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Watershed Assessment

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What is a watershed assessment?

A watershed is the total land area that contributes runoff to a particular water body. Land use within a watershed affects the water quality of the streams within the watershed because pollution on the land will wash into the stream when it rains or snows. A watershed assessment is a tool for determining the health of streams within a watershed and locating potential pollutant sources that could adversely affect these streams.

There are various methods available for conducting a watershed assessment. A good watershed assessment method identifies issues, examines the history of the watershed, describes its features, and evaluates various resources. The assessment outlines a method for describing stream health and pinpointing specific issues that may need further investigation. Typically watershed assessments can be completed on an individual or group basis.

Why is a watershed assessment important?

Watershed assessments are an important tool for watershed management. Watershed assessments aid groups and organizations in conducting watershed studies and developing watershed management plans and stormwater management plans. Issues such as point and nonpoint source pollution, stream bank erosion, and other problems such as ecological degradation are identified within the watershed when an assessment is conducted. The overall health of a watershed can be determined, and management plans that direct remediation and protection of sensitive or impaired areas can be developed from these watershed assessments.

What factors contribute to stream health?

Streams are complex ecosystems that involve biological, physical, and chemical processes. Stream systems exist in a delicate balance, and if one component is disturbed, then the entire system may suffer. For example, an increased input of storm water can lead to channel erosion and result in channel widening and sediment deposition downstream. Increased sediment loads may alter the habitats of fish and/or the benthic macroinvertebrates on which they feed, thus degrading the ecological balance of the stream system.

Structural diversity such as fallen trees, pools within the stream channel, and a variety of substrate shapes and sizes increases the opportunity for various species to find habitat. This results in greater species diversity.

Most healthy streams spill over their banks onto the surrounding flood plain at least once every one and one half to two years. When streams are not constricted, the biological integrity of the flood plain and riparian zone

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are maintained, and the erosive force of an increased volume of water on the channel is decreased.

Chemical pollution is also a major contributor to poor stream health. Pollutants such as nitrogen and phosphorus found in fertilizers, acids, pesticides, animal waste, salts, and metals can be toxic to stream life.

All of these factors are essential in maintaining a healthy, diverse, and stable stream system. Watershed assessment tools have been developed to evaluate these particular elements to better understand the overall health of the system.

Who can conduct a watershed assessment?

Most watershed assessment methods can utilize community volunteers, thereby promoting stewardship within the watershed and reducing costs. The volunteers are usually recruited to do field work by watershed organizations. Community volunteers are valuable because they are familiar with the setting of the area and may be able to notice minor changes in a stream that may go unnoticed by someone not as familiar with the area.

Sources of nonpoint source pollution such as road salt buildup near this stormwater grate can be identified in a watershed assessment.

How is a watershed assessment tool used?

Watershed assessments are usually conducted as a part of the watershed or stormwater management planning process. Assessment methods can be successfully applied by trained volunteers. Volunteers are trained through classroom and field sessions that emphasize the scoring of channel features such as stream bank stability and water appearance. Typically, classroom sessions include an overview of the assessment protocol, outline how to complete data sheets, and explain how the data can be used. A field training session is typically conducted after the classroom session. For the field training session, volunteers are taken to a stream and work through the evaluation process, completing the evaluation forms. The assessments involve walking along in the streams, ranking conditions, taking pictures of the stream reaches, pointing out any extenuating circumstances, making simple measurements, and making note of any changes since prior evaluations. Given the importance of stormwater regulations, volunteers are typically asked to locate and record information about any stormwater outfall pipes they may encounter.

Stormwater outfall pipe.

What are some common assessment techniques?

There are a number of different watershed assessment methods. Some of the more common watershed assessment methods, such as the U.S. Department of Agriculture's (USDA) Stream Visual Assessment Protocol and Save Our Streams, are outlined below.

