Quality Assurance Project Plan
For the
New Jersey Ambient Monitoring Program

Prepared by

New Jersey Department of Environmental Protection
Division of Water Monitoring and Standards
Bureau of Marine Water Monitoring

Effective: Jan 2017

_____	_____
Robert Schuster ***NJDEP Project Manager***	Date
_____	_____
Bill Heddendorf ***NJDEP Quality Assurance Manager***	Date
_____	_____
Eric Ernst ***NJDEP Inorganic QA Manager***	Date
_____	_____
Marc Ferko	Date

Table of Contents

Distribution List

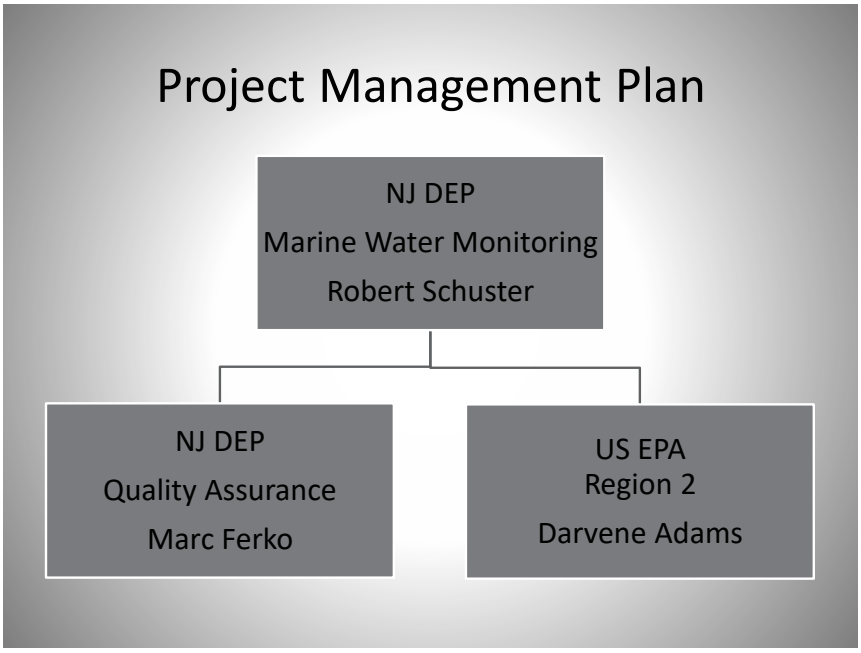
Robert Schuster, NJDEP
Bill Heddendorf, NJDEP
Eric Ernst, NJDEP
Marc Ferko, NJDEP
Darvene Adams, USEPA Region 2

Project/Task Organization

Project Manager: Robert Schuster Bureau of Marine Water Monitoring New Jersey Dept. of Environmental Protection PO Box 405, Stoney Hill Road Leeds Point, NJ 08220 Phone: 609 748 2000 Fax: 609 748 2014 Robert.Schuster@dep.nj.gov	***QA Manager:*** Bill Heddendorf Bureau of Marine Water Monitoring New Jersey Dept. of Environmental Protection PO Box 405, Stoney Hill Road Leeds Point, NJ 08220 Phone: 609 748 2000 Fax: 609 748 2014 Bill.Heddendorf@dep.nj.gov
Inorganic QA Manager: Eric Ernst Bureau of Marine Water Monitoring New Jersey Dept. of Environmental Protection PO Box 405, Stoney Hill Road Leeds Point, NJ 08220 Phone: 609 748 2000 Fax: 609 748 2014 Eric.Ernst@dep.nj.gov	***QA Research Scientist:*** Marc Ferko Bureau of Quality Assurance New Jersey Dept. of Environmental Protection PO Box 424 Trenton, NJ 08625 Phone: 609 292 3950 Fax: 609 777 1774 Marc.Ferko@dep.nj.gov

Project Partner:

Darvene Adams, Section Chief Monitoring and Assessment Branch USEPA Region 2 2890 Woodridge Ave., MS 220 Edison, NJ 08837 Phone: 732 321 6700 Fax: 732 321 6616 Adams.Darvene@epamail.epa.gov



3.2.5 A5 – Problem Definition/Background

The coastal water quality of New Jersey can be adversely impacted by anthropogenic activities like commercial and residential development, stormwater runoff, and recreational uses. Problems such as anoxic conditions, widespread phytoplankton blooms, public health concerns, and a decline in harvestable fish and shellfish can result.

