Barnegat Bay

Long Term Ambient Monitoring Program

New Jersey Department of Environmental Protection

Water Monitoring and Standards

June 2013
Revision 1, June 2014
QUALITY ASSURANCE SAMPLING PLAN
Barnegat Bay Watershed, WMA 13
Revision 1, June 2014

Project Officer:

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Water Monitoring and Standards

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Debra Waller, Research Scientist
Office of Quality Assurance
1. **Project Name**: Barnegat Bay Long Tcrm Ambient Monitoring Program

2. **Requesting Agency**: NJDEP, Water Monitoring and Standards

3. **Date of Project Requested**: June, 2013 (QAPP Revision 1 – June 2014)

4. **Date of Project Initiation**: July, 2013

5. **Project Officer**: Patricia Gardner, Director, WM&S

6. **Project Duration**: July 2013 thru June 2018

7. **Special Training Needs/Certification**

   This project utilizes the assistance of several partners to conduct sample collection and field analysis. Approval of project partners will be performed annually by the Office of Quality Assurance. The Project Officer (QQA) or designee will be responsible for facilitating any necessary training and the project approval process with QQA.

8. **Project Description**

8.1. **Background: Barnegat Bay Ambient Water Monitoring Project**

   On June 6, 2011, DEP and its partners launched a comprehensive ambient monitoring project that measured both water quality and water quantity in ways never done before in the Bay. The Department had enlisted numerous Partners, including local and county governments, State and Federal agencies, a science high school, a university and other organizations to assist the Department in sampling and sample analysis. Water quality was measured with grab samples taken at 12 streams which enter the Bay, as well as at 14 locations within the Bay. Water flow into the Bay was measured at 12 streams, and water flows into and out of the Bay at the three inlets from the Atlantic Ocean. Also, water circulation within the Bay was measured at 3 locations. Continuous monitoring (at select locations), intensive summer season monitoring, continuous temperature monitoring around the Oyster Creek facility, sediment monitoring and a survey to map the bottom of the Bay (i.e. bathymetric survey) was carried out. On a given sampling day, the Department and its Partners sampled water quality and measured flow at both stream and bay locations. The continuous and intensive monitoring components complemented the discrete sampling to capture the full range of daily, tidal and seasonal variations.

   The purpose of this study was to address the following objectives:

   1. Provide a more comprehensive assessment of the relevant water quality conditions throughout the Barnegat Bay both spatially and temporally;
2. Provide water quality and biomass data to better quantify biological productivity and its impact on dissolved oxygen (DO) concentrations in the Bay;
3. Estimate the nutrient loadings into the bay and establish boundary conditions for the significant tributaries to the bay;
4. Provide nutrient concentration and loading data needed to evaluate the effects of nutrient load reduction scenarios;
5. Provide an understanding of the physical factors affecting the bay water quality; such as the flushing rate, temperature, salinity and the depth of the bay. These factors play a major role in the physical, chemical and biological processes operating within the bay;
6. Collect data that captured daily and seasonal variability as well as variability between years;
7. Collect sufficient data (minimum 24 months) to develop water quality and hydrodynamics models;
8. Calibrate and validate modeling tools that can be used to direct water quality restoration of the bay.

This project was conducted in three phases, over a 2 year period, which included 3 intensive events. While the development of the water quality and hydrodynamics models continues, THE MONITORING PROJECT WAS SUCCESSFULLY CONCLUDED ON JUNE 30, 2013.

8.2 - Objective and Coverage: Barnegat Bay Long Term Ambient Monitoring Program

Building on the success of the completed monitoring project, the purpose of this new program is to monitor on-going quality of the bay and those tributaries with the most significant impacts/loadings to the bay, as well as different land uses. This monitoring program started on July 24, 2013.

The goals of the program are to:

1. Capture changes in water quality in the Barnegat Bay watershed over time.
2. Document changes in nutrient loadings to the Barnegat Bay watershed and its watershed resulting from the fertilizer legislation.
3. Document changes as a result of restoration actions taken as part of the Governor’s Comprehensive Plan, including actions guided by the water quality and hydrodynamics models under development, as well as other restoration actions.
4. Data will also be used for assessment purposes as part of the Integrated Water Quality Monitoring and Assessment Report process.
5. Superstorm Sandy: On October 25, 2012, Superstorm Sandy directly hit the New Jersey coast including Barnegat Bay. While the damage and some of the impacts are evident, it will be years before the full impact of the storm on the Bay are known. This long term monitoring program will help capture those changes that impact water quality over time.
6. To be able to better characterize the normal fluctuations in water quality so that we can have a better definition of the uncertainty surrounding any given water quality measurement.
7. To provide water quality data that can be referenced to the biological research, which is occurring concurrently.
8. Interpretation of the narrative nutrient criteria requires water quality data to be collected at the same time as biological studies.
Sampling Network and Design Rationale

9.1 Station Selection

The stations included within Barnegat Bay Long Term Ambient Monitoring Program overlap with, but are not identical to those sampled by Barnegat Bay Ambient Water Monitoring Project. The station selection rationale was:

1. Major tributary stations where the major tributary loads come into the Bay.
2. Station BT 07 – NB Forked River, in the vicinity of the Oyster Creek Nuclear Generating Station. During the monitoring project, intensive monitoring was conducted in the vicinity of the Oyster Creek Plant to assure that the model being built can appropriately simulate the conditions pre- and post- plant closure. For the long term monitoring program BT 07 was included to keep a station in that area.
3. Tributary monitoring stations with long term historic records and located in the upper watershed were included in this network to track changes and for potential trend analysis. (During 2011-2013 sampling, tributary stations were selected at closest to the Head of Tide as possible with the goal to quantify the loading from the tributary to the Bay).
4. An analysis of the 2011-2013 data indicates some similarity among the data collected from different in-bay stations. For the long term monitoring program 9 out of 15 in-bay stations were selected as representative.
5. Four in-bay stations that have long-term historic records were included in this network to track changes and for potential trend analysis.