USDA's Stream Visual Assessment Protocol

A very useful assessment tool is the Stream Visual Assessment Protocol (SVAP) developed by the USDA's Natural Resource Conservation Service. The protocol was developed to aid farmers in the evaluation of their own lands and to help them become more aware of the types of issues that they might encounter. The method promotes communication between the landowner and the conservationist during the assessment process and relies on the understanding that the landowners know their land the best. The protocol provides an assessment based primarily on physical conditions within the watershed and serves as a useful first approximation of stream condition. Stream reaches are assessed individually when using SVAP. A length of a stream reach is defined as approximately 12 times the active channel width and is representative of the stream in the area. The reach is identified, drawn, and photographed, and then each parameter is scored on a scale of 1 to 10 (1 being the worst). The scores can be incorporated into a Geographic Information System (GIS), and then statistics can be performed on the scores. Parameters include both physical and biological attributes of the stream:

- ✓ channel condition
- ✓ hydrologic alterations
- ✓ riparian zones
- ✓ bank stability

- ✓ water appearance
- ✓ nutrient enrichment
- ✓ barriers to fish movement
- ✓ instream fish cover
- ✓ pools
- ✓ macroinvertebrates
- ✓ canopy cover
- ✓ manure presence
- ✓ salinity
- ✓ riffle embeddedness

These categories are very user-friendly because they rely on visual characteristics. An evaluator can actually see cloudy water, erosion on a stream bank, or how much of the stream bank is covered by plants, which makes it easy to learn and use. Some of the categories are optional, such as macroinvertebrates, manure, and salinity. Parameters such as channel condition, hydrologic alterations, and bank stability give clues as to how the stream may have changed over time due to land use or erosion.

The straight channel of this stream shows evidence of past alterations. The right bank shows signs of erosion. There is adequate canopy cover. Features such as these are scored independently using SVAP.

Unstable banks may indicate large volumes of stormwater flows, while past straightening of the stream may alter how it flows. Nonpoint source pollution may appear as nutrient enrichment or show up as a change in the water appearance. Fish may be affected by the sediment build up that causes riffle embeddedness, the lack of pools, or sparse canopy cover over the stream. Once scores are assigned, an overall average for the reach is calculated. An overall score less than 6 is considered poor, 6.1–7.4 is fair, 7.5–8.9 is good and any score greater than 9.0 is excellent. The overall score is useful in prioritizing reaches for remediation.

(Natural Resources Conservation Service (NRCS). NWCC Technical Note 99-1, Stream Visual Assessment Protocol, December 1998.)

Save Our Streams

Save Our Streams (SOS) is a national watershed education and outreach program directed by the Izaak Walton League. SOS conducts water quality evaluations based on benthic macroinvertebrate counts and indicators such as surface water appearance, stream bed stability, algae color, etc. The evaluation identifies three groups of macroinvertebrates based on their sensitivity to pollution. The three groups are: pollution sensitive, somewhat pollution tolerant, and pollution tolerant. The SOS method involves collecting a sample of macroinvertebrates from the stream, identifying the organisms, and rating the water quality. Water quality ratings of excellent, good, fair, and poor are based on the tolerance levels of the organisms found and the diversity of organisms in the sample. A stream with excellent water quality should support organisms from all three pollution tolerance groups. The SOS assessment method is used for biological monitoring by the Watershed Ambassadors who carry out assessments for the New Jersey Department of Environmental Protection (NJDEP) Watershed Program.

(Save our Streams found at *www.iwla.org/sos/*.)

Rapid Stream Assessment Technique (RSAT)

Various watershed assessment techniques have been streamlined into the Rapid Stream Assessment Technique (RSAT). RSAT was developed for the Maryland Peidmont region, but it may be useful when both channel conditions and macroinvertebrates are to be evaluated. RSAT involves six general evaluation categories.

- ✓ channel stability
- ✓ channel scouring/sediment deposition
- ✓ physical instream habitat
- ✓ water quality
- ✓ riparian habitat conditions
- ✓ biological indicators (macroinvertebrates)

RSAT is applicable when a broad survey of the characteristics of the watershed is desired.

(Rapid Stream Assessment Technique found at The Center for Watershed Protection, *www.stormwatercenter.net/*.)

