Chesapeake Bay Virginia (CBV) NERR Nutrient Metadata
January – December 2023
Latest Update: June 4, 2025

I. Data Set and Research Descriptors

1) Principal investigator(s) and contact persons –

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Additional monitoring program support in addition to above stated:

Betty Neikirk (Marine Scientist Supervisor), Erin Shields (Marine Scientist), Hank Brooks (Field Manager), Steve Snyder (Laboratory Specialist), Lisa Ott (Laboratory Specialist), Kaitlyn Parker (Laboratory Specialist), Alex Demeo (Reserve Support Technician).

2) Research objectives –

a) Monthly Grab Sampling Program

Monthly grab samples are collected to quantify the spatial and temporal variability of selected nutrients and plant pigments in the water column along a salinity gradient within the York River estuary system. The Chesapeake Bay, Virginia National Estuarine Research Reserve (CBV NERR) began collecting monthly grab samples on January 16, 2002.

b) Diel Sampling Program

On a monthly basis, samples are collected at Taskinas Creek, a small tributary of the York River, every two and one-half hours throughout a complete tidal cycle in order to quantify the short-term temporal variability of selected nutrients and plant pigments in the water column.

3) Research methods

a) Monthly Grab Sampling Program

Monthly grab samples were taken at six stations within the York River estuary. Samples were taken at the four primary SWMP and CBV NERR data sonde stations (Goodwin Islands, Clay Bank, Taskinas Creek, and Sweet Hall Marsh and one other station which is considered secondary SWMP station: Catlett Islands. All grab samples were taken on the same day between +3 hrs. before or after slack low-water. No distinction was made between neap and spring tide conditions. Efforts were made to allow for an antecedent dry period of 72 hours prior to sampling. Replicate (N=2) samples were collected by hand at an approximate depth of 25 cm. At the time of sample collection, water temperature, salinity and dissolved oxygen was measured with a YSI EXO 1 mini sonde. All samples were collected in amber, wide-mouth, Nalgene sample bottles that were previously acid washed (20% HCl), rinsed (3x) with distilled deionized water, dried and followed by rinsing (3x) of ambient water prior to collection of the sample. Samples were immediately placed on ice, in the dark and returned to the laboratory. Once in the laboratory, samples were shaken and processed for nutrient and plant pigment analysis. The CBV NERR nutrient lab analyzes samples for PO4F, NH4F, NO2F, NO23F, CHLA_N and PHEA.

b) Diel Sampling Program

Diel grab samples were taken at the Taskinas Creek long-term data sonde station. Samples were collected over a lunar day (24 hr: 48 min) time period at 2.5-hour intervals using an ISCO auto-sampler. Collection of samples began at predicted slack low water. Samples were collected at a fixed depth (0.25 m) from the bottom which reflected the water mass sampled by the data sonde. No distinction was made between neap and spring tide conditions. Efforts were made to allow for an antecedent dry period of 72 hours prior to sampling. Samples were collected in 1000 ml bottles that were previously acid washed (10% HCl), rinsed (3x) with distilled-deionized water and dried. Prior to sample collection, the ISCO sampler including all sample tubing was rinsed with ambient water. Samples were collected and stored inside an ISCO sampler that contained ice. Once in the laboratory, samples were shaken and processed for nutrient and plant pigments. The CBV NERR nutrient lab analyzes samples for PO4F, NH4F, NO2F, NO23F, CHLA_N and PHEA.

4) Site location and character –

a) Goodwin Islands (Lat 37.215796; Long -76.392675)

The Goodwin Islands component of CBV NERR is located on the southern side of the mouth of the York River. The station is located approximately 400 meters from shore, with an average water depth on the order of 1 meter. MHW depth at the sample location is approximately 1.70 meters. Goodwin Islands are a 315 ha (777 acre) archipelago of salt-marsh islands surrounded by inter-tidal flats and extensive beds of submerged aquatic vegetation dominated by eelgrass (*Zostera marina*) and Widgeon grass (*Ruppia maritime*). Water circulation patterns around the island are influenced by York River discharge and wind patterns of the Chesapeake Bay. Tides at the Goodwin Islands are semi-diurnal and display an average range of 0.7 m (range: 0.4-1.1 m). Mean seasonal water temperature values ranged from 13.7-15.6°C for spring (March-May), 25.7-27.2°C for summer (June-August), 18.0-19.2°C for fall

(September-November), and 4.7-8.2°C for winter (January-February, and December). Mean seasonal salinity values ranged from 13.9-23.0 psu for spring, 17.2-23.0 psu for summer, 16.5-24.0 for fall, and 15.9-23.3 psu for winter. Potential activities that could impact the site include, light recreational and commercial boating activity.

