

**NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
WATER MONITORING AND STANDARDS
BUREAU OF FRESHWATER AND BIOLOGICAL MONITORING
P.O. Box 420; Mail Code 35-01
TRENTON, NEW JERSEY**

**QUALITY ASSURANCE PROJECT PLAN
Ambient Macroinvertebrate Network (AMNET),
Atlantic Water Region, 2020-2021**

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1.0 Project Name: Ambient Macroinvertebrate Network, Atlantic Water Region

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

3.0 Date of Project: April 2020 – November 2021 (in part)

4.0 Project Fiscal Information: Job Number-7W106CXX Activity Code-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 – Melissa Hornsby, 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. Safety training and safety requirements will comply with BFBM's Field Work Health and Safety Plan (HASP) Version #2 August 2019. 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 Atlantic Water Region includes WMA's

12, 13, 14, 15, and 16.

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 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 Protection 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 Atlantic Water Region in 2020-21 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 Atlantic Water Region currently includes 187 active sites in the AMNET program (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). Vehicle used for sampling is equipped with a Garmin Nuvi 2797 GPS. All site coordinates have been uploaded to this unit to navigate to the correct locations. At site, coordinates are recorded using a handheld unit, GPSMAP 62s, to confirm correct location was sampled. Locational confirmation is performed using GIS at office.

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 Atlantic Water Region are within the Atlantic Coastal Pine Barrens ecoregion (Level III)(Woods et al., 2007). These 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). Therefore, these habitats are the focus of sampling in low gradient streams, with sampling effort proportioned based on the presence of these habitat types. Using “jab and sweep” method, the sampler will use a D-net, as well as hands or feet if needed, to dislodge organisms from these substrates. After disturbing the targeted habitat, organisms are collected using a sweeping motion with the D-net in the water column.

Approximately one liter of sample will be collected into a re-usable one-liter wide-mouth plastic container (thoroughly rinsed with water 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 form for 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 Aquatic 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, Fantastik (heavy duty), and rinsing with tap water. Rinse water is captured and returned to laboratory for disposal. 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 Atlantic Water Region will be sampled once within the index period from April 2020 through June 2021, beginning on or around April 1, 2020.

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 Pinelands Macroinvertebrate Index (PMI)(Jessup, et al., 2005) and the Coastal Plains Macroinvertebrate Index (CPMI)(Maxted et al., 2000) will be used for the appropriate sites in the Atlantic Water Region. CPMI has been re-scaled to a 100-point scale and is now called CPMI100 (Tetra Tech, 2014). 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 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 after these reviews, the complete data set will be reported as valid. The Project Officer will notify the Project Data Manager when data validation is completed and the data is ready for further dissemination.

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 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.

<u>Assessment Rating</u>	<u>PMI Score</u>	<u>CMPI100 Score</u>
Excellent	≥ 63	≥ 75
Good	56- <63	41- <75
Fair	34- <56	21- <41
Poor	<34	<21

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

- Gerritsen, Jeroen and Erik W. Leppo, 2005. Biological Condition Gradient for Tiered Aquatic Life Use in New Jersey. Tetra Tech Inc., Owings Mill, MD.
- Jessup, B, et al., 2005. Development of the New Jersey Pinelands Macroinvertebrate Index (PMI). TetraTech, Inc. Owings Mills, MD.
- Maxted, J.R., M.T. Barbour, J. Gerritsen, V. Poretti, N. Primrose, A. Silvia, D. Penrose, and R. Renfrow, 2000. Assessment framework for mid-Atlantic coastal streams using benthic macroinvertebrates. Journal of North American Benthological Society, 19(1):128-144.
- N.J.A.C 7:18, as amended September 4, 2018. Regulations governing the certification of laboratories and environmental measurements. N.J.A.C. 7:18. NJDEP. Trenton, NJ.
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- Stribling, J.B., B.K. Jessup, and D.L. Feldman, 2008. Precision of benthic macroinvertebrate indicators of stream condition in Montana. J.N. Am. Benthol. Soc. 27(1):58-67.
- Tetra Tech, 2014. Monitoring Design and Application of CPMI, Upper Salem River, NJ. Technical Memorandum, Tetra Tech Inc., Owings Mill, MD.
- USEPA, 1999. Rapid bioassessment protocols for use in streams and rivers: periphyton, benthic macroinvertebrates, and fish. Second edition. EPA 841-B-99-002. U.S. Environmental Protection Agency. Washington, D.C. Ch. 1–11 and appendices.
- Woods, A.J., J.M. Omernik, and B.C. Moran, 2007. Level III and IV Ecoregions of New Jersey. Partly conducted under auspices of the Program for Cooperative Research on Aquatic Indicators Award #CR-831682-01.

