

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

**Quality Assurance/Quality Control Project Plan**

**Fish Index of Biotic Integrity**

**2019 Statewide Monitoring Project (Raritan Targeted Region)**

Written By: \_\_\_\_\_ Date \_\_\_\_\_

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**1.0 Project Name:** Fish IBI Monitoring Program

**2.0 Requesting Agency:** NJDEP Water Monitoring and Standards

**3.0 Date of Project:** 4/2019 - 5/2020; Index Period 6/2019 – 10/2019

**4.0 Project Fiscal Information:** Job Number 35950000, Activity Code V4DT

**5.0 Project Officer:** John Vile, Research Scientist I, BFBM

**6.0 Special Training Needs/Certification**

Assistants to the project will be trained in the operation and use of all sampling equipment including the proper safety and handling procedures for electroshocking equipment. The training will entail calibration methods, deployment techniques, and data retrieval from the equipment. The Project Officer or designee will be responsible for any necessary training.

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

**7.0 Project Description/Objective:**

The objective of the project is to enhance the ability of Water Monitoring & Standards to evaluate water quality in wadeable streams by providing a comprehensive biological assessment. This will be done using the Index of Biotic Integrity (IBI) for New Jersey fish assemblages statewide using the Northern Fish IBI and the Inner Coastal Plain Fish IBI (Southern IBI). The intended use is the assessment of aquatic life use in State waters as required by the federal CWA under section 305(b) and the identification of State impaired waters under section 303(d) of the federal CWA. In addition, Fish IBI data is a significant part of the intensive, data-driven, Category 1 (C-1) selection process (N.J.A.C. 7:9B). Additional uses may occur, such as water quality classifications and trout status.

**8.0 Network Design/Site Selection:**

There will be a total of 37 sites sampled in 2019 consisting of the following: 26 fixed network sites, 5 sentinel sites, 2 leftover sites from the Northwest region, and 4 leftover sites from the Northeast region. If resources are limited, sampling at sentinel sites will be suspended in 2019. The data from fixed sites is used to assess long term trends. Starting in 2017, the IBI and Headwaters IBI (HIBI) programs made an effort to select new sites or relocate old fixed sites to ensure spatial coverage within each rotating basin. The goal is to have a representative fish site (IBI or HIBI) at the pour point of as many hydrologic units (HUC-14) as possible. These sites are part of the new Fish IBI targeted monitoring network in which all fixed site sampling will occur in one of the five specific DEP Water Regions (Upper Delaware, Lower Delaware, Raritan, Northeast, and Atlantic). In 2019, fixed sites will be mainly sampled in the Raritan region, along with a few leftover sites from the Northeast and Northwest. Sentinel sites are considered high quality waterbodies located in fully or partially protected watersheds which are sampled on a routine basis to assess environmental changes and natural variability. Sentinel sites are split between the region north of the fall line and the inner coastal plain. Fixed sites are sampled on a five-year basis, while sentinel sites are sampled every other year.

All Northern IBI sites will be above the fall line with drainage areas greater than 4 square miles. Southern IBI sites will consist of Delaware drainage streams in the inner coastal plain with drainage areas greater than 2.0 square miles. The selected sites will address the varied program needs of the Bureau of Freshwater and Biological Monitoring.

All network sites will be visited prior to selection to make sure they are wadeable, meet the habitat criteria of Barbour et al. (1999) where applicable, and to mark off a 150-meter stream reach. All sites to be sampled will be selected prior to the end of the index period. Using a Trimble GPS capable of sub-meter accuracy, the start and finish of each sample site are recorded as waypoints and later incorporated into GIS. Below is the list of 2019 Fish IBI sites. Note, final site list may change following site reconnaissance due to sampling conditions and access. The final site list will be included in an addendum.

