BRODHEAD WATERSHED ASSOCIATION

CITIZEN STREAMWATCH PROGRAM

PROCEDURE MANUAL

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Brodhead Watershed Association
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INTRODUCTION

The Brodhead Watershed Association was founded in 1989 to protect and preserve the water resources of the Brodhead Creek and its tributaries. The organization has a diverse membership including individuals, municipalities, businesses, educators, sportsmen/women, resort owners and environmentalists. Our work focuses on increasing public awareness of issues relating to water resources through education, community involvement, and stewardship.

The Brodhead Watershed Association's Streamwatch Program has been developing since August 1990. The parameters included in the study were identified with the assistance of the Monroe County Planning Commission and East Stroudsburg University's Biology Department. Procedures were standardized under the direction of the Monroe County Cooperative Extension Office and Dickenson University's ALLARM program.

The Streamwatch Program is dependent entirely upon volunteer commitment. A study of this kind would be financially impossible if professional services were contracted. Given reliable equipment, informative training sessions, and standardized procedures, volunteers have proven to be a reliable means of stream monitoring.

As a volunteer with the Brodhead Watershed Association's Streamwatch Program, you are committing approximately one to two hours per month of your valuable time. More importantly, you are becoming involved in the future of your own water quality. The individuals who choose to participate in this program will be rewarded by a new sense of appreciation for the incomparable significance these streams give to the Pocono Mountains.

Sometimes it's cold and rainy when we are out on the stream, but more often the weather is beautiful, the stream flows clear and you'll be glad you have a reason to be out enjoying nature.

Thank You...

VOLUNTEERS' EXPECTATIONS

A Streamwatch Volunteer commits one to two hours once a month to get out on the stream and monitor their site(s). Volunteers are encouraged to work in pairs for safety in the field and back up if one person is occasionally not available.

Streamwatchers are also asked to become members of the Brodhead Watershed Association. By being BWA members, Streamwatchers are covered by the Association's liability insurance -- if anything should happen that triggers a suit against the Association, members are covered but others are not. We also hope Streamwatchers are committed to the goals of the BWA and are members. BWA depends on contributions from members to buy equipment, and keep the organization functioning.

Streamwatch volunteers are organized in seven Teams according to the major tributaries in the watershed: Marshalls, Upper Brodhead, Paradise, Pocono, McMichael, Lower Brodhead and Cherry. Each Team has a Team Leader.

TEAM LEADERS' EXPECTATIONS

Team Leaders train volunteers, assign volunteers to sites and answer questions about procedures or sites. Team Leaders review field data sheets from their volunteers to assure data is being recorded properly, contact volunteers to clarify handwriting or data entry errors and pass data sheets on to database manager.

Team Leaders keep Streamwatchers supplied with necessary forms and equipment, and see that the equipment is passed along quickly so monitoring continues on schedule.
Team Leaders work with the Streamwatch Coordinator to manage the program in each sub watershed of the Brodhead watershed. The Team Leaders' job combines the talents of cheerleader and coach to ensure a quality program.

STREAMWATCH COORDINATOR

The Streamwatch Coordinator is the Chair of the Streamwatch Committee and a member of the Board of Directors. S/he works with the Streamwatch Committee and through the Team Leaders to manage the Streamwatch Program. S/he arranges for annual training sessions for prospective volunteers.
S/he is also the Quality Control Supervisor of the program. Those responsibilities are to:

1) conduct quality control sessions,
2) train Team Leaders and oversee training of volunteer monitors and their replacements,
3) Order equipment and supplies.

STREAMWATCH COMMITTEE

The Streamwatch Committee consists of the Streamwatch Coordinator as chair, Team Leaders, interested volunteers and advisors on such issues as data management, testing procedures and public outreach. The Committee meets on the Coordinator's call and assists with all facets of the Streamwatch program.

DATA MANGEMENT

Team Leaders review data sheets and sends them to the volunteer database manager who enters data into an Excel database. Streamwatch data can be viewed here:

https://www.dropbox.com/sh/3ohtowzd3k0l5kx/AACdoTeLsQmja4GdRTstlVVga?dl=0

CHOICE OF PARAMETERS

For each site, volunteers record the date, time, weather, stream level, air temperature, water temperature, pH, conductivity and chloride where indicated.

In addition, stream and site conditions are recorded. This data is extremely important. Records of the stream and site visual appearance may indicate follow-up examination is needed.

