

**NATURE FORWARD
WATER QUALITY MONITORING PROGRAM
QUALITY ASSURANCE – QUALITY CONTROL PLAN
OCTOBER 2022**

I. Project Description

Nature Forward's Water Quality Monitoring Program commenced with a pilot workshop in 1992 after receiving grant support from the Chesapeake Bay Trust. Subsequently, we established a Steering Committee to help guide our efforts to develop a training and monitoring program. Under the guidance of the committee, we established the following goals for the program:

- To increase the public's knowledge and understanding of conditions in healthy and degraded streams within watersheds surrounding the Washington, D.C. metropolitan area; and
- To create a bridge of cooperation and collaboration between citizens and natural resource agencies concerned about water quality protection and restoration.

Since 1992, Nature Forward (formerly the Audubon Naturalist Society) has operated a water quality monitoring program that generates important data on stream health at more than 25 stream sites in Washington, DC, and nearby counties in Maryland. From 1998-2007, Nature Forward also operated a water quality monitoring program in Northern Virginia. The program continues to be grant-funded.¹

Water quality factors to be measured at each site include identification of macroinvertebrate populations to class, order, and for aquatic insects to family level and sometimes to genus; stream habitat assessment; air and water temperature; and pH. Data collected are entered onto a paper data survey form in the field and subsequently into and stored in an online Salesforce database from which reports can be generated.

During all Nature Forward-sponsored water quality activities, participants will be covered by Nature Forward's liability insurance plan.

¹ In 1997, Nature Forward (formerly Audubon Naturalist Society or ANS) received funding through Section 319 of the Clean Water Act. The U.S. Environmental Protection Agency and the Maryland Department of Natural Resources administered the grant. Part of the work program for the Section 319 grant included review and revision of this Quality Control/Quality Assurance document by the Steering Committee.

II. Project Objectives

The objectives of the Nature Forward Water Quality Monitoring Program are:

- To collect information about macroinvertebrate populations, habitat conditions, and some abiotic factors that provide important indicators of water quality trends; and
- To deliver reconnaissance data of known quality and provide observational information about the areas(s) monitored.

III. Volunteer Training and Testing

The following training will be provided on a periodic basis and made available to all monitors, prospective monitors, and the public:

- An introduction to the volunteer's role in assessing the environmental health of streams using macroinvertebrate indicators;
- An introduction to macroinvertebrate orders and in-depth instruction on aquatic insect families, macroinvertebrate adaptations, and use of a key to identify macroinvertebrates;
- Stream habitat assessment techniques;
- Stream temperature and pH measurement procedures; and
- An introduction to watershed observation skills.

Training methods will include instruction in identification techniques such as counting number of legs, identifying gills, antennae, segmentation, size, and behavior characteristics, including preferred habitat and movement. A voucher collection of common aquatic macroinvertebrates found in local streams has been established as an educational tool for aiding in macroinvertebrate identification and testing. The collection will be maintained at Nature Forward headquarters.

A PowerPoint slide show will be presented at each indoor class to teach how to distinguish differences and similarities between common orders and families of macroinvertebrates. This will be followed up with lab work focusing on identification using voucher specimens. For identification classes that are given online, videos of benthic macroinvertebrates will be substituted for lab work. These will be selected to show the characteristics and behaviors of the macroinvertebrates being studied.

Field programs will be scheduled to introduce and reinforce a standardized macroinvertebrate

collection method, as well as to develop skills in identification of live macroinvertebrates and stream habitat observations.

Participants in the program will be asked to take a test in macroinvertebrate identification before the beginning of each spring monitoring season. The test can be administered on an individual basis at other times, as well. The test will determine the monitor's ability to identify aquatic insects, mollusks, and flat worms to family level; certain crustaceans to order; and leeches and worms to class. Representative samples of each major aquatic insect order – stoneflies (Plecoptera); mayflies (Ephemeroptera); caddisflies (Trichoptera); true flies (Diptera); fishflies, dobsonflies, alderflies (Megaloptera); dragonflies and damselflies (Odonata); and beetles (Coleoptera) -- will be included. Participants may use their keys and other identification sources during the test.

Only those who successfully pass the test (correctly identifying 24 of 26 specimens) will be responsible for identifying macroinvertebrates at a monitoring site. These persons will be given team leadership responsibilities. The Coordinator will have the discretion to allow those who narrowly fail to pass the test to be responsible for identification under certain conditions, such as submitting voucher specimens of those organisms misidentified.