Site	Waterbody	Network	Latitude	Longitude
FIBI008a	Grandin Stream	N_IBI	40.6137	-74.9245
FIBI013	Heathcote Brook	N_IBI	40.3700	-74.6156
FIBI015	Mile Run	N_IBI	40.5049	-74.4674
FIBI017	Pleasant Run	N_IBI	40.5525	-74.7852
FIBI017a	Rahway River SB	N_IBI	40.5775	-74.3072
FIBI020	Rahway River	N_IBI	40.6743	-74.3133
FIBI025	Peters Brook	N_IBI	40.5677	-74.6054
FIBI038	Middle Brook	N_IBI	40.6477	-74.6806
FIBI042	Elizabeth River	N_IBI	40.6757	-74.2229
FIBI054	Lamington River	N_IBI	40.6901	-74.7227
FIBI070	Stony Brook	N_IBI	40.3267	-74.6804
FIBI073	Rockaway River SB	N_IBI	40.6394	-74.8163
FIBI087	Neshanic River	N_IBI	40.4934	-74.7534
FIBI091	Green Brook	N_IBI	40.5670	-74.5254
FIBI092	Holland Brook	N_IBI	40.5686	-74.7382
FIBI093a	Raritan River NB	N_IBI	40.6915	-74.6470
NJS11-109	Drakes Brook	N_IBI	40.8542	-74.6817
TBD	3rd Neshanic	N_IBI	40.4749	-74.8628
TBD	Cedar Brook	N_IBI	40.5930	-74.4097
TBD	Beaver Brook	N_IBI	40.6371	-74.9058
TBD	Prescott Brook	N_IBI	40.5841	-74.8631
TBD	Royce Brook	N_IBI	40.5048	-74.6240
TBD	Cruser Brook	N_IBI	40.4553	-74.6547
TBD	Beden Brook	N_IBI	40.3814	-74.7525
FIBI101	Rockaway Creek NB	N_IBI	40.6360	-74.7615
TBD	Lamington River	N_IBI	40.7207	-74.7284
FIBI058	Musconetcong R	N_IBI	40.8735	-74.8061
FIBI110	Musconetcong R	N_IBI	40.6083	-75.1668
FIBI024	Passaic River	N_IBI	40.6712	-74.5258
FIBI094a	Passaic River	N_IBI	40.7339	-74.3758
FIBI115	Harrisons Brook	N_IBI	40.6590	-74.5749
FIBI124	Rockaway River	N_IBI	40.9310	-74.5946
FIBI039	VanCampens Bk	N_IBI	41.0578	-75.0033
FIBI053	Mulhockaway Ck	N_IBI	40.6476	-74.9690
FIBI077	Pequannock River	N-IBI	41.0023	-74.3154
FIBI107	Shimers Brook	N_IBI	41.3130	-74.7786
FIBI225	Lahaway Creek	S_IBI	40.1175	-74.4933

\*Site list may change due to site conditions and access (Addendum). Final list will be submitted to all signees.

## 9.0 Sampling Procedures:

Sampling procedures for fish collection are described by Kurtenbach (1994), available as a .pdf document upon request. The sampling objective is to obtain a representative sample of the fish assemblage in a 150 meter stream reach. Fish will be captured using electrofishing equipment (either backpack units or barge mounted unit), identified to species level, and then released. Electrofishing is inherently dangerous and, therefore, team leaders must be trained in safe electrofishing techniques and practices to ensure safe working conditions for themselves and the field staff (AFS Professional Safety Committee 2008). Exposure to low electrical current (like that used in electrofishing) may cause death due to respiratory arrest or cardiac fibrillation (AFS Professional Safety Committee 2008). Due to these dangers, the field team leader and at least one other crew member must be trained in CPR and AED procedures. All crew members are required to wear chest waders with non-slip soles and electrician gloves rated at 7,500 watts. All crew members are required to adhere to the BFBM Field Work Health and Safety Plan developed in cooperation with NJDEP Office of Occupational Health and Safety (OOHS). Crew members must also adhere to any guidance provided by OOHS during the QAPP period. Sampling gear and crew size is directly related to stream width, but is at the discretion of the field team leader.

Stream width (m)	Gear*	Crew size*
≤ 3	1 backpack	3 to 4
3 to 10	2 backpacks	5 to 6
10 to 15	3 backpacks/barge	6 to 8
> 15	barge	5 to 7
* At the discretion of the Team Leader		

Sampling will include qualitative habitat assessments for high gradient streams as described in Barbour et al. (1999). In-stream measurements of temperature, DO, pH, conductivity, discharge, substrate, and canopy will be taken at each site as described below in section 6.

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 by cleaning with a commercial disinfectant and rinsing with tap water. Also, the use of felt-soled waders will be avoided.