9.2 Continuous in-situ water quality monitoring

Continuous monitoring multi-parameter probes will be deployed at the monitoring sites in the Barnegat Bay. Table 1 specifies the list of parameters, frequency of collection and the number of sites for each phase of sampling. Figure 1 shows the location of all of the sampling sites.
Table 1: Continuous Monitoring Plan: Monitoring Parameters and Frequency of Collection

<table>
<thead>
<tr>
<th>Continuous Monitoring Plan¹</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Bay</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sampling Stations</strong></td>
</tr>
<tr>
<td>-----------------------</td>
</tr>
<tr>
<td>4 buoy locations and 1 fixed station, as identified in Table 2 and Figure 1 below⁵</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tributary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sampling Stations</strong></td>
</tr>
<tr>
<td>-----------------------</td>
</tr>
<tr>
<td>Toms River near Toms River (USGS 01408500)</td>
</tr>
</tbody>
</table>

¹Separate QAPPs have been developed for the Department’s continuous monitoring efforts.
²Sampling sites where depth is greater than 12 feet, two samples will be taken at 1/3 and 2/3 depth.
³Salinity to be calculated from conductivity.
⁴Requires the use of a NJ Certified laboratory.
⁵One buoy station BB10 located in Manahawkin Bay is identified only in Figure 1, not Table 2, its coordinates are: - 74.206530 longitude and 39.660950 latitude.
Table 2: List of monitoring sites within the Barnegat Bay

<table>
<thead>
<tr>
<th>Station ID</th>
<th>Site Description</th>
<th>Type: Grab/Buoy/Fixed</th>
<th>Longitude</th>
<th>Latitude</th>
<th>Site Reference ID</th>
<th>Site Partner</th>
</tr>
</thead>
<tbody>
<tr>
<td>BB01 (1605A)</td>
<td>Barnegat Bay at Mantoloking</td>
<td>G,F</td>
<td>-74.054320</td>
<td>40.03820</td>
<td>USGS-01408168</td>
<td>DEP-Leeds Pt.</td>
</tr>
<tr>
<td>BB03 (1629B)</td>
<td>Barnegat Bay by Route 37 Bridge</td>
<td>G</td>
<td>-74.101530</td>
<td>39.9481700</td>
<td>BMWM1629B</td>
<td>DEP-Leeds Pt.</td>
</tr>
<tr>
<td>BB04a</td>
<td>Barnegat Bay near the Mouth of Toms River</td>
<td>G,B</td>
<td>-74.14069</td>
<td>39.93289</td>
<td>BMWM1502A</td>
<td>DEP-Leeds Pt.</td>
</tr>
<tr>
<td>BB06</td>
<td>Barnegat Bay below Cedar Creek and above Forked River</td>
<td>G</td>
<td>-74.102080</td>
<td>39.852600</td>
<td>BMWM1651D</td>
<td>DEP-Leeds Pt.</td>
</tr>
<tr>
<td>BB07a</td>
<td>Barnegat Bay below Oyster Creek and above Barnegat Inlet</td>
<td>G,B</td>
<td>-74.157172</td>
<td>39.801261</td>
<td>DEPMODELSITE</td>
<td>DEP-Leeds Pt.</td>
</tr>
<tr>
<td>1661F</td>
<td>Barnegat Bay at Station 1661F</td>
<td>G</td>
<td>-74.1018</td>
<td>39.80984</td>
<td>BMWM1661F</td>
<td>DEP-Leeds Pt.</td>
</tr>
<tr>
<td>BB09 (1674B)</td>
<td>Barnegat Bay below Barnegat Inlet and close to Long Beach</td>
<td>G,F</td>
<td>-74.147920</td>
<td>39.742600</td>
<td>BMWM1674B</td>
<td>DEP-Leeds Pt.</td>
</tr>
<tr>
<td>1712</td>
<td>Manahawkin Bay at Station 1712</td>
<td>G</td>
<td>-74.2701</td>
<td>39.61679</td>
<td>BMWM1712</td>
<td>DEP-Leeds Pt.</td>
</tr>
</tbody>
</table>

9.3-Grab Water Quality Sampling
Grab samples will be collected at the Barnegat Bay locations listed on Table 2 and at tributary sites listed on Table 5. Locations are shown in Figure 1. The proposed frequency varies by season and is listed in Table 3. Samples will be collected in accordance with approved field sampling procedures and analyzed by a certified laboratory. The water quality parameters to be sampled are those listed in Table 3. The sampling
schedule through June 2015 is included in Appendix D. DEP staff will notify partners of any weather related sampling cancellations and rescheduling. This QAPP will be modified annually to include an updated sampling schedule.

All water quality grab samples will be collected following procedures found in “NJDEP Field Sampling Procedures Manual, August 2005”. Sampling locations have been marked and verified with GPS. In addition NJDEP staff and project partners will utilize detailed site sketches to locate the sampling location on the first and subsequent visits. The freshwater tributary locations samples will be collected as center of flow grab samples. At tributary locations greater than 20 ft. wide specific conductance measurements were made along a transect and it was determined that at all locations the stream is well mixed and that a center of flow grab sample would be representative of the water quality at that location. Because the water depth at the tributary monitoring locations is never greater than 12 ft., samples will be collected at a depth of 1 ft. If the water depth is less than 1 foot, samples will be collected at mid-water level. Bay water quality samples will be taken as surface grab samples. All tributary samples not filtered in the field, will be transported to the BMWM Leeds Point Laboratory for filtration as reflected in Table 4 and Figures 2-3.

All sample containers are being supplied by the DEP and only these sample containers can be used for the project. All sample containers must be transported on ice in coolers to preserve the integrity of the samples and maintain sample temperature at greater then freezing and less than 6°C. Necessary preservatives will be added at the Bureau of Marine Water Monitoring (BMWM) Leeds Point Laboratory, except those stations sampled and processed in the field by Bureau of Freshwater and Biological Monitoring (BFBM) Staff.