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.

Table 1 Site List

Station ID(WQDE compliant and referenced)	Waterbody/Location	Latitude-dd	Longitude-dd	County	Site exists in WQDE already?	Location Type
AN0456	UNT to Matawan Ck @ Morganville Rd	40.403527	-74.261833	Middlesex	YES	River/Stream
AN0458	Wilkson Ck @ Church Rd	40.406722	-74.221305	Monmouth	YES	River/Stream
AN0459	Flat Ck @ Rt 516 (Middle Rd)	40.427055	-74.174888	Monmouth	YES	River/Stream
AN0460	Mahoras Bk @ Rt 35	40.411392	-74.139096	Monmouth	YES	River/Stream
AN0461	Town Bk @ Spruce Dr	40.388916	-74.104944	Monmouth	YES	River/Stream
AN0462	McClees Ck @ Whipporwill Rd	40.385194	-74.066111	Monmouth	YES	River/Stream
AN0462A	Poricy Bk @ Middletown-Lincroft Rd (Rt 50)	40.365919	-74.112530	Monmouth	YES	River/Stream
AN0464	Nut Swamp Bk @ nr. Normandy Rd	40.346888	-74.111444	Monmouth	YES	River/Stream
AN0466	Hop Bk @ Willow Brook Rd	40.330000	-74.172194	Monmouth	YES	River/Stream
AN0468	Willow Bk @ Willow Brook Rd	40.329805	-74.173416	Monmouth	YES	River/Stream
AN0470	Big Bk @ Cross Rd	40.323578	-74.173670	Monmouth	YES	River/Stream
AN0471	Yellow Bk @ School Rd E	40.276027	-74.218611	Monmouth	YES	River/Stream
AN0472	Yellow Bk @ Creamery Rd	40.296960	-74.170823	Monmouth	YES	River/Stream
AN0473	Mine Bk @ Creamery Rd	40.291722	-74.169194	Monmouth	YES	River/Stream
AN0473A	UNT to Swimming River @ Thompson County Park	40.331004	-74.152367	Monmouth	YES	River/Stream
AN0473B	UNT to Swimming River @ Longbridge Rd	40.319030	-74.160672	Monmouth	YES	River/Stream
AN0476	Pine Bk @ Rt 537 (Tinton Ave)	40.304277	-74.100750	Monmouth	YES	River/Stream
AN0477	Whale Pond Bk @ Larchwood Ave	40.275361	-74.009888	Monmouth	YES	River/Stream

AN0478	Poplar Bk @ Almyr Ave	40.256666	-73.996861	Monmouth	YES	River/Stream
AN0478A	Harvey Bk @ Monmouth Rd (CR 15)	40.243401	-74.013889	Monmouth	YES	River/Stream
AN0480	Jumping Bk @ Rt. 33 / Corlies Ave	40.208473	-74.069122	Monmouth	YES	River/Stream
AN0482	Shark River @ Remsen Mill Rd	40.198638	-74.069833	Monmouth	YES	River/Stream
AN0483A	Wreck Pond Bk @ Ocean Rd	40.145779	-74.056946	Monmouth	YES	River/Stream
AN0484	Hannabrand Bk @ Old Mill Rd	40.143583	-74.053277	Monmouth	YES	River/Stream
AN0485A	Manasquan River @ Burke Rd	40.207403	-74.328748	Monmouth	YES	River/Stream
AN0485B	Manasquan River @ Georgia Rd	40.211876	-74.295711	Monmouth	YES	River/Stream
AN0487	Debois Ck @ Strickland Rd	40.208972	-74.268638	Monmouth	YES	River/Stream
AN0489	Manasquan River @ Rt 9	40.204361	-74.256333	Monmouth	YES	River/Stream
AN0490	Manasquan River @ West Farms Rd	40.192755	-74.195117	Monmouth	YES	River/Stream
AN0492	Marsh Bog Bk @ Yellow Brook Rd	40.167027	-74.158944	Monmouth	YES	River/Stream
AN0493	Manasquan River @ Rt 547	40.161694	-74.154527	Monmouth	YES	River/Stream
AN0494	Mingamahone Bk @ Cranbury Rd	40.212666	-74.168027	Monmouth	YES	River/Stream
AN0495	Mingamahone Bk @ Rt 524	40.165972	-74.149916	Monmouth	YES	River/Stream
AN0497	Squankum Bk @ Rt 549	40.150972	-74.153527	Monmouth	YES	River/Stream
AN0498	Manasquan River @ Hospital Rd	40.143168	-74.117156	Monmouth	YES	River/Stream
AN0500	N Br Metedeconk River @ Jackson Mills Rd (CR23)	40.181333	-74.287555	Monmouth	YES	River/Stream
AN0502	N Br Metedeconk River @ Rt 9	40.110083	-74.218888	Ocean	YES	River/Stream
AN0504	Haystack Bk @ Rt 547	40.124083	-74.188194	Monmouth	YES	River/Stream