## 11.0 Field Measurements/QAQC:

Dissolved oxygen (DO), pH, water temperature, and specific conductivity will be measured in-field at each site by biomonitoring staff, concurrent with fish sampling, in accordance with N.J.A.C. 7:18 *Regulations Governing the Certification of Laboratories and Environmental Measures* (NJDEP, 2003), Subchapter 8, Analyze-Immediately Environmental Measurements, and NJDEP's *Field Sampling Procedures Manual* (NJDEP, 2005). These physical/chemical parameters will be taken *in situ*, mid-depth, in a free-flowing area of the stream. BFBM is certified by the Office of Quality Assurance for each parameter sampled (Certified Lab ID # 11896). Water temperature, pH, specific conductance, and dissolved oxygen are measured using a Hydrolab MS5. The Hydrolab MS5 is a multi-parameter water quality system that combines temperature, pH, conductance, and luminescent dissolved oxygen (LDO) probes into one meter. The pH, specific conductance, and dissolved oxygen probes will be calibrated on a weekly basis per the manufacturer recommendations.

Visual based habitat assessments will be performed at each site using the format given in the Rapid Bioassessment Protocols (Barbour et al, 1999) for high gradient and low gradient streams. Habitats will be assessed at each site at the time that fish are collected from the site. In addition, a number of qualitative measurements will be made based on visual observation including: substrate composition, weather conditions, water clarity, and presence of aquatic vegetation.

**pH:** pH will be measured in-stream using a Hydrolab MS5 Water Quality Monitoring System. The meter and probe will be maintained and calibrated in accordance with the Operating Manual (February 2006 Edition 3, HACH Environmental, Loveland, CO). The probe is calibrated on a weekly basis per the manufacturer recommendations. The probe is also checked each day of use with a buffer which corresponds to the expected

range of the values to be measured. After three hours of continuous use, the pH of the certified buffer will be checked. Records of all calibrations and calibration checks shall be maintained in the BFBM Fish IBI Field Log.

**Dissolved Oxygen:** Dissolved oxygen will be measured in-stream using a Hydrolab MS5 Water Quality Monitoring System. The meter and probe will be maintained and air calibrated at each site in accordance with the Operating Manual (February 2006 Edition 3, HACH Environmental, Loveland, CO). The meter is barometrically compensated and checked at each sampling site. The meter will be checked weekly against a Winkler DO analysis. Calibration records are maintained in the BFBM Fish IBI Field Log.

**Water Temperature:** Water temperature will be measured in-stream using a Hydrolab MS5 Water Quality Monitoring System. The meter and probe will be maintained and calibrated in accordance with the Operating Manual (February 2006 Edition 3, HACH Environmental, Loveland, CO). Water temperature will be checked against a NIST certified thermometer. Calibration records are maintained in the BFBM Fish IBI Field Log.

**Ambient Air Temperature:** Air temperature will be measured streamside using a Traceable Flip-Stick thermometer (Fisher Scientific, Friendswood, Texas). The thermometer accurately measures ambient air temperature. The thermometer will be maintained and sent for recalibration in accordance with operating procedures. Air temperature will be checked against a NIST certified thermometer. Calibration records are maintained in the BFBM Fish IBI Field Log.

**Specific Conductance:** Specific conductance will be measured in-stream using a Hydrolab MS5 Water Quality Monitoring System. The meter and probe will be maintained and calibrated in accordance with the Operating Manual (February 2006 Edition 3, HACH Environmental, Loveland, CO). Specific conductance will be calibrated weekly using the conductivity standard (1800  $\mu\text{mhos/cm}$ ). To ensure accuracy, the probe will be checked each day of use with a certified standard (1800  $\mu\text{mhos/cm}$ ). Calibration records are maintained in the BFBM Fish IBI Field Log.

**Canopy:** The percentage of open or closed forest canopy cover over the stream channel will be measured using either a convex or concave Forestry Suppliers Spherical Crown Densiometer. Measurements will be taken at the starting point and at intervals 50, 100, and 150 meters along the sampled reach.

**Discharge:** Stream discharge will be measured at each stream reach sampled. A typical stream cross-section will be located at each sampling site and the cross-section width measured and divided into approximately 10 equal segments. (For small streams with a width of less than 20 feet, the number of segments may be reduced.) At each segment, the average velocity will be measured using a Marsh McBirney Flo-Mate 2000; the depth of the water at each segment will also be measured. This data will be used to calculate discharge in cubic feet or meters per second.

