

**Waquoit Bay NERR (WQB) Nutrient Metadata
(January 2005 to December 2005)
Latest Update January 6, 2012**

I. Data Set and Research Descriptors

1) Principal investigator(s) and contact persons –

a) Reserve Contact

MaryKay Fox
Assistant Research Coordinator
Waquoit Bay NERR
149 Waquoit Hwy
East Falmouth, MA 02536
Phone: 508-457-0495 x109
Email: MaryKay.Fox@state.ma.us

b) Laboratory Contact

Gordon Wallace
Environmental, Coastal & Ocean Sciences
University of Massachusetts at Boston
100 Morrissey Blvd.
Boston, MA 02125
Phone: 617-287-7447
Email: gordon.wallace@umb.edu
Gordon's trace element lab is responsible for the nutrient analysis.

c) Other Contacts and Programs

Christopher R. Weidman
Research Coordinator
Waquoit Bay NERR
149 Waquoit Hwy
East Falmouth, MA 02536
Phone: 508-457-0495 x105
Email: chris.weidman@state.ma.us

2) Research objectives

The main purpose of the SWMP program is to aid Waquoit Bay NERR in one of its priority missions: to perform as a living laboratory and platform for coastal and estuarine research. The long term, continuous detailed monitoring of the estuary's basic hydro-physical, meteorological and chemical parameters are an essential tool and context for any research activities located here. Besides this overarching mission, there are also several specific research interests. One primary issue for the Waquoit Bay ecosystem is the influence of anthropogenic induced alterations by nitrogen enrichment. Waquoit Bay receives nitrogen from several sources, such as septic systems (their leachate percolates into groundwater which then enters the bay), run off from roads, run off containing domestic and agricultural fertilizer and animal waste, and atmospheric sources. This elevated nitrogen loading to the bay has resulted in enhanced eutrophication that has contributed to the alteration of the bay's habitats. For example, thick mats of seaweeds (macroalgae) now cover the bottom where eelgrass meadows thrived in the 1970's. Unfortunately, there are few definitive records of the bay's water quality conditions during that period, which makes it difficult to evaluate the rates of change. To facilitate future evaluation, long-term records from SWMP can be used to track water column conditions. Of obvious interest are measurements of dissolved nutrients in the bay's water column, as well as measurements of dissolved oxygen (DO), turbidity, and chlorophyll concentration. Such records will facilitate evaluation of changes which may come about from a continuation of watershed alteration that result from current development patterns (i.e., non-sewered residential areas served by private septic systems typically consisting of septic tanks and leach fields) as well as non-industrial commercial development, such as golf courses, cranberry bogs, and retail shopping outlets. The records will be useful for evaluating the efficacy of remediation efforts intended to reduce the nitrogen loading from these sources to Waquoit Bay.

Another focus of long-term research interest is the detection of climate change and the determination of its effects on the estuarine environment. Characterizing the variability of the various water column parameters, such as their scale, magnitude and frequency, is likely to be an important aspect of the estuarine ecosystem that may be sensitive to climate change. Related to this focus is an interest in the impact of storms (hurricanes and northeasters) and other extreme meteorological events on the estuary. For example, what temperature and wind field thresholds exist that might bring about or trigger certain conditions within the bay? The observations recorded by the SWMP will allow for these types of studies.

a) Monthly Grab

Monthly grab samples are collected to quantify the horizontal spatial and seasonal variability of important nutrients in the water column at the four long-term water quality monitoring sites located throughout the Waquoit Bay system representative of the local salinity and habitat gradients as well as differences in upland and marine influence.

b) Diel Sampling Program

Once per month, samples are collected every 135 minutes (2.25 hrs) through a lunar day tidal cycle (24.75 hrs) at the Childs River SWMP long-term water quality monitoring site to quantify the temporal variability of important nutrients in the water column as a function of tidal and daily cycle dynamics. The Childs River site was chosen specifically for this because it is one of the most eutrophic areas in the Waquoit Bay system.

