Hudson River (HUD) NERR Nutrient Metadata
January - December 2002
Latest Update: May 16, 2025

I. Data set and research descriptors

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2. Research objectives:

a) Monthly Grab Sampling

The objective of this study is to monitor nutrient concentrations at the Tivoli Bays component of the Hudson River National Estuarine Research Reserve. Grab samples are taken from two freshwater tidal wetlands, Tivoli North Bay and Tivoli South Bay, and their primary upland tributaries, Stony Creek and Saw Kill Creek respectively. YSI datasondes are deployed at all grab sampling sites and meterological data are collected continuously, thus relationships can be established between nutrient levels, the aquatic environment, and meterological conditions. The tributaries are sampled above the area of tidal influence, allowing for determination of nutrient inputs to the Tivoli Bays via stream flow. This is important because it has previously been determined that urban and residential land use practices are markedly influencing the water chemistry of the tributaries, especially Saw Kill Creek. Since residential coverage continues to increase, we hope that the intensive monitoring of the surface waters in this watershed will identify trends caused by this rapid development. Tivoli North and South Bays are sampled on an ebb tide, which accounts for nutrient inputs to the wetlands via stream flow and tidal exchange, and includes the influence of intertidal areas on nutrient levels. In addition, ebb tide sampling allows for determination of nutrient inputs to the Hudson River Estuary via the Tivoli Bays.

b) Diel Sampling

Monthly diel sampling is conducted at Tivoli South Bay. Diel sampling highlights the relative importance of tidal forcing on nutrient levels within Tivoli South Bay through the inclusion of two complete tidal cycles. Sampling on a flood tide allows for isolation of nutrient inputs via tidal exchange. As with grab sampling, diel sampling on an ebb tide accounts for nutrient inputs via tidal exchange and stream flow and includes the influence of intertidal areas on nutrient levels. The combination of grab and diel sampling data will provide a better understanding of the relative importance of each water source in terms of nutrient delivery to Tivoli South Bay. In addition, these data will help us develop a better understanding of the effects of the intertidal area on nutrient dynamics.

3. Research methods:

a) Monthly Grab Sampling

Monthly grab samples are collected near the four YSI data logger locations within the Tivoli Bays component of the Hudson River National Estuarine Research Reserve. These sites include Tivoli South Bay, Tivoli North Bay, Saw Kill Creek, and Stony Creek. Monthly sampling at the two bays and the two creeks is conducted on the same day, during an ebb tide within three hours of slack low-water. Efforts are made to avoid precipitation events within 48 hours of sampling. Two replicate samples are collected sequentially at each site using 1 L amber Nalgene bottles. Prior to sample collection, bottles are acid washed with 10% HCL and rinsed with distilled-deionized water. At each site, bottles are rinsed three times with ambient water just before sample collection. All sampling sites are highly mixed and samples are collected at only one depth, approximately 15 cm below the surface. At the time of sample collection, a YSI Model 85 meter is used to measure temperature, salinity, specific conductivity and dissolved oxygen (% and mg/L), and the values are recorded. Grab samples are placed on ice and returned to the laboratory. Within 24 hours, pH and alkalinity are measured and samples are filtered for seston (TSS) and chlorophyll A (CHLA). The filtrate is collected and transferred to 125 ml Nalgene bottles that have been acid washed, rinsed with distilled-deionized water, and rinsed three times with the filtrate. Filtered samples are stored at 4°C until nutrient analysis and 1 ml of 1 N H_2SO_4 is added to samples that will be analyzed for ammonium. Filters for CHLA analysis are placed in borosilicate vials and stored in a freezer.