**Nutrients:** Total phosphorus and total nitrogen (calculated) samples are being collected at IBI sites as part of the ongoing Biological Nutrient Correlation Project. See Biological Nutrient Correlation QAPP for more information.

## **12.0 Fish Identification/QAQC:**

Identification of IBI species shall be according to the following references:

Cooper, E. L. 1983. Fishes of Pennsylvania and the United States. The Pennsylvania State University Press, University Park, PA.

Eddy, S., and J.C. Underhill. 1983. How to Know the Freshwater Fishes 3<sup>rd</sup> ed. William C. Brown Company, Dubque, Iowa.

Jenkins, R.E. and N.M. Burkhead. 1993. Freshwater Fishes of Virginia American Fisheries Society. Bethesda, MD.

Page, L.M., and B.M. Burr. 1991. Peterson Field Guides, Freshwater Fishes. Houghton Mifflin Company, New York.

Werner, R.G. 1980. Freshwater Fishes of New York State: A Field Guide. Syracuse University Press, New York.

The staff of the BFBM is experienced at identifying freshwater fish species expected to be collected. Individuals that cannot be identified in the field will be preserved in 10% formalin and brought back to the lab for further evaluation. Additionally, experienced fisheries biologists from the Philadelphia Academy of Natural Sciences of Drexel University are available to assist with unidentified or questionable individuals.

### **13.0 Data Analysis:**

Once fish from sample collections have been identified, counted, examined for disease and anomalies, and recorded, a Fish IBI score will be calculated using the appropriate Northern IBI or Southern IBI metrics. Fish IBI scores are calculated automatically in Access and are hand checked by staff members to ensure accuracy. Any discrepancies in scoring are re-evaluated by the project officer.

### **14.0 Time Line – Schedule of Tasks:**

Site evaluation and selection is expected to begin during the 1<sup>st</sup> week of April 2019.

Fish IBI sampling will take place in the daytime, June through early October 2019, during normal or low flows, and never under atypical conditions such as drought, high flows or excessive turbidity caused by significant precipitation. The postponement of a sampling event is determined by the professional judgment of the field crew leader following a visual inspection of the waterbody. Waters stocked with trout will be sampled between July 1 and early October 2019.

**15.0 Resource Needs:** BFBM will need three hourly staff to complete this project.

### **16.0 Data Storage and Distribution:**

Sampling results will be stored locally in a Microsoft Access database. Following the QA/QC verification of fish identifications and water quality measurements, data will be entered into New Jersey's Water Quality Data Exchange (WQDE) and will be accessible through the USEPA, USGS and National Water Monitoring Council's Water Quality Portal June the following year data is verified. (Appendix). This data includes: habitat assessment data, taxonomic data and counts, and metric and index scores, as well as water quality data. All raw data records shall be maintained for a period of no less than five years.

### **17.0 Data Reporting**

All habitat assessment and flow 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 fish identifications will be recorded on the BFBM's Data Sheet and entered into a Microsoft Access database.

A data summary table, including index scores and ratings, will be posted on the BFBM website ([www.state.nj.us/dep/wms/bfbm](http://www.state.nj.us/dep/wms/bfbm)) after completion of all sample analyses for the Water Region and data review. A summary report will be issued for each site and will contain at a minimum: taxa and counts of fish, field chemistry results, score and assessment of biological condition ratings, and habitat assessment score and rating.

Final data and evaluations will be forwarded to the DEP BEARS for use in the generation of the biennial New Jersey Integrated Water Quality Monitoring and Assessment Report [305(b) and 303(d)].

Summary data will be available on BFBM's website: <http://www.state.nj.us/dep/wms/bfbm/>.

### **18.0 Audits**

The Office of Quality Assurance (OQA) will be notified prior to commencement of any sampling activities in order that an audit may be performed.

## **19.0 Corrective Actions**

The Project Officer will be responsible for the oversight of all activities relating to this project. The Project Officer 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.