AN0505	Haystack Bk(Muddy Ford Bk) @ Ramtown-Greenville Rd	40.109583	-74.161638	Monmouth	YES	River/Stream
AN0506	N Br Metedeconk River @ Rt 88	40.081638	-74.151805	Ocean	YES	River/Stream
AN0508	S Br Metedeconk River @ Leesville-Siloam Rd (Diamond Rd)	40.165592	-74.357577	Ocean	YES	River/Stream
AN0509	S Br Metedeconk River @ Jacksons Mill Rd	40.147555	-74.325222	Ocean	YES	River/Stream
AN0510	S Br Metedeconk River @ Bennetts Mill Rd	40.126777	-74.277888	Ocean	YES	River/Stream
AN0510A	S Br Metedeconk River @ Cooks Bridge Rd	40.134836	-74.295146	Ocean	YES	River/Stream
AN0511	S Br Metedeconk River @ Cedar Bridge Ave	40.086944	-74.212166	Ocean	YES	River/Stream
AN0512	S Br Metedeconk River @ Chambers Bridge Rd (Rt. 549)	40.078833	-74.156444	Ocean	YES	River/Stream
AN0513	Beaverdam Ck @ Rt 88	40.073444	-74.114805	Ocean	YES	River/Stream
AN0514	Cedar Bridge Br @ Rt 70	40.055333	-74.138500	Ocean	YES	River/Stream
AN0515A	Kettle Ck @ Shorrock Rd	40.052617	-74.160658	Ocean	YES	River/Stream
AN0519	Toms River @ Rt 528	40.109777	-74.373694	Ocean	YES	River/Stream
AN0519A	Toms River @ Anderson Rd	40.152334	-74.412372	Ocean	YES	River/Stream
AN0520A	Toms River @ Bowman Road (CR52)	40.089547	-74.315038	Ocean	YES	River/Stream
AN0521	Maple Root Br @ Bowman Rd	40.081250	-74.327138	Ocean	YES	River/Stream
AN0522	Dove Mill Br @ Grawtown Rd	40.069111	-74.291166	Ocean	YES	River/Stream
AN0523	Toms River @ S. Hope Chapel Rd	40.061694	-74.274583	Ocean	YES	River/Stream
AN0523A	Toms River @ Rt. 70	40.032791	-74.251790	Ocean	YES	River/Stream
AN0526	Shannae Bk @ Colliers Mill Wildlife Area	40.058750	-74.391555	Ocean	YES	River/Stream
AN0527	Ridgeway Br @ near Legler off Rt 571	40.047305	-74.334666	Ocean	YES	River/Stream