Site name	**Goodwin Island**
Latitude and longitude	Lat 37.215796; Long -76.392675
Tidal range *(meters)*	0.75 m
Salinity range *(psu)*	17.1 psu – 24.2
Type and amount of freshwater input	No fresh water input
Water depth (*meters, MLW*)	vdatum ver 4.6.1 (Sept 2023) 37.224660, -76.404178 MLW -0.425
Sonde distance from bottom (*meters*)	0.10 m
Bottom habitat or type	Soft sediment, grass-bed, oyster bar, etc.
Pollutants in area	light recreational and commercial boating activity
Description of watershed	Goodwin Islands are used extensively for SAV, material flux, fisheries science, and trophic interaction research activities.

b) Claybank (Lat 37.346665; Long -76.611263)

The Claybank station is located within a shallow (<2m) littoral area approximately 300-400 meters wide along the mesohaline portion of the York River estuary. The site is approximately 26 km upriver from the mouth of the estuary. The shoreline consists of a narrow fringe of salt marsh with some areas armored with bulkhead or stone. Tidal range is on the order of 0.85 meters and depth at MHW is approximately 2.25 meters. This station is located along the north shoreline of the estuary in an area that historically (prior to 1972) supported submersed aquatic vegetation. The sampling station is influenced by a secondary turbidity maximum that moves back and forth in a region of about 20-40 km from the mouth of the York River estuary. The site is exposed to strong winds from the northwest and re-suspension of sediment during storm events can be high. There is no freshwater input at this site. Seasonal water quality conditions described here are from spring: March-May; summer: June-August; fall: September-November; winter: December-February. Mean seasonal water temperature ranged between 14.0-16.2°C for spring; 26.1-27.7°C for summer; 17.5-19.4°C for fall; and 4.9-8.0°C in winter. Mean seasonal salinity ranged between 15.7-20.3 psu for spring; 16.5-21.3 psu for summer; 13.2-21.6 psu for fall; and 14.3-20.0 psu in winter. Potential activities that could impact the site include, light recreational and commercial boating activity.

Site name	**Claybank**
Latitude and longitude	Lat 37.346665; Long -76.611263
Tidal range *(meters)*	0.85 m
Salinity range *(psu)*	14.7 psu – 22.2 psu
Type and amount of freshwater input	Located within the mesohaline portion of the York River estuary. No fresh water input.

Water depth (*meters, MLW*)	-0.432 MLW (*estimate*)
Sonde distance from bottom (*meters*)	0.25m
Bottom habitat or type	Soft sediment
Pollutants in area	Light recreational and commercial boating activity.
Description of watershed	Claybank is used extensively to study sediment dynamics and environmental stress on SAV.

c) Taskinas Creek (Lat 37.414986; Long -76.71442)

Taskinas Creek Reserve, component of CBV NERR, encompasses 397 ha (980 acres) and is located within the boundaries of York River State Park near the town of Croaker, Virginia. The small sub-estuary of the York River is located on the southern side of the river, approximately 37 km upriver from the mouth of the York River. The Taskinas Creek watershed is representative of an inner coastal plain, rural watershed within the southern Chesapeake Bay system. The watershed is dominated by forested and agricultural land uses with an increasing residential land use component. The non-tidal portion of Taskinas Creek contains feeder streams that drain oak-hickory forests, maple-gum-ash swamps, and freshwater marshes. Freshwater mixed wetlands are found in the upstream reaches of Taskinas Creek. The creek is roughly 2 meters deep and 20 meters wide towards the lower end of the creek where substrate is dominated by fine sediment. Mean tidal range at Taskinas Creek is on the order of 0.85 m and the MHW depth at the sample location is approximately 2.0 meters. Mean seasonal water temperature values ranged from 15.2-19.0°C for spring, 26.8-28.2°C for summer, 15.7-18.3°C for fall, and 3.6-9.0°C for winter. Located within the meso-polyhaline region of the York River estuary, mean seasonal salinity values ranged from 4.0-14.0 psu for spring, 7.0-18.2 psu for summer, 6.9-17.0 for fall, and 5.8-15.3 psu for winter. Potential activities that could impact the site include residential development, selective hardwood logging, and light recreational boating activity. Wildlife populations have been shown to influence microbiological water quality within the watershed.

Site name	**Taskinas Creek**
Latitude and longitude	Lat 37.414986; Long -76.71442
Tidal range *(meters)*	0.58 m – 2.06 m
Salinity range *(psu)*	2.87 psu – 18.03 psu
Type and amount of freshwater input	Located within the meso-polyhaline region of the York River estuary.
Water depth (*meters, MLW*)	vdatum ver 4.6.1 (Sept 2023) 37.416553, -76.714859 MLW -0.541
Sonde distance from bottom (*meters*)	0.25 m
Bottom habitat or type	substrate is dominated by fine sediment
Pollutants in area	Residential development, selective hardwood logging, and light recreational boating activity.
Description of watershed	Taskinas Creek is suited for investigating hydrologic and non-point source water quality issues associated with developing land use patterns.

(d) Sweet Hall Pier (Lat 37.571398; Long -76.883990)

Sweet Hall Marsh is the most downriver extensive tidal freshwater marsh located in the Pamunkey River, one of two major tributaries of the York River. The marsh is located approximately 77 km upriver from the mouth of the York River estuary. The reserve is 353 ha (871 acres) in area and includes 331 ha (818 acres) of emergent fresh-water marsh, 14 ha (35 acres) of permanently flooded broad-leaved forested wetlands and approximately 4 ha (9 acres) of scrub-shrub. The marsh community is classified as freshwater mixed. Mean tidal range at Sweet Hall Marsh is on the order of 0.9 meters and MHW depth at the sample location is approximately 1.5 meters. The Pamunkey River, which surrounds Sweet Hall Marsh, can reach depths up to 15 meters. Substrate within the littoral zone and channel is dominated by fine sediment. The datalogger probes are located 0.25 m above the bottom. Mean seasonal water temperature values ranged from 14.7-16.7°C for spring, 26.7-27.9°C for summer, 18.6-19.1°C for fall, and 4.7-6.3°C for winter. Located within the oligohaline, lower freshwater reaches of the Pamunkey River, mean seasonal salinity values ranged from 0.1-3.4 psu for spring, 0.1-8.4 psu for summer, 0.3-8.4 psu for fall, and 0.1-3.2 psu for winter Potential activities that could impact the site include minor municipal point source discharges above and below river of Sweet Hall Marsh, a major industrial discharge