CHOOSING TEST SITES

Test sites were chosen using the guidelines below. If the stream conditions change at your test site, or the site needs to be moved for any reason, please follow these guidelines. They are designed to make your stream monitoring experience not only valid, but also safe and pleasurable.

Do not change your assigned site(s) without consulting with your Team Leader.

1.) Tributary sites are located relatively (100 - 200 feet) close to where the trib meets the larger stream. The rational for this is that if the tributary shows high quality at its mouth, it is most probable that the quality of the water upstream is high as well.

2.) If there are discharge points (or other suspected problem areas) on the stream, sites are located above the discharge (or suspected problem) and below.

3.) Your safety is our prime concern! Access to sites should be safe and relatively easy to get to.

4.) We only test where we have property owner's permission. Property Owner Permission forms are kept in the BWA office files.

5.) The actual test location should be in a riffle, i.e. running water, and not a still pool.

6.) Sites are marked with a "BWA Streamwatch Site" sign.

PERFORMING THE TEST AT YOUR SITE

Please keep in mind that this is a scientific study, which requires standardization and objectivity. If the data is to be useful in the future it is very important that you follow the same procedure each time you test your site(s).

1.) Take your readings from the same spot, at the same time, and during the same week of each month. If you question the results of any test, **repeat the test** to verify your results.

2.) Work with one or more partners. This is important in terms of objectivity, safety and backup.

3.) Begin by filling out the site number, stream name, location, date, time, and weather information on the data sheet. This will allow sufficient time for the thermometer to adjust to the air temperature. Then record the air temperature (in Celsius). (To convert F to C use an on-line converter or the formula ([F-32] x 5/9= C).

4.) pH test – follow instructions that are in the kit. Rinse test tubes in the stream for three times before taking a sample. With the sunlight coming over your shoulder, hold the comparator against a white background and turn the wheel until the color matches in the two openings. You and your partner should determine the reading that matches most closely color of the sample. Dispose of the liquid away and back from the stream bank. Record the results on the data sheet. Two types of kits are used in the BWA program:
Hach Mid-Range (5.6 -8.4) pH Test Kit (Model 17-F, catalog No. 1470-06) – uses Bromothymol Blue reagent
Hach Wide-Range (4.0–10.0) pH Test Kit Model 17-N, catalog No 1470-11) uses Wide range indicator reagent.

5.) Record the water level as Low, Medium or High (add Very if appropriate).

6.) Record water clarity and color information using the following terms: clear, muddy, brown, rusty, gray, green, milky (add v= very, m= moderately, or s= slightly, as needed).

7.) Fill a jar with water and wave your hand over the opening to check water odor.

Use the Hanna Conductivity meter (DIST 3), see instructions with the meter, and record conductivity reading and water temperature (in Celsius) from the read-out. Swirl the probe section of the meter in the stream for several seconds before holding it still to take a reading. Let the readout settle before recording the reading.

8.) The conductivity unit given is uS/cm (microsiemens/centimeter). If the conductivity measure more than 200 uS/cm, test for chloride using test strips provided. Follow instructions on Chloride strips bottle. (Note: In Cherry Creek, which flows over limestone, a higher conductivity level triggers the need for measuring chloride.)

9.) Record any unusual observations about your site or stream in the comment section.

RED FLAG PROCEDURES

If at any time you detect a significant change at your site(s), e.g. plus or minus 1.0 units of pH, unexplained high conductivity reading, unusual odor and cloudiness, or any other unusual occurrence, collect a water ample and refrigerate it. Notify your Team Leader and the BWA Executive director, by email or text, immediately. If possible, walk or drive upstream to determine the point of change, however, do not trespass on private property.

Describe the condition on your Data Sheet, complete an Incident Report form and transmit the form to your Team Leader and the BWA office by email. Collect a water sample and deliver it to your Team Leader or the BWA office ASAP. The Team Leader and/or the BWA office will repeat the test(s).

If a reportable issue is found, the BWA Executive director will notify the appropriate regulatory agency and follow-up as needed. The ED will also report back to Streamwatcher and Team Leader of any response by the regulatory agency. At no time should a Streamwatch volunteer confront a possible offender. The role of the BWA's Streamwatch program is to monitor water quality, not to enforce regulations.