3) Research methods

a) Monthly Grab Sampling Program

Monthly grab samples are taken at the four principal long term SWMP stations in the Waquoit Bay watershed (Metoxit Point, Child's River, Menauhant and Sage Lot Pond). Grab samples are taken on the same day, collected between +3 hours before slack low-water and slack low-water. No distinction is made between neap and spring tide conditions. Efforts are made to collect samples at approximately monthly (30 day) intervals (roughly mid-month). Grab samples are reflective of the water mass sampled by the water quality data sonde, at depths approximately 0.5 m above the bottom. Samples were taken following SWMP protocol, with two sequential grab samples (in immediate sequence – 1-3 minute interval between samples) obtained from each site. This results in a total of eight grab samples from 4 sites. At the time of sample collection, water temperature, salinity, pH and dissolved oxygen are also measured with an YSI 650. All samples are collected in amber, wide-mouth, Nalgene 1000mL sample bottles that are pre-cleaned with 10% HCL and rinsed 3 times with distilled water. Samples are collected using a 1L van Doren sampler, with the sample bottle rinsed 3 times with ambient water prior to collection of the sample. Samples are immediately returned to the lab (within one hour) to be filtered for nutrients and chlorophyll, and frozen (-20° C). The pre-baked (400 °C) glass filters that are used for filtering nutrients are also kept and frozen for PC/PN analysis. In 2005, the frozen nutrient samples (including particulate filters) were delivered to the trace element laboratory at University of Massachusetts-Boston within one week for analysis. In 2005, samples were not taken from the Sage Lot sites during January, February, March, and December and at the Metoxit Point during January, February, and March due to severe winter conditions and ice over at these two stations.

b) Diel Sampling Program

Diel (24.75 hr or 2-full tidal cycles) grab samples are taken monthly at the Child's River long-term SWMP water quality station, and diel sampling is scheduled to overlap with the monthly grab sampling. Diel sampling generally begins in the morning and is scheduled without regard for tide state as it captures 2 full tidal cycles in any case (also no distinction is made between neap and spring tide conditions). Twelve samples are collected over a lunar day (24hr and 45min) time period at 2.25 hour intervals using an ISCO auto-sampler. Sampling depth of the ISCO ranges between 0.5 to 1.2 meters depending on the tidal stage, but the sampling height above the bottom is fixed at 0.4 meters, where the adjacent YSI data sonde sensors are located. Samples are collected in 1000mL clear polypropylene bottles (kept dark inside the ISCO until returning to the lab) that are pre-cleaned with 10% HCl and rinsed 3 times with distilled water. Due to the use of ISCO auto samplers, ambient water rinses prior to sample collection are not possible. During the summer months ice is added inside the ISCO sampler in an effort to decrease sample alteration by providing cold storage

conditions. All samples are filtered for nutrients and chlorophyll, the initial bottle and subsequent sample bottles (up to bottle #4) are collected and filtered after the ISCO begins the sampling cycle. The remaining samples are collected the next day when the ISCO sampler is finished. The frozen nutrient samples (-20° C) are delivered to the trace metal element lab at UMass Boston for analysis within one week along with the grabs samples.

4) Site location and character

a) General description of Waquoit Bay estuarine system:

The Waquoit Bay National Estuarine Research Reserve (WBNERR) is located in the northeastern United States on the southern coast of Cape Cod, Massachusetts. About 8,000 people maintain permanent residency in Waquoit Bay's drainage area, which covers parts of the towns of Falmouth, Mashpee, and Sandwich. During summer months, the population swells 2-3 times with the greatest housing concentrations immediate to the coastline (water views and frontage). In addition, the upper portions of the watershed include a military base, Otis Air Force Base and the Massachusetts Military Reservation, portions of which have been designated by the EPA as Superfund sites due to past practices of dumping jet fuel and other volatile groundwater contaminants.

WBNERR's estuaries are representative of shallow tidal lagoons that occur from Cape Cod to Sandy Hook, New Jersey. WBNERR is within the northern edge of the Virginian biogeographic province, on the transitional border (Cape Cod) with the Acadian biogeographic province to the north and east. Like many embayments located on glacial outwash plains, Waquoit Bay is shallow (< 5 m), fronted by prominent barrier beaches (i.e., those of South Cape Beach State Park and Washburn Island), and is backed by salt marshes and upland coastal forests of scrub pine and oak. Two narrow, navigable inlets, one reinforced with granite jetties, pass through two barrier beaches to connect Waquoit Bay with Vineyard Sound to the south.

