QUALITY ASSURANCE PROJECT PLAN
Ambient Macroinvertebrate Network (AMNET),
Raritan Water Region, 2019

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NJDEP Bureau of Freshwater and Biological Monitoring (BFBM)

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1.0 **Project Name:** Ambient Macroinvertebrate Network (AMNET), Raritan Water Region

2.0 **Requesting Agency:** NJDEP, Bureau of Freshwater and Biological Monitoring (BFBM)

3.0 **Date of Project:** April 2019 – November 2019

4.0 **Project Fiscal Information:** 7W106CXX V38A

5.0 **Project Oversight:**
   - Project Officer, Field and Laboratory- Anna Marie Signor, BFBM
   - Project Officer, Data Analysis- Tom Miller, BFBM
   - Project Supervisor- Dean Bryson, BFBM
   - Project Data Manager- Leigh Lager, BFBM
   - Quality Assurance Officer - Marc Ferko, NJDEP-OQA

6.0 **Special Training Needs/Certification**
   Any personnel assisting with field sampling and/or laboratory processing of samples for this project will be trained on all applicable methods and techniques. For physical/chemical analysis, the training will entail calibration of meters, deployment techniques, and data retrieval from the equipment. Assistants will also be trained in the proper methods for benthic macroinvertebrate sample collection, sample processing, performing habitat assessments and observations. Training in the laboratory will entail the proper sorting of a subsample. The Project Officer or Project Supervisor will be responsible for all necessary training.

Only designated, experienced, full-time professional staff will perform taxonomic identifications.

BFBM is certified by the Office of Quality Assurance (certified lab ID # 11896) for all physical/chemical parameters to be measured.

7.0 **Project Description/Objective**

The major goal of the AMNET program is to provide a cost-efficient means of gauging the quality of streams and watershed areas throughout the state. This objective is accomplished through sampling and analysis of macroinvertebrate communities from a stream network
representative of New Jersey’s five (5) major Water Regions (Northwest (Upper Delaware), Lower Delaware, Northeast, Raritan, and Atlantic). In addition to adequately assessing the major Water Regions, sites were also selected to represent and assess individual sub-watersheds (HUC 14 scale). The study area of the Raritan Water Region includes Watershed Management Areas (WMA’s) 7, 8, 9, and 10.

The spatial distribution of stations is adequate to provide biological impact data on a long-term, region-wide or statewide scale. It is likely not enough, however, to assess the biological impact(s) of any one-point source of pollution, as this would be better served by a site-specific or intensive survey of the stream segment in question. The designated five-year sampling interval for AMNET reflects a realistic temporal lag between cessation of an environmental perturbation and recovery of the impacted biological community.

The methodology is based on the Rapid Bioassessment Protocols (RBP), scientifically designed and validated under the auspices of the U. S. Environmental Protections Agency (USEPA, 1999).

The AMNET program was initiated in 1992. To date, five full rounds have been completed which allows for trend analysis to be calculated. Sampling of the Raritan Water Region in 2019 continues the sixth round of statewide AMNET monitoring.

Samples will also be collected at AMNET sites designated in this QAPP for the Biological Nutrient Correlation Project. Sample collection will take place during the AMNET sampling visit. Total Phosphorus and Total Nitrogen (calculated) samples will be collected. Project description and other details are defined in the QAPP for the Biological Nutrient Correlation Project (2017-2019).

8.0 Data Usage

Data obtained will be used by NJDEP in the generation of the biennial Integrated Water Quality Assessment Report (includes 305(b) report and 303(d) list), to support sound policy decisions in water quality/watershed management, in designation of Category One (C1) waters based on “exceptional ecological significance”, to track environmental trends with water quality, to inform regulatory or “permit” activities, and to correlate nutrient concentrations with biological impairments. Once all samples are analyzed and the data thoroughly reviewed, a data summary, including the index scores and ratings, will be posted on the BFBM website: www.nj.gov/dep/wms/bfbm.
9.0 Network Design/Site Selection

The Raritan Water Region now includes 159 active sites in the AMNET network (See Appendix A, Table 1). These sites were initially selected using a stratified approach to ensure complete and representative coverage of the Water Region. Enhancements to the network were instituted to include sites that best evaluate the sub-watersheds (HUC14 scale) of the Water Region for Aquatic Life Use attainment in the Integrated Water Quality Assessment Report.