Site name	**Sweethall Pier**
Latitude and longitude	Lat 37.571398; Long -76.883990
Tidal range *(meters)*	1.5 m – 3.07m
Salinity range *(psu)*	0.04 psu – 11.6 psu
Type and amount of freshwater input	Located within the oligohaline, lower freshwater reaches of the Pamunkey River. The marsh community is classified as freshwater mixed.
Water depth (*meters, MLW*)	vdatum ver 4.6.1 (Sept 2023) 37.565471, -76.882083 MLW -0.632
Sonde distance from bottom (*meters*)	0.25 m
Bottom habitat or type	Substrate within the littoral zone and channel is dominated by fine sediment.
Pollutants in area	Minor municipal point source discharges above and below river of Sweet Hall Marsh, a major industrial discharge.
Description of watershed	Sweet Hall Marsh has been used extensively to study general ecology and material flux within tidal freshwater marshes.

All Chesapeake Bay, VA NERR historical nutrient/pigment monitoring stations:

Station Code	SWMP Status	Station Name	Location	Active Dates	Reason Decommissioned	Notes
cbvcbnut	P	Claybank	37° 20' 47.99 N, 76° 36' 40.55 W	01/01/2002 - current	NA	NA
cbvcinut	S	Catlett Islands	37° 17' 60.00 N, 76° 32' 60.00 W	01/01/2002 - current	NA	NA
cbvginut	P	Goodwin Islands	37° 12' 56.87 N, 76° 23' 33.63 W	01/01/2002-current	NA	NA
cbvspnut	P	Sweethall Pier	37° 34' 17.03 N, 76° 53' 02.36 W	11/03/2016 – current	NA	NA

cbvtcnut	P	Taskinas Creek	37° 24' 53.95 N, 76° 42' 51.91 W	01/01/2002 – current	NA	NA
cbvybnut	S	York River Bridge	37° 14' 41.64 N, 76° 30' 18.72 W	01/01/2002 – 06/15/2020	Discontinued in June 2020	NA

5) Coded variable definitions –

cbvcbnut = Chesapeake Bay Virginia Claybank nutrients
cbvcinut = Chesapeake Bay Virginia Catlett Island nutrients
cbvginut = Chesapeake Bay Virginia Goodwin Island nutrients
cbvspnut = Chesapeake Bay Virginia Sweethall Pier nutrients
cbvtcnut = Chesapeake Bay Virginia Taskinas Creek nutrients

Monitoring program codes:
monthly grab sample program = 1
diel grab sample program = 2

6) Data collection period –

a) **Monthly Grab Sample Program (Monitoring Program 1)**

Note: Times are in EST

Station Code	Start Date	Start Time	End Time
cbvcbnut	1/17/23	10:06	10:07
cbvcbnut	2/14/23	9:49	9:50
cbvcbnut	3/16/23	10:30	10:31
cbvcbnut	4/12/23	8:00	8:01
cbvcbnut	5/11/23	8:03	8:04
cbvcbnut	6/12/23	10:03	10:05
cbvcbnut	7/11/23	9:42	9:43
cbvcbnut	8/9/23	9:20	9:21
cbvcbnut	9/7/23	9:13	9:14
cbvcbnut	10/9/23	10:45	10:47
cbvcbnut	11/8/23	10:27	10:28
cbvcbnut	12/6/23	10:12	10:13
Station Code	**Start Date**	**Start Time**	**End Time**
cbvcinut	1/17/23	9:49	9:50
cbvcinut	2/14/23	9:27	9:28
cbvcinut	3/16/23	10:10	10:11
cbvcinut	4/12/23	7:41	7:42
cbvcinut	5/11/23	7:40	7:41
cbvcinut	6/12/23	9:40	9:41
cbvcinut	7/11/23	9:22	9:23
cbvcinut	8/9/23	8:59	9:00
cbvcinut	9/7/23	8:54	8:55
cbvcinut	10/9/23	10:27	10:29
cbvcinut	11/8/23	10:03	10:04
cbvcinut	12/6/23	9:47	9:48

Station Code	Start Date	Start Time	End Time
cbvginut	1/17/23	9:02	9:03

cbvginut	2/14/23	8:22	8:23
cbvginut	3/16/23	9:16	9:17
cbvginut	4/12/23	6:49	6:50
cbvginut	5/11/23	6:46	6:47
cbvginut	6/12/23	8:39	8:40
cbvginut	7/11/23	8:20	8:21
cbvginut	8/9/23	8:04	8:05
cbvginut	9/7/23	8:06	8:08
cbvginut	10/9/23	9:38	9:39
cbvginut	11/8/23	9:06	9:07
cbvginut	12/6/23	8:57	8:58
Station Code	**Start Date**	**Start Time**	**End Time**
cbvspnut	1/17/23	13:23	13:24
cbvspnut	2/14/23	11:24	11:25
cbvspnut	3/16/23	13:01	13:03
cbvspnut	4/12/23	9:36	9:38
cbvspnut	5/11/23	9:36	9:37
cbvspnut	6/12/23	11:51	11:53
cbvspnut	7/11/23	11:08	11:10
cbvspnut	8/9/23	10:36	10:39
cbvspnut	9/7/23	11:10	11:12
cbvspnut	10/9/23	12:59	13:01
cbvspnut	11/8/23	13:15	13:17
cbvspnut	12/6/23	12:13	12:14