For these reasons, the Department of Environmental Protection established a program for the sampling and analysis of New Jersey's coastal waters. Samples are collected on a monthly basis for 43 annually alternating sites and analyzed for a series of parameters. The data collected is periodically evaluated and summarized. The availability of water quality data provides environmental managers and researchers a valuable tool for understanding the relationship between water quality and the impacts described above.

3.2.6 A6 – Project/Task Description

The objective of this program is to collect, analyze, and report data pertaining to the quality of New Jersey's coastal waters. Data collected includes: nitrate/nitrite, total nitrogen, orthophosphate, total phosphorous, ammonia, non-purgeable organic carbon, biogenic silica, chlorophyll a, total suspended solids, secchi depth, temperature, salinity, enterococcus, turbidity, pH, alkalinity, and dissolved oxygen.

Routine water quality monitoring is accomplished by collecting field measurements for secchi depth, salinity, dissolved oxygen, pH, and temperature and laboratory analysis of the remaining

parameters. A NJDEP boat captain collects the samples in the field throughout New Jersey's estuaries. They are then brought to the laboratory for preservation and/or analysis.

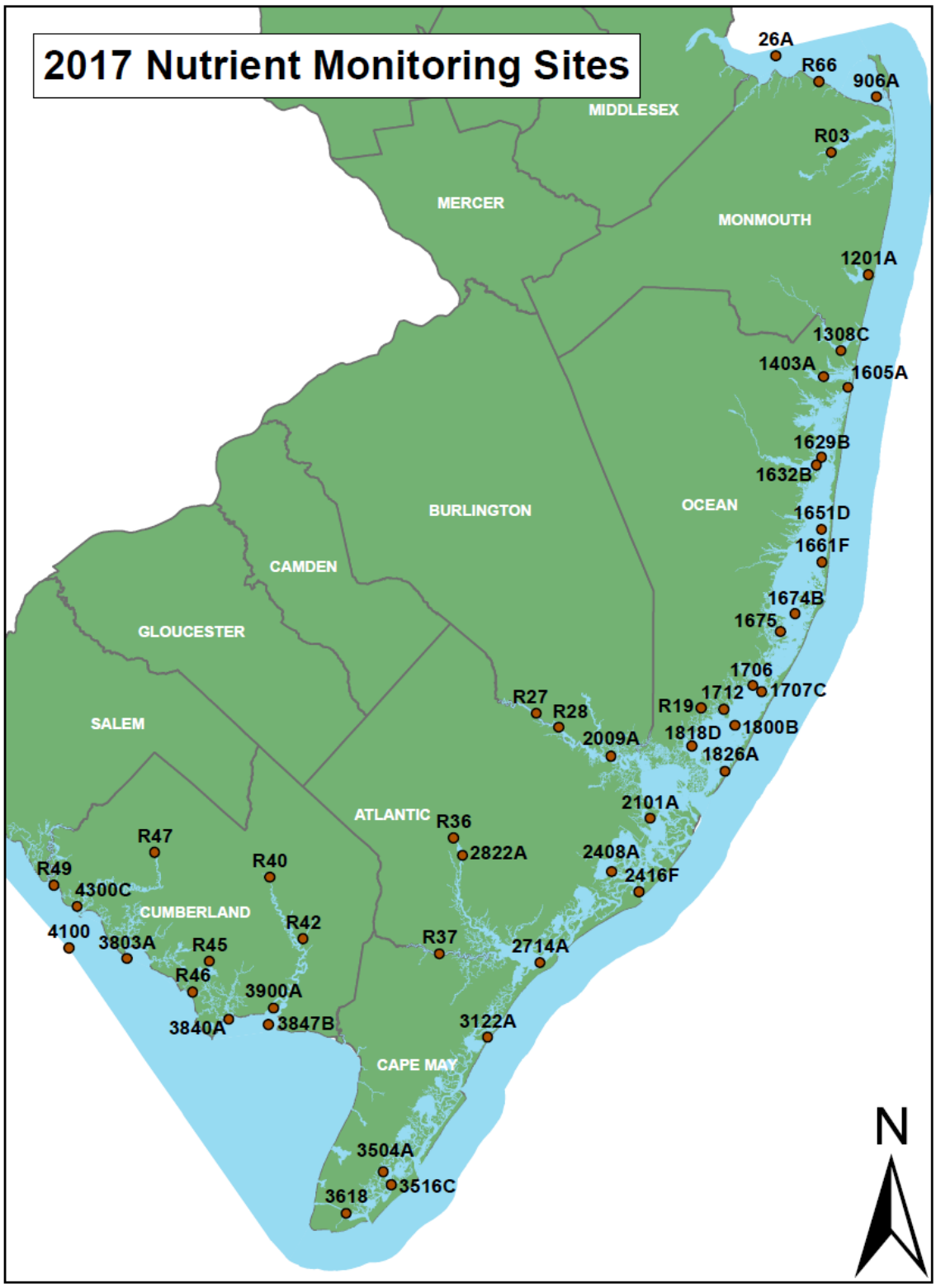


Figure 1. Sampling stations for NJDEP's nutrient monitoring program.

3.2.7 A7 – Quality Objectives and Criteria

The coastal water quality measurements can be used by researchers and the public to assess the quality of the waters and trends of particular waterways. Most nutrient data collected for water quality analysis is not subject to specific criteria with the exception of dissolved oxygen. Levels of dissolved oxygen at or below 2 mg/L do not meet the objective's acceptance criteria and are known to cause severe biological stress on the water column.