Please refer to the "Who to Call When" handout that is with your test kit. If you see any of the conditions described on that sheet, follow those reporting directions, in addition to completing the Incident Report form, and notifying your Team Leader and BWA ED.

Note re nutrients (nitrate and ortho-phosphate) – In some cases, we may need to test for nutrients in a stream, however most Brodhead streams show very low level of nutrients. Nutrients are often found below wastewater treatment plant (WWTP) discharges.
Modern WWTPs, with updated discharge permits, remove nutrients during treatment. Older plants, with older permits, are not required to remove nutrients. Historical data, collected by BWA Streamwatchers, shows what levels of nutrients are found at our test sites.

RECORD KEEPING

Record test results each month on the Field Data sheets. Data sheets, and other tools, can be downloaded from the Streamwatch Volunteer page on the BWA website:
https://brodheadwatershed.org/volunteer/

In your written comments on the Data Sheet be sure to indicate any information you think would be useful in characterizing the stream condition. This might include extreme weather conditions (e.g. very dry, or flood conditions), new impacts occurring upstream or nearby (e.g. construction activities) or sightings of animals (e.g. ducks or geese that are fouling the stream).

Your team leader will request your data periodically; make a copy of your completed data sheets for yourself and deliver completed sheets to your Team Leader. If requested by your Team Leader, you can send data electronically to the database manager (wendylichty@hotmail.com).

For your own information record your temperature data for your sites on the temperature graph. This will show whether your site is meeting the temperature standard for cold-water fish. Temperature is an important pollutant in cold water streams.

Extra sample containers are available from your Team Leader or the BWA office (839-1120).

EQUIPMENT CLEANING PROCEDURES + CALIBRATION

The Hanna conductivity meter should be calibrated periodically. Team leaders have packets of calibration solution. Follow the instructions with the meter on how to calibrate. The calibration solution is just salt water and can be discarded after use. Discard the empty packet.

Cleaning. Between sampling events, rinse the probe section of the meter in distilled water and let dry before replacing cap.

Test tubes used to measure pH should be cleaned after each sampling trip. If testing more than one sample at streamside, rinse the test tubes three times in the stream, before collecting a sample.

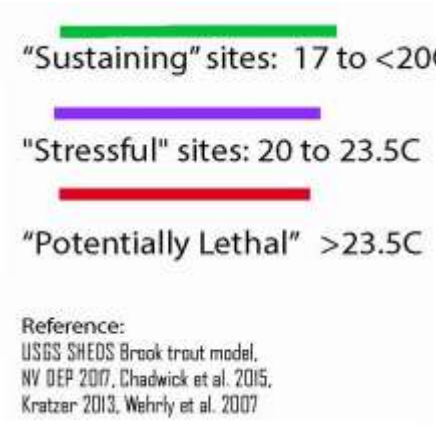
1. **wash with non-phosphate detergent, such as Dawn liquid dish detergent**
2. **rinse with tap water until all soap is gone**
3. **rinse with white vinegar, (use small amount and shake vigorously)**
4. **rinse twice with tap water**
5. **rinse twice with distilled water**
6. **dry on paper towels**

DEFINITION AND IMPORTANCE OF PARAMETERS

Water temperature – Stable water temperatures are critical to the survival, health and well-being of fish and other aquatic life. Gradual changes in temperature throughout the seasons are expected and predictable, with aquatic organisms able to successfully adapt. However, rapid changes in water temperature can be fatal. Warm water has less capacity to hold dissolved oxygen, which most aquatic organisms depend on for respiration. In addition, dissolved chloride ions, heavy metals and many other pollutants are more toxic at higher water temperatures.

PADEP regulations list the maximum in-stream temperature for cold water streams over the year. A permitted discharge cannot warm a stream higher than 18.9C (66F) in July and August. Your kit includes a chart and graph giving the regulatory maximum water temperature over the year. See page 10 for temperature chart.

Some information on Brook Trout sensitivity to temperature levels is given in the chart on the right.



pH - The pH of a substance is a measure of its acidity or alkalinity. Values below 7 are acid; those above are alkaline. pH monitoring and control are critical to the continuation and quality of all plant and animal life. The pH value of most natural waters fall within the range of 4 to 9. Most fish can tolerate pH values from 5.0 to 9.0; however, the best fishing waters fall within the 6.5 to 8.2 range.