AN0528	Ridgeway Br @ Rt 70	40.021277	-74.273750	Ocean	YES	River/Stream
AN0529	Blacks Br @ end of Central Ave	40.012972	-74.379944	Ocean	YES	River/Stream
AN0531	Old Hurricane Br @ Beckerville Rd (Central Ave)	39.991361	-74.379083	Ocean	YES	River/Stream
AN0531A	Old Hurricane Br @ Rt. 70	39.997636	-74.351026	Ocean	YES	River/Stream
AN0532	Manapauqua Br @ Rt 70	40.012333	-74.302472	Ocean	YES	River/Stream
AN0534A	Union Br @ 10th Ave	40.003828	-74.241519	Ocean	YES	River/Stream
AN0535	Toms River @ Oak Ridge Pkwy	39.986583	-74.223750	Ocean	YES	River/Stream
AN0536	Wrangel Bk @ Congasia Rd	39.972805	-74.324027	Ocean	YES	River/Stream
AN0536A	Tice Van Horn Br @ Congasia Rd	39.949782	-74.333063	Ocean	YES	River/Stream
AN0539	Wrangel Bk @ Southampton Rd	39.960972	-74.228138	Ocean	YES	River/Stream
AN0540A	Davenport Br @ Pinewald Rd (Rt. 530)	39.941458	-74.296834	Ocean	YES	River/Stream
AN0541	Davenport Br @ Mule Rd (Rt 642)	39.960500	-74.244500	Ocean	YES	River/Stream
AN0542	Jakes Br @ Dover Rd (Rt 618)	39.915472	-74.273527	Ocean	YES	River/Stream
AN0543	Jakes Br @ Double Trouble Rd	39.935416	-74.211555	Ocean	YES	River/Stream
AN0544	UNT to Toms River (Long Swamp Ck) @ Rt 37	39.955555	-74.166083	Ocean	YES	River/Stream
AN0545A	Webbs Mill Br @ off Swains Bog Rd	39.883743	-74.335189	Ocean	YES	River/Stream
AN0545B	Chamberlain Br @ Jones Rd (off Rt. 539)	39.872808	-74.344460	Ocean	YES	River/Stream
AN0546	Cedar Ck @ Lacey Rd	39.897305	-74.316277	Ocean	YES	River/Stream
AN0547	Factory Br @ Lacey Rd (Rt 614)	39.881166	-74.275194	Ocean	YES	River/Stream
AN0548	Cedar Ck @ Double Trouble St Park	39.894055	-74.225194	Ocean	YES	River/Stream

AN0549	Cedar Ck @ Rt 9	39.867694	-74.168916	Ocean	YES	River/Stream
AN0550	Long Br of N Br Forked River @ dirt road off Rt. 532	39.817250	-74.292833	Ocean	YES	River/Stream
AN0551	N Br Forked River @ at Power Lines	39.858722	-74.224972	Ocean	YES	River/Stream
AN0552	Oyster Ck @ Rt 532	39.798305	-74.250083	Ocean	YES	River/Stream
AN0554	Four Mile Br @ nr. Mill Ck confl.	39.707444	-74.266944	Ocean	YES	River/Stream
AN0555	Mill Ck @ Rt 72	39.692694	-74.258861	Ocean	YES	River/Stream
AN0555A	Mill Ck @ off Hay Rd	39.728730	-74.319310	Ocean	YES	River/Stream
AN0556	Cedar Run @ Rt 9	39.680277	-74.270833	Ocean	YES	River/Stream
AN0557	Westecunk Ck @ Forge Rd (Stafford Forge)	39.666555	-74.320250	Ocean	YES	River/Stream
AN0558	Westecunk Ck @ Railroad Ave	39.640250	-74.307805	Ocean	YES	River/Stream
AN0559	Mill Br of Tuckerton Ck @ Nugentown Rd	39.610416	-74.349944	Ocean	YES	River/Stream
AN0559A	Mill Br @ Poor Mans Pkwy	39.642340	-74.362923	Ocean	YES	River/Stream
AN0560A	Alquatka Br @ off Jackson Rd, Wharton St. Forest	39.784212	-74.807138	Burlington	YES	River/Stream
AN0561	Mullica River @ off Jackson Rd	39.776277	-74.798750	Burlington	YES	River/Stream
AN0562	Mullica River @ Burnt House Rd	39.743055	-74.757111	Burlington	YES	River/Stream
AN0563	Wesickaman Ck @ Quaker Bridge Rd	39.741083	-74.723361	Burlington	YES	River/Stream
AN0564	Mullica River @ Constable Bridge	39.659254	-74.658588	Atlantic	YES	River/Stream
AN0565	Hays Mill Ck @ Tremont Ave	39.750666	-74.840916	Camden	YES	River/Stream
AN0566	Sleeper Br @ Fleming Pike, Parkdale	39.722777	-74.756555	Camden	YES	River/Stream
AN0567	Clarks Br @ Burnt Mill Rd	39.713527	-74.777833	Camden	YES	River/Stream

