Licking County Soil and Water Conservation District

Stream Team:
Chemical Sampling

Chemical Survey

The chemical water quality monitoring consists of the collection of water samples and their analysis for specific chemical constituents.

Water quality monitoring can be used for many purposes:

- To identify whether waters are meeting designated uses
- To evaluate the effectiveness of pollution control programs
- To determine long and short term water quality trends
- To screen for impairments
- To educate watershed residents and increase awareness about local water resources

Create a Stream Chemical Survey Schedule

It is best to visit your site and sample at least four times a year, during the different seasons (i.e. early spring, early summer, late summer, and fall). Do remember, the more you sample, the more data you collect, and the better you can determine what is going on with the water quality.

Remember safety first! Your safety is more important than the data you are collecting.

Conducting the Chemical Survey

Step 1: Pick a sampling site that represents a water sample that is typical of the water source and does not represent a localized condition.

Step 2: Collect the water sample…. Usually water samples are collected away from the stream bank and in the main current. You should never collect a water sample in stagnant water or water that you have disturbed while entering the stream. Stand facing upstream and collect your water sample in front of you.

Step 3: Rinse the sample container two or three times with the water you will be sampling. Deposit rinse water downstream from the actual sample site.

Step 4: Collect a water sample mid-way between the surface and the bottom of the stream.

Step 5: Complete the data sheet.

Step 6: Check to make sure your data forms are complete and pour water samples into the waste water container. When you get home, pour the waste water down the toilet or sink. For coliform bacteria, add 1/3 tsp (20 drops) of household chlorine bleach to the test tube and recap immediately. Let tube stand upright for at least 4 hours. Then dispose of closed tubes in the trash. Do not open tubes.

Biochemical Oxygen Demand (BOD) and Why it is Important

Biochemical oxygen demand (BOD) measures the amount of oxygen consumed by microorganisms in decomposing organic matter in stream water. A test is used to measure the amount of oxygen consumed by these organisms during a specific period of time (usually 5 days at 20°C). The rate of oxygen consumption in a stream is affected by a number of variables: temperature, pH, the presence of certain kinds of microorganisms, and the type of organic and inorganic material in the water.

BOD directly affects the amount of dissolved oxygen in rivers and streams. The greater the BOD, the more rapidly oxygen is depleted in the stream. This means less oxygen is available to higher forms of aquatic life which could lead to suffocation or death. Sources of BOD include leaves and woody debris, dead plants and animals, animal manure, wastewater treatment plants, feedlots, and food-processing plants, failing septic systems, and urban storm water runoff. BOD is affected by the same factors that affect dissolved oxygen. Aeration of water by rapids and waterfalls will accelerate the decomposition of organic and inorganic material. Therefore, BOD levels at a sampling site with slower moving water may be higher in comparison to more aerated water. Chlorine can also affect BOD measurement by inhibiting or killing the microorganisms that decompose the organic and inorganic matter in a sample. If sampling in chlorinated waters, such as those below the effluent from a sewage treatment plant, it may be necessary to neutralize the chlorine.

BOD measurement requires taking two samples at each site. One is tested immediately for dissolved oxygen, and the second is incubated at room temperature in the dark for 5 days and the tested for the amount of dissolved oxygen remaining. The difference in oxygen levels between the first test and the second test, in parts per million (ppm), is the amount of BOD. This represents the amount of oxygen consumed by microorganisms to break down the organic matter present in the sample bottle during the incubation period.

Unpolluted, natural waters have a BOD of 6 ppm or less, indicating good water quality. If BOD levels increase to above 8 ppm, water quality is considered poor.

Dissolved Oxygen (DO) and Why it is Important

Dissolved Oxygen (DO) is the concentration of oxygen that is dissolved in water. All fish and aquatic life must have adequate amounts of DO in the water at all times to survive. A stream system both produces and consumes oxygen. Problems occur when organic material enters surface water. Microorganisms in the water use the organic material as food and consume DO in the process. Other sources of oxygen – consuming waste include stormwater runoff from farmland or urban streets, feedlots, and failing septic systems. When DO levels decline, some sensitive animals may move away, weaken, or die.