Field Parameters
Field parameters, pH (Electronic SM 4500-H B-11), water temperature (Thermometric SM 2550B), dissolved oxygen (Electronic SM 4500-O G-11) and specific conductance (Wheatstone Bridge, SM 2510 B-11), will be measured on site. Collected turbidity samples will be measured at a project field station by staff certified for turbidity measurements. Sample filtration for tributary stations only for dissolved parameters will be conducted by BFBM staff in the field or BMWM staff at the Leeds Point Laboratory. At each sampling location, parameters requiring immediate analysis (i.e. pH, specific conductance, salinity (calculated from specific conductance), and dissolved oxygen,) will be taken using handheld meters or multi parameter sensors. The turbidity sample may be as a field measurement from the meter by BFBM staff or at the BMWM Leeds Point Laboratory.
<table>
<thead>
<tr>
<th>Parameters</th>
<th>Lab</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Suspended Solids (TSS)</td>
<td>Leeds Point</td>
<td>Bay</td>
</tr>
<tr>
<td>Chlorophyll-a (w/species ID)</td>
<td>Leeds Point</td>
<td>Tributaries</td>
</tr>
<tr>
<td>Total Nitrogen (TN)</td>
<td>Leeds Point</td>
<td></td>
</tr>
<tr>
<td>Dissolved Total N</td>
<td>Leeds Point</td>
<td></td>
</tr>
<tr>
<td>Dissolved Ammonia</td>
<td>Leeds Point</td>
<td></td>
</tr>
<tr>
<td>Dissolved Nitrate+Nitrite</td>
<td>Leeds Point</td>
<td></td>
</tr>
<tr>
<td>Total Phosphorus (TP)</td>
<td>Leeds Point</td>
<td></td>
</tr>
<tr>
<td>Dissolved Total Phosphorus</td>
<td>Leeds Point</td>
<td></td>
</tr>
<tr>
<td>Dissolved Ortho-P</td>
<td>Leeds Point</td>
<td></td>
</tr>
<tr>
<td>Total Organic Carbon (TOC)</td>
<td>Leeds Point</td>
<td></td>
</tr>
<tr>
<td>Dissolved Organic Carbon</td>
<td>Leeds Point</td>
<td></td>
</tr>
<tr>
<td>Dissolved Inorganic Carbon</td>
<td>Leeds Point</td>
<td></td>
</tr>
<tr>
<td>Alkalinity</td>
<td>Leeds Point</td>
<td></td>
</tr>
<tr>
<td>Biogenic Si**</td>
<td>Leeds Point</td>
<td></td>
</tr>
<tr>
<td>Turbidity</td>
<td>Leeds/BFBM</td>
<td></td>
</tr>
<tr>
<td>Secchi depth</td>
<td>Field</td>
<td></td>
</tr>
<tr>
<td>Transmissometry</td>
<td>Field</td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>Field</td>
<td></td>
</tr>
<tr>
<td>Dissolved Oxygen (DO)</td>
<td>Field</td>
<td></td>
</tr>
<tr>
<td>DO Saturation</td>
<td>Field</td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td>Field</td>
<td></td>
</tr>
<tr>
<td>Conductivity (Salinity)</td>
<td>Field</td>
<td></td>
</tr>
</tbody>
</table>

* Need for second sampling event in April or May dependent on arrival of spring conditions

** Samples will be filtered for Biogenic Silica by the testing laboratory

Locations are identified in Tables 2 and 5.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Prep</th>
<th>Code</th>
<th>Method</th>
<th>Container</th>
<th>Preservative</th>
<th>Holding Time</th>
<th>Bottle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turbidity</td>
<td>FwSw</td>
<td>U</td>
<td>Turb</td>
<td>SM 2130 B-11</td>
<td>50 mL centrifuge tube</td>
<td>Ice, 4°C</td>
<td>48 hours</td>
</tr>
<tr>
<td>Total Suspended Solids</td>
<td>FwSw</td>
<td>U</td>
<td>TSS</td>
<td>USGS I-3765-85</td>
<td>Amber 500 mL HDPE</td>
<td>Ice, 4°C</td>
<td>24 hours</td>
</tr>
<tr>
<td>Chlorophyll a (bay only)</td>
<td>Sw</td>
<td>U</td>
<td>Chla</td>
<td>SM 10200-H1+2</td>
<td>Amber 500 mL HDPE</td>
<td>Ice, 4°C</td>
<td>24 hours</td>
</tr>
<tr>
<td>Total Nitrogen</td>
<td>FwSw</td>
<td>U</td>
<td>TN</td>
<td>USGS I-4650-03</td>
<td>50 mL centrifuge tubes</td>
<td>Ice, 4°C</td>
<td>28 days</td>
</tr>
<tr>
<td>Total Phosphorus</td>
<td>FwSw</td>
<td>U</td>
<td>TP</td>
<td>USGS I-4650-03</td>
<td>50 mL centrifuge tubes</td>
<td>Ice, 4°C</td>
<td>28 days</td>
</tr>
<tr>
<td>Dissolved Ammonia</td>
<td>FwSw</td>
<td>F</td>
<td>DNH3</td>
<td>350.1 MOD</td>
<td>50 mL centrifuge tubes</td>
<td>2 ml 3.5% Phenol</td>
<td>14 days</td>
</tr>
<tr>
<td>Dissolved Nitrite + Nitrate</td>
<td>FwSw</td>
<td>F</td>
<td>DNO3</td>
<td>EPA 353.4</td>
<td>50 mL centrifuge tubes</td>
<td>Ice, 4°C</td>
<td>28 days</td>
</tr>
<tr>
<td>Dissolved Orthophosphate</td>
<td>FwSw</td>
<td>F</td>
<td>DPO4</td>
<td>EPA 365.5</td>
<td>50 mL centrifuge tubes</td>
<td>Ice, 4°C</td>
<td>28 days</td>
</tr>
<tr>
<td>Dissolved Nitrogen</td>
<td>FwSw</td>
<td>F</td>
<td>DN</td>
<td>USGS I-4650-03</td>
<td>50 mL centrifuge tubes</td>
<td>Ice, 4°C</td>
<td>28 days</td>
</tr>
<tr>
<td>Dissolved Phosphorus</td>
<td>FwSw</td>
<td>F</td>
<td>DP</td>
<td>USGS I-4650-03</td>
<td>50 mL centrifuge tubes</td>
<td>Ice, 4°C</td>
<td>28 days</td>
</tr>
<tr>
<td>Total Organic Nitrogen</td>
<td>FwSw</td>
<td>NA</td>
<td>TON</td>
<td>Calculated</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Dissolved Organic Nitrogen</td>
<td>FwSw</td>
<td>NA</td>
<td>DON</td>
<td>Calculated</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Dissolved Organic Phosphorus</td>
<td>FwSw</td>
<td>NA</td>
<td>DOP</td>
<td>Calculated</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Particulate Organic Nitrogen</td>
<td>FwSw</td>
<td>NA</td>
<td>PON</td>
<td>Calculated</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Particulate Phosphorus</td>
<td>FwSw</td>
<td>NA</td>
<td>PP</td>
<td>Calculated</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Dissolved Organic Carbon</td>
<td>Sw</td>
<td>F</td>
<td>DOC</td>
<td>SM 5310 C-11</td>
<td>Glass, 250ml</td>
<td>Conc. H2SO4, pH&lt;2</td>
<td>28 days</td>
</tr>
<tr>
<td>Total Organic Carbon</td>
<td>Fw</td>
<td>F</td>
<td>DOC</td>
<td>SM 5310 C-11</td>
<td>250 mL HDPE</td>
<td>Conc. H2SO4, pH&lt;2</td>
<td>28 days</td>
</tr>
<tr>
<td>Alkalinity</td>
<td>FwSw</td>
<td>U</td>
<td>Alk</td>
<td>SM 2320 B-11</td>
<td>250 mL HDPE</td>
<td>Ice, 4°C</td>
<td>14 days</td>
</tr>
<tr>
<td>Biogenic Silica</td>
<td>FwSw</td>
<td>U</td>
<td>Si</td>
<td>EPA 360.0 MOD</td>
<td>125 mL HDPE</td>
<td>Ice, 4°C</td>
<td>6 months</td>
</tr>
</tbody>
</table>