Salinity is the only parameter subjected to accuracy criteria due to the instrumentation used to measure it. The accuracy is measured at $\pm$ 0.1 PPT when using the conductivity method to determine salinity content.

3.2.8 A8 – Special Training/Certification

The Bureau of Marine Water Monitoring is a State Certified Environmental Laboratory (#01179) having met the requirements of the Regulations Governing the Certification of Laboratories and Environmental Measurements (N.J.A.C 7:18 et. seq.).

3.2.9 A9 – Documents and Records

Changes or revisions to the QA Project Plan will be sent by mail or email to the appropriate project personnel. These personnel will include but not limited to project managers, QA managers, and Laboratory personnel involved with the program.

Each parameter performed has a corresponding paper copy of the results. Paper copies are stored in laboratory notebooks and /or appropriate folders. The parameter results are recorded on paper copy and then entered into an Access database. Data collected is stored in a STORET database. Periodically, accumulated data is compiled and a report on water quality is generated. Hard copies are prepared and the most recent report is available on the Bureau's web site.

3.3 GROUP B: DATA GENERATION AND ACQUISTION

The elements in this group (Table 2) address data generation and acquisition to ensure that appropriate methods for sampling, measurement and analysis, data collection and generation, data handling, and QC activities are employed and documented. The following QA Project Plan elements describe the requirements related to the actual methods or methodology used for the:

- Collection, handling, and analysis of samples
- Data obtained from other sources, and
- The management of data