## **20.0 Literature Cited**

Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stribling. 1999. "*Rapid Bioassessment Protocols for Use in Streams and Wadable Rivers: Periphyton, Benthic Macroinvertebrates and Fish, Second Edition.*" EPA 841-B-99-002. U.S. Environmental Protection Agency; Office of Water; Washington, D.C.

Kurtenbach, J. P. 1994. "*Index of Biotic Integrity Study of Northern New Jersey Drainages*" U.S.EPA, Region 2, Div. Of Environmental Assessment, Edison, N. J. (Metrics revised April, 2000).

New Jersey Department of Environmental Protection (NJDEP), 2003. Regulations governing the certification of laboratories and environmental measures, N.J.A.C. 7:18, subchapter 8. Trenton, NJ.

New Jersey Department of Environmental Protection (NJDEP), 2005. Field sampling procedures manual. Ch. 6, Trenton, NJ.

New Jersey Department of Environmental Protection (NJDEP), 2005-2008. Annual Volume I Fish IBI Reports. <http://www.nj.gov/dep/wms/bfbm/ibireports.html>. Trenton, NJ.

Professional Safety Committee. 2008. Fisheries safety handbook. American Fisheries Society, Bethesda, Maryland.



## Appendix

Inventory

<b>Geographic Regions</b>	Statewide
<b>Counties</b>	Monmouth, Warren, Sussex, Morris, Hunterdon, Union, Somerset, Middlesex, Mercer
<b>Dates</b>	6/1/2019 - 10/7/2019
<b>Status</b>	Future/Planned
<b>Sample Frequency</b>	Other
<b>Seasons Sampled</b>	Spring, Summer, Fall
<b>Waterbody Type</b>	River/Stream
<b>Salinity Category</b>	Fresh
<b>Tidal Influence</b>	Non-tidal
<b>Project Description</b>	The objective of the project is to enhance the ability of Water Monitoring & Standards to evaluate water quality in wadeable streams by providing a comprehensive biological assessment. This will be done using the Index of Biotic Integrity (IBI) for New Jersey fish assemblages statewide using the Northern Fish IBI and the Inner Coastal Plain Fish IBI (Southern IBI). The intended use is the assessment of aquatic life use in State waters as required by the federal CWA under section 305(b) and the identification of State impaired waters under section 303(d) of the federal CWA. In addition, Fish IBI data is a significant part of the intensive, data-driven, Category 1 (C-1) selection process (N.J.A.C. 7:9B). Additional uses may occur, such as water quality classifications.
<b>Parameters analyzed type</b>	Habitat, Biology:Fish,

Data Management Supplement

QAPP network path file location?	V:\LUM\BFBM\Bfbm\Quality Assurance Plans\Calendar Year 2019 QAPPS\IBI2019
Where will data be recorded in field (media)	Paper
If on tablets or phones, will download at office occur or will you connect wirelessly?	
If on tablets or phones, who will do the download?	
If data collected electronically, where will it be stored?	
Format to be received from Lab	
Method of receipt from lab/s	
Personnel receiving outside lab data	
Is data expected to go to WQDE/STORET?	Yes