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Table 5: Tributary Sampling Locations

<table>
<thead>
<tr>
<th>Station ID</th>
<th>Site #</th>
<th>Description</th>
<th>LATITUDE</th>
<th>LONGITUDE</th>
<th>Flow-Measurement Type</th>
<th>Flow Site Partner</th>
<th>Water Quality Site Partner</th>
</tr>
</thead>
<tbody>
<tr>
<td>01408100*</td>
<td></td>
<td>North Branch Metedeconk River at Lakewood</td>
<td>40.109722</td>
<td>-74.219167</td>
<td>NA staff gage present</td>
<td>NA</td>
<td>NJDEP/BFBM</td>
</tr>
<tr>
<td>USGS-01408123</td>
<td>BT01</td>
<td>North Branch Metedeconk R near Laurelton</td>
<td>40.081648</td>
<td>-74.151811</td>
<td>Extrapolate from existing gage</td>
<td>NA</td>
<td>Brick MUA</td>
</tr>
<tr>
<td>USGS-01408152</td>
<td>BT02</td>
<td>SB Metedeconk River near Laurelton (Chambers Bridge Rd)</td>
<td>40.078763</td>
<td>-74.156729</td>
<td>Gage (see Table 6)</td>
<td>USGS</td>
<td>Brick MUA</td>
</tr>
<tr>
<td>01408136**</td>
<td></td>
<td>South Branch Metedeconk River at Bennetts Mills</td>
<td>40.126667</td>
<td>-74.277778</td>
<td>NA</td>
<td>NA</td>
<td>NJDEP/BFBM</td>
</tr>
<tr>
<td>01408260**</td>
<td></td>
<td>Toms River near Van Hiseville</td>
<td>40.109722</td>
<td>-74.373611</td>
<td>NA</td>
<td>NA</td>
<td>NJDEP/BFBM</td>
</tr>
<tr>
<td>01408492**</td>
<td></td>
<td>Ridgeway Brook at Route 70 near Lakelhurst</td>
<td>40.020833</td>
<td>-74.273611</td>
<td>NA</td>
<td>NA</td>
<td>NJDEP/BFBM</td>
</tr>
<tr>
<td>USGS-01408505*</td>
<td>BT03</td>
<td>Toms River near Toms River</td>
<td>39.976389</td>
<td>-74.218333</td>
<td>Gage</td>
<td>USGS</td>
<td>NJDEP/BFBM</td>
</tr>
<tr>
<td>USGS-01408640</td>
<td>BT04</td>
<td>Wrangle Brook near South Toms River</td>
<td>39.952854</td>
<td>-74.218515</td>
<td>Measure</td>
<td>NJDEP/BFBM</td>
<td>NJDEP/BFBM</td>
</tr>
<tr>
<td>01408830*</td>
<td></td>
<td>Cedar Creek upstream at Cedar Crest</td>
<td>39.897222</td>
<td>-74.316389</td>
<td>NA* staff gage present</td>
<td>NA</td>
<td>NJDEP/BFBM</td>
</tr>
<tr>
<td>USGS-01408950</td>
<td>BT06a</td>
<td>Cedar Creek at RR</td>
<td>39.871111</td>
<td>-74.173889</td>
<td>Gage1</td>
<td>USGS</td>
<td>MATES</td>
</tr>
<tr>
<td>USGS-01409055</td>
<td>BT07</td>
<td>NB Forked R at Forked River</td>
<td>39.836035</td>
<td>-74.196013</td>
<td>Measure</td>
<td>NJDEP/BFBM</td>
<td>MATES</td>
</tr>
<tr>
<td>BFBM000167</td>
<td>BT10</td>
<td>Oyster Creek (upstream Rt 9 @ JCPL)</td>
<td>39.810584</td>
<td>-74.204626</td>
<td>Gage</td>
<td>USGS</td>
<td>NJDEP/BFBM</td>
</tr>
<tr>
<td>USGS-01409210</td>
<td>BT11</td>
<td>Mill Ck at Manahawkin (Bay Avenue)</td>
<td>39.695405</td>
<td>-74.259527</td>
<td>Gage (new)</td>
<td>USGS</td>
<td>BBP</td>
</tr>
<tr>
<td>USGS-01409281</td>
<td>BT12</td>
<td>Westecunk Ck at Railroad Ave at West Ck</td>
<td>39.640297</td>
<td>-74.30797</td>
<td>Extrapolate from upstream gage USGS-01409280</td>
<td>USGS</td>
<td>BBP</td>
</tr>
</tbody>
</table>

*is also sampled as part of the Ambient Surface Water Quality Monitoring Network

**is also sampled as part of the Supplemental Ambient Surface Water Quality Monitoring Network

Revision 1, June 2014
9.4 - Flow monitoring

The locations of existing gages are presented in Table 6 and shown in Figure 1. At selected tributary locations where gages are absent, flow will be measured using hand held equipment such as SONTek Flow Tracker (or equivalent). Flow measurement SOP is available in Flow Tracker Handheld ADV User’s Manual (SonTek/YSI 2009 FlowTracker Handheld ADV User’s Manual Firmware Version 3.7). References are available online at http://pubs.er.usgs.gov/usgspubs/sir/sir20055183 and http://pubs.er.usgs.gov/usgspubs/fs/fs20083096.