Participants interested in monitoring who do not take the quiz or who do not achieve a passing score will be assigned to a monitoring team as collection and logistics assistants. Team participants will be encouraged to take/retake the test to improve their identification skills and strengthen their role on the monitoring team.

IV. Macroinvertebrate Collection Methods

Our sampling method is based on the protocol of the Maryland Biological Stream Survey. Monitors will use a 500-micron D-net to take 20 one-foot square net samples in the best available habitat for benthic macroinvertebrates within a pre-determined 75-meter reach. The sampling protocol will be made available with equipment to be checked out and posted on the Nature Forward website, as well.

The collected sample will be subsampled in the field using a plastic sorter box with 27 cells. All macroinvertebrates collected will be placed randomly in cells. A randomized list will be created to determine the order in which cells will be chosen for counting. Macroinvertebrates will be identified until 100 individuals are reached, including identifying all macroinvertebrates in the last cell.

Our minimum impact monitoring philosophy attempts to be sensitive to the populations of macroinvertebrates that we are observing and to the fragile habitats that support them. After they are collected and identified, organisms will be returned to the stream unless further identification or verification is necessary.

V. Macroinvertebrate Identification Methods

The key to macroinvertebrate population data accuracy is extensive training in macroinvertebrate identification to order and family level, follow-up field experience, and data collection events. Refresher and retraining courses are given periodically throughout the year.

Monitors are encouraged to acquire books and dichotomous keys that will help them identify aquatic insects to family level. In addition, Nature Forward has developed keys to common families of aquatic insects. These are disseminated during advanced identification classes. Teams are expected to use their keys in the field to help with identification.

If macroinvertebrates cannot be reliably identified in the field, teams are instructed to preserve specimens in a vial of 70% ethyl alcohol. Nature Forward staff or other experts will identify the specimens in the lab and report back to the team with proper identification. Teams are also asked to preserve and send in for confirmation certain uncommon macroinvertebrates, those that are easily confused, and those that are difficult to identify in the field.

VI. Stream Habitat Assessment

The second component of the volunteer monitoring project will be to make observations of stream habitat. Since spring 2011, we have used the same habitat assessment forms as Montgomery County's Watershed Management Division of the Department of Environmental Protection. These cover the same information as the MBSS Spring and Summer Habitat Data Sheets and EPA's habitat assessment parameters for high gradient streams, as described in *Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers*, 2nd Edition (1999). Habitat assessment protocols will be provided to teams along with equipment and on the Nature Forward website.

VII. Temperature

Armored thermometers reading from -5.0 degrees Celsius to +45.0 degrees Celsius, from LaMotte Company, are used to measure air and water temperatures. Water temperature is taken in three places, and then averaged for recording purposes. Temperature data, including the time of day, is recorded on the data sheet used by each team. Conversion formulas are listed on the data sheet to enable monitors to record temperatures in Celsius and Fahrenheit.

At the beginning of each monitoring season, all thermometers used in the program will be tested in a pan of water. Thermometers that register a 0.5 degree Celsius or greater deviation will be retired from the program.

VIII. pH

PH of water within the sampling area will be taken using a Mini pH Test Kit by Aquarium Pharmaceuticals, Inc., or the equivalent. The kits measure pH levels in a range from 6.0 to 7.6 in two-tenth increments. According to Elizabeth Yuster, aquatic biologist and member of the original Steering Committee, readings from the Mini pH Test Kit have consistently matched those of more sophisticated electronic pH equipment. Monitors will follow procedures in the test kit instructions and record results on the data sheet.

IX. Data Management

After completing a stream survey at the monitoring station, monitors will enter their data into a Salesforce database. Monitors will also submit copies of the paper forms as a backup for review and long-term storage. Nature Forward staff and specially trained volunteers will approve the data in Salesforce after reviewing it for accuracy and completeness. The Salesforce database will automatically generate a stream health score for each monitoring visit using the benthic index of biotic integrity (BIBI) calculator developed for the Maryland Stream Waders Program of the Maryland Department of Natural Resources.

Data collected by Nature Forward monitors will be submitted to the Montgomery County Department of Environmental Protection, the Maryland Department of the Environment, the Maryland Department of Natural Resources, the District Department of Energy and Environment, the National Park Service, and the Chesapeake Monitoring Cooperative.