Station Code	Start Date	Start Time	End Time
cbvtcnut	1/17/23	12:32	12:33
cbvtcnut	2/14/23	10:08	10:09
cbvtcnut	3/16/23	11:49	11:51
cbvtcnut	4/12/23	8:08	8:09
cbvtcnut	5/11/23	8:43	8:44
cbvtcnut	6/12/23	10:14	10:15
cbvtcnut	7/11/23	10:14	10:15
cbvtcnut	8/9/23	9:32	9:33
cbvtcnut	9/7/23	9:14	9:18
cbvtcnut	10/9/23	11:49	11:51
cbvtcnut	11/8/23	11:46	11:48
cbvtcnut	12/6/23	10:04	10:06

b) **Diel Sample Program (Monitoring Program 2)**

Note: Times are in EST

Station Code	Start Date	Start Time	End Date	End Time
cbvtcnut	1/17/23	12:55	1/18/23	13:55
cbvtcnut	2/14/23	11:20	2/15/23	12:20
cbvtcnut	3/15/23	13:00	3/16/23	14:00*
cbvtcnut	4/16/23	2:15	4/17/23	3:15
cbvtcnut	5/11/23	9:31	5/12/23	10:31
cbvtcnut	6/12/23	11:56	6/13/23	12:56
cbvtcnut	7/11/23	12:25	7/12/23	13:25
cbvtcnut	8/9/23	11:54	8/10/23	12:54

cbvtcnut	9/7/23	11:23	9/8/23	12:23
cbvtcnut	10/9/23	13:48	10/10/23	14:48
cbvtcnut	11/8/23	13:16	11/9/23	14:16
cbvtcnut	12/6/23	11:34	12/7/23	12:34

*The 3/16 14:00 diel sample is missing.

7) Associated researchers and projects–

a) USEPA Chesapeake Bay Mainstem and Tributary Monitoring Program. Since 1984, biweekly to monthly water quality sampling at a series of sites located along the mid-river channel has been conducted as part of the Chesapeake Bay Program (www.chesapeakebay.net). Station ID's: York River proper (WE4.2, LE4.3, LE4.2, LE4.1, RET4.3), the Pamunkey River (RET4.1, TF4.2) and Mattaponi River (RET4.2 and TF4.4).

b) VIMS Shoal Survey. Since 1984, biweekly to monthly water quality sampling at a series of sites located along the shoal areas of the lower York River estuary has been conducted by the Biological Sciences Department at the Virginia Institute of Marine Science. Station ID's include: Guinea Marsh, Goodwin Island, VIMS, Yorktown, Mumfort Islands, Catlett Islands and Clay Bank.

c) Alliance for the Chesapeake Bay Volunteer Monitoring Program. Physical and chemical (limited nutrients) data are collected by a volunteer network along the York River system (www. Acb-online.org). Station ID's include: Thorofare Creek, Wormley Creek, Blackwell Landing, Pamunkey Trail, Timberneck Creek, Yorktown Naval Weapons Station, Gloucester Point, West Point and Croaker Landing. Note: Some stations may be inactive.

d) VIMS Juvenile Abundance Monitoring Survey. As part of their Juvenile Abundance Monitoring Surveys, water quality and hydrographic data has been collected since 1968 along a series of sites in the York River estuary (includes the Mattaponi and Pamunkey River systems) by the Fisheries Science Department (www.fisheries.vims.edu/research.html at the Virginia Institute of Marine Science. Surveys include the VIMS Trawl Survey, the Striped Bass Seine Survey and the Juvenile Shad/River Herring Pushnet Survey.

e) Virginia Department of Health. The Virginia Department of Health, Division of Shellfish Sanitation's (www.vdh.state.va.us/shellfish) Seawater Sampling Program collects microbial and general water quality and hydrographic data along a series of sites in the York River estuary (includes lower portions of the Mattaponi and Pamunkey River systems).

f) USEPA Chesapeake Bay Shallow Water Monitoring Program. Since May 2003, CBV NERR has maintained additional continuous (15 minute) fixed water monitoring stations within the York, Piankatank, James River, Rappahannock River, Potomac River, Mobjack Bay, CB5, and Pocomoke River estuary systems using YSI 6600 EDS and YSI 6600V2 Data Sondes. Measurements for this program include: temperature, specific conductivity, dissolved oxygen, pH, turbidity, situ fluorescence, and depth. York River stations are located at Gloucester Point and White House (Pamunkey River). Piankatank River stations were located at Burton's Point, Bland's Wharf, and Dragon Run. James River stations were located at Wythe Point, James River Country Club, 4H Club, Chickahominy Haven, Rice Center, Appomattox, and Osborne Landing. Rappahannock River stations were located at Hicks Landing, Kendale Farms, Bowler's Wharf, Christ Church, and Corrotoman River. Potomac River stations are located Potomac Creek, Colonial Beach, Yeocomico River, and Nomini Bay. Mobjack Bay stations were located in Back River, Dyer's Creek, Horn Harbor, Mobjack Bay, and Ware River. CB5 stations were located in Dividing Creek, Great Wicomico Creek, and Indian Creek. The Eastern Shore, (Western Shore) Pocomoke River stations were located in the (Mesohaline) Hunting Creek and the (Oligohaline) Tall Pines Harbor Campground. CB7 stations on the Eastern Shore (Western Shore) are located in Cherrystone, Hungars Creek, Nassawadox Creek, Occohannock Creek, and Onancock Creek. An additional surface water quality mapping program, which monitors the above stated parameters, at sub-surface depths of approximately 0.25 m along continuous cruise tracts, occurs on a monthly basis in the York River estuary (www3.vims.edu/vecos). This sub-surface continuous sampling of water quality has been conducted since May 2003 on the York River until present, and for the Pamunkey and Mattaponi Rivers from May 2003 through October 2005. Rappahannock and Potomac Rivers were monitored 2007 through 2009. Mobjack Bay