b) Diel Sampling

Monthly diel sampling occurs at Tivoli South Bay near the YSI datasonde location. An ISCO 6712 Portable Sampler equipped with a 25 ft siphoning tube is used for sample collection. The siphoning tube is deployed approximately one meter from the datasonde and water is collected 20 cm off the bottom, approximate sampling depths are 0.5 meters at low tide and 2.5 meters at high tide. Two sequential samples were collected once every 2 hours for 22 hours until November 2002, when collection of the two sequential samples changed to once every 2.5 hours for 27.5 hours. The first sample is always collected at slack low tide. Samples are collected in 1 liter clear Nalgene bottles that are acid washed with 10% HCL and rinsed with distilled-deionized water prior to deployment of the ISCO. The second sample bottle in each sequence receives 2 ml of 10 N H_2SO_4 prior to deployment in order to preserve the sample for ammonium analysis. The inside of the ISCO is packed with ice to keep the samples cool until the instrument is retrieved. Samples are processed on the day of retrieval. Acidified samples, the second in each collection sequence, are filtered and the filtrate is collected and transferred to 125 ml Nalgene bottles that have been acid washed and rinsed as described previously. Non-acidified samples, the first in each collection sequence, are filtered for seston and

CHLA. The filtrate is collected and transferred to 125 ml Nalgene bottles that have been acid washed and rinsed as described previously. All filtered water samples are stored at 4°C until nutrient analysis is conducted. Filters used for CHLA analysis are placed in borosilicate vials and stored in a freezer.

4. Site location and character:

The Hudson River National Estuarine Research Reserve (HUDNERR) is a multi-component site totaling approximately 5,000 acres. Each component of the reserve is referenced by River Mile (RM) of the Hudson River in New York State proceeding north from the southern tip of Manhattan (RM 0). The reserve includes the following four component sites: Piermont Marsh, Rockland County (RM 24)(41°02'30"N 73°54'15"W), Iona Island, Rockland County (RM 45)(41°18'15"N 73°58'45"W), Tivoli Bays, Dutchess County (RM 98)(42°02'15"N 73°55'10"W), and Stockport Flats, Columbia County (RM 124)(42°02'30"N 73°46'00"W). The four component sites include open water, tidal wetland, and adjacent upland buffer habitats and are representative of the diverse plant and animal communities that occupy the salinity gradient within the Hudson River Estuary. Development within the watersheds of the four component sites ranges from predominantly urban/suburban to forested/agricultural.

The highlighted component for this study is the Tivoli Bays in Annandale, NY. This component includes four monitored sites: Tivoli South Bay(TS), Tivoli North Bay(TN), Saw Kill Creek(SK), and Stony Creek(SC). All four monitored sites are freshwater (0.0 ppt salinity).

Tivoli South Bay (latitude 42° 01' 37.336" N, longitude 73° 55' 33.445" W) is a tidal freshwater wetland with intertidal mudflats exposed at low tide. During the growing season (June – September), the subtidal area of Tivoli South Bay is dominated by the invasive floating macrophyte *Trapa natans*. Tivoli South Bay has a tidal range of 1.19 meters and a soft, silt/clay bottom type. The depth at the sampling location ranges from 0.5 to 2.5 meters. The non-tidal freshwater input to Tivoli South Bay includes that of a large upland tributary and a few small perennial streams.

Tivoli North Bay (latitude 42° 02' 11.56464" N, longitude 73° 55' 31.16645" W) is a freshwater tidal marsh with emergent marsh vegetation dominated by the cattail *Typha angustifolia.* Tivoli North Bay has a tidal range of 1.19 meters, a soft, silt/clay bottom type, and a depth range from 0.5 to 3.0 meters at the sampling location. The non-tidal freshwater input to Tivoli North Bay includes that of a large upland tributary and a few small perennial streams.

Saw Kill Creek (latitude 42° 01' 01.543" N, longitude 73° 54' 53.589" W) is the main tributary flowing into Tivoli South Bay. The Saw Kill Creek watershed is 26.6 square miles and land use within the watershed includes forested (51.1%), agricultural (25.8%), and urban (16.5%) areas. Characteristics of Saw Kill Creek at the sampling location include a rocky bottom type, a depth range of 0.5 to 2.0 meters, and discharge that can range from $2x10^{-5}$ to 1.2 m^3/sec.

