



ASSESSING A LAKE'S WATER QUALITY STATUS

A FACT SHEET OF THE:
PENNSYLVANIA LAKE MANAGEMENT SOCIETY

Gathering information on about a lake and its watershed is an important step in managing a lake. The goal of a lake monitoring program is to determine the water quality and ecological condition of a lake.

MONITORING LAKE WATER QUALITY

There are many reasons for performing a water quality assessment of a lake. You may be concerned because you see excessive algae or aquatic weeds in your lake. You may have a pristine lake, but want to document the existing condition of the lake. You may want to determine and evaluate the long-term condition of your lake. The type, extent, and cost of your lake study will depend on the reason for your study and the amount of information you want. A monitoring program for a lake can be as simple as keeping a diary of observations or as sophisticated as a regular detailed scientific study. A detailed scientific study of your lake, however, should be performed by an environmental scientist or engineer educated and trained in lake ecology.

WHAT TO MONITOR

In order to properly monitor the complete lake ecosystem, you should monitor the physical, biological, and chemical aspects of your lake.

Physical

- < Historical water uses and management
- < Lake depth, area, and volume
- < Location of structures such as rocks and tree stumps that make good fisheries habitat
- < Depth of bottom sediments in lake
- < Hydrological information such as precipitation amounts, inlet and outlet flows
- < Transparency (as measured using a Secchi disk)
- < Temperature profiles

Biological

- < Location, type and abundance of aquatic plant species
- < Types (species) and amount of phytoplankton (free-floating algae)
- < Fisheries data (fish species and sizes)
- < Types and amount of zooplankton
- < Fecal coliform bacteria
- < Chlorophyll *a* (a measure of phytoplankton biomass)

Chemical

Water chemistry plays a critical role in the ecological condition of a lake. While there are numerous tests that can be performed (see *Water Quality Parameters fact sheet*), some of the more important ones are:

- < Nutrients that affect plant growth, particularly phosphorus and nitrogen
- < Lake acidity status, measured as pH and alkalinity
- < Total suspended solids
- < Dissolved oxygen profiles

WHERE TO MONITOR

For many lakes, one lake monitoring station, located at the deepest part of the lake, is sufficient. For large lakes or lakes with complex shapes or many inlet streams, multiple stations should be monitored. In deep lakes that have thermal stratification, water samples should be collected at different depths because the water quality is different in these stratified layers. Generally, samples should be collected at the surface, mid-depth, and just above the lake's bottom. As a minimum, however, samples should be collected at the surface, approximately two feet below the water surface. There are specific methods and equipment that should be used to collect water samples for chemical and biological analysis. If samples are collected incorrectly, the results could be misleading or incorrect.

When to Monitor

The scheduling of your monitoring program will depend on the objectives of your monitoring program and your budget. The EPA that sampling be performed twice per month from May through September and once per month from October through April. This is an excellent but very expensive monitoring program. A good moderate monitoring program would be to monitor your lake once per month from April through September. If you're on a limited budget and just want to know the condition of your lake during the critical summer months, you could monitor your lake once per month in July and August.

Citizens Volunteer Monitoring Program

There are many excellent guides and workshops available for designing and performing lake monitoring programs. The Pennsylvania Department of Environmental Protection (DEP) has an excellent Citizens' Volunteer Monitoring Program. A volunteer monitoring program is best suited for monitoring basic lake aspects such as aquatic weed growth, water transparency (using the Secchi disk), and analyzing for simple chemical parameters such as pH, hardness, and alkalinity. The presently available chemical test kits can not be used to measure parameters such as total phosphorus and nitrogen. These parameters and others, such as chlorophyll *a* and total suspended solids, should be performed by a qualified laboratory.

If you want to perform a detailed scientific study of your lake, you should contract with a qualified lake management consultant or university.

UNDERSTANDING LAKE MONITORING

As discussed above, lake monitoring includes the measurement of physical, biological and chemical data to determine the water quality and ecological condition of your lake. Measuring the vertical profiles of temperature is important because this information indicates whether your lake is thermally stratified. The chemistry and biology of a stratified lake is different than that of a completed mixed lake. The temperature and oxygen data also indicates the occurrence and extent of oxygen depletion in the lake's bottom waters, and thus the quality of the lake for fish and other aquatic organisms.

Biological lake parameters indicate the biological condition of your lake. For example, chlorophyll *a*, a green pigment

present in all algae, is a measure of the algal biomass. Algal (phytoplankton) cell counts and identification gives an indication of the algal diversity. The presence of blue-green algae, for instance, indicates that a lake may be eutrophic or becoming eutrophic. Eutrophic lakes are often dominated by one or a few algal species during the late summer.

Macrophyte surveys, which are usually performed by visual observations, show the extent and variety of aquatic plants in the lake. Fecal coliform bacteria are indicator organisms; most are harmless, but their presence indicates the possible presence of pathogenic (disease causing) bacteria.

The chemical parameters are also very important. In most fresh water lakes, phosphorus and nitrogen are the key nutrients used by algae and aquatic plants to grow. The amounts and chemical forms of phosphorus and nitrogen, therefore, are important in understanding the condition of your lake. Total suspended solids provide an indication of the amount of suspended sediments in the lake. These sediments could be from erosion and runoff from the watershed, or they could be from the algae and other biota in the lake.

All of these parameters are evaluated together to determine the ecological condition of the lake.

LAKE MONITORING REFERENCES

- US Environmental Protection Agency (EPA): www.epa.gov
- PA Department of Environmental Protection (DEP): www.state.pa.us
- National Resource Conservation Service (NRCS): www.nrcs.gov
- Clean Lakes Program Guidance Manual, EPA-440/5-81-003, December, 1980, Office of Water, Washington, DC

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