Table 1. Site List

Station ID (WQDE compliant and referenced)	Waterbody/Location	Latitude	Longitude	County	Site exists in WQDE already?	Location Type
FIBI008a	Grandin Stream	40.6137	-74.9245	HUNTERDON	YES	River/stream
FIBI013	Heathcote Brook	40.3700	-74.6156	MIDDLESEX	YES	River/stream
FIBI015	Mile Run	40.5049	-74.4674	SOMERSET	YES	River/stream
FIBI017	Pleasant Run	40.5525	-74.7852	HUNTERDON	YES	River/stream
FIBI017a	Rahway River SB	40.5775	-74.3072	MIDDLESEX	YES	River/stream
FIBI020	Rahway River	40.6743	-74.3133	UNION	YES	River/stream
FIBI025	Peters Brook	40.5677	-74.6054	SOMERSET	YES	River/stream
FIBI038	Middle Brook	40.6477	-74.6806	SOMERSET	YES	River/stream
FIBI042	Elizabeth River	40.6757	-74.2229	UNION	YES	River/stream
FIBI054	Lamington River	40.6901	-74.7227	HUNTERDON	YES	River/stream
FIBI070	Stony Brook	40.3267	-74.6804	MERCER	YES	River/stream
FIBI073	Rockaway River SB	40.6394	-74.8163	HUNTERDON	YES	River/stream
FIBI087	Neshanic River	40.4934	-74.7534	SOMERSET	YES	River/stream
FIBI091	Green Brook	40.5670	-74.5254	MIDDLESEX	YES	River/stream
FIBI092	Holland Brook	40.5686	-74.7382	HUNTERDON	YES	River/stream
FIBI093a	Raritan River NB	40.6915	-74.6470	SOMERSET	YES	River/stream
NJS11-109	Drakes Brook	40.8542	-74.6817	MORRIS	YES	River/stream
TBD	3rd Neshanic	40.4749	-74.8628	HUNTERDON	NO	River/stream
TBD	Cedar Brook	40.5930	-74.4097	MIDDLESEX	NO	River/stream
TBD	Beaver Brook	40.6371	-74.9058	HUNTERDON	NO	River/stream
TBD	Prescott Brook	40.5841	-74.8631	HUNTERDON	NO	River/stream
TBD	Royce Brook	40.5048	-74.6240	SOMERSET	NO	River/stream
TBD	Cruser Brook	40.4553	-74.6547	SOMERSET	NO	River/stream
TBD	Beden Brook	40.3814	-74.7525	MERCER	NO	River/stream
FIBI101	Rockaway Creek NB	40.6360	-74.7615	HUNTERDON	YES	River/stream
TBD	Lamington River	40.7207	-74.7284	MORRIS	NO	River/stream
FIBI058	Musconetcong R	40.8735	-74.8061	WARREN	YES	River/stream

FIBI110	Musconetcong R	40.6083	-75.1668	WARREN	YES	River/stream
FIBI024	Passaic River	40.6712	-74.5258	SOMERSET	YES	River/stream
FIBI094a	Passaic River	40.7339	-74.3758	UNION	YES	River/stream
FIBI115	Harrisons Brook	40.6590	-74.5749	MORRIS	YES	River/stream
FIBI124	Rockaway River	40.9310	-74.5946	MORRIS	YES	River/stream
FIBI039	VanCampens Bk	41.0578	-75.0033	WARREN	YES	River/stream
FIBI053	Mulhockaway Ck	40.6476	-74.9690	HUNTERDON	YES	River/stream
FIBI077	Pequannock River	41.0023	-74.3154	MORRIS	YES	River/stream
FIBI107	Shimers Brook	41.3130	-74.7786	SUSSEX	YES	River/stream
FIBI225	Lahaway Creek	40.1175	-74.4933	MONMOUTH	YES	River/stream