Exact AMNET site locations were initially determined via the Global Positioning System (GPS) using a Trimble unit and the appropriate correction sources utilized by NJDEP. All positions were logged into the Geographic Information System (GIS). Hand-held GPS units, either Garmin model “GPSMAP 62s”, Garmin Nuvi 2797, or Trimble “Geo XT”, will be used to confirm correct locations at the time of sampling.

10.0 Sampling Procedures

Macroinvertebrate Sampling

Benthic macroinvertebrates will be sampled from each site focusing on the most productive habitats present at the site, as outlined in Rapid Bioassessment Protocols for Use in Streams and Rivers, Second edition (USEPA1999), and Standard Operating Procedures (SOP) For Ambient Biological Monitoring Using Benthic Macroinvertebrates (NJDEP 2007). A re-usable 800x900µm mesh D-frame dip net will be used to collect samples from the most productive habitats present in the stream.

Sites in the Raritan Water Region include both high gradient and low gradient (coastal plain) streams. Substrate of high gradient streams consists predominantly of cobble and have riffle/run type habitat. For high gradient streams, macroinvertebrate abundance and diversity are usually highest on cobble (riffle/run) habitats, which are, therefore, the focus of sampling. The sampler will use their feet and/or hands to dislodge organisms from these substrates, immediately upstream of the net, using current to carry them into the net.

Coastal plain streams are characterized as low-gradient streams with sandy beds, typically lacking riffle/run habitat. Macroinvertebrate abundance and diversity in these streams are highest on submerged macrophytes, submerged vegetated banks, and submerged snags (woody debris such as logs and branches). These habitats are the focus of sampling in low gradient streams. The sampler will use a D-net in a “jab and sweep” motion, as well as hands or feet if needed, to dislodge organisms from these substrates. After disturbing the targeted substrate, organisms are collected by sweeping net back and forth a few times in
the water column.

Approximately one liter of sample will be collected into a re-usable one-liter wide-mouth plastic container (thoroughly cleaned between uses) and preserved on site using a 5-10% formalin solution. Specimens fixed with formalin will remain preserved indefinitely. Each site in the Water Region will be sampled one time for the project within the April through November sampling window. Sampling will be postponed at a site if flow conditions have increased due to a storm event, making it temporarily unsafe to wade. Sampling will be rescheduled when the stream returns to normal wadeable flow conditions.

For quality control, a duplicate macroinvertebrate sample will be taken at an adjacent reach at approximately 10% of the samples. This adjacent reach for the duplicate sampling, will usually be immediately upstream from point where sampling for primary sampling ended. The reaches for both the primary and duplicate samples should be similar in terms of habitat, riparian zone condition, and land use. The results from only the primary sample will be reported. The duplicate results will be stored internally and used to provide precision estimates of the individual metrics and overall index scores and ratings (Stribling, 2008).

**Physical/Chemical Parameters**

Dissolved oxygen, pH, Water Temperature, and Specific Conductivity will be measured *in situ*, at each site as per procedures outlined in N.J.A.C. 7:18, Subchapter 8 and NJDEP Field Sampling Procedures Manual (2005). BFBM (#11896) is certified by NJDEP’s OQA to perform these analyze-immediately parameters. The measurements are made mid-depth, mid-stream. Turbidity will also be measured from a grab sample taken mid-depth, mid-stream.