Table 6: Gauging Stations*

<table>
<thead>
<tr>
<th>Station Description</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Westecunk Creek at Stafford Forge NJ</td>
<td>39.666667</td>
<td>-74.320278</td>
<td>Tributary</td>
</tr>
<tr>
<td>Cedar Creek at RR</td>
<td>39.87917</td>
<td>-74.1906</td>
<td>Tributary</td>
</tr>
<tr>
<td>North Branch Metedeconk River near Lakewood NJ</td>
<td>40.091667</td>
<td>-74.1525</td>
<td>Tributary</td>
</tr>
<tr>
<td>Point Pleasant Canal at Point Pleasant, NJ</td>
<td>40.070278</td>
<td>-74.059722</td>
<td>Outlet/Inlet</td>
</tr>
<tr>
<td>Barnegat Bay at Mantoloking Bridge at Mantoloking</td>
<td>40.04</td>
<td>-74.057222</td>
<td>In Bay</td>
</tr>
<tr>
<td>Barnegat Bay at Route 37 Bridge near Bay Shore,</td>
<td>39.946111</td>
<td>-74.103056</td>
<td>In Bay</td>
</tr>
<tr>
<td>Barnegat Inlet at Barnegat Light, NJ</td>
<td>39.766389</td>
<td>-74.099167</td>
<td>Outlet/Inlet</td>
</tr>
<tr>
<td>Barnegat Bay at Route 72 Bridge near Ship Bottom</td>
<td>39.663333</td>
<td>-74.206944</td>
<td>In Bay</td>
</tr>
<tr>
<td>Little Egg Harbor Inlet near Beach Haven Heights</td>
<td>39.5075</td>
<td>-74.3075</td>
<td>Outlet/Inlet</td>
</tr>
<tr>
<td>Oyster Creek near Brookville, NJ</td>
<td>39.798333</td>
<td>-74.250556</td>
<td>Tributary</td>
</tr>
<tr>
<td>S.B. Metedeconk River at New Hampshire Ave. near Lakewood, NJ</td>
<td>40.083055</td>
<td>-74.179722</td>
<td>Tributary</td>
</tr>
<tr>
<td>Mill Creek at Manahawkin, NJ</td>
<td>39.695278</td>
<td>-74.26</td>
<td>Tributary</td>
</tr>
</tbody>
</table>

* NOTE: Maintaining all of the existing gauging stations over the entire project term will depend on the availability of continuing funding.
10. Data Usage
Water quality data sampled under this project will be used to assess water quality and other purposes discussed in Section 8.2. All sampling procedures must be in conformance with NJDEP or USGS (URL http://water.usgs.gov/owq/FieldManual/index.html) field sampling procedures as well as other applicable guidance. If a method or procedure requires change and is not contained in Table 3 and Table 4, this information must be brought to the attention of the signatories of this QAPP in writing and needs approval prior to being used. Data sampled outside of this project plan which have been collected under an approved QAPP and analyzed in a New Jersey certified laboratory may also be utilized.

11. Reports and Data Storage
Data will be stored locally in electronic format (MS Access). All raw data records shall be maintained for a period of no less than five years. All water quality data collected, locations of final sampling sites, and related field notes should be entered in the New Jersey Water Quality Data Exchange (WQDE) and USEPA STORET Data Warehouse. Data quality assurance reviews will be by BMWM staff using protocols found in USGS open file Report 02-383 “Methods for Quality Assurance Review of Water Quality Data in New Jersey”. In addition to WQDE and USEPA STORET, data is also available by clicking on a station on the Barnegat Bay Interactive Map found on the DEP website at http://www.nj.gov/dep/barnegatbay/bbmapviewer.htm.

12. Project area
Watershed project area covered under this program is the Barnegat Bay Watershed in WMA 13 (see Figure 1 for the spatial extent of the study). The GIS map provided identifies bay and tributary water quality station locations, gauging station locations and the watershed boundary.

13. Data Representativeness
The same methods and techniques will be used by all field collection staff, except that sample filtration in the field will only be performed by BFWM staff. Technical assessments in the field and laboratory audits performed by NJDEP’s Office of Quality Assurance will ensure that all samples are collected and analyzed per the QAPP. Any deviations from the QAPP will be documented and will be resolved prior to the next sampling event.

14. Data Validation
Method blank (lab), equipment blank, duplicate, and replicate samples will add approximately 10 percent more to the total number of samples collected. The sample data is validated using the QC data. The QC sample must fall between two standard deviations at the 95th percentile confidence level to be valid. All laboratory and field spikes must be within 80-120%. Water quality results will be assessed against available, historical water quality data from the locations monitored. Data will also be assessed using USGS Open-File Report 02-383 “Methods for Quality Assurance Review of Water-Quality Data in New Jersey “. That report provides information on standard ranges of specific parameters in New Jersey streams and standard relationships between specific parameters. All data collected will be provided to NJDEP and BMWM staff will perform the data validation process. Data that cannot be confirmed by these reviews or explained by circumstances (i.e. heavy rain, drought) or project QA data will be classified as questionable by NJDEP. In addition, quality
assurance protocols will be used by BMWM staff for the data validations under the supervision of a quality assurance officer.

15. Data Quality Requirements

Continuous Data Quality
Data recorders are calibrated and programmed within 24 hours of each deployment following the manufacturer’s manual. Duplicate DO measurements are made at the time of meter deployment and meter retrieval with a second meter, calibrated on site. Comparative DO readings not within the stated accuracy of the meters used will be reviewed against historical water quality data from that site as an additional quality review step. Data outside the stated accuracy of the meters used in the comparative readings and outside the historical range for DO at that location will not be used. At each sampling event, water quality grab samples will be taken at the location of the continuous meters and analyzed for the parameters listed in Table 4. This data will be utilized to validate the data collected by the continuous meters.

Field Quality Assurance and Quality Control
NJDEP and Partner group’s field staff will be approved by DEP’s Office of Quality Assurance for field measurements, which include: specific conductance (Wheatstone Bridge, SM 2510 B-11), dissolved oxygen (electronic SM 4500-O G-11), pH (Electronic SM 4500-H B-11) and temperature (Thermometric SM 2550B). Program staff will follow manufacturer’s manuals regarding calibration and operating procedures for specific meters. Results of daily pH calibrations, DO air calibrations and specific conductance calibrations will be recorded on field calibration forms. Quarterly temperature ASTM-QC checks and weekly Winkler DO checks are also recorded. Turbidity samples may be as a field measurement using the meter by BFWM staff or will be analyzed at the Leeds Point Laboratory by BMWM staff who are certified for the measurement of turbidity (Nephelometric, SM 2130 B-11). The marine sample field quality control will consist of analyzing in the laboratory, the remaining sample not used for filtration for salinity; in addition, a dissolved oxygen Winkler titration sample will be collected at the time of sample collection and preserved immediately with manganous sulfate and alkaline-iodide-azide solutions. This data will be used to validate the data collected by the sondes in the field. The Winkler titration sample must be protected from the intrusion of atmospheric oxygen and needs to be analyzed prior to the validation for the salinity.