b) The Metoxit Point station (MP) (41° 34.131' N 070° 31.294' W, 2.2 m deep) is located in the main basin of Waquoit Bay and was selected to be within or near the outer regions of the gyre (described above) and more or less represents "typical" water mass conditions and residence times for the bay. The location is at least a half mile from shore, well flushed by tides, and is in an area that is minimally disturbed by routine activities on the bay (e.g. boat traffic, shell fishing, etc.). Bottom sediments at the site are organic rich muds overlain by thick algal mats. Because of this site's fairly open exposure to south (greatest fetch over the bay), we have observed that when sustained southerly winds are greater than about 20 kts, the Metoxit Point site experiences increased turbidity (sediment suspension event). A mean tidal range of 0.46m (SD = 0.17) is calculated based on one month of data (May 2003), with a minimum of 0.13 m and a maximum of 0.91 m. Mean monthly salinity range (calculated for 2002) was 4.2 ppt from a mean monthly minimum of 27.8 ppt to 32.0 ppt.

c) The Menauhant station (MH) (41° 33.156' N 070° 32.912' W, 1.2 m deep) is located within the Eel Pond Inlet at the Menauhant Yacht Club dock. Eel Pond Inlet is the westernmost of the two main tidal inlets into the Waquoit Bay system. The site was chosen because it occupies one of the strategic locations for gauging the system's water mass characteristics. Entering waters represent the marine end-member while outflows represent the final product of estuarine water mass modification and export to shelf waters. The site also has easy walk-in access to a secure private pier that extends into the throat of the inlet. Also, because of the turbulent tidal flow within the inlet, conditions are vertically well mixed, and the site can be maintained year round even through ice-over conditions in the rest of the bay. Bottom sediments at this site are clean sands and gravels with almost no attached bottom vegetation.

Since inception, we have noted that strong south to southeast (onshore) winds tend to produce turbidity events at this site from the wave induced suspension of fine sediments and organic material in the upstream near-shore zone. While we have found that these types of turbidity events are localized to windward near-shore areas in the bay, the transport of these sediments at inlet mouths during such times is perhaps a dominant sedimentation process within the estuarine system. In other words while the choice of our location may be producing a localized signal in one of our measured parameters that signal may reflect key processes in the system at large. A mean tidal range of 0.48m (SD = 0.19) is calculated based on one month of data (May 2003), with a minimum of 0.11 m and a maximum of 0.99 m. Mean monthly salinity range (calculated for 2002) was 3.9 ppt from a mean monthly minimum of 28.5 ppt to 32.4 ppt.

- d) The Child's River station (CR) (41° 34.793' N 070° 31.854' W, 1.2 m deep) is located on a dock piling at Edwards Boat Yard, a commercial marina near the upper tidal reaches of Child's River—the second largest input of surface freshwater to the bay. It runs through densely developed residential areas. The Childs River sub-watershed receives the highest nitrogen loading and is the largest nitrogen contributor to the Waquoit Bay system of all the sub-watersheds. In the upper tidal portions of the river we have consistently recorded the highest chlorophyll levels and the lowest dissolved oxygen readings of any region in the bay and so this location represents an end-member for looking at anthropogenic inputs and impacts on the system. This location is very strongly stratified, characterized by a salt wedge with fresher river water overlying saline ocean water. Vertical salinity ranges can run from 0-10 ppm at the surface to more than 30 ppm just 1 m below. The sonde sensors are usually well within the salt wedge portion of the water column, nonetheless this location is also our freshest SWMP site, and is at the opposite end of Child's River from the seaward Menauhant station. Bottom sediments are fine organic rich muds. This location represents the most terrigenously and anthropogenically-impacted SWMP site. Monthly water quality, collected near this location for the past decade, shows very high chlorophyll concentrations during the warmer months and more recent dissolved nutrient records show very high nutrient-loads. Boat traffic at the marina likely leads to increased turbidity during the boating season as well. As this site is dockside at a private marina, general security is high along with easy access. The station is also serviceable year-round and usually not subject to seasonal shutdown due to ice over. A mean tidal range of 0.46 m (SD = 0.17) is calculated based on one month of data (May 2003), with a minimum of 0.11 m and a maximum of 0.95 m. Mean monthly salinity range (calculated for 2002) was 14.7 ppt from a mean monthly minimum of 15.8 ppt to 30.5 ppt.
- e) The Sage Lot station (SL) (41° 33.254' N 070° 30.612' W, 1.2 m deep) is located in deeper portion of Sage Lot Pond – a small sub-estuary of Waquoit Bay (20 ha) surrounded by salt marsh and barrier beach. Its small watershed is the least developed of all of Waquoit Bay's sub-watersheds and Sage Lot Pond is considered to be its least impacted and most pristine sub-estuary. Bottom sediments are organic rich muds. Sage Lot Pond possesses one of the few remaining eelgrass beds in the Waquoit Bay system. Indeed the Child's River and Sage Lot Pond sites are considered to represent opposite end-members of nutrient-loading and human-induced influence. Researchers often locate their experiments in these two locations to take advantage of this difference. However, Sage Lot Pond is hydrologically connected to an upstream brackish source -- Flat Pond -- via a series of tidal creeks, drainage ditches and culverts. Flat Pond borders a country club and golf course and some concern exists for its impact on the water quality of Sage Lot Pond. A mean tidal range of 0.40m (SD = 0.14) is calculated based on one month of data (May 2003), with a minimum of 0.11 m and a