Stony Creek (latitude 42° 02' 45.556" N, longitude 73° 54' 40.237" W) is the main tributary flowing into Tivoli North Bay. The Stony Creek watershed is approximately 23 square miles and is dominated by agricultural land use. Characteristics of Stony Creek at the sampling location include a solid rock bottom and a depth range of 0.5 to 1.5 meters. Stony Creek discharge is currently being determined. Both Stony Creek and Saw Kill Creek are non-tidal and freshwater input to the tributaries consists of smaller creeks in the watershed.

The entire tidal Hudson River south of the Troy Dam is affected by polychlorinated biphenyls (PCBs), and Tivoli North and South Bays have low sedimentary concentrations of PCBs. Nutrient inputs to the Tivoli Bays via the non-tidal tributaries are the main concern in terms of pollutants. High concentrations of nitrate and phosphate have previously been documented in both Saw Kill Creek and Stony Creek. Saw Kill Creek appears to be strongly influenced by residential land use practices. This highlights the importance of continued monitoring and identification of non-point sources of pollution at these sites.

5. Coded variable definitions

Site name codes:
SK=Saw Kill Creek, SC=Stony Creek, TN=Tivoli North Bay, TS=Tivoli South Bay

Station codes (in EQWin):
hudsknut = Hudson River Reserve nutrient data for Saw Kill Creek
hudscnut = Hudson River Reserve nutrient data for Stony Creek
hudtnnut = Hudson River Reserve nutrient data for Tivoli North Bay
hudtsnut = Hudson River Reserve nutrient data for Tivoli South Bay

Monitoring program codes:
1=Monthly grab sampling
2=Diel sampling

6. Data collection period:

Monthly grab samples have been collected at the four monitored sites of Tivoli Bays since 06/17/1991. Diel sampling at Tivoli South Bay began in June 2002. The exact dates and times for the 2002 Nutrient Data collection period are listed below. Data collection is hampered during the winter months (December-March) because snow and ice often prohibit safe access to the sites.

a) Grab Sampling

Site	Date	Time collected	Site	Date	Time collected
TS	Jan 2002	No sample	SK	01/18/02	11:10
TS	02/28/02	08:30	SK	02/28/02	09:45
TS	03/22/02	09:12	SK	03/22/02	08:40
TS	04/29/02	09:00	SK	04/29/02	10:36
TS	05/30/02	08:25	SK	05/30/02	07:40
TS	06/27/02	08:25	SK	06/27/02	08:55
TS	07/24/02	07:35	SK	07/24/02	09:35
TS	08/29/02	09:40	SK	08/29/02	10:15
TS	09/26/02	09:10	SK	09/26/02	09:45
TS	10/28/02	10:17	SK	10/28/02	09:34
TS	11/25/02	09:00	SK	11/25/02	08:25
TS	12/18/02	15:20	SK	12/18/02	14:15

Site	Date	Time collected	Site	Date	Time collected
TN	Jan 2002	No sample	SC	01/18/02	10:50
TN	02/28/02	08:45	SC	02/28/02	09:20
TN	03/22/02	09:18	SC	03/22/02	09:40
TN	04/29/02	09:26	SC	04/29/02	10:08
TN	05/30/02	08:35	SC	05/30/02	08:00
TN	06/27/02	08:10	SC	06/27/02	07:44
TN	07/24/02	08:30	SC	07/24/02	09:05
TN	08/29/02	09:20	SC	08/29/02	08:45
TN	09/26/02	08:55	SC	09/26/02	08:15

TN	10/28/02	10:28	SC	10/28/02	10:50
TN	11/25/02	09:25	SC	11/25/02	09:50
TN	12/18/02	15:03	SC	12/18/02	14:40

b) Diel Sampling

Site	Start Date	Start Time	End Date	End Time
TS	06/04/02	03:00	06/05/02	01:00
TS	06/24/02	08:30	06/25/02	06:30
TS	07/15/02	12:00	07/16/02	10:00*
TS	08/21/02	07:05	08/22/02	05:05
TS	09/17/02	06:00	09/18/02	04:00
TS	10/16/02	04:30	10/17/02	02:30*
TS	11/14/02	04:00	11/15/02	07:30
TS	Dec 2002	No Sample		

*See Section 14 for further information.