Table 2. Parameters

STATION ID	Field Msr/Obs	Flow	Water Chemistry	Continuous Monitoring	Biological	Sediment	Bacteria Collection	Habitat	Metrics	Indices
					Sampling	Collection				
FIBI008a	YES	YES	NO	NO	YES	NO	NO	Yes	Yes	Yes
FIBI013	YES	YES	NO	NO	YES	NO	NO	Yes	Yes	Yes
FIBI015	YES	YES	NO	NO	YES	NO	NO	Yes	Yes	Yes
FIBI017	YES	YES	NO	NO	YES	NO	NO	Yes	Yes	Yes
FIBI017a	YES	YES	NO	NO	YES	NO	NO	Yes	Yes	Yes
FIBI020	YES	YES	NO	NO	YES	NO	NO	Yes	Yes	Yes
FIBI025	YES	YES	NO	NO	YES	NO	NO	Yes	Yes	Yes
FIBI038	YES	YES	NO	NO	YES	NO	NO	Yes	Yes	Yes
FIBI042	YES	YES	NO	NO	YES	NO	NO	Yes	Yes	Yes
FIBI054	YES	YES	NO	NO	YES	NO	NO	Yes	Yes	Yes
FIBI070	YES	YES	NO	NO	YES	NO	NO	Yes	Yes	Yes
FIBI073	YES	YES	NO	NO	YES	NO	NO	Yes	Yes	Yes
FIBI087	YES	YES	NO	NO	YES	NO	NO	Yes	Yes	Yes
FIBI091	YES	YES	NO	NO	YES	NO	NO	Yes	Yes	Yes
FIBI092	YES	YES	NO	NO	YES	NO	NO	Yes	Yes	Yes
FIBI093a	YES	YES	NO	NO	YES	NO	NO	Yes	Yes	Yes
NJS11-109	YES	YES	NO	NO	YES	NO	NO	Yes	Yes	Yes
3rd Neshanic	YES	YES	NO	NO	YES	NO	NO	Yes	Yes	Yes
Cedar Brook	YES	YES	NO	NO	YES	NO	NO	Yes	Yes	Yes
Beaver Brook	YES	YES	NO	NO	YES	NO	NO	Yes	Yes	Yes
Prescott Brook	YES	YES	NO	NO	YES	NO	NO	Yes	Yes	Yes
Royce Brook	YES	YES	NO	NO	YES	NO	NO	Yes	Yes	Yes
Cruser Brook	YES	YES	NO	NO	YES	NO	NO	Yes	Yes	Yes
Beden Brook	YES	YES	NO	NO	YES	NO	NO	Yes	Yes	Yes
FIBI101	YES	YES	NO	NO	YES	NO	NO	Yes	Yes	Yes
Lamington River	YES	YES	NO	NO	YES	NO	NO	Yes	Yes	Yes
FIBI058	YES	YES	NO	NO	YES	NO	NO	Yes	Yes	Yes
FIBI110	YES	YES	NO	NO	YES	NO	NO	Yes	Yes	Yes
FIBI024	YES	YES	NO	NO	YES	NO	NO	Yes	Yes	Yes
FIBI094a	YES	YES	NO	NO	YES	NO	NO	Yes	Yes	Yes
FIBI115	YES	YES	NO	NO	YES	NO	NO	Yes	Yes	Yes
FIBI124	YES	YES	NO	NO	YES	NO	NO	Yes	Yes	Yes
FIBI039	YES	YES	NO	NO	YES	NO	NO	Yes	Yes	Yes
FIBI053	YES	YES	NO	NO	YES	NO	NO	Yes	Yes	Yes

FIBI077	YES	YES	NO	NO	YES	NO	NO	Yes	Yes	Yes
FIBI107	YES	YES	NO	NO	YES	NO	NO	Yes	Yes	Yes
FIBI225	YES	YES	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
FIBI008a	DEP	DEP	NO	NO	DEP	NO	No
FIBI013	DEP	DEP	NO	NO	DEP	NO	No
FIBI015	DEP	DEP	NO	NO	DEP	NO	No
FIBI017	DEP	DEP	NO	NO	DEP	NO	No
FIBI017a	DEP	DEP	NO	NO	DEP	NO	No
FIBI020	DEP	DEP	NO	NO	DEP	NO	No
FIBI025	DEP	DEP	NO	NO	DEP	NO	No
FIBI038	DEP	DEP	NO	NO	DEP	NO	No
FIBI042	DEP	DEP	NO	NO	DEP	NO	No
FIBI054	DEP	DEP	NO	NO	DEP	NO	No
FIBI070	DEP	DEP	NO	NO	DEP	NO	No
FIBI073	DEP	DEP	NO	NO	DEP	NO	No
FIBI087	DEP	DEP	NO	NO	DEP	NO	No
FIBI091	DEP	DEP	NO	NO	DEP	NO	No
FIBI092	DEP	DEP	NO	NO	DEP	NO	No
FIBI093a	DEP	DEP	NO	NO	DEP	NO	No
NJS11-109	DEP	DEP	NO	NO	DEP	NO	No
3rd Neshanic	DEP	DEP	NO	NO	DEP	NO	No
Cedar Brook	DEP	DEP	NO	NO	DEP	NO	No
Beaver Brook	DEP	DEP	NO	NO	DEP	NO	No
Prescott Brook	DEP	DEP	NO	NO	DEP	NO	No
Royce Brook	DEP	DEP	NO	NO	DEP	NO	No
Cruser Brook	DEP	DEP	NO	NO	DEP	NO	No
Beden Brook	DEP	DEP	NO	NO	DEP	NO	No
FIBI101	DEP	DEP	NO	NO	DEP	NO	No
Lamington River	DEP	DEP	NO	NO	DEP	NO	No