maximum of 0.67 m. Mean monthly salinity range (calculated for 2002) was 4.9 ppt from a mean monthly minimum of 27.2 ppt to 32.1 ppt.

5) Code Variable Definitions

- Wqbcnut – Waquoit Bay NERR Child’s River nutrients
- Wqbmhnut – Waquoit Bay NERR Menauhant Yacht Club nutrients
- Wqbmpnut – Waquoit Bay NERR Metoxit Point nutrients
- Wqbslnut – Waquoit Bay NERR Sage Lot Pond nutrients
- 1 – grab sample (collected with van Doren sampler)
- 2 – diel sample (collected with ISCO)

6) Data collection period

Diel Sampling:

Site	Start Date	Start Time	End Date	End Time
CR	1/19/05	13:15	1/20/05	14:00
CR	2/14/05	11:20	2/15/05	12:05
CR	3/22/05	8:35	3/23/05	9:20
CR	4/19/05	8:18	4/20/05	9:03
CR	5/31/05	8:35	6/1/05	9:20
CR	6/27/05	8:45	6/28/05	9:30
CR	7/12/05	9:19	7/13/05	10:04
CR	8/9/05	8:28	8/10/05	9:13
CR	9/12/05	9:31	9/13/05	10:15
CR	10/20/05	12:30	10/21/05	13:15
CR	11/21/05	16:00	11/22/05	16:45
CR	12/19/05	10:53	12/20/05	11:38

Grab Sampling:

Sage Lot Pond

Site	Start Date	Start Time	End Date	End Time
SL	4/19/05	14:40	4/19/05	14:43
SL	5/31/05	12:25	5/31/05	12:28
SL	6/27/05	10:44	6/27/05	10:47
SL	7/12/05	11:01	7/12/05	11:03
SL	8/9/05	9:34	8/9/05	9:37
SL	9/12/05	13:15	9/12/05	13:18
SL	10/21/05	09:03	10/21/05	09:06
SL	11/21/05	09:46	11/21/05	09:49

Metoxit Point

Site	Start Date	Start Time	End Date	End Time
MP	4/19/05	13:35	4/19/05	13:38
MP	5/31/05	14:08	5/31/05	14:10
MP	6/27/05	10:00	6/27/05	10:03

MP	7/12/05	11:40	7/12/05	11:46
MP	8/9/05	11:00	8/9/05	11:05
MP	9/12/05	10:59	9/12/05	11:04
MP	10/21/05	10:15	10/21/05	10:18
MP	11/21/05	10:39	11/21/05	10:48
MP	12/20/05	08:14	12/20/05	8:20

Child's River

Site	Start Date	Start Time	End Date	End Time
CR	1/20/05	12:33	1/20/05	12:36
CR	2/15/05	09:06	12/15/05	09:09
CR	3/22/05	12:17	3/22/05	12:20
CR	4/19/05	12:14	4/19/05	12:17
CR	5/31/05	09:50	5/31/05	09:52
CR	6/27/05	08:52	6/27/05	08:55
CR	7/12/05	09:15	7/12/05	09:18
CR	8/9/05	08:15	8/9/05	08:18
CR	9/12/05	09:30	9/12/05	09:33
CR	10/21/05	08:19	10/21/05	08:22
CR	11/21/05	08:04	11/21/05	08:10
CR	12/20/05	07:27	12/20/05	07:42

Menauhant

Site	Start Date	Start Time	End Date	End Time
MH	1/20/05	12:05	1/20/05	12:08
MH	2/15/05	08:48	2/15/05	08:51
MH	3/22/05	11:53	3/22/05	11:56
MH	4/19/05	11:54	4/19/05	11:57
MH	5/31/05	09:30	5/31/05	09:32
MH	6/27/05	09:30	6/27/05	09:33
MH	7/12/05	09:42	7/12/05	09:46
MH	8/9/05	08:33	8/9/05	08:36
MH	9/12/05	09:54	9/12/05	10:02
MH	10/21/05	07:50	10/21/05	08:05
MH	11/21/05	08:52	11/21/05	08:59
MH	12/20/05	07:02	12/20/05	07:09