stations were monitored March 2010 through 2012. Rappahannock Profiler was added to our monitoring program May 2009 to 2012. James River station was added May 2012 to 2013. CB5 and Pocomoke stations were monitored from March 2013 to 2015. The Virginia Eastern Shore, Chesapeake Bay Western Shore, (CB7) was added to the Shallow Water Monitoring Program in March 2016 to 2018. The Western Lower Chesapeake Bay (CB8PH – Polyhaline) and the Lynnhaven River, which consist of the Southeast corner of the Chesapeake Bay (LYNPH –Polyhaline), were monitored from 2019 and 2020. Western Lower Chesapeake stations include Little Creek and Salt Ponds, Lynnhaven River stations include Broad Bay, Linkhorn Bay and Western Branch. In 2021, Rappahannock River stations, Hicks Landing, Kendale Farms, Bowler's Wharf, Christ Church, and Corrotoman River were re-introduced back into the Chesapeake Bay Shallow Water Monitoring Program.

g) Chesapeake Bay National Estuarine Research Reserve (CBV) SWMP Water Quality Monitoring Program. The Chesapeake Bay Virginia NERR maintains a long-term water quality monitoring stations at Goodwin Island, Claybank, Sweet Hall Marsh, and Taskinas Creek within the York River estuary. Goodwin Island station was established in 1997, Claybank in 2001, Sweet Hall Marsh in 2000, and Taskinas Creek in 1997. Using YSI 6600 EDS, 6600 V2, and EXO2 data sondes, measurements for this program include: temperature, specific conductivity, dissolved oxygen, pH, turbidity, in situ fluorescence, and depth. Data are available at www.nerrsdata.org.

h) Chesapeake Bay National Estuarine Research Reserve (CBV) SWMP Meteorological Monitoring Program. Since 2001, CBV NERR has maintained a meteorological monitoring station located at Taskinas Creek within the York River estuary system. Measurements for this program include: Air Temperature (degrees C), Relative Humidity (%), Barometric Pressure (mb), Wind speed (m/s),Wind Direction (degrees), PAR (mmol/m^2), and Precipitation (mm) data. 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 2022.

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.

The nutrient lab at CBV NERR analyses PO4F, NO2F, NH4F, and NO23F and reports results in μM. For purposes of consistency in the NERR System, Chesapeake Bay Virginia NERR calculates the concentrations as mg/ l-1 based on atomic weights of 14.01, 30.97 for N and P respectively. Therefore, CBV NERR staff multiplies the concentrations reported by VIMS by 0.01401 and 0.030973762 to obtain concentration values in mg/L as N and P respectively. CHLA_N and PHEA are also analyzed by CBV NERR's nutrient laboratory and are reported in μg/L.

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
Phosphorus and Nitrogen:			
	*Orthophosphate, filtrated	PO_4F	mg/L as P
	*Ammonium, Filtered	NH_4F	mg/L as N
	*Nitrite, Filtered	NO_2F	mg/L as N
	*Nitrate, Filtered	NO_3F	mg/L as N
	*Nitrite + Nitrate, Filtered	$NO_{23}F$	mg/L as N
	Dissolved Inorganic Nitrogen	DIN	mg/L as N
Plant Pigments:			
	*Chlorophyll a	CHLA_N	μg/L
	Phaeophytin	PHEA	μg/L
Field Parameters:			
	Water Temperature	WTEM_N	ºC
	Salinity	SALT_N	psu
	% Dissolved Oxygen Saturation	DO_S_N	%
	Dissolved Oxygen	DO_N	mg/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 –

Method Detection Limits (MDL), the lowest concentration of a parameter that an analytical procedure can reliably detect, have been established by the CBV NERR and VIMS nutrient analytical laboratories in the same manner. The MDL is determined as 3 (or the correct Student's t value, for example, nine replicates and eight degrees of freedom, t=2.896 (alpha=0.01)) times the standard deviation of a minimum of 7 replicates of a single low concentration sample.

In addition, we use the following inequalities for evaluating a calculated MDL:
Calculated MDL < Spike Level < 10 x Calculated MDL

These values are reviewed and revised periodically. The MDLs were calculated on January 19, 2023.