Conductivity – or Electrical Conductivity (EC) measures the ability of a substance to conduct electricity. Conductivity is measured in microsiemens per centimeter (µS/cm). Distilled water has a conductivity in the range of 0.5 to 3 µS/cm. Typical drinking water is in the range of 200– 800 µS/cm, while sea water is about 50,000 µS/cm. Most larger streams in the watershed have conductivity of 200 µS/cm or less.

Measuring conductivity is a fast, inexpensive and reliable way of determining the ionic content of a solution. In Brodhead watershed streams, the ion most likely to cause elevated conductivity is chloride (Cl-). De-icing compounds used on roads, sidewalks and parking lots are typically made of sodium and chloride (Na, Cl) or calcium and chloride (Ca,Cl). The salt on your table is made up of sodium and chloride (NaCl).

Chloride - is measured in milligrams per liter (mg/l), or its equivalent, parts per million (ppm). Chloride is not naturally present in the environment of the Brodhead watershed. In our streams chloride comes primarily from salt based de-icing compounds that wash off the land and into streams. It also is present in wastewater treatment plant discharges as treatment does not remove salt. Chloride can build up in groundwater from de-icing compounds that soak into the ground over time. In some areas of the watershed, high levels of chloride are found even during summer months when most of flow in streams comes from groundwater.

Nutrients - primarily nitrogen and phosphorus, come from fertilizers, wastewater treatment plants and overloaded septic systems. Nutrients feed plant growth, primarily algae, in streams. When plant growth dies, it uses up oxygen in the water and can cause fish kills. The BWA Streamwatch program monitored nitrogen (nitrate) and phosphorus (orthophosphate) for a number of years and found most streams contain very low levels of either nutrient. Modern, well-operated wastewater treatment plants are

designed to remove these compounds from the waste stream. The data BWA has collected will serve as a baseline of water quality in future years.

Dissolved Oxygen (DO) - is essential for trout and macroinvertebrate survival. In the high- gradient streams (having a steep slope and rapid flows) of the Brodhead watershed, dissolved oxygen is generally very high. As streams tumble down waterfalls and over a rocky bottoms, the waters absorb oxygen from the air. Wastewater treatment plants are required to maintain a high level of DO in their discharge. We do not test for DO.

Aquatic macro-invertebrates – Because they are relatively immobile and are year-round residents, macro-invertebrates (organisms that lack a backbone and can be seen with the naked eye) are perhaps the best long-term indicator of water quality. Many insects, such as stoneflies, mayflies and caddis flies, require high levels of dissolved oxygen and extremely low levels of toxic substances. If temperatures rapidly fluctuate or pollutants or excess silt are introduced into the waterway, macroinvertebrate populations are often negatively affected. Therefore, the health of a stream can be evaluated by measuring the number and diversity of aquatic macro- invertebrates present. In general, the greater the abundance and diversity of insect life, the better the water quality.

Pick up a rock at your site and see what insects are clinging to the bottom of the rock. This will give you an idea of what's living in the water. As you become more familiar with the insects, note what you see on your data sheet.

Effects of pH on Fish and Aquatic Animals (Limiting pH Values)

Minimum	Maximum	Results of Some Scientific Studies
3.8	10.0	Fish eggs could be hatched, but deformed young were produced.
4.0	10.1	Limits for the most resistant fish eggs.
4.1	9.5	Range tolerated by trout.
4.3	--	Carp died in five days.
4.5	9.0	Trout eggs and larvae develop normally.
4.6	9.5	Limits for perch.
5.0	--	Limits for stickleback fish.
5.0	9.0	Tolerable range for most fish.
--	8.7	Upper limits for good fishing waters.
5.4	11.4	Fish avoided waters beyond these limits.
6.0	7.2	Optimum range for fish eggs.
1.0	--	Mosquito larvae were destroyed at this pH.
3.3	4.7	Mosquito larvae lived within this range.
7.5	8.4	Best range for the growth of algae.

TIME PERIOD	***MAXIMUM IN-STREAM TEMPERATURE FOR STREAMS DESIGNATED CWF (F)***
January 1-31	38
February 1-29	38
March 1-31	42
April 1-15	48
April 16-30	52
May 1-15	54
May 16-31	58
June 1-15	60
June 16-30	64
July 1-31	66
August 1-15	66
August 16-30	66
September 1-15	64
September 16-30	60
October 1-15	54
October 16-31	50
November 1-15	46
November 16-30	42
December 1-31	40