7) Associated researchers and projects

a) SWMP Water Quality Monitoring data

In order to understand long-term changes in water quality, YSI 6600UPG data loggers are deployed. Measurements of dissolved oxygen, salinity, temperature, pH, depth and turbidity are taken every 30 minutes, continuously at each of the 4 sites. The data collected provides background data for other research about the ecology of these habitats. Visit <http://cdmo.baruch.sc.edu/> if you are interested in the data.

b) BayWatchers

BayWatchers is a Citizen Water Quality Monitoring group based in Waquoit Bay since 1995. Volunteers measure for dissolved oxygen concentration, salinity, temperature (air and water),

water clarity (using secchi depth), chlorophyll-a and nutrients at 7 sites throughout the Reserve. Visit <http://www.waquoitbayreserve.org/baywatch.htm> to view the data.

8) **Distribution –**

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 this 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 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.

NERR water quality and weather 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.

9) **Entry verification –**

The nutrient data is imported directly from the instrument into an excel file. Therefore, it is not possible for human error to occur during data entry. The data is then QA/QC and checked over by Gordon Wallace at the UMASS lab before being sent to WQB as an excel spreadsheet. The data units are converted from uM/L to mg/L by WQB's Assistant Research Coordinator MaryKay Fox. She also checked the chlorophyll and field parameters 100% against the field notebooks and data sheets.

10) **Parameter Titles and Variable Names by Data Category**

Required NOAA/NERRS System-wide Monitoring Program water quality parameters are denoted by an asterisks “*”.

Data Category	Parameter	Variable Name	Units of Measure
Phosphorus:	*Orthophosphate	PO4F	mg/L as P
Nitrogen:	*Nitrite + Nitrate, Filtered	NO23F	mg/L as N
	*Ammonium, Filtered	NH4F	mg/L as N
	*Dissolved Inorganic Nitrogen	DIN	mg/L as N

	Total Dissolved Nitrogen	TDN	mg/L as N
	Dissolved Organic Nitrogen	DON	mg/L as N
	Particulate Organic Nitrogen	PON	mg/L as N
	Total Nitrogen	TN	mg/L as N
Carbon:	Particulate Organic Carbon	POC	mg/L as C
Other Lab Parameters:			
	Chlorophyll a	CHLA	µg/L
	Phaeophytin	PHEA	µg/L
	Silicate, filtered	SiO4F	mg/L as Si
Field Parameters:			
	Dissolved Oxygen	DO_N	mg/L
	%Dissolved Oxygen Saturation	DO_S_N	%
	pH	PH_N	standard units
	Salinity	SALT_N	ppt
	Water Temperature	WTEM_N	°C

Notes:

1. Time is coded based on a 2400 hour clock and all times are changed to Eastern Standard Time (EST).
2. Waquoit Bay Reserve was measured NO₂ until July 2003 after one year of monthly measurements, when it was determined that NO₂ was not usually a significant component of NO₂₃ and so NO₂₃ is considered to be overwhelmingly NO₃. Since July 2003 NO₂₃ and NH₄ were the only measured DIN species.
3. PON/POC began to be measured in April 2003, allowing calculation of TN.

11) Measured and Calculated Laboratory Parameters –

i) Variables Measured Directly

Nitrogen species:	NO ₂₃ F, NH ₄ F, TDN, PON
Carbon species:	POC
Phosphorus species:	PO ₄ F
Other:	CHLA, PHEA, SiO ₄ F

ii) Computed Variables

DIN:	NO ₂₃ F+NH ₄ F
DON:	TDN-NH ₄ F-NO ₂₃ F
TN:	TDN+PON

12) Limits of Detection

Table 1. **Method Detection Limits** (MDL) for measured water quality parameters for each sample month's nutrient analysis

	NO ₂₃ F (mg/L)	NH ₄ F (mg/L)	PO ₄ F (mg/L)	SiO ₄ F (mg/L)	TDN (mg/L)	Chla (ug/L)	Phea (ug/L)	PON mg N per filter	POC mg C per filter
January 2005	0.000	0.00	0.00	0.000	0.02	0.5	0.5		
February 2005	0.000	0.003	0.001	0.012	0.02	0.5	0.5		