AN0568	Prices Br @ Burnt Mill Rd	39.722111	-74.796638	Camden	YES	River/Stream
AN0568G	Gun Br @ Rt 206	39.698744	-74.753187	Atlantic	YES	River/Stream
AN0569	Pump Br @ Old White Horse Pike	39.699638	-74.844222	Camden	YES	River/Stream
AN0569A	Pump Br @ Barrett Ave	39.706110	-74.884170	Camden	YES	River/Stream
AN0570	Blue Anchor Bk @ Rt 30	39.688194	-74.834472	Camden	YES	River/Stream
AN0572	Albertson Bk @ Old Bridge Crossing	39.694694	-74.743972	Atlantic	YES	River/Stream
AN0574	Great Swamp Bk @ Rt 206	39.684277	-74.763305	Atlantic	YES	River/Stream
AN0575	Cedar Bk @ Myrtle Ave (Columbia Rd)	39.664555	-74.765583	Atlantic	YES	River/Stream
AN0575A	Sleeper Br @ off Pleasant Mills Road @ Batona trail xing	39.646670	-74.660560	Atlantic	YES	River/Stream
AN0576	Nescohague Ck @ Pleasant Mills	39.641333	-74.661361	Atlantic	YES	River/Stream
AN0577	Hammonton Ck @ Boyer Rd	39.632750	-74.760444	Atlantic	YES	River/Stream
AN0578	Hammonton Ck @ Columbia Rd	39.628000	-74.693527	Atlantic	YES	River/Stream
AN0579	Batsto River @ Carranza Rd	39.800666	-74.672444	Burlington	YES	River/Stream
AN0580	Roberts Br @ Carranza Rd	39.787833	-74.659416	Burlington	YES	River/Stream
AN0581	Skit Br @ Carranza Rd	39.785722	-74.658277	Burlington	YES	River/Stream
AN0582A	Indian Mills Br @ Burnt House Rd	39.791921	-74.745415	Burlington	YES	River/Stream
AN0585	Springers Bk @ Hampton Rd	39.755416	-74.696222	Burlington	YES	River/Stream
AN0586	Batsto River @ Quaker Bridge	39.709638	-74.666333	Burlington	YES	River/Stream
AN0586A	Batsto River @ Hampton Furnace	39.770950	-74.679601	Burlington	YES	River/Stream
AN0587	Pen Swamp Br @ Quaker Bridge-Batsto Rd	39.684166	-74.650388	Burlington	YES	River/Stream

AN0588	Batsto River @ Rt 542	39.642013	-74.649883	Burlington	YES	River/Stream
AN0589	Lucas Br @ Pleasant Mills-Weekstown Rd (CR643)	39.617611	-74.630111	Atlantic	YES	River/Stream
AN0589A	Bull Ck @ off Bulltown Rd	39.625394	-74.597409	Burlington	YES	River/Stream
AN0590	Landing Ck @ Rt 30	39.535777	-74.657472	Atlantic	YES	River/Stream
AN0592	Landing Ck @ Indian Cabin Rd	39.556805	-74.602861	Atlantic	YES	River/Stream
AN0594	Indian Cabin Ck @ outlet of Egg Harbor City Lake	39.558666	-74.604944	Atlantic	YES	River/Stream
AN0594A	Landing Ck @ off San Francisco Ave (at powerlines)	39.572804	-74.583392	Atlantic	YES	River/Stream
AN0595	West Br Wading River @ Rt 532	39.814444	-74.547027	Burlington	YES	River/Stream
AN0596	West Br Wading River @ Rt 563	39.789861	-74.535777	Burlington	YES	River/Stream
AN0597	Shoal Br @ Jones Mill Rd	39.776472	-74.508555	Burlington	YES	River/Stream
AN0597A	Shoal Br @ off Rt 532	39.814562	-74.478484	Burlington	YES	River/Stream
AN0600	Tulpehocken Ck @ Maxwell-Friendship Rd	39.714388	-74.565888	Burlington	YES	River/Stream
AN0601	Little Hauken Run @ Rt 563	39.716055	-74.535000	Burlington	YES	River/Stream
AN0602	West Br Wading River @ Rt 563	39.673944	-74.537166	Burlington	YES	River/Stream
AN0603	Oswego River @ Rt 539	39.775888	-74.367400	Ocean	YES	River/Stream
AN0603A	Oswego River @ Beaver Dam Rd	39.749629	-74.377342	Ocean	YES	River/Stream
AN0604	Plains Br @ Jenkins Rd	39.764394	-74.407431	Burlington	YES	River/Stream
AN0605	Papoose Br @ Jenkins Rd	39.742383	-74.452282	Burlington	YES	River/Stream
AN0606	Oswego River @ Andrews Rd	39.731655	-74.488427	Burlington	YES	River/Stream
AN0607	Oswego River (E Br Wading River) @ Rt 679	39.663460	-74.523486	Burlington	YES	River/Stream