The BMWM Leeds Point Laboratory is certified to perform the parameters conducted for ambient water quality monitoring and will follow the Laboratory methods as outlined in Table 7. Any changes to the methods used must be pre-approved by the DEP before sample testing continues. Quality control procedures (including required calibrations and quality control procedures required by regulation or by the method) shall be defined in the laboratory’s Quality Manual (QM) or Standard Operating Procedures (SOPs). The QM and SOPs must be approved by the OQA

The field meters or multi parameter meters will be calibrated using manufacturer specifications and the OQA requirements for accuracy and precision. Calibration and verification will be performed with the following:

Temperature
Temperature thermistors are factory calibrated. Thermistors must be checked against a National Institute of Standards and Technology (NIST)-certified/traceable thermometer on a quarterly basis. If not found to be accurate within + 0.5 °C of the certified thermometer an offset value will be applied to correct the reading or if drift is continuing to take place sonde/sensor will be replaced. Any change will be noted in the calibration log and will be applied to all temperature measurements. Temperature units will be
degrees Celsius (°C). On June 26 and 27, 2014, the temperature monitoring devices were calibrated by DEP personnel against a NIST certified thermometer. This calibration must be repeated quarterly thereafter through the duration of the program. Duplicate testing is required once every 20 samples tested.

**Salinity/Specific Conductance**
Specific conductance is calibrated using a factory prepared conductivity standard with a value of 50 mS/cm or a 35 ppt salinity standard for the marine samples and 1.412 mS/cm for the fresh water locations, although alternative mS/cm solutions can be utilized as long as they are in the range of expected sample results. Specific conductance units will be mS/cm, Salinity will be expressed in parts per thousand (ppt). For sonde/sensor verification, another standard from a different source will be analyzed. The calibration must be checked in the measure mode with a standard. The required accuracy is that the calibration check data must be within 1% of the true value of the standard used to be acceptable for analysis. Duplicate testing is required once every 20 samples tested.

**Dissolved Oxygen**
Calibration of a dissolved oxygen (DO) meter at 100 percent oxygen saturation is made by adjusting the meter reading for air saturated with water vapor, as per the manufacturer’s instructions. Sonde/Sensors will record both DO milligrams/liter (mg/l) and DO percent saturation (%). Samples for the Winkler titration will be collected at the marine water sites for sonde/sensor verification. Each week of use the DO meter must be verified against a Winkler titration procedure. The accuracy required between the reading from the DO meter and the results of the Winkler test must be within +/- 0.3 mg/L of each other to be acceptable. Duplicate testing is required once every 20 samples tested.

**pH**
Most multi-meters require the use of a three point calibration with 4, 7 and 10 pH buffers. A three point calibration is the preferred approach to a quality calibration. All calibrations must meet the accuracy requirement of being within 0.05 s.u. of the true value of the buffer used to be considered acceptable. A two point calibration can be performed using 7 and 10 buffers for the marine locations and 4 and 7 buffers for the fresh water locations as long as a calibration check (with the instrument in the measure mode) is conducted with the second of the two buffers used for calibration (i.e., 10 buffer for the marine and 7 buffer for the freshwater). The required calibration check result must be within 0.10 s.u. of the true value of the buffer used. Every three hours of use the meter must be checked with the calibration check buffer and must be accurate to 0.2 s.u. of the true value to be considered acceptable for continued use. The field staff may also recalculate the meter at each site as an alternative to the three hour calibration check requirement. All readings for pH must be made in standard units. Duplicate testing is required once every 20 samples tested. Millivolt readings are also taken as a check of probe performance. For sonde/sensor verification, another certified pH buffer from a different source will be analyzed.

**Turbidity**
Turbidity samples will be analyzed in the field or at the Leeds Point Laboratory using a Hach model 2100P turbidimeter. Calibration of the turbidity meter will be accomplished by a 4 point method using HACH produced microbead synthetic turbidity primary standards every 3 months. The calibration is checked against HACH Gelox secondary standards and deionized water (0NTU) each day of use. Turbidity units will be (NTU). Duplicate testing is required once every 20 samples tested. A formazin standard or a standard from a different source will be analyzed for sonde/sensor verification.
Filtration Quality Control

Filtration quality control will consist of analyzing a filtration blank, that will be deionized water run through the pump tubes and the filter, preserved and analyzed as the other nutrient samples, prior to the filtration of samples. Between each sample, the pump tubes will be flushed with a cycle of deionized water/ 10% HCl/ deionized water. The filtration blank will be repeated after roughly half (13 samples) and at the end of the processing of 27 samples. This will ensure the validity of the data and the pump cleansing process. In addition, 2 filtration spikes and replicates will be performed for each sample run. The spike will consist of adding a known amount of analyte to a volume of sample, and the sample will be filtered and processed as the other samples, the spike will ensure that there are no interferences, loss of analyte or contamination of the sample. Filtrations must be performed within 8 hours of sample collection or sooner and the time of filtration will be documented in the laboratory records or on the chain of custody form for the project.