7. Associated researchers and projects:

The HUDNERR water quality monitoring program examines the physical and chemical constituents of tributary and tidal waters entering and leaving HUDNERR marshes. Field measurements include dissolved oxygen, alkalinity, pH, temperature, salinity, and conductivity. Laboratory measurements include concentrations of suspended solids, nitrate, phosphate, sulfate, and chloride. Meteorological data are collected continuously at the Tivoli Bays component site, including air temperature, barometric pressure, precipitation, wind speed and direction, relative humidity and photosynthetically active radiation. These data will help us to better understand the relationships between the atmospheric and aquatic environments at this component site.

Associated researchers working at Tivoli Bays include scientists from the Institute of Ecosystem Studies, Millbrook, NY; Yale School of Forestry and Environmental Studies, New Haven, CT; and Rensselaer Polytechnic Institute, Troy, NY.

8. Distribution:

According to the Ocean and Coastal Resource Management Data Dissemination Policy for the NERRS System-wide Monitoring Program, NOAA/ERD retains the right to analyze, synthesize and publish summaries of the NERRS System-wide Monitoring Program data. The PI retains the right to be fully credited for having collected and processed the data. Following academic courtesy standards, the PI and NERR site where the data were collected will be contacted and fully acknowledged in any subsequent publications in which any part of the data are used. Manuscripts resulting from the NOAA/OCRM supported research that are produced for publication in open literature, including refereed scientific journals, will acknowledge that the research was conducted under an award from the Estuarine Reserves Division, Office of Ocean and Coastal Resource Management, National Ocean Service, National Oceanic and Atmospheric Administration. The data set enclosed within this package/transmission is only as good as the quality assurance/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.

NERR nutrient data and metadata can be obtained from the Research Coordinator at the individual NERR site (please see Section 1 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 http://cdmo.baruch.sc.edu/. Data are available in text tab delimited format, Microsoft Excel spreadsheet format, and comma delimited format.

II. Physical Structure Descriptors

9. Entry verification

Following sample analysis (ammonium, nitrate, orthophosphate), data files are transferred directly from analytical instruments to desktop computers. Reports are generated as Excel spreadsheets and verified by the head of the IES analytical laboratory. The Excel spreadsheets are then sent to Hudson River Research Reserve staff. Data are examined for completeness, consistency and outliers. Suspect data are flagged, data are reviewed at IES, and if possible, samples are analyzed a second time.

For chlorophyll a and phaeophytin data, raw fluorescence data are entered by hand into spreadsheets that have been set up to perform necessary calculations. Entered data are checked twice for errors and calculated values are examined for completeness, consistency and outliers. Suspect data are flagged.

All laboratory data are then assigned an ID and imported into an Access database. Field data are entered directly into Access with a corresponding sample ID. The field and laboratory data for the four sites described here are then queried out of Access, imported into Excel, reformatted and pre-processed with the NutrientRound.xls macro. The NutrientRound.xls macro was developed by the CDMO in order to prevent incorrect reporting of directly measured values, incorrect rounding of values, and incorrect reporting of calculated values. The macro formats data to a specified number of decimal places and utilizes banker's rounding rules for rounding numbers. The data are then imported into EQWin and archived in a permanent database. Serena Ciparis, Research Assistant, is responsible for this task.