AN0607A	Beaver Br @ Rt. 679 (Chatsworth Rd)	39.648647	-74.506897	Burlington	YES	River/Stream
AN0609A	Ives Br @ Leektown Rd (Rt 653)	39.613701	-74.488305	Burlington	YES	River/Stream
AN0610	West Br Bass River @ Stage Rd	39.624277	-74.445833	Burlington	YES	River/Stream
AN0612	East Br Bass River @ Stage Rd	39.623373	-74.441116	Burlington	YES	River/Stream
AN0613	Clarks Mill Stream @ Rt 575	39.516083	-74.507833	Atlantic	YES	River/Stream
AN0614	Morses Mill Stream @ Riverside Dr	39.510861	-74.503277	Atlantic	YES	River/Stream
AN0615	Mattix Run (Frenches Ditch) @ Moss Mill Rd	39.494277	-74.479250	Atlantic	YES	River/Stream
AN0616	N Br Absecon Ck @ Garden State Pkwy	39.445027	-74.538916	Atlantic	YES	River/Stream
AN0617	S Br Absecon Ck @ FAA Tech Center	39.439833	-74.566333	Atlantic	YES	River/Stream
AN0618	Mill Br (Fenton's Mill) @ Spruce Ave (CR 684)	39.395722	-74.593194	Atlantic	YES	River/Stream
AN0619	Maple Run (Asbury Run) @ Mill Rd (CR 662)	39.375666	-74.571750	Atlantic	YES	River/Stream
AN0621	Great Egg Harbor River @ Williamstown-New Freedom Rd (Rt 536 spur)	39.733820	-74.951395	Camden	YES	River/Stream
AN0621A	Great Egg Harbor River @ Causeway Rd	39.701479	-74.937473	Camden	YES	River/Stream
AN0622	Four Mile Br @ Malaga Rd	39.696555	-74.939944	Gloucester	YES	River/Stream
AN0623	Great Egg Harbor River @ Winslow Rd	39.669555	-74.913416	Gloucester	YES	River/Stream
AN0624	Squankum Br @ Malaga Rd	39.667888	-74.960611	Gloucester	YES	River/Stream
AN0624A	Great Egg Harbor River @ Piney Hollow Rd	39.620553	-74.892584	Camden	YES	River/Stream
AN0625	Great Egg Harbor River @ Rt 54	39.594397	-74.851175	Atlantic	YES	River/Stream
AN0626	Penny Pot Stream @ Eighth Ave	39.580055	-74.817388	Atlantic	YES	River/Stream
AN0627	Hospitality Br @ Blue Bell Rd	39.644500	-74.985750	Gloucester	YES	River/Stream