Table 2. Group B: Data Generation and Acquisition Elements	
B1	**Sampling Process Design**
B2	**Sampling Methods and Handling**
B3	**Analytical Methods**
B4	**Quality Control**
B5	**Instrument/Equipment Testing, Inspection and Maintenance**
B6	**Instrument/Equipment Calibration and Frequency**
B7	**Inspection/Acceptance of Supplies and Consumables**
B8	**Non-Direct Measurements**
B9	**Data Management**

3.3.1 B1 – Sampling Process Design (Experimental Design)

This program generates information on water quality by collecting approximately 40 estuarine water samples from Raritan Bay to the Delaware River in New Jersey. Samples are collected monthly. The sampling stations were chosen for one of the following reasons:

- To be representative of a major water body
- To be representative of fresh water input into an estuary

The samples are analyzed for temperature, secchi depth, chlorophyll a, total suspended solids, dissolved oxygen, non-purgeable organic carbon (NPOC), biogenic silica, salinity, ammonia, orthophosphate, total phosphorus, nitrate/nitrite, total nitrogen, alkalinity and enterococcus.

3.3.2 B2 – Sampling Methods and Handling

Samples are collected, by Bureau staff, in their corresponding sample containers (Table 3) and placed on ice in an ice chest. They are delivered to the laboratory at the Bureau of Marine Water Monitoring in Leeds Point, where they are analyzed or preserved according to their individual parameter. Samples are used for monitoring purposes only therefore Chain of Custody forms are not required. To avoid contamination, reusable bottles are double rinsed with hot water and double rinsed with deionized water.

Table 3: Sample Storage and Holding Times

Parameter	Preservation		Container	Holding
	Method1	Reference	Material	Time
Alkalinity	P1	Std Meth 20ed	polyethylene	24 hours
Biogenic Silica	P1	Unesco, 1981	polypropylene	28 days
NPOC	P2	Std Meth 18ed	polypropylene	28 days
Total Suspended Solids	P1	USEPA 1979	polyethylene	7 days
Chlorophyll a	P1	Std Meth 20ed	opaque	24 hours
Ammonia	Phenol	Parsons 1985	polypropylene	14 days
Nitrate/Nitrite	Freeze	Parsons 1985	polypropylene	28 days
Total Nitrogen	Freeze	Parsons 1985	polypropylene	28 days
Orthophosphate	Freeze	Parsons 1985	polypropylene	28 days
Total Phosphorus	Freeze	Parsons 1985	polypropylene	28 days

Enterococcus	P1	Std Meth 20ed	polypropylene	6 hrs

[1]Preservation Method: P1=store on ice; P2=Acidify to pH<2 with H_2SO_4

3.3.3 B3 – Analytical Methods

Table 4: Analytical Methodology

Parameter	Method	Measure Unit	Lower Reporting Limit	Method Detection Limit
Enterococci	EPA 1600	#/100mL	1	
Dissolved Oxygen	APHA 4500-OC	mg/L		
Alkalinity	APHA 2320-B	mg/L	1	
Ammonia	EPA 350.1	ug/L	10	4.18
Biogenic Silica	EPA 366.0	mg/L	0.1	0.03
Chlorophyll a	APHA 10200-H	ug/L	0.42	
Nitrate + Nitrite	EPA 353.4	ug/L	10	5.53
Non-Purgeable Organic Carbon*	APHA 5310-B	mg/L	1	0.26
Orthophosphate	EPA 365.5	ug/L	5	1.35
Total Nitrogen	USGS I-4650-03	ug/L	100	33.32
Total Phosphorus	USGS I-4650-03	ug/L	10	5.68
Total Suspended Solids	USGS I-3765-85	mg/L	1	
Turbidity	APHA 2130	NTU	1	

***Non-Purgeable Organic Carbon Replaced Total Organic Carbon 7/1/16**

3.3.4 B4 – Quality Control

There are no quality control standards in place for temperature, secchi depth, or total suspended solids. Dissolved oxygen and salinity standards are prepared and analyzed before the meter is brought into the field. An alkalinity standard is prepared and analyzed before each analysis set. Ammonia, Orthophsphate, Total Phosphorus, Nitrate/Nitrite, Total Nitrogen, Biogenic Silica, and Non-Purgeable Organic Carbon quality controls are as follows:

Calibration

Calibration standards

One blank and five standards over the expected range of sample target analyte concentrations are analyzed. Acceptable correlation coefficients are 0.99500 and above.