Stony Brook-Millstone StreamWatch Program

The Stony Brook-Millstone Watershed Association launched a StreamWatch Program to monitor water quality within its watershed. The program relies on volunteers to continually assess watershed features. Volunteers in the StreamWatch Program can participate on three different action teams: Chemical Action Teams (CATs), Biological Action Teams (BATs), and River Action Teams (RATs). Training for a particular team involves a half day training session. CATs learn to collect chemical water quality data across the watershed: temperature, phosphates, nitrates, pH, turbidity, and dissolved oxygen. The results of the water sampling are analyzed and reported to all municipalities in the watershed and to other interested parties. BATs are trained with a protocol based on EPA Rapid Bioassessment II. They test for the presence of

benthic macroinvertebrates within a stream and base water quality ratings on the abundance and sensitivities of these organisms to pollutants. Healthy streams support an abundance of a wide variety of macroinvertebrates in a relatively small sample of water. A reduction in the macroinvertebrate population may indicate pollution. RATs visually assess the streams in a fashion similar to the physical features scored in the SVAP method. Volunteers are responsible for two mile stretches of stream. The RATs program is designed to document the appearance of waterways and stream corridors during every season and also during different flow conditions.

(Stony Brook-Millstone Watershed Association, *http://www.thewatershed.org/water_monitoring.php*)

Delaware Riverkeeper Network Monitoring

The Delaware Riverkeeper Network has a well established monitoring program that utilizes several watershed assessment techniques. Volunteer monitors perform biweekly chemical water quality tests, survey for sediment pollution, and participate in macroinvertebrate surveys at monitoring locations in the watershed. Volunteers fill out water chemistry, macroinvertebrate, and restoration survey datasheets while conducting their assessments. Data such as turbidity, pH, dissolved oxygen content, size and type of sediment on the stream bottom, depth, and amount of phosphorous and nitrogen are recorded during a water chemical survey. Macroinvertebrate surveys indicate the abundance and the species of organisms encountered. Restoration surveys record the types of plants in the area, the condition of the plant community, and extent of erosion, and also score parameters such as restoration buffer width, trees and shrubs, herbaceous vegetation, biodiversity, exotic invasive vegetation, and condition of bioengineering techniques present on a scale of 1–10. The Delaware Riverkeeper Network also offers the Consortium for Scientific Assistance to Watersheds (C-SAW) to help groups set up their own volunteer monitoring programs that utilize watershed assessment techniques.

(Delaware Riverkeeper Network, *www.delawareriverkeeper.org/Monitoring/monitoring.htm.*)

EPA Rapid Bioassessment Protocol and Habitat Assessment

The U.S. Environmental Protection Agency (EPA) has developed Rapid Bioassessment Protocols (RBPs), which compare habitat features, water quality, and biological measures with reference conditions. With the Habitat Assessment, scores from 1–20 are assigned to features of the streams. The physical condition of the stream is described and then habitat characteristics such as bank stability and vegetative protection are scored. When using this watershed assessment technique, plant, algae, fish, and macroinvertebrate data are also recorded. The RBPs and Habitat Assessments are most useful in situations where there are resources available to conduct biological surveys.

(USEPA Rapid Bioasessment Protocol and Habitat Assessments, *www.epa.gov/owow/monitoring/rbp/download.html.*)

Where are assessment methods used?

Watershed assessments are currently underway throughout the state of New Jersey. The Rutgers Cooperative Research & Extension Water Resources Program is using SVAP to evaluate streams in their various watershed management projects including the Tenakill Brook, Troy Brook, Robinsons Branch, and the Pompeston Creek. SVAP has also been used in a GIS analysis of Watershed Management Area 3 of New Jersey which includes Passaic, Bergen, Morris, and Sussex counties to study the effects of land use, soils, and impervious surface on assessment scores.

How can you get involved?

Many local watershed organizations look for volunteers to help collect data about the areas they are trying to protect or remediate. Look in the local newspaper or search the internet to find out about these organizations and their meeting times. Information about the NJDEP Stream Monitoring Network can be found at *www.state.nj.us/dep/watershedmgt/*.

Photos courtesy of Katie Buckley

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