**Habitat Assessment**

A visual-based habitat assessment will be performed at each site using the appropriate form for high gradient streams or low gradient streams (USEPA, 1999). This method, which assesses 10 different in-stream and riparian zone parameters, is tabulated for each site. Based on the score, the habitat is rated as optimal, suboptimal, marginal, or poor. The habitat assessment is performed concurrent with the collection of the benthic macroinvertebrate sampling. The stream reach sampled plus the immediate upstream area that can be adequately observed will be assessed using the respective protocol. The habitat assessment scores and rating will be presented along with the index score and rating. These habitat scores and ratings do not factor into the calculation of the index scores but are collected as additional information in the assessment of sampling results, along with photographs and observations related to potential stressors.
Field Precautions for Invasives

To prevent the potential spread of nuisance or invasive organisms such as *Didymosphenia* sp. from stream to stream, all nets, waders, etc. will be decontaminated in the field between sites by spraying with a commercial disinfectant cleaner and rinsing with tap water. Also, the use of felt-soled waders will be avoided.

11.0 Data Quality/Quality Control Requirements

Water Temperature, pH, Specific Conductivity, and Dissolved Oxygen (DO) are measured using a Hydrolab MS5. The Hydrolab MS5 is a multi-parameter water quality meter that combines temperature, pH, Specific Conductivity and Luminescent DO probes into one device that is submersible to the desired depth. All equipment will be calibrated, maintained, and used following manufacturer's instructions and in accordance with the specifications given in N.J.A.C. 7:18 (NJDEP, as amended 2017). All calibration and water quality data will be recorded in a spiral-bound logbook.

Conductivity: This probe is calibrated on a weekly basis per the manufacturer recommendations. The probe is also checked each day of use with a certified standard which corresponds to the expected range of the values to be measured. Records of all calibrations and calibration checks shall be maintained in the field log.

Dissolved Oxygen: A Winkler check is performed on a weekly basis and the meter is barometrically calibrated on the day of use in the field. A calibration check is performed once daily. A 100% oxygen saturated water bath is checked at the beginning and end of day when in use. Records of all calibrations and calibration checks shall be maintained in the field log.

pH: The probe is calibrated daily with two certified buffers that bracket the expected range of the value being measured per the manufacturer’s recommendations. A third certified pH buffer, within the bracket, is then used to check the calibration. After three hours of continuous use, the pH of the third certified buffer will be checked. Records of all calibrations and calibration checks shall be maintained in the field log.

Temperature: The probe is calibrated with a NIST-certified thermometer on a quarterly basis. Records of the calibration shall be maintained by the BFBM.
Barometer: Thommen TX Mechanical Barometer.

Turbidity meter: Hach Model 2100Q turbidimeter is calibrated once a month per manufacturer recommendations. The meter is then checked with certified standards for accuracy within the calibration range during each day of use. Records of all calibrations and calibration checks shall be maintained in the field log.

**Chain of Custody**

No chain of custody is required. Results of this study will not be used for compliance or enforcement actions. The project officer and project supervisor are responsible for sampling and laboratory method validation.

**12.0 Macroinvertebrate Identification/QAQC**

**Macroinvertebrate Identification**

In the laboratory, a 100-organism subsample will be randomly sorted from each sample, as described in USEPA (1999); all individuals will be identified to the lowest possible taxonomic level (usually genus or species). Only designated, experienced, staff will perform taxonomic identifications. A thorough program for taxonomic quality control, as given in the biomonitoring laboratory Standard Operating Procedures (SOP) is practiced (NJDEP, 2007). A comprehensive collection of over 50 major references (including books and monographs), by recognized experts in invertebrate taxonomy, is maintained in the laboratory; new references are added when appropriate to keep abreast of taxonomic advances.

For taxonomic quality control, 10% of the samples are sent to an outside qualified consultant for parallel identifications. Results of the parallel identifications will be analyzed by calculating the Percent Taxonomic Disagreements (%PTD), using procedure defined by Stribling *et al.*, 2003. The project goal is less than 15% disagreements. Data from the duplicate identifications will be stored internally, with only the BFBM identifications being reported.

**Equipment for Macroinvertebrate Identification**

Macroinvertebrates will be identified using a stereomicroscope capable of up to 40x magnification. The biomonitoring laboratory uses Leica Model MZ6 stereomicroscopes,
each with fiber optic illumination. A compound microscope with 100x, 200x, 400x, and 1000x magnification will be used for very detailed identifying features. The biomonitoring laboratory currently uses Leica models DMLS (with phase contrast) and DME.