10. Parameter titles and variable names by data category

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

Data Category	Parameter	Variable Name	Units
Phosphorus and Nitrogen:			
	*Orthophosphate	PO4F	mg/L as P
	*Nitrate, Filtered	NO3F	mg/L as N
	*Ammonium, Filtered	NH4F	mg/L as N
Plant Pigments:			
	*Chlorophyll a	CHLA_N	ug/L
	*Phaeophytin	PHEA	ug/L
Other Lab Parameters:			
	Total Suspended Solids	TSS	mg/L
Field Parameters:			
	Water Temperature	WTEM_N	degrees C

Specific Conductivity	SCON_N	mS/cm
Salinity	SALT_N	ppt
Dissolved oxygen (conc.)	DO_N	mg/L
Dissolived oxygen (% sat)	DO_S_N	%
Cloud Cover	CLOUD	code
Precipitation	PRECIP	code
Tide Period	TIDE	code

Notes:

1. Time is coded based on a 2400 hour clock and is referenced to Eastern Standard Time (EST).
2. Reserves have the option of measuring either NO23 or NO2 or NO3.
3. "_N" indicates a non-continuous measurement
4. Descriptions of codes for cloud cover, precipitation, and tidal period are listed in Section 16.
5. Field parameters are not measured for diel samples, however cloud cover and precipitation are recorded at the time of deployment, once during sampling, and at the time of retrieval.

11. Measured and calculated laboratory parameters

a) Variables measured directly:

Nitrogen species:	NO3F, NH4F
Phosphorus species:	PO4F
Other:	CHLA_N, PHEA_N, TSS

b) Computed:
None

12. Limits of Detection

A method detection limit (MDL), the lowest concentration of a parameter an analytical procedure can reliably detect, has been established by the IES Analytical Laboratory for each parameter. The MDL is determined as three times the standard deviation of a minimum of 10 replicates of a single low concentration sample. These values are reviewed and revised periodically. The current MDLs are listed below.

Parameter	Variable	MDL
Ammonium	NH4F	0.02 mg/L as N
Nitrate	NO3F	0.004 mg/L as N *
Orthophosphate	PO4F	0.0006 mg/L as P
Chlorophyll a	CHLA_N	0.2 ug/L **
Phaeophytin	PHEA_N	0.2 ug/L

*NITRATE IS NOT ANALYZED DOWN TO THE DETECTION LIMIT; HUDNERR HAS BEEN USING 0.128 mg/L NO3 (ion) AS THE CONCENTRATION OF THE LOWEST NITRATE STANDARD FOR SAMPLE ANALYSIS SINCE 1991. THEREFORE, THE MINIMUM REPORTED CONCENTRATION (MRC) OF NITRATE AS NITROGEN IS 0.029 mg/L.

**MDLs for CHLA ANALYSIS ARE STILL BEING TESTED/VERIFIED

13. Laboratory Methods

a) Parameter: NH4F

Method Reference: Standard Alpkem Method, Phenate Method #000578
Method Descriptor: Ammonium in the sample reacts with phenol and alkaline hypochlorite to form indophenol blue. The blue color is intensified with sodium nitroferricyanide. The absorbance is measured at 640 nm, and this wavelength is linearly proportional to the concentration of ammonia in the sample.
Preservation Method: Samples are filtered using 25mm GF/F filters within 24 h of collection and 1 ml of 1 N H_2SO_4 is added to the filtrate. Samples are stored at 4°C for up to one month prior to analysis.

b) Parameter: NO3F

Method Reference: Small, H., Stevens, T.S. and Bauman, W.C. 1975. Anal. Chem. 47:1801-1809.
Method Descriptor: A small volume of sample is injected into an ion-exchange column and eluted with a flowing stream of carbonate-bicarbonate. The sample is pumped through two different ion exchange columns, a suppressor device, and into a conductivity detector. Ions from the sample are separated into discrete bands due to different retention times, and the ions are compared to known standards.
Preservation Method: Samples are filtered using 25mm GF/F filters within 24 h of collection. Samples are stored at 4°C for up to two months prior to analysis.

