11, 12, 13.

9/17/24 First set of grab samples at Dean Creek site taken early (just outside of 3 hours prior to low tide) to ensure sample filtering was completed by afternoon ferry departure.

Certain diel samples from October, November, and December may have been influenced by the island passenger ferry's operations. This ferry makes multiple trips to the mainland and back each day and was docked at the floating dock where the ISCO is deployed for these three months. Below is a list of when the ferry arrived and departed this dock during diel sampling. All times listed in Eastern Standard Time and were approximated based on regular schedule (+/- 10 minutes). The ferry returned to its regular dock in late December 2024.

10/28/24

Arrivals: 15:00, 17:00

Departures: 11:00, 15:30

10/29/24

Arrivals: 8:00

Departures: 6:00

11/13/24

Arrivals: 16:00, 18:00

Departures: 12:00, 16:30

11/14/24

Arrivals: 9:00

Departures: 7:00

12/12/24

Arrivals: 16:00, 18:00

Departures: 14:30, 16:30

12/13/24

Arrivals: 9:00

Departures: 7:00

The following is a list of rain events that may have potentially affected sample values. Certain data has been flagged as <0> [CRE], but none has been flagged suspect or rejected.

- On 1/6/24, 25.9mm (1.02in) of rain was recorded at the Sapelo Island NERR Marsh Landing meteorological station.
- On 3/6/24, 30.5mm (1.2in) of rain was recorded at the Sapelo Island NERR Marsh Landing meteorological station.
- On 5/18/24, 10.2mm (0.4in) of rain was recorded at the Sapelo Island NERR Marsh Landing meteorological station.
- On 5/19/24, 24.6mm (0.97in) of rain was recorded at the Sapelo Island NERR Marsh Landing meteorological station.
- On 5/20/24, 3.6mm (0.14in) of rain was recorded at the Sapelo Island NERR Marsh Landing meteorological station.
- On 9/15/24, 4.6mm (0.18in) of rain was recorded at the Sapelo Island NERR Marsh Landing meteorological station.
- On 12/11/24, 10.4mm (0.41in) of rain was recorded at the Sapelo Island NERR Marsh Landing meteorological station.

Sample hold times for 2024: Samples are filtered at the reserve lab on the same day as collection. These filtered samples are frozen at -20°C until shipped to the analytical lab. NERRS SOP allows nutrient samples to be held for up to 28 days (CHLA for 30) at -20°C, plus allows for up to 5 days for collecting, processing, and shipping samples. Filtered samples are held at the reserve lab for less than 5 days (actual hold time at reserve varies) and overnighed to the analytical lab in a cooler with ice packs to retain sample integrity. Samples held beyond that time period are flagged suspect <1>and coded (CHB). If measured values were below MDL, this resulted in <-4> [SBL] (CHB) flagging/coding. **All samples were analyzed within the specified holding time for 2024.** See table below for hold times for each month's sampling.

		Date of Analysis				
Month	Sample Description	NH ₄	NO ₂	NO ₃	PO ₄	CHLA_N, PHEA
January	1/8/24 grab	1/18/24	1/18/24	1/18/24	1/18/24	1/16/24
	1/7-8/24, diel	1/18/24	1/18/24	1/18/24	1/18/24	1/16/24
February	2/20/24, grab	3/5/24	3/5/24	3/5/24	3/5/24	3/7/24
	2/19-20/24, diel	3/5/24	3/5/24	3/5/24	3/5/24	3/7/24
March	3/8/24, grab	3/29/24	3/29/24	3/29/24	3/29/24	3/19/24
	3/7-8/24, diel	3/29/24	3/29/24	3/29/24	3/29/24	3/19/24
April	4/19/24, grab	4/30/24	4/30/24	4/30/24	4/30/24	5/7/24
	4/18-19/24, diel	4/30/24	4/30/24	4/30/24	4/30/24	5/7/24
May	5/21/24, grab	6/10/24	6/10/24	6/10/24	6/10/24	6/11/24
	5/20-21/24, diel	6/10/24	6/10/24	6/10/24	6/10/24	6/11/24
June	6/20/24, grab	6/26/24	6/26/24	6/26/24	6/26/24	7/10/24
	6/19-20/24, diel	6/26/24	6/26/24	6/26/24	6/26/24	7/10/24

July	7/18/24, grab	7/30/24	7/30/24	7/30/24	7/30/24	8/1/24
	7/17-18/24, diel	7/30/24	7/30/24	7/30/24	7/30/24	8/1/24
August	8/16/24, grab	8/22/24	8/22/24	8/22/24	8/22/24	9/4/24
	8/15-16/24, diel	8/22/24	8/22/24	8/22/24	8/22/24	9/4/24
September	9/17/24, grab	10/3/24	10/3/24	10/3/24	10/3/24	9/24/24
	9/16-17/24, diel	10/3/24	10/3/24	10/3/24	10/3/24	9/24/24
October	10/29/24, grab	11/19/24	11/19/24	11/19/24	11/19/24	11/12/24
	10/28-29/24, diel	11/19/24	11/19/24	11/19/24	11/19/24	11/12/24
November	11/14/24, grab	11/21/24	11/21/24	11/21/24	11/21/24	12/4/24
	11/13-14/24, diel	11/21/24	11/21/24	11/21/24	11/21/24	12/4/24
December	12/13/24, grab	12/19/24	12/19/24	12/19/24	12/19/24	1/2/25
	12/12-13/24, diel	12/19/24	12/19/24	12/19/24	12/19/24	1/2/25