13.0 Resource Needs: BFBM will need 4 full-time staff to complete this project.

14.0 Sampling Schedule

All sites in the Raritan Water Region will be sampled once within the April 2019 through November 2019 index period, beginning on or around April 1, 2019.

15.0 Data Analysis

Multi-metric indices were developed for use in New Jersey, with guidance from the Rapid Bioassessment Protocols (USEPA, 1999), to assess the taxonomic data. The High Gradient Macroinvertebrate Index (HGMI) and the Coastal Plains Macroinvertebrate Index (CPMI) will be used to assess appropriate sites in the Raritan Water Region. Based on the index score, a rating is assigned, Excellent, Good, Fair, and Poor. Detailed methods for analysis are outlined in the biomonitoring laboratory Standard Operating Procedures (NJDEP, 2007).

16.0 Data Validation

The Project Officer and the Project Supervisor are responsible for all initial data validation. If apparent anomalous data is suspected, the Project Officer and/or the Project Supervisor will review the sampling procedures with the field sampler to make sure the proper collection and preservation procedures were followed. If the data is still suspect, an internal review of the laboratory procedures and/or calculations used in the analysis of the suspect sample will be conducted with special emphasis on transcription of data to assure that no transposition of figures occurred. If no problems are found in the laboratory procedures, the data may then be compared to any historical data that might have been collected at the same site prior to the most recent sampling event to see if similar anomalies might have been found previously. The suspect data may also be compared to literature values or standard analytical treatises to verify if the results are within the limits of accuracy of the test method.

If no obvious problems are found after these reviews, the complete data set will be reported with the suspect data identified as it relates to the objectives(s) and data accuracy required in this project.
17.0 Performance System Audits

BFBM is subject to audits and guidelines of the Office of Quality Assurance’s Laboratory Certification Program as well as internal performance evaluations.

18.0 Data Storage and Distribution

All habitat assessment data, physical/chemical analysis, and site observations will be recorded on the BFBM’s Biological Field Observations and Data Sheet, and also recorded electronically in a Microsoft Access database. All macroinvertebrate identifications will be recorded on the BFBM’s Macroinvertebrate Laboratory Data Sheet and entered into a Microsoft Access database. Taxonomic data and counts, metric scores, index scores and ratings, habitat assessment scores and ratings, and analyze-immediately field parameters will be entered into NJDEP’s Water Quality Data Exchange (WQDE) and will be accessible through the USEPA, USGS and National Water Monitoring Council’s Water Quality Portal (www.waterqualitydata.us) by June the following year results are validated.

A data summary table, including index scores and ratings, will be posted on the BFBM website (www.nj.gov/dep/wms/bfbm) after completion of all sample analyses for the Water Region and data validation.

Following the QA/QC validation of results, data will be entered into NJDEP’s WQDE and uploaded to USEPA’s WQX by June of the year following verification. All raw data records shall be maintained for a period of no less than five years.

19.0 Data Reporting

Results and data analysis for the entire Water Region will be issued and will contain at a minimum: datasheets for each site with taxa and counts of benthic macroinvertebrates, field chemistry results and observations, index scores and impairment ratings, habitat assessment scores and ratings. Index scores and ratings will also be posted in tabular form on the Bureau’s website. The appropriate GIS shapefiles of the study area will be updated to reflect these results.
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<th>Assessment Rating</th>
<th>HGMI Score</th>
<th>CMPI100 Score</th>
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</thead>
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<td>Poor</td>
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20.0 **Corrective Action**

The Project Officer will be responsible for the oversight of all activities related to this project. The Project Officer will assess field collections 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 objective(s) and data accuracy required in this project, all original signees of the QAPP will be notified.