FIBI058	DEP	DEP	NO	NO	DEP	NO	No
FIBI110	DEP	DEP	NO	NO	DEP	NO	No
FIBI024	DEP	DEP	NO	NO	DEP	NO	No
FIBI094a	DEP	DEP	NO	NO	DEP	NO	No
FIBI115	DEP	DEP	NO	NO	DEP	NO	No
FIBI124	DEP	DEP	NO	NO	DEP	NO	No
FIBI039	DEP	DEP	NO	NO	DEP	NO	No
FIBI053	DEP	DEP	NO	NO	DEP	NO	No
FIBI077	DEP	DEP	NO	NO	DEP	NO	No
FIBI107	DEP	DEP	NO	NO	DEP	NO	No
FIBI225	DEP	DEP	NO	NO	DEP	NO	No

Table 4. Field Measurements

<b><u>Field Name</u></b>	<b><u>WQDE Name</u></b>	<b><u>Media</u></b>	<b><u>Units</u></b>
DO	Dissolved oxygen (DO)	Water	mg/l
Water Temp	Temperature, Water	Water	deg C
Spec Cond	Specific conductance	Water	uS/cm
pH	pH	Water	None
Flow	Flow	Water	cfs
Barometric Pressure	Barometric Pressure	Air	mmHg
DO Sat	Dissolved oxygen saturation	Water	%
Temperature, air	Temperature, air	Air	deg C

Table 7. RBP Habitat

Characteristic Name

RBP2, Low G, Pool Variability (choice list)
RBP2, Low G, Sediment Deposition (choice list)
RBP2, Low G, Channel Flow Status (choice list)
RBP2, Low G, Channel Alteration (choice list)
RBP2, Low G, Epifaunal Substrate/Available Cover (choice list)
RBP2, Low G, Pool Substrate Characterization (choice list)
RBP2, Low G, Bank Stability, Left Bank (choice list)
RBP2, Low G, Vegetative Protection, Left Bank (choice list)
RBP2, Low G, Channel Sinuosity (choice list)
RBP2, Low G, Bank Stability, Right Bank (choice list)
RBP2, Low G, Vegetative Protection, Right Bank (choice list)
RBP2, Low G, Riparian Vegetative Zone Width, Left Bank (choice list)
RBP2, Low G, Riparian Vegetative Zone Width, Right Bank (choice list)
RBP2, High G, Embeddedness (choice list)
RBP2, High G, Velocity/Depth Regime (choice list)
RBP2, High G, Sediment Deposition (choice list)
RBP2, High G, Channel Flow Status (choice list)
RBP2, High G, Frequency of Riffles (or bends) (choice list)
RBP2, High G, Epifaunal Substrate/Available Cover (choice list)
RBP2, High G, Bank Stability, Right Bank (choice list)
RBP2, High G, Channel Alteration (choice list)
RBP2, High G, Bank Stability, Left Bank (choice list)
RBP2, High G, Vegetative Protection, Left Bank (choice list)
RBP2, High G, Vegetative Protection, Right Bank (choice list)
RBP2, High G, Riparian Vegetative Zone Width, Left Bank (choice list)
RBP2, High G, Riparian Vegetative Zone Width, Right Bank (choice list)

Table 8. RBP Total Habitat

CharacteristicName
RBP2, High G, habitat assessment total score
RBP2, High G, habitat assessment total rating
RBP2, Low G, habitat assessment total score
RBP2, Low G, habitat assessment total rating

Table 9. Fish Metrics

CharacteristicName
Percent Richness of Rheophilic Species (adjusted for drainage size minus T. Darter)
Percent Abundance Cold and Nontolerant Coolwater Species (adjusted for drainage size)
Percent Richness Generalist Feeders
Tolerance Index
Percent Richness of Lithophilic Spawners (minus w. sucker)
Percent Abundance Cyprinidae (adjusted for drainage size)
Percent Abundance Dominant Three Taxa (not including Blacknose Dace)
Percent Richness Benthic Insectivores
Percent Insectivore Individuals
Number of individuals in sample
Percent Piscivore Individuals
Percent DELT Anomalies
Native Species Richness
Benthic Species Richness
Intolerant Species Richness
Percent Tolerant Individuals

Table 10. Total Fish Score and Rating

CharacteristicName
Fish Index of Biotic Integrity
FIBI Rating
Inner Coastal Plain Low Gradient Fish Index
ICPLGFI Rating