<table>
<thead>
<tr>
<th>Lab</th>
<th>Parameter</th>
<th>Prep</th>
<th>Code</th>
<th>Lab Reporting Limit</th>
<th>Method</th>
<th>Holding Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leeds Point</td>
<td>Turbidity</td>
<td>FwSw</td>
<td>U</td>
<td>Turb 0.1 NTU</td>
<td>SM 2130 B-11</td>
<td>48 hours</td>
</tr>
<tr>
<td>Leeds Point</td>
<td>Total Suspended Solids</td>
<td>FwSw</td>
<td>U</td>
<td>TSS 1.0 mg/l</td>
<td>USGS I-3765-85</td>
<td>24 hours</td>
</tr>
<tr>
<td>Leeds Point</td>
<td>Chlorophyll a (bay only)</td>
<td>Sw</td>
<td>U</td>
<td>Chla 0.42 ug/l</td>
<td>SM 10200-H1+2</td>
<td>24 hours</td>
</tr>
<tr>
<td>Leeds Point</td>
<td>Total Nitrogen</td>
<td>FwSw</td>
<td>U</td>
<td>TN 0.1 mg/l</td>
<td>USGS I-4650-03</td>
<td>28 days</td>
</tr>
<tr>
<td>Leeds Point</td>
<td>Total Phosphorus</td>
<td>FwSw</td>
<td>U</td>
<td>TP 0.010 mg/l</td>
<td>USGS I-4650-03</td>
<td>28 days</td>
</tr>
<tr>
<td>Leeds Point</td>
<td>Dissolved Ammonia</td>
<td>FwSw</td>
<td>F</td>
<td>DNH3 0.025 mg/l</td>
<td>350.1 MOD</td>
<td>14 days</td>
</tr>
<tr>
<td>Leeds Point</td>
<td>Dissolved Nitrite + Nitrate</td>
<td>FwSw</td>
<td>F</td>
<td>DNO3 0.025 mg/l</td>
<td>EPA 353.4</td>
<td>28 days</td>
</tr>
<tr>
<td>Leeds Point</td>
<td>Dissolved Orthophosphate</td>
<td>FwSw</td>
<td>F</td>
<td>DPO4 0.005 mg/l</td>
<td>EPA 365.5</td>
<td>28 days</td>
</tr>
<tr>
<td>Leeds Point</td>
<td>Dissolved Nitrogen</td>
<td>FwSw</td>
<td>F</td>
<td>DN 0.1 mg/l</td>
<td>USGS I-4650-03</td>
<td>28 days</td>
</tr>
<tr>
<td>Leeds Point</td>
<td>Dissolved Phosphorus</td>
<td>FwSw</td>
<td>F</td>
<td>DP 0.010 mg/l</td>
<td>USGS I-4650-03</td>
<td>28 days</td>
</tr>
<tr>
<td>Leeds Point</td>
<td>Total Organic Nitrogen</td>
<td>FwSw</td>
<td>NA</td>
<td>TON NA</td>
<td>Calculated</td>
<td>NA</td>
</tr>
<tr>
<td>Leeds Point</td>
<td>Dissolved Organic Nitrogen</td>
<td>FwSw</td>
<td>NA</td>
<td>DON NA</td>
<td>Calculated</td>
<td>NA</td>
</tr>
<tr>
<td>Leeds Point</td>
<td>Dissolved Organic Phosphorus</td>
<td>FwSw</td>
<td>NA</td>
<td>DOP NA</td>
<td>Calculated</td>
<td>NA</td>
</tr>
<tr>
<td>Leeds Point</td>
<td>Particulate Organic Nitrogen</td>
<td>FwSw</td>
<td>NA</td>
<td>PON NA</td>
<td>Calculated</td>
<td>NA</td>
</tr>
<tr>
<td>Leeds Point</td>
<td>Particulate Phosphorus</td>
<td>FwSw</td>
<td>NA</td>
<td>PP NA</td>
<td>Calculated</td>
<td>NA</td>
</tr>
<tr>
<td>Leeds Point</td>
<td>Alkalinity</td>
<td>FwSw</td>
<td>U</td>
<td>Alk 1.0 mg/l</td>
<td>SM 2320 B-11</td>
<td>14 days</td>
</tr>
<tr>
<td>Leeds Point</td>
<td>Biogenic Silica</td>
<td>FwSw</td>
<td>U</td>
<td>Si 0.05 mg/l</td>
<td>EPA 366.0 MOD</td>
<td>6 months</td>
</tr>
<tr>
<td>Leeds Point</td>
<td>Total Organic Carbon</td>
<td>FwSw</td>
<td>U</td>
<td>TOC 1.0 mg/l</td>
<td>SM 5310 C-11</td>
<td>28 days</td>
</tr>
<tr>
<td>Leeds Point</td>
<td>Dissolved Organic Carbon</td>
<td>FwSw</td>
<td>F</td>
<td>DOC 1.0 mg/l</td>
<td>SM 5310 C-11</td>
<td>28 days</td>
</tr>
<tr>
<td>Leeds Point</td>
<td>Particulate Organic Carbon</td>
<td>FwSw</td>
<td>NA</td>
<td>POC NA</td>
<td>Calculated</td>
<td>NA</td>
</tr>
</tbody>
</table>
16. Chain Of Custody

Chain of custody procedures will be instituted for this project. Chain of custody procedures will be employed until samples reach the Leed’s Point Laboratory. Once samples reach the laboratory the laboratory’s internal sample tracking procedures will be utilized. (See Appendix A for sample forms)

17. Corrective Action

The Leeds Point Laboratory is required to maintain standard operating procedures which outline specific action to pursue should corrective action be necessary. If acceptable results cannot be obtained due to: either field or laboratory errors (calibration standards, proficiency testing samples, blanks, spikes, or duplicates falling out of range) the affected samples will be re-analyzed and steps will be taken 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. NJDEP designated project officers and the NJDEP QAO will be notified in writing anytime a deviation from the approved work plan has occurred.

18. Assessment, Oversight and Response

The Project Officer or designee will be responsible for ensuring the oversight of all activities relating to this program. The Project Officer or designee will assess field collection functions and make corrections when necessary to maintain the data accuracy as defined in this plan. If any changes or modifications are made to this plan regarding data collection, as it relates to the objectives(s) and data accuracy required in this project, all original signees of the QAPP will be notified.
Figure 1: Barnegat Bay sampling sites
Appendix A:
Sample Chain of Custody Form
### Barnegat Bay Ambient Monitoring Program Chain of Custody Form (June 2014)

#### General Information

<table>
<thead>
<tr>
<th>Site #</th>
<th>Site Description</th>
<th>Sample #</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sample Collection Date (mm/dd/yyyy)</th>
<th>Sample Collector</th>
<th>Sample Type (circle one)</th>
<th>Sample Blank Replicate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sample Collection Time (hh:mm)</th>
<th>Collector Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Filtration Time (hh:mm)

<table>
<thead>
<tr>
<th>Turbidity Measurements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turbidity (NTU) Time (hh:mm)</td>
</tr>
</tbody>
</table>

#### Field Measurements/Observations

<table>
<thead>
<tr>
<th>Surface</th>
<th>Bottom (Bay samples only)</th>
<th>Site Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Field Measurement Time (hh:mm)</th>
<th>pH</th>
<th>Specific Conductance uS/cm</th>
<th>Ambient Transmissionmetry</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Uncorrected Water Temperature (deg C)</th>
<th>Corrected Water Temperature (deg C)</th>
<th>Underwater Transmissionmetry</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dissolved Oxygen (mg/l)</th>
<th>Salinity (ppt)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dissolved Oxygen Saturation (%)</th>
<th>Secchi Depth (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Raw Sample

<table>
<thead>
<tr>
<th>Container ID</th>
<th>Container</th>
<th>Matrix</th>
<th>Parameter</th>
<th>Fraction</th>
<th>Preservative</th>
</tr>
</thead>
<tbody>
<tr>
<td>[1]</td>
<td>L 1 - U</td>
<td>Amber HDPE, 500 mL</td>
<td>Freshwater / Saltwater</td>
<td>TSS, Chlorophyll a</td>
<td>Total</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Container ID</th>
<th>Container</th>
<th>Matrix</th>
<th>Parameter</th>
<th>Fraction</th>
<th>Preservative</th>
</tr>
</thead>
<tbody>
<tr>
<td>[1]</td>
<td>R 1 - U</td>
<td>HDPE, 2L</td>
<td>Freshwater / Saltwater</td>
<td>NH3, NO2+NO3, PO4, TN, TP, Turbidity, TOC, DOC, Silica Total</td>
<td>Total</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Container ID</th>
<th>Container</th>
<th>Matrix</th>
<th>Parameter</th>
<th>Fraction</th>
<th>Preservative</th>
</tr>
</thead>
<tbody>
<tr>
<td>[1]</td>
<td>L 6 - U</td>
<td>Polyethylene , 2 X 1L</td>
<td>Saltwater</td>
<td>Phytoplankton</td>
<td>Total</td>
</tr>
</tbody>
</table>