21.0 **References**


Appendix A Data Management Tables

For Data Management purposes, Water Chemistry is defined as parameters analyzed by a laboratory; Field measurements are defined as analyze-immediately parameters.
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<th>Station ID (WQDE compliant and referenced)</th>
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<th>Latitude-dd</th>
<th>Longitude-dd</th>
<th>County</th>
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<td>Mine Bk @ Far Hills Rd (Rt 512)</td>
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<td>AN0382C</td>
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<td>Shallow Bk @ industrial driveway off Shalks Crossing Rd</td>
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<tr>
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<td>Royce Bk @ Rt 533</td>
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<tr>
<td>AN0414A</td>
<td>Millstone River @ park access off Lincoln Ave</td>
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<td>AN0424B</td>
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### Table 2 Sample Types

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<th>Field Msr/Obs</th>
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<th>Water Chemistry</th>
<th>Continuous Monitoring</th>
<th>Biological Sampling</th>
<th>Sediment Collection</th>
<th>Bacteria Collection</th>
<th>Habitat</th>
<th>Metrics</th>
<th>Indices</th>
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### Table 3 Partners

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<th>Water Chemistry</th>
<th>Continuous Monitoring</th>
<th>Biological Sampling</th>
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<th>Bacteria Collection</th>
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### Table 4 Field Measures

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<td>Spec Cond</td>
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<td>pH</td>
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<td>DO</td>
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Table 5 Habitat Assessment Parameters

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<td>HAB_0207</td>
<td>RBP2, High G, Bank Stability, Left Bank</td>
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<td>RBP2, High G, Channel Alteration (choice list)</td>
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<td>HAB_0210</td>
<td>RBP2, High G, Channel Flow Status</td>
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Table 6 Habitat Assessment Metrics

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## Table 7 Individual Index Metrics

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<td>Percent of sensitive EPT individuals</td>
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## Table 8 Overall Metrics

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Table 9 Data Inventory Supplement

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<tr>
<td>Counties</td>
<td>Essex, Hunterdon, Mercer, Middlesex, Monmouth, Morris, Somerset, Union</td>
</tr>
<tr>
<td>Dates</td>
<td>April 1-November 30, 2019</td>
</tr>
<tr>
<td>Status</td>
<td>In progress- discrete</td>
</tr>
<tr>
<td>Sample Frequency</td>
<td>Once</td>
</tr>
<tr>
<td>Seasons Sampled</td>
<td>Spring; Summer; Fall;</td>
</tr>
<tr>
<td>Waterbody Type</td>
<td>River/Stream</td>
</tr>
<tr>
<td>Salinity Category</td>
<td>Fresh</td>
</tr>
<tr>
<td>Tidal Influence</td>
<td>Non-tidal</td>
</tr>
<tr>
<td>Project Description</td>
<td>Through sampling and analysis of macroinvertebrate communities at a network of freshwater, non-tidal rivers and streams sites, the biological condition of these waterbodies and watersheds in the Raritan Water Region is assessed.</td>
</tr>
<tr>
<td>Parameters analyzed type</td>
<td>Habitat; Biological- Benthic macroinvertebrates</td>
</tr>
</tbody>
</table>
### Table 10 Data Management Supplement

<table>
<thead>
<tr>
<th><strong>QAPP network path file location?</strong></th>
<th>V:\LUM\BFBM\Bfbm\Quality Assurance Plans\Calendar Year 2019 QAPPS\2019 AMNET QAPP-Raritan Region</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Where will data be recorded in field (media)?</strong></td>
<td>Paper</td>
</tr>
<tr>
<td><strong>If on tablets or phones, will download at office occur or will you connect wirelessly?</strong></td>
<td>N/A</td>
</tr>
<tr>
<td><strong>If on tablets or phones, who will do the download?</strong></td>
<td>N/A</td>
</tr>
<tr>
<td><strong>If data collected electronically, where will it be stored?</strong></td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Format to be received from Lab</strong></td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Method of receipt from lab/s</strong></td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Personnel receiving outside lab data</strong></td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Is data expected to go to WQDE/STORET?</strong></td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Data manager - (Bureau and Name)</strong></td>
<td>BFBM - Leigh Lager</td>
</tr>
</tbody>
</table>