AN0628	Hospitality Br @ Rt 538	39.620611	-74.927055	Gloucester	YES	River/Stream
AN0629	Faraway Br @ Jackson Rd	39.616222	-74.936027	Gloucester	YES	River/Stream
AN0630	White Oak Br @ Jackson Rd	39.596388	-74.918111	Gloucester	YES	River/Stream
AN0631	Marsh Lake Br (Collings Br) @ Unexpected Rd	39.566083	-74.926027	Gloucester	YES	River/Stream
AN0632	Marsh Lake Br (Collings Br) @ Cains Mill Rd	39.589833	-74.881472	Atlantic	YES	River/Stream
AN0633	Hospitality Br @ Rt 54	39.588472	-74.85875	Atlantic	YES	River/Stream
AN0634	Three Pond Bk @ Rt 54	39.581083	-74.86725	Atlantic	YES	River/Stream
AN0635	Great Egg Harbor River @ Rt 559	39.518138	-74.778666	Atlantic	YES	River/Stream
AN0635A	Makepeace Stream @ AC Expressway, WB, 1/2 mile east of Farley Plaza	39.542997	-74.728792	Atlantic	YES	River/Stream
AN0637	Deep Run @ Rt 559	39.507277	-74.781916	Atlantic	YES	River/Stream
AN0638	Mare Run @ Rt 559	39.478777	-74.7575	Atlantic	YES	River/Stream
AN0639	Watering Race @ Rt 50 (Cape May Ave)	39.47275	-74.715277	Atlantic	YES	River/Stream
AN0640	Babcock Ck @ Rt 322	39.468944	-74.692527	Atlantic	YES	River/Stream
AN0641	Gravelly Run @ Rt 559	39.42725	-74.70175	Atlantic	YES	River/Stream
AN0642	Miry Run @ Thelma Ave	39.405638	-74.691444	Atlantic	YES	River/Stream
AN0643	South River @ Estelle Ave	39.471166	-74.843138	Atlantic	YES	River/Stream
AN0644	South River @ Walkers Forge Rd (Forty Wire Rd)	39.440361	-74.755583	Atlantic	YES	River/Stream

AN0646	Stephens Ck @ Rt 50	39.393833	-74.748194	Atlantic	YES	River/Stream
AN0647	Gibson Ck @ Rt 50	39.353138	-74.756194	Atlantic	YES	River/Stream
AN0648	Tuckahoe River @ Cumberland Ave (Rt637)	39.372222	-74.853444	Atlantic	YES	River/Stream
AN0648A	Tuckahoe River @ beneath powerlines in Peaslee WMA	39.343987	-74.863727	Cumberland	YES	River/Stream
AN0649A	Tarkiln Bk @ Rt. 548 (Weatherby Rd)	39.305386	-74.832241	Cape May	YES	River/Stream
AN0650	Tuckahoe River @ Rt 49 (Head of River)	39.307055	-74.820333	Atlantic	YES	River/Stream
AN0651	McNeals Br @ Rt 666 (Cape May Ave)	39.316027	-74.824333	Atlantic	YES	River/Stream
AN0652	Mill Ck @ Rt 557 (Woodbine Rd.)	39.284333	-74.792	Cape May	YES	River/Stream
AN0765	West Ck @ Rt 550	39.259833	-74.911777	Cumberland	YES	River/Stream
AN0766	Savages Run (East Ck) @ Sunset Rd	39.242111	-74.876222	Cape May	YES	River/Stream
AN0769	Old Robins Br @ Beaver Causeway	39.197222	-74.8695	Cape May	YES	River/Stream
AN0771	Fishing Ck @ Rt 47	39.027524	-74.896191	Cape May	YES	River/Stream

Table 2 Sample Types

STATION ID	Field Msr/Obs	Flow	Water Chemistry	Continuous Monitoring	Biological Sampling	Sediment Collection	Bacteria Collection	Habitat	Metrics	Indices
All Sites	Yes	No	No	No	Yes	No	No	Yes	Yes	Yes

Table 3 Partners

STATION ID	Field Msr/Obs	Flow	Water Chemistry	Continuous Monitoring	Biological Sampling	Sediment Collection	Bacteria Collection
All Sites	DEP	NO	NO	NO	DEP	NO	NO

Table 4 Field Measures

Field Name	WQDE Name	Media	Units
Water Temp	Temperature, Water	Water	deg C
Spec Cond	Specific conductance	Water	uS/cm
pH	pH	Water	None
DO	Dissolved Oxygen (DO)	Water	mg/l
Turbidity	Turbidity	Water	NTU

Table 5 Habitat Assessment Parameters

CODE	NAME	DESCRIPTION
HAB_0221	RBP2, Low G, Bank Stability, Left Bank	RBP2, Low G, Bank Stability, Left Bank (choice list)
HAB_0222	RBP2, Low G, Bank Stability, Right Bank	RBP2, Low G, Bank Stability, Right Bank (choice list)
HAB_0223	RBP2, Low G, Channel Alteration	RBP2, Low G, Channel Alteration (choice list)
HAB_0224	RBP2, Low G, Channel Flow Status	RBP2, Low G, Channel Flow Status (choice list)
HAB_0225	RBP2, Low G, Channel Sinuosity	RBP2, Low G, Channel Sinuosity (choice list)
HAB_0226	RBP2, Low G, Epifaunal Substrate/Available Cover	RBP2, Low G, Epifaunal Substrate/Available Cover (choice list)
HAB_0228	RBP2, Low G, Pool Substrate Characterization	RBP2, Low G, Pool Substrate Characterization (choice list)
HAB_0229	RBP2, Low G, Pool Variability	RBP2, Low G, Pool Variability (choice list)