c) Parameter: PO4F

Method Reference: Standard Alpkem Method, Phosphomolybdate Method #00580.
Method Descriptor: Orthophosphate reacts with molybdenum (VI) and antimony (III) in an acidic medium to form an antimonyphosphomolybdate complex. This complex is subsequently reduced with ascorbic acid to form a blue complex and the absorbance is measured at 660 nm.
Preservation Method: Samples are filtered with 25mm GF/F filters within 24 h of collection. Samples are stored at 4°C for up to one month prior to analysis.

d) Parameter: CHLA_N and PHEA_N

Method references:
Holm-Hansen, O. and B. Riemann. 1978. Chlorophyll a determination: improvements in methodology. Oikos 30: 438-447.
Wetzel, R.G. and G.E. Likens. 1991. Limnological Analysis, 2nd ed. Springer-Verlag, New York: 168-169.
Method Descriptor: CHLA and PHEA are measured fluormetrically. Standards with known CHLA concentrations in 90% acetone are used to determine a relationship between CHLA and fluorescence (F). The standards are then acidified with 0.1 N HCL to determine the fluorescence ratio (t) of CHLA and PHEA for pure chlorophyll. Sample filters are extracted using basic methanol (5 ml) and the fluorescence is recorded (Rb). The samples are then acidified with 0.1 N HCL and the fluorescence is recorded (Ra). The following equations are used to determine CHLA and PHEA concentrations in samples:

CHLA (ug/L) = F*(t/t-1)*(Rb-Ra)*(v/V)
PHEA (ug/L) = F*(t/t-1)*(tRa-Rb)*(v/V)

where v is the volume used for extraction (ml) and V is the volume filtered (ml).

Preservation method: Filters are stored in borosilicate vials in the dark at -20°C. Extraction solvent is not added until 24 h prior to fluorometry.

14. Descriptors of missing data and data lower than the detectable limit:

Comment codes and definitions are provided in the following table (Table 1). Explanations for samples that were never collected are reported below. Nutrient/Chla comment codes and definitions are provided in the following table. Missing data are denoted by a blank cell " " and commented coded with an "M". Laboratories in the NERRS System submit data that are censored at a lower detection rate limit, called the Method Detection Limit or MDL. MDL's for specific parameters are listed in the Laboratory Methods and Detection Limits Section (Section II, Part 14) of this document. Measured concentrations that are less than this limit are replaced with the minimum detection limit value and comment coded with a "B" in the variable code comment column. For example, the measured concentration of NO23F was 0.0005 mg/L as N (MDL=0.0008), the reported value would be 0.0008 with a "B" placed in the NO23F comment code column. Calculated parameters are comment coded with a "C" and if any of the components used in the calculation are below the MDL, the calculated value is removed and also comment coded with a "B". If a calculated value is negative, the value is removed and comment coded with an "N".

Note: The way below MDL values are handled in the NERRS SWMP dataset was changed in November of 2011. Previously, below MDL data from 2002-2006 were also coded with a B, but replaced with -9999 place holders. Any 2002-2006 nutrient/pigment data downloaded from the CDMO prior to December November of 2011 will contain -9999s representing below MDL concentrations.

Comment Code	Definition
A	Value above upper limit of method detection
B	Value below method detection limit
C	Calculated value
D	Data deleted or calculated value could not be determined due to deleted data, see metadata for details
H	Sample held beyond specified holding time
K	Check metadata for further details
M	Data missing, sample never collected or calculated value could not be determined due to missing data
P	Significant precipitation (reserve defined, see metadata for further details)
U	Lab analysis from unpreserved sample
S	Data suspect, see metadata for further details

Missing data events during the 2002 sampling period:

a) Grab Sampling:

January 2002: Monthly grab samples were not collected at TS and TN due to winter conditions preventing access to the sites.

NH4: Analysis was not initiated for each site until April 2002, therefore data are missing from January through March.

b) Diel Sampling:

16 July 2002 : The ISCO sampler lost power and the last four samples, 04:00, 06:00, 08:00, and 10:00 were not collected.

17 October 2002: The ISCO sampler lost power and the last two samples, 0:30 and 02:30 were not collected.

December 2002: Diel sampling was not conducted due to overnight temperatures that were below freezing.