DO levels fluctuate seasonally and over a 24-hour period. They vary with water temperature and altitude. Cold water holds more oxygen than warm water and water holds less oxygen at higher altitudes. The DO in rivers and streams changes horizontally along the course of the waterway. The DO levels in and below riffle areas, waterfalls, or dam spillways are typically higher than those found in pools and slower-moving stretches. Since DO levels are critical to fish, a good place to sample is in the pools that fish tend to favor or in the spawning areas they use.

DO is measured either in parts per million (ppm) or “percent saturation.” Ppm is the amount of oxygen

in a liter of water. Percent saturation is the amount of oxygen in a liter of water relative to the total amount of oxygen the water can hold at that temperature. The amount of dissolved oxygen required varies according to species and stage of life. DO levels of 5 to 6 ppm are usually required for growth and activity. DO levels below 3pm are stressful to most aquatic organisms. Dissolved oxygen levels of 5 ppm or more is an indication of good water quality. If dissolved oxygen levels fall below 4ppm, water quality is considered poor.

Nitrates and Why they are Important

Introduction

Nitrogen makes up about 80 percent of the air that we breathe and is an essential component of proteins. In aquatic systems, the inert nitrogen gas (N) is converted to useable forms by bacteria which can then be taken up by algae and other plants. These forms of nitrogen include ammonia (NH3), nitrates (NO3), and nitrites (NO2). Nitrates are essential plant nutrients, but in excess can cause significant water quality problems. Together with phosphorus, nitrates in excess amounts can accelerate dramatic increases in aquatic plant growth and changes in the types of plants and animals that live in the stream. This, in turn, affects other water quality indicators. The natural level of nitrate in surface water is typically low (less than 3 ppm).

High levels of nitrates are generally the result of improperly treated sewage, either from wastewater treatment plants or failing on site-septic systems, runoffs from fertilized lawns and cropland, runoff from animal manure storage areas, and industrial discharges that contain corrosion inhibitors. Nitrates from land sources in d up in rivers and streams quickly because they dissolve in water more readily than other nutrients. Water that is polluted with nitrogen-rich organic matter might show low levels of nitrates.

Decomposition of organic matter lowers the dissolved oxygen level, which in turn slows the rate at which ammonia is oxidized to nitrite and then to nitrate. The growth of algae and aquatic plants is stimulated principally by nutrients such as phosphorus and nitrogen. Nutrient-stimulated plant production is of most concern in lakes and estuaries. Plant production in streams and rivers is most often controlled by physical factors, such as light penetration, timing of flow, and type of substrate available, instead of by nutrients.

The natural level of nitrate in surface water is typically less than 3 ppm. Nitrate concentrations of 5 ppm or less are an indication of good water quality. If nitrate levels rise above 20 ppm, water quality is considered poor.

pH and Why it is Important

pH is a term used to indicate the alkalinity or acidity of a substance as ranked on a scale from 1.0 to 14.0. A pH of 7.0 is neutral and ideal for water conditions. Readings that fall below 7.0 identify acidic conditions while readings above 7.0 identify alkaline conditions.

pH affects many chemical and biological processes in the water. Low pH can allow toxic elements and compounds to become mobile and “available” for uptake by aquatic plants and animals.
The pH scale measures the logarithmic concentration of hydrogen (H+) and hydroxide (OH-) ions, which make up water. When both types of ions are in equal concentration, the pH is 7.0 or neutral.

A range of pH 6.5 to pH 8.5 is optimal for most aquatic organisms. pH level at or near 7.0 is an

indication of good water quality. If pH levels increase to above 8.0 or decrease to below 6.0, water quality is considered poor.

Phosphates and Why they are Important

Phosphorus like nitrogen is an essential nutrient for the plants and animals that make up the aquatic food web. Phosphorus is the nutrient that is in short supply in most fresh waters. There are many sources of phosphorus, both natural and human. These include soil and rocks, effluent from wastewater treatment plants, runoff from fertilized lawns and cropland, failing on-site septic systems, and drained wetlands.

Phosphorus usually exists as part of a phosphate molecule (PO4). Inorganic phosphorus is the form required by plants. Animals can use either organic or inorganic phosphate. In unimpaired waters, phosphorus concentrations are normally low, with phosphorus availability being the limiting factor in the growth of plants.

The natural levels of orthophosphate in surface water are typically between 0.005 and 0.05 ppm. Phosphate concentrations of 2 ppm or less are an indication of good water quality. If phosphate levels rise above 4 ppm, water quality is considered poor.