HAB_0230	RBP2, Low G, Riparian Vegetative Zone Width, Left Bank	RBP2, Low G, Riparian Vegetative Zone Width, Left Bank (choice list)
HAB_0231	RBP2, Low G, Riparian Vegetative Zone Width, Right Bank	RBP2, Low G, Riparian Vegetative Zone Width, Right Bank (choice list)
HAB_0232	RBP2, Low G, Sediment Deposition	RBP2, Low G, Sediment Deposition (choice list)
HAB_0233	RBP2, Low G, Vegetative Protection, Left Bank	RBP2, Low G, Vegetative Protection, Left Bank (choice list)
HAB_0234	RBP2, Low G, Vegetative Protection, Right Bank	RBP2, Low G, Vegetative Protection, Right Bank (choice list)

Table 6 Habitat Assessment Metrics

CODE	NAME	DESCRIPTION
HAB_0227	RBP2, Low G, habitat assessment total score	RBP2, Low G, habitat assessment total score
HAB_0241	RBP2, Low G, habitat assessment total rating	RBP2, Low G, habitat assessment total rating

Table 7 Individual Index Metrics

CODE	NAME	DESCRIPTION
PMI_001	Insect taxa	Insect taxa
PMI_002	Non-insect taxa	Non-insect taxa
PMI_003	Percent Plecoptera and Trichoptera	Percent Plecoptera and Trichoptera
PMI_004	Percent Diptera excluding Tanytarsini	Percent Diptera excluding Tanytarsini
PMI_005	Percent Mollusca and Amphipoda	Percent Mollusca and Amphipoda
PMI_006	Beck's Biotic Index (using Hilsenhoff taxa attributes)	Beck's Biotic Index (using Hilsenhoff taxa attributes)
PMI_007	Percent Filterers	Percent Filterers
CPHGMIG_001	Hilsenhoff Biotic Index	Hilsenhoff Biotic Index
CPMI_001	Total number of taxa	Total number of taxa
CPMI_002	Ephemeroptera taxa	Ephemeroptera taxa
CPMI_003	Percent Ephemeroptera taxa	Percent Ephemeroptera taxa
CPMI_004	Percent Clingers	Percent Clingers

Table 8 Overall Metrics

CODE	NAME	DESCRIPTION
COASTAL	Coastal Plain Macroinvertebrate Index	Coastal Plain Macroinvertebrate Index
CPMIR	CPMI Rating	CPMI Rating
PINELANDS	Pinelands Macroinvertebrate Index	Pinelands Macroinvertebrate Index
PMIR	PMI Rating	PMI Rating

Table 9 Data Inventory Supplement

Geographic Regions	River Basins- Great Egg Harbor, Mullica, Barnegat Bay, Monmouth, Cape May
Counties	Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Middlesex, Monmouth, Ocean
Dates	April 1-November 30, 2021
Status	In progress- discrete
Sample Frequency	Once
Seasons Sampled	Spring; Summer; Fall;
Waterbody Type	River/Stream
Salinity Category	Fresh
Tidal Influence	Non-tidal
Project Description	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 Atlantic Water Region is assessed.
Parameters analyzed type	Habitat; Biological- Benthic macroinvertebrates

Table 10 Data Management Supplement

QAPP network path file location?	V:\LUM\BFBM\Bfbm\Quality Assurance Plans\Calendar Year 2020 QAPPS\2020 AMNET QAPP-Atlantic Water Region
Where will data be recorded in field (media)	Paper
If on tablets or phones, will download at office occur or will you connect wirelessly?	N/A
If on tablets or phones, who will do the download?	N/A
If data collected electronically, where will it be stored?	N/A
Format to be received from Lab	N/A
Method of receipt from lab/s	N/A
Personnel receiving outside lab data	N/A
Is data expected to go to WQDE/STORET?	Yes
Data manager - (Bureau and Name)	BFBM- Leigh Lager