TSS: Total suspended solids were not measured for diel samples in 2002.

c) Chlorophyll a and Phaeophytin (Grab and Diel sampling):

During method development and verification, pigment samples from January through October 2002 were not stored properly and the data were questionable. Therefore, CHLA_N/PHEA_N data were only reported for November and December of 2002.

15. QA/QC programs

a) Precision

i) Field variability

At each monitored site, monthly duplicate grab samples are true replicates, collected separately and sequentially, not simultaneously.

During diel sampling at Tivoli South Bay, two samples are collected at each time, but one is acidified for ammonium analysis. Therefore, diel samples do not have replicates.

ii) Laboratory variability

At each monitored site, duplicate monthly grab samples are analyzed for NO3F, PO4F, and NH4F, providing two true replicates for each parameter. CHLA_N and PHEA_N are also analyzed as true replicates, one from each grab sample. Diel samples are analyzed for NO3F, PO4F, NH4F, CHLA_N and PHEA_N, but only one replicate is analyzed for each parameter. Analytical QA/QC procedures include periodic duplicate analysis of the same sample in order to verify precision of the analytical instrumentation.

iii) Inter-organizational Splits

None.

b) Accuracy

i) Sample Spikes

Site	% Recovery of Parameter			
	NH4	NO23	DIN	PO4

TS	75	90	90	90
SK	75	90	90	90
TN	75	75	80	75
SC	70	90	90	90

ii) Standard Reference Material Analysis

TBD.

iii) Cross Calibration Exercises

None.

16. Other Remarks/notes:

On 08/04/2024 this dataset was updated to include embedded QAQC flags and codes for anomalous/suspect, rejected, missing, and below detection limit data. System-wide monitoring data beginning in 2007 were processed to allow for QAQC flags and codes to be embedded in the data files rather than using the original single letter codes used for the nutrient and pigment dataset along with the detailed sections in the metadata document for suspect, missing, and rejected data. Please note that prior to 2007, rejected data were deleted from the dataset so they are unavailable to be used at all. Suspect, missing, rejected and below minimum detection flags and appropriate three letter codes were embedded retroactively for dataset consistency. The QAQC flag/codes corresponding to the original letter codes are detailed below.

Flag/code	***If also C***	**Historic Letter Code**	Historic Code Definition
<1> [SUL]		A	Value above upper limit of method detection
<-4> [SBL]	<-4> [SCB]	B	Value below method detection limit
no need to flag/code unless combined		C	Calculated value
<-3> [GQD]	<3> [GCR]	D	Data deleted or calculated value could not be determined due to deleted data, see metadata for details
<1> (CHB)		H	Sample held beyond specified holding time
<0> (CSM) unless other flag		K	Check metadata for further details
<-2> [GDM]	<-2> [GCM]	M	Data missing, sample never collected or calculated value could not be determined due to missing data
<-3> [SNV] and <1> [SCC] for components		N	Negative calculated value
(CRE) or F_Record {CRE}		P	Significant precipitation (reserve defined, see metadata for further details)
<0> (CUS)		U	Lab analysis from unpreserved sample
<1> (CSM)		S	Data suspect, see metadata for further details

The following tables contain the codes used to describe cloud cover, precipitation and tide periods.

Table 2. Cloud Cover Table.

Code	Description
0	Clear (0-10%)
1	Scattered to partly cloudy (10-50%)
2	Partly to broken (50-90%)
3	Overcast (>90%)
4	Foggy
5	Hazy
6	Cloud (with precipitation)

Table 3. Precipitation Table.

Code	Description
0	None
1	Drizzle
2	Light rain
3	Heavy rain
4	Squally
5	Frozen precipitation
6	Mixed rain and snow

Table 4. Tide Stages Code Table.

Code	Description
1	Ebb tide (E)
2	Flood tide (F)
3	High tide (H)
4	Low tide (L)