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

____________________  __________________
Roberta Schuster     Date
NJDEP Project Manager

____________________  __________________
Bill Hedendorf       Date
NJDEP Quality Assurance Manager

____________________  __________________
Eric Ernst           Date
NJDEP Inorganic QA Manager

____________________  __________________
Marc Ferko           Date
Table of Contents

GROUP A: PROJECT MANAGEMENT
3.2.1  A1 – Title and Approval Sheet  
3.2.2  A2 – Table of Contents  
3.2.3  A3 – Distribution List  
3.2.4  A4 – Project/Task Organization  
3.2.5  A5 – Problem Definition/Background  
3.2.6  A6 – Project/Task Description  
3.2.7  A7 – Quality Objectives and Criteria  
3.2.8  A8 – Special Training/Certification  
3.2.9  A9 – Documents and Records

GROUP B: DATA GENERATION AND ACQUISITION
3.3.1  B1 – Sampling Process Design  
3.3.2  B2 – Sampling Methods and Handling  
3.3.3  B3 – Analytical Methods  
3.3.4  B4 – Quality Control  
3.3.5  B5 – Instrument/Equipment Testing, Inspection, and Maintenance  
3.3.6  B6 – Instrument/Equipment Calibration and Frequency  
3.3.7  B7 – Inspection/Acceptance of Supplies and Consumables  
3.3.8  B8 – Non-Direct Measurements  
3.3.9  B9 – Data Management

GROUP C: ASSESSMENT AND OVERSIGHT
3.4.1  C1 – Assessments and Response Actions  
3.4.2  C2 – Reports to Management

GROUP D: DATA VALIDATION AND USABILITY
3.5.1  D1 – Data Review, Verification, and Validation  
3.5.2  D2 – Verification and Validation Methods  
3.5.3  D3 – Reconciliation with User Requirements

REFERENCES

FIGURES
1.  Sampling Stations for NJDEP Nutrient Monitoring Program

TABLES
1.  Project/Task Organization  
2.  Data Generation and Acquisition Elements  
3.  Sample Storage and Holding Times  
4.  Analytical Methodology  
5.  Assessments and Oversight Elements  
6.  Data Validation and Usability Elements

Revision 1  January 2017
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

Revision 1  January 2017
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 ± 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 ACQUISITION

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
### 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>
<thead>
<tr>
<th>Parameter</th>
<th>Preservation</th>
<th>Container Material</th>
<th>Holding Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alkalinity</td>
<td>P1</td>
<td>Std Meth 20ed</td>
<td>polyethylene</td>
</tr>
<tr>
<td>Biogenic Silica</td>
<td>P1</td>
<td>Unesco, 1981</td>
<td>polypropylene</td>
</tr>
<tr>
<td>NPOC</td>
<td>P2</td>
<td>Std Meth 18ed</td>
<td>polypropylene</td>
</tr>
<tr>
<td>Total Suspended Solids</td>
<td>P1</td>
<td>USEPA 1979</td>
<td>polyethylene</td>
</tr>
<tr>
<td>Chlorophyll a</td>
<td>P1</td>
<td>Std Meth 20ed</td>
<td>opaque</td>
</tr>
<tr>
<td>Ammonia</td>
<td>Phenol</td>
<td>Parsons 1985</td>
<td>polypropylene</td>
</tr>
<tr>
<td>Nitrate/Nitrite</td>
<td>Freeze</td>
<td>Parsons 1985</td>
<td>polypropylene</td>
</tr>
<tr>
<td>Total Nitrogen</td>
<td>Freeze</td>
<td>Parsons 1985</td>
<td>polypropylene</td>
</tr>
<tr>
<td>Orthophosphate</td>
<td>Freeze</td>
<td>Parsons 1985</td>
<td>polypropylene</td>
</tr>
<tr>
<td>Total Phosphorus</td>
<td>Freeze</td>
<td>Parsons 1985</td>
<td>polypropylene</td>
</tr>
<tr>
<td>Parameter</td>
<td>Method</td>
<td>Measure Unit</td>
<td>Lower Reporting Limit</td>
</tr>
<tr>
<td>-----------------------</td>
<td>--------------</td>
<td>--------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>Enterococci</td>
<td>EPA 1600</td>
<td>#/100mL</td>
<td>1</td>
</tr>
<tr>
<td>Dissolved Oxygen</td>
<td>APHA 4500-OC</td>
<td>mg/L</td>
<td>1</td>
</tr>
<tr>
<td>Alkalinity</td>
<td>APHA 2320-B</td>
<td>mg/L</td>
<td>1</td>
</tr>
<tr>
<td>Ammonia</td>
<td>EPA 350.1</td>
<td>ug/L</td>
<td>10</td>
</tr>
<tr>
<td>Biogenic Silica</td>
<td>EPA 366.0</td>
<td>mg/L</td>
<td>0.1</td>
</tr>
<tr>
<td>Chlorophyll a</td>
<td>APHA 10200-H</td>
<td>ug/L</td>
<td>0.42</td>
</tr>
<tr>
<td>Nitrate + Nitrite</td>
<td>EPA 353.4</td>
<td>ug/L</td>
<td>10</td>
</tr>
<tr>
<td>Non-Purgeable Organic Carbon*</td>
<td>APHA 5310-B</td>
<td>mg/L</td>
<td>1</td>
</tr>
<tr>
<td>Orthophosphate</td>
<td>EPA 365.5</td>
<td>ug/L</td>
<td>5</td>
</tr>
<tr>
<td>Total Nitrogen</td>
<td>USGS I-4650-03</td>
<td>ug/L</td>
<td>100</td>
</tr>
<tr>
<td>Total Phosphorus</td>
<td>USGS I-4650-03</td>
<td>ug/L</td>
<td>10</td>
</tr>
<tr>
<td>Total Suspended Solids</td>
<td>USGS I-3765-85</td>
<td>mg/L</td>
<td>1</td>
</tr>
<tr>
<td>Turbidity</td>
<td>APHA 2130</td>
<td>NTU</td>
<td>1</td>
</tr>
</tbody>
</table>

*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, Orthophosphate, 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:

\[
\text{% Recovery} = \frac{\text{Ms} - (\text{Ms}/2)}{\text{Ts}} \times 100
\]

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).

\[
\text{RPD} = \left(\frac{\text{Absolute Value} (\text{R1} - \text{R2})}{\text{R3}}\right) \times 100
\]

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>
<thead>
<tr>
<th>Table 5. Assessments and Oversight Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
</tr>
<tr>
<td>C2</td>
</tr>
</tbody>
</table>

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>
<thead>
<tr>
<th>Table 6: Data Validation and Usability Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1 Data Review, Verification, and Validation</td>
</tr>
<tr>
<td>D2 Verification and Validation Methods</td>
</tr>
<tr>
<td>D3 Reconciliation with User Requirements</td>
</tr>
</tbody>
</table>

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 95th 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


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