March 2005	0.001	0.001	0.001	0.000	0.02	0.5	0.5		
April 2005	0.001	0.001	0.001	0.002	0.02	0.5	0.5		
May 2005	0.000	0.003	0.00	0.016	0.00	0.5	0.5		
June 2005	0.000	0.003	0.00	0.020	0.00	0.5	0.5		
July 2005	0.000	0.003	0.00	0.020	0.00	0.5	0.5		
August 2005	0.001	0.003	0.001	0.002	0.00	0.5	0.5		
September 2005	0.001	0.003	0.001	0.002	0.00	0.5	0.5		
October 2005	0.000	0.001	0.001	0.001	0.03	0.5	0.5		
November 2005	0.000	0.001	0.000	0.002	0.03	0.5	0.5		
December 2005	0.000	0.001	0.004	0.003	0.03	0.5	0.5		
Yearly Average								0.007	0.035

MDLs for NO₂3F, NH₄F, PO₄F, PON/POC and TDN are determined by the UMASS laboratory. PON and POC MDLs were given for yearly averages based on blank filter data expressed as mass (mg/filter) for filters without water passing through them or apparent concentration (in mg/l and umol/l).

Monthly MDLs for Chla and Phae were a priori set at 0.5 ug/L and not calculated directly in 2005. Currently laboratory approaches for setting Chla and Phae MDLs are quite varied when they exist at all, and we find most of the commonly used methods unacceptable. Consequently, we are presently (Spring 2006) developing a more rigorous MDL protocol at WBNERR for future use. Mean (per monthly run) standard deviation on blanks for 2005 was 0.02 ug/L for Chla and Phaeo (6 blanks are run during every monthly run).

13) Laboratory Methods

a) *Contact Waquoit Bay NERR Assistant Research Coordinator for a copy (electronic or hard) of the following SOP's (#i-vi). MaryKay.Fox@state.ma.us (508-457-0495 ext 109).*

i) **Parameter: NH₄F**

UMass Boston Laboratory SOP # [Nut_03](#)
See Appendix A

ii) **Parameter: NO₂3F**

UMass Boston Laboratory SOP # [Nut_02](#)
See Appendix B

iii) **Parameter: PO₄F**

UMass Boston Laboratory SOP # [Nut_04](#)
See Appendix C

iv) **Parameter: DON**

UMass Boston Laboratory SOP #
See Appendix D

v) **Parameter: POC/PON**

UMass Boston Laboratory
See Appendix E

vi) **Parameter: Silicate**

UMass Boston Laboratory
See Appendix F

vii) **Parameter: Chlorophyll *a* and Phaeophytin**

Waquoit Bay NERR Laboratory

See Appendix G

The Nutrients values were analyzed by a Lachat QuikChem 8500 Flow Injection Nutrient at the Trace Element Analytical Facility (TEAF) at UMass-Boston. This method is consistent with and approved by the EPA. The laboratory benchmark for performance continues to be the available NIST or other reference standards. The SOP methods are similar between the two machines, except that the QuickChem 8500 utilizes slow injection. The new SOP is expected to be completed this year.

14) **Reporting of Missing Data, Data with Concentrations Lower than Method Detection Limits etc**

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:

January 2005:

No nutrient samples were collected from the Metoxit Point and Sage Lot open water sites this month, owing to heavy ice over of the bay waters.

February 2005:

No nutrient samples were collected from the Metoxit Point and Sage Lot open water sites this month, owing to heavy ice over of the bay waters.

March 2005:

No nutrient samples were collected from the Metoxit Point and Sage Lot open water sites this month, owing to heavy ice over of the bay waters.

August 2005:

PON/POC for Diel Sample (CR-D1) were lost during laboratory analysis, also resulting in loss of derived TN value for this sample.

December 2005:

PON/POC for Grab Sample (MP-A) was lost during laboratory analysis, also resulting in loss of derived TN value for this sample.

Suspect data: No suspect Data for this year.

15) **QA/QC Programs** –

a) **Precision** –

- i) **Field Variability** – WQBNERR collects two successive grab samples for the monthly grab sample program.
- ii) **Laboratory Variability** – The UMass laboratory analyzed replicates on 10% of our samples.
- iii) **Inter-organizational splits** – none.

b) **Accuracy** –

- i) **Sample Spikes** – see lab protocols
- ii) **Standard Reference Material Analysis** – see lab protocols
- iii) **Cross Calibration Exercises** – Summer 2005-NERRs-wide inter-lab reference comparison.

16) **Other Remarks**