#### NJDEP Lees Point Laboratory (NJ Lab Certification #: 01179)

<table>
<thead>
<tr>
<th>Container ID</th>
<th>Container</th>
<th>Matrix</th>
<th>Parameter</th>
<th>Fraction</th>
<th>Preservative</th>
</tr>
</thead>
<tbody>
<tr>
<td>[1]</td>
<td>L 1 - U</td>
<td>Amber HDPE, 500 mL</td>
<td>Freshwater / Saltwater</td>
<td>TSS, Chlorophyll a</td>
<td>Total</td>
</tr>
<tr>
<td>[1]</td>
<td>L 2 - U</td>
<td>50 mL HDPE centrifuge tube</td>
<td>Freshwater / Saltwater</td>
<td>TN, TP</td>
<td>Total</td>
</tr>
<tr>
<td>[1]</td>
<td>L 3 - F</td>
<td>50 mL HDPE centrifuge tube</td>
<td>Freshwater / Saltwater</td>
<td>DNH3</td>
<td>Total</td>
</tr>
<tr>
<td>[1]</td>
<td>L 4 - F</td>
<td>50 mL HDPE centrifuge tube</td>
<td>Freshwater / Saltwater</td>
<td>DNA3, DPO4, DN, DP</td>
<td>Dissolved</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Container ID</th>
<th>Container</th>
<th>Matrix</th>
<th>Parameter</th>
<th>Fraction</th>
<th>Preservative</th>
</tr>
</thead>
<tbody>
<tr>
<td>[1]</td>
<td>L 5 - U</td>
<td>HDPE, 125 mL</td>
<td>Freshwater / Saltwater</td>
<td>BSI</td>
<td>Total</td>
</tr>
<tr>
<td>[1]</td>
<td>L 6 - U</td>
<td>Polyethylene , 2 X 1 L</td>
<td>Saltwater</td>
<td>Phytoplankton</td>
<td>Total</td>
</tr>
<tr>
<td>[1]</td>
<td>L 7 - U</td>
<td>HDPE, 125 mL</td>
<td>Freshwater/Saltwater</td>
<td>TOC</td>
<td>Total</td>
</tr>
<tr>
<td>[1]</td>
<td>L 8 - F</td>
<td>HDPE, 125 mL</td>
<td>Freshwater/Saltwater</td>
<td>DOC</td>
<td>Total</td>
</tr>
<tr>
<td>[1]</td>
<td>L 9 - U</td>
<td>50 mL HDPE centrifuge tube</td>
<td>Freshwater / Saltwater</td>
<td>Turbidity</td>
<td>Total</td>
</tr>
<tr>
<td>[1]</td>
<td>L 10 - U</td>
<td>HDPE, 250 mL</td>
<td>Freshwater / Saltwater</td>
<td>Total Alkalinity</td>
<td>Total</td>
</tr>
</tbody>
</table>

#### Chain of Custody

<table>
<thead>
<tr>
<th>Container ID</th>
<th>Relinquished</th>
<th>Received</th>
<th>Date/Time</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1 -_______</td>
<td>R1-U</td>
<td></td>
<td></td>
<td>Sample drop off at LEEDS</td>
</tr>
<tr>
<td>L1 -_______</td>
<td>R1-U</td>
<td></td>
<td></td>
<td>Placement in coolers for lab transfer (runner signs received)</td>
</tr>
<tr>
<td>L1 -_______</td>
<td>R1-U</td>
<td></td>
<td></td>
<td>Transfer to lab for analysis</td>
</tr>
</tbody>
</table>

Revision 1, June 2014
Figure 2

Tributary Sample Field Preparation

L9: Biogenic Silica
   125 mL HDPE bottle + Ice

L7: Dissolved Organic Carbon
   250 mL amber HDPE bottle + Sulfuric Acid

L3: Dissolved Ammonia
   50 mL HDPE centrifuge tube + Phenol

L4: Dissolved Nutrients
   50 mL HDPE centrifuge tube + Ice

L8: Alkalinity
   250 mL HDPE bottle + Ice

L6: Total Organic Carbon
   250 mL amber HDPE bottle + Sulfuric Acid

L2: Total Nitrogen and Phosphorus
   50 mL HDPE centrifuge tubes + Ice

R1: 1 or 2 liter HDPE Unfiltered

T1: Field Turbidity Meter

0.45 μ filter

475 mL

675 mL

L1: 500 mL or 1 liter HDPE Unfiltered

Ice

Ice

Ice
Appendix C: Example Field Calibration

Field Calibration Record-Barnegat Bay Monitoring Program

**pH Meter Calibration**

Required Accuracy: ± 0.05 standard units (su) of the true value for the calibration buffers used, ± 0.10 for the mid-range calibration check buffer. The temperature of the buffers must be recorded (if available).

<table>
<thead>
<tr>
<th>Buffer</th>
<th>Temp</th>
<th>“As Found” Meter Reading</th>
<th>Set Meter Reading</th>
<th>Time</th>
<th>Date</th>
<th>Tech</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Buffer used for Calibration Check:_______ Temp of Buffer:_________
Calibration Check Buffer result (performed in measure mode):_________
Time of Calibration Check and Tech:_________

**Conductivity Meter Calibration**

Required Accuracy: Within 1% of the true value for the standard used.
Meter is calibrated according to manufacturer’s instructions. Standard check is required each day of use.

mS/cm Standard used for Calibration Check (performed in measure mode):_____
Date of Calibration Check:_________
Tech:_________

**DO Meter Calibration**

Meters are to be calibrated each day of use against air or water saturated air.
Meters also require a Winkler test each week of testing.

Required Accuracy between the Winkler titration and meter: ± 0.3 mg/L
Normality of Titrant (from container of sodium thiosulfate):_________

Beginning mls:_________
Ending mls:_________
Change in mls:_________
DO reading from Meter for the sample used for Winkler:_________
Tech:_________
Date:_________

**Temperature Calibration**

Thermometer calibrations must be performed on a quarterly basis prior to use for any sampling events. Records of the calibration will be retained.

Revision 1, June 2014
Appendix D: Sampling Schedule

July 9, 2014
July 23, 2014
August 6, 2014
August 20, 2014
September 10, 2014
September 24, 2014
October 15, 2014
December 17, 2014
February 11, 2015
April 15, 2015
May 6, 2015
May 20, 2015
June 3, 2015
June 17, 2015

Note: this QAPP will be modified annually to add scheduled sampling dates beyond June 2015.