Parameter	Start Date	End Date	MDL
PO_4F	1/1/2023	12/31/2023	0.0023
NH_4F	1/1/2023	12/31/2021	0.0029
NO_2F	1/1/2023	12/31/2021	0.0004
$NO_{23}F$	1/1/2023	12/31/2021	0.0046
CHLA_N	1/1/2023	12/31/2021	1.00
PHEA	1/1/2023	12/31/2021	1.00

13) Laboratory methods –

a) Parameter: NH_4F

i) Method Summary: Ammonia in the sample is analyzed using a modified Solorzano (1969) method. Ammonia in the sample reacts to alkaline phenol and hypochlorite to form indophenol blue. The blue color is then intensified by the addition of sodium nitroprusside. A three-reagent procedure is followed; using tri-sodium citrate reagent, a combined phenol disodium nitroprusside dihydrate reagent and a dichloroisocyanuric acid reagent. After reagents are added to the water samples, they are set in the dark for a minimum of 6 hours and less than 24 hours. Samples are read spectrophotometrically at 630 μm using 1 cm cell.

ii) Method Reference(s):

Solorzano, L. 1969. Determination of ammonia in natural waters by phenol hypochlorite method. Limno. Oceanogr. 14 (1969), pp. 799–801

iii) Preservation Method: Samples are immediately filtered with a 0.45 μm membrane filter upon return to the laboratory from the field and stored at –20°C until analysis. Maximum holding time is 28 days.

b) Parameter: $NO_{23}F$

i) Method Summary: Nitrate is reduced to nitrite using a cadmium-copper column. The nitrite produced reacts with sulfanilamide in an acid solution. The resulting diazonium compound is coupled with N-(naphthyl)-ethylenediamine dihydrochloride to form a colored azo dye, the extinction of which can be measured spectrophotometrically. A correction must be made for any nitrite initially present in the sample.

ii) Method Reference(s):

Strickland, J.D.H. and Parsons, T.R. 1968. Determination of reactive nitrite. In: *A Practical Handbook of Seawater Analysis*. Fisheries Research Board of Canada Bulletin 167, 71-75.

Wetzel, R.G. and Likens, G.E. 1991. *Limnological analysis*. 2nd Edition. Pgs. 84-87. New York: Springer.

Johnstone, R. and Preston, M. 1993. Determination of nitrite. In: Nutrient analysis in tropical marine waters: Practical guidance and safety notes for the performance of dissolved micronutrient analysis in sea water with particular reference to tropical waters. Intergovernmental Oceanographic Commission. Manual and Guides 28. UNESCO.

iii) Preservation Method: Samples are immediately filtered with a 0.45 μm membrane filter upon return to the laboratory from the field and stored at –20°C until analysis. Maximum holding time is 28 days.

c) Parameter: NO_2F

i) Method Summary: The determination of nitrite is based on the method of Strickland and Parsons (1968). Nitrite reacts with sulfanilamide in an acid solution resulting in a diazonium compound. This is then coupled with N-(1-naphthyl)-ethylenediamine dihydrochloride to form a highly colored azo dye, the extinction of which is measured in the spectrophotometer.

ii) Method Reference(s):

Strickland, J.D.H. and Parsons, T.R. 1968. Determination of reactive nitrite. In: *A Practical Handbook of Seawater Analysis*. Fisheries Research Board of Canada Bulletin 167, 71-75.

Wetzel, R.G. and Likens, G.E. 1991. *Limnological analysis*. 2nd Edition. Pgs. 84-87. New York: Springer.

Johnstone, R. and Preston, M. 1993. Determination of nitrite. In: Nutrient analysis in tropical marine waters: Practical guidance and safety notes for the performance of dissolved micronutrient analysis in sea water with particular reference to tropical waters. Intergovernmental Oceanographic Commission. Manual and Guides 28. UNESCO.

iii) Preservation Method: Samples are immediately filtered with a 0.45 μm membrane filter upon return to the laboratory from the field and stored at –20°C until analysis. Maximum holding time is 28 days.

d) Parameter: PO_4F

i) Method Summary: Ammonium molybdate and potassium antimonyl tartrate react with orthophosphate in an acid medium to form an antimony-phosphomolybdate complex, which, on reduction with ascorbic acid yields an intense blue color suitable for photometric measurement.

ii) Method Reference(s):

Eaton, A. D.; Clesceri, L.S.; Rice, E.W. and Greenberg A.E. 2005. 4500-P E. Ascorbic Acid Method. In: *Standard Methods for the Examination of Water and Wastewater*. American Water Works Association.

iii) Preservation Method: Samples are immediately filtered with a 0.45 μm membrane filter upon return to the laboratory from the field and stored at –20°C until analysis. Maximum holding time is 28 days.

e) Parameter: CHLA_N

i) Method Summary: The method used requires filtering a known quantity of water through a glass fiber filter (4.7 cm GF/F). This filter is later ground with a tissue grinder made of Teflon/glass. Approximately 1-3 ml of 90% acetone is added to the filter before grinding. Acetone is also used to wash the filter into a 17 x 150 test tube with tight fitting cap. The sample is steeped at least 2 hours and not exceeding 24 hours at 4ºC, in the dark. The samples are stirred and read on a fluorometer. If the samples cannot be read within that time period, storage in the freezer at -20ºC for a few days is acceptable.

iii) Method Reference(s):

Arar E.J. and Collins. G.B. 1997. Method 445.0. *In Vitro* determination of chlorophyll a and pheophytin a in marine and freshwater algae by fluorescence. Revision 1.2. National Exposure Research Laboratory. Office of Research and Development. U.S. Environmental Protection Agency.

iii) Preservation Method: Samples are immediately filtered with a 0.7 μm glass fiber filter upon return to the laboratory. The filter is drawn dry, folded, sealed in an aluminum foil packet and stored at –20°C until analysis. Maximum holding time is 28 days.