Calibration check standard
One mid-range standard is prepared independently from the initial calibration standards and analyzed at the beginning of the run, every ten samples, and at the end of every run. Percent recovery below 90% or above 110% will result with the samples being reanalyzed or flagged as estimated values.

Method Detection Limit

MDL
Method detection limits are determined by analyzing the lowest standard throughout the year. MDLs are determined annually.

LRL
The laboratory reporting limit is the lowest standard that is used in the calibration curve and is checked at the end of every run.

Accuracy

Matrix spikes
Known amounts of target analytes are added to random samples. Acceptable percent recovery is 80 – 120%. If acceptable limits are exceeded, the cause of the problem is determined. The system is to be recalibrated and all samples will be reanalyzed or flagged as estimated values.

Precision

Laboratory replicates
Replicate aliquots of samples are prepared per 20 samples. Acceptable limit for range percent difference are 20%. If acceptable limits are exceeded, the cause of the problem will be determined. The system will be recalibrated and all suspect samples will be reanalyzed or flagged as estimated samples.

Contamination Assessment

Blanks
One method blank is analyzed at the beginning of the run, every ten samples, and at the end of every run.

Calculations

Method Detection Limit
The minimum concentration of an analyte in a given matrix that can be measured and reported with 99 percent confidence is greater than zero. The MDL is determined by multiplying the

appropriate (i.e., n-1 degrees of freedom) one-sided 99% Student's t-statistic (t0.99) by the standard deviation (S) obtained from the analyzed lowest standard. Therefore, the MDL = (t0.99)(S).

Accuracy
Accuracy is calculated as percent recovery from the analysis of matrix spike samples as follows:

% Recovery = {[Ms – (Ms/2)]/Ts}*100
Where
Ms = Measured concentration of target analyte in the spiked sample
Mu = Measured concentration of target analyte in the unspiked sample
Ts = "True" concentration of target analyte added to the spiked sample

Precision
Precision is estimated through the use of the Range Percent Difference (RPD).

RPD = [Absolute Value (R1 – R2)/R3]*100
Where R1 and R2 are replicate values and R3 is the average of the replicates

3.3.5 B5 – Instrument/Equipment Testing, Inspection, and Maintenance And 3.3.6 B6 – Instrument/Equipment Calibration and Frequency

The Bureau of Marine Water Monitoring's Chemistry Laboratory is state certified to perform the parameters conducted for water quality monitoring. The laboratory participates in independent laboratory proficiency testing annually. If the results of a particular parameter do not meet the acceptable limits, a new sample is sent from the company and the parameter is reanalyzed. Certificates are posted in the laboratory. All maintenance is recorded in the laboratory's Equipment Maintenance Log. All expired standards and reagents are properly discarded. Glassware is rinsed in hot water and deionized water, acid washed with 1:1 hydrochloric acid overnight, and then rinsed in hot water and deionized water. Balances are calibrated yearly and checked quarterly. Pipettes are calibrated yearly and monitored on a quarterly basis and replaced when needed. Filters are regularly replaced for the deionized water set-up. The temperature of ovens and refrigerators are monitored and recorded daily.

3.3.7 B7 – Inspection/Acceptance of Supplies and Consumables

Inventory of supplies and consumables is performed on a monthly basis. The list is forwarded to the Quality Assurance Manager for the laboratory. Supplies are inspected for defects and/or damage by laboratory personnel and accepted or returned. Accepted chemicals are dated and properly stored.

3.3.8 B8 – Non-direct Measurements

All indirect measurements are calculated using either Microsoft Excel or Access.