f) Parameter: PHEA

i) Method Summary: The method used requires filtering a known quantity of water through a glass fiber filter (4.7 cm GF/F). This filter is later ground with a tissue grinder made of Teflon/glass. Approximately 1-3 ml of 90% acetone is added to the filter before grinding. Acetone is also used to wash the filter into 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 stirred and read on a fluorometer. For pheophytin measurements, the sample is acidified and read again. If the samples cannot be read within that time period, storage in the freezer at -20°C for a few days is acceptable.

ii) Method Reference(s):

Arar E.J. and Collins. G.B. 1997. Method 445.0. *In Vitro* determination of chlorophyll a and pheophytin a in marine and freshwater algae by fluorescence. Revision 1.2. National Exposure Research Laboratory. Office of Research and Development. U.S. Environmental Protection Agency.

iii) Preservation Method: Samples are immediately filtered with a 0.7 μm glass fiber filter upon return to the laboratory. The filter is drawn dry, folded, sealed in an aluminum foil packet and stored at –20°C until analysis. Maximum holding time is 28 days.

14) Field and Laboratory QAQC programs –

a) Precision

i) Field variability: CBV NERR collects two successive grab samples for the monthly grab sample program.
ii) Laboratory variability: The CBV NERR nutrient lab and the VIMS Analytical Service Center for Nutrients analyze a laboratory duplicate once for every ten samples.
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.
ii) Standard reference material analysis: CBV NERR has participated in the 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, and 2018 NOAA/NERR Inter-laboratory Comparison Studies. VIMS Analytical Service Center results have all fallen within acceptable control limits. For details, contact the Reserve Research Coordinator.
iii) Cross calibration exercises: CBV NERR participates in cross calibration exercises. Cross calibration exercises include the Chesapeake Bay Quarterly Split Sample Program and the US EPA Method Validation Studies.

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%)
CSP	scattered to partly cloudy (10-50%)
CPB	partly to broken (50-90%)
COC	overcast (>90%)
CFY	foggy
CHY	hazy
CCC	cloud (no percentage)

Precipitation

PNP	none
PDR	drizzle
PLR	light rain
PHR	heavy rain
PSQ	squally
PFQ	frozen precipitation (sleet/snow/freezing rain)
PSR	mixed rain and snow

Tide stage

TSE	ebb tide
TSF	flood tide
TSH	high tide
TSL	low tide

Wave height

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

Wind direction

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
Wind speed	
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 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 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.

a) Precipitation data for the sampling date and three days prior to the monthly grab and Diel sampling programs. Data are presented for two meteorological stations, locations are the Sweet Hall Marsh (SH) reserve and the Taskinas Creek (TC) reserve. Data units are in mm.

Type of Sampling	Dates	TC precip. (mm)	SH precip. (mm)
Monthly Grab & Diel	1/14/22	0.00	0.00
Monthly Grab & Diel	1/15/22	0.00	0.00
Monthly Grab & Diel	1/16/22	0.00	0.00
Monthly Grab & Diel	1/17/22	0.00	0.00
Diel	1/18/22	1.30	
Monthly Grab & Diel	2/11/23	0.00	0.00
Monthly Grab & Diel	2/12/23	24.40	27.40
Monthly Grab & Diel	2/13/23	1.30	2.30
Monthly Grab & Diel	2/14/23	0.00	0.00
Diel	2/15/23	0.00	
Monthly Grab & Diel	3/13/23	0.30	3.00
Monthly Grab & Diel	3/14/23	0.00	0.00

Monthly Grab & Diel	3/15/23	0.00	0.00
Monthly Grab & Diel	3/16/23	0.00	0.00
Diel	3/17/23	0.50	
Monthly Grab	4/9/23	0.00	0.00
Monthly Grab	4/10/23	0.00	0.00
Monthly Grab	4/11/23	0.00	0.00
Monthly Grab	4/12/23	0.50	0.00
Diel	4/13/23	0.00	
Diel	4/14/23	10.40	
Diel	4/15/23	0.50	
Diel	4/16/23	0.30	
Monthly Grab & Diel	5/8/23	0.30	2.00
Monthly Grab & Diel	5/9/23	0.00	0.00
Monthly Grab & Diel	5/10/23	0.00	0.00
Monthly Grab & Diel	5/11/23	0.00	0.00
Diel	5/12/23	0.00	
Monthly Grab & Diel	6/9/23	0.00	0.00
Monthly Grab & Diel	6/10/23	0.00	0.00
Monthly Grab & Diel	6/11/23	0.00	0.00
Monthly Grab & Diel	6/12/23	0.00	0.00
Diel	6/13/23	0.80	
Monthly Grab & Diel	7/8/23	11.40	61.70
Monthly Grab & Diel	7/9/23	0.30	0.00
Monthly Grab & Diel	7/10/23	0.00	0.00
Monthly Grab & Diel	7/11/23	0.00	0.00
Diel	7/12/23	0.00	
Monthly Grab & Diel	8/6/23	0.30	0.00
Monthly Grab & Diel	8/7/23	0.00	0.00
Monthly Grab & Diel	8/8/23	0.00	0.00
Monthly Grab & Diel	8/9/23	0.00	0.00
Diel	8/10/23	2.30	
Monthly Grab & Diel	9/4/23	0.00	0.00
Monthly Grab & Diel	9/5/23	0.00	0.00
Monthly Grab & Diel	9/6/23	0.00	0.00
Monthly Grab & Diel	9/7/23	0.00	0.00
Diel	9/8/23	0.00	
Monthly Grab & Diel	10/6/23	0.00	0.00
Monthly Grab & Diel	10/7/23	1.50	2.50
Monthly Grab & Diel	10/8/23	0.00	0.00
Monthly Grab & Diel	10/9/23	0.00	0.00