3.3.9 B9 – Data Management

Data Owner

Robert Schuster
New Jersey Department of Environmental Protection
Bureau of Marine Water Monitoring
P. O. Box 405
Leeds Point, NJ 08220
(609) 748 – 2000
Robert.Schuster@dep.nj.gov

The samples are collected at approximately 40 designated sites in the bays and rivers of New Jersey on a monthly basis. Ocean samples will be collected only if necessary due to adverse conditions. The samples collected by the Bureau's captains are brought to the laboratory where they are analyzed for each parameter. The data collected is entered and archived into an Access file dedicated to nutrient monitoring. The raw data is uploaded to the USEPA's STORET data system. Periodically, a report detailing and summarizing the data is generated. The report is available in hard copy and on the Bureau of Marine Water Monitoring web page.

3.4 Group C: Assessment and Oversight

Table 5 addresses the elements for assessing the effectiveness of the project implementation and associated QA and QC activities. This is to ensure that the QA Project Plan is implemented as prescribed.

Table 5. Assessments and Oversight Elements	
C1	**Assessments and Response Actions**
C2	**Reports to Management**

3.4.1 C1 – Assessments and Response Actions

The laboratory participates in an independent proficiency testing annually. In addition, laboratory personnel use quality control samples (with known concentrations), replicate data, and percent recovery to assess the quality of the data. If any of the quality assurance fails, steps are taken to troubleshoot and correct the situation to ensure that the data produced is accurate. Standards and reagents will be replaced, equipment will be checked, or other action will be taken to remedy the situation.

3.4.2 C2 – Reports to Management

Reports of performance evaluations and significant quality assurance problems and solutions are reported to the Inorganic QA Manager. The QA manager and Project manager are contacted via email of any problems in the laboratory and the timeline for remediation.

3.5 Group D: Data Validation and Usability

Table 6 addresses the QA activities that occur after the data collection is complete. Implementation of these elements determines whether or not the project objectives have been satisfied.

Table 6: Data Validation and Usability Elements	
D1	**Data Review, Verification, and Validation**
D2	**Verification and Validation Methods**
D3	**Reconciliation with User Requirements**

3.5.1 D1 – Data Review, Verification, and Validation

Data that falls below the Method Detection Limits are flagged as a K value. Data that falls between the Method Detection Limit and Laboratory Reporting Limit are flagged as a J-R value. Samples held past holding times, or if the data are suspect in any way are flagged with a J. This identifies them as an estimated value.

3.5.2 D2 – Verification and Validation Methods

The data is verified using the replicate data percent difference discussed in section B5. The data is validated using the QC data. The QC sample should fall between two standard deviations at the 95^{th} percentile confidence level to be valid.

3.5.3 D3 – Reconciliation with User Requirements

The data generated is compiled in a report describing the Estuarine and Coastal Water Quality of New Jersey.

References

1. APHA, AWWA, WEF, 1995. Standard Methods for the Examination of Water and Wastewater. 19th ed., Washington: American Public Health Association.

2. APHA,1979; 1984. Recommended Procedures for the Examination of Seawater and Shellfish, 4th and 5th editions, APHA, Washington, D.C.

3. NJDEP, 2014. Standard Operating Procedures Manual, Leeds Point Laboratory, Trenton: Water Monitoring and Standards, New Jersey Department of Environmental Protection

4. NJDEP. 2005. New Jersey Department of Environmental Protection, Field Sampling Procedures Manual, Trenton, NJ.

5. US EPA,2002. EPA QA/G8. Guidance on Environmental Data Verification and Data Validation, Environmental Protection Agency, Office of Environmental Information, Washington, D.C. United States

6. N.J.A.C. (New Jersey Administrative Code), Department of Environmental Protection. Chapter 7:12.

7. Parsons, Timothy R., 1985. A Manual of Chemical and Biological Methods for Seawater Analysis.