Diel	10/10/23	0.30	
Monthly Grab & Diel	11/5/23	0.00	0.00
Monthly Grab & Diel	11/6/23	0.00	0.00
Monthly Grab & Diel	11/7/23	0.00	0.00
Monthly Grab & Diel	11/8/23	0.00	0.00
Diel	11/9/23	0.00	
Monthly Grab & Diel	12/3/23	5.60	11.40
Monthly Grab & Diel	12/4/23	0.00	0.00
Monthly Grab & Diel	12/5/23	0.30	0.00
Monthly Grab & Diel	12/6/23	2.30	2.30
Diel	12/7/23	0.00	

Sample hold times for 2022: Samples are held at -20°C. 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. 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.

b) Holding Time

Parameter	Method	Holding Time
PO4F	Filter 0.45 µm, freeze -20°C	28 days
NH4F	Filter 0.45 µm, freeze -20°C	28 days
NO2F	Filter 0.45 µm, freeze -20°C	28 days
NO23F	Filter 0.45 µm, freeze -20°C	28 days
CHLA_N	Filter 0.45 µm, freeze filter -20°C	30 days
PHEA	Filter 0.45 µm, freeze filter -20°C	30 days

Sample hold times for 2022: NERRS SOP allows nutrient samples to be held for up to 24 hours if held at 4°C with no preservation, for NH4F and NO23F up to 28 days if acidified and held at 4°C, and up to 28 days (CHLA for 30 days) if held at -20°C. In all cases, up to an additional 5 days is allowed for collecting, processing, and shipping samples. Samples held beyond that time period are flagged suspect and coded CHB in the data set.

Date Collected		PO4F	NH4F	NO2F	NO23F	CHLA_N	PHEA
1/17/2023	Date Run	1/19/2023	1/19/2023	1/19/2023	1/19/2023	1/23/2023	1/23/2023
Days over holding time		0	0	0	0	0	0
2/14/2023	Date Run	2/16-17/2023	2/16-17/2023	2/16-17/2023	2/16-17/2023	2/22/2023	2/22/2023
Days over holding time		0	0	0	0	0	0
3/16/2023	Date Run	3/24/2023	3/24/2023	3/24/2023	3/24/2023	3/27/2023	3/27/2023
Days over holding time		0	0	0	0	0	0
4/12/2023	Date Run	4/19/2023	4/19/2023	4/19/2023	4/19/2023	4/24/2023	4/24/2023
Days over holding time		0	0	0	0	0	0

4/16/2023	Date Run	4/19/2023	4/19/2023	4/19/2023	4/19/2023	4/24/2023	4/24/2023
Days over holding time		0	0	0	0	0	0
5/11/2023	Date Run	5/15/2023	5/15/2023	5/15/2023	5/17/2023	5/22/2023	5/22/2023
Days over holding time		0	0	0	0	0	0
6/12/2023	Date Run	6/15/2023	6/15/2023	6/15/2023	6/15/2023	6/21/2023	6/21/2023
Days over holding time		0	0	0	0	0	0
7/11/2023	Date Run	7/20/2023	7/20/2023	7/20/2023	8/28/2023	7/24/2023	7/24/2023
Days over holding time		0	0	0	**15**	0	0
8/9/2023	Date Run	8/14/2023	8/14/2023	8/14/2023	8/14/2023	8/16/2023	8/16/2023
Days over holding time		0	0	0	0	0	0
9/7/2023	Date Run	9/11/2023	9/11/2023	9/11/2023	9/13/2023	9/18/2023	9/18/2023
Days over holding time		0	0	0	0	0	0
10/9/2023	Date Run	10/11/2023	10/11/2023	10/11/2023	10/16/2023	10/30/2023	10/30/2023
Days over holding time		0	0	0	0	0	0
11/8/2023	Date Run	11/28/2023	11/28/2023	11/28/2023	11/29/2023	11/30/2023	11/30/2023
Days over holding time		0	0	0	0	0	0
12/6/2023	Date Run	12/7/2023	12/7/2023	12/7/2023	12/11/2023	12/11/2023	12/11/2023
Days over holding time		0	0	0	0	0	0

c) Algae Bloom

During the month of February, the York River System experienced a bloom of *dinoflagellate Heterocapsa triquetra* with some *Skeletonema sp.*

During the months of July, the York River System experienced algae bloom activity of as *Gyrodinium instriatum (Levanderina fissa) and Margalefidinium polykrikoides, Alexandrium monilatum, Heterocapsa rotundata*

During the month of August and the York River System experienced algae bloom activity of Marg (*Margalefidinium polykrikoides*).

d) Notes regarding codes in data

Station Code	DateTimeStamp	Monitoring Program	Rep	Parameter	Comment
cbvtcnut	3/16/23 14:00	2	1	all	Sample was not collected
cbvtcnut	5/11/23 9:31	2	1	all	Sample was not collected
cbvtcnut	9/7/23 11:23	2	1	NH4F	Sample was contaminated

cbvtcnut	8/9/23 21:54	2	1	Chla_N, PHEA	Sample was contaminated
cbvtcnut	12/6/23 19:04	2	1	Chla_N, PHEA	Sample was contaminated

e) NO23 in July were run by

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