FRWA Curriculum Guide

Week V

Pollution and Monitoring

Pollution and Monitoring Background Information

"We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect." – Aldo Leopold

Pollution is defined as contamination; something that causes harm to an area of the natural environment, the air, soil, or water, usually by introducing damaging substances such as chemicals or waste products. Pollutants can enter the environment either naturally or by human activities. When the source of the pollution is identified, it is termed point source pollution. Examples of source point pollution are drainage from factory pipes, exhaust from a car, leakage from an underground oil tank or smoke from a power plant.

When it is difficult to identify the source or location of the pollution, then it is considered non-point source pollution (NPS). The pollution may stem from run-off water. Impervious surfaces refer to pavement, parking lots and roadways. The water "runs-off" the surfaces and is not absorbed into the ground to recharge groundwater. The surfaces may also contain oil or gas leaks that can flow into the waterways, causing non-point source pollution. Other examples, including motor oil, are as follows:

1. **motor oil** – improper disposal or leakage of motor oil can seriously pollute ground water and surface waters. It can kill plants, smother animals and contaminate fish and drinking water.
2. **acid rain or deposition** – when rain, snow or dry particles from the atmosphere is more acidic than normal (normal is usually a pH of 5.6). Carbon dioxide combines with the water droplets to form carbonic acid. Sources can stem from the burning of fossil fuels, such as oil, and emissions from industry and cars. Acid rain can contribute to the depletion of nutrients in the soil and the addition of metals into the water.
3. **animal wastes** – livestock, pets and concentrated populations of wildlife can cause diseases in the water.
4. **excessive nutrients** – oversupply of nitrogen and phosphorous can come from leaking septic tanks, fertilizers or manure from farms and lawns, sewage, laundry detergents and some grass clippings and leaves.
5. **household hazardous waste** – toxic or poisonous substances in the home, such as gasoline, nail polish remover, paints, and oven cleaners should not be dumped down sinks or drains.

6. **litter** – roadside trash, unswept parking lots, and wind blown trash can cause hazards to wildlife and contamination of waterways.
7. **pesticides** – these substances contain chemicals that are used agriculturally (farms) and on lawns. The chemicals harm both the environment (soil) and can also impact human health.
8. **road salts** – used to de-ice highway surfaces, parking lot pavements and other road surfaces and paved areas. Too much going into waterways can change the salinity of water that support certain animals and plants.
9. **sediment** – tiny soil and rock particles are carried away by rain into the waterways, increasing turbidity and reducing light penetration; sedimentation can occur as a result of erosion.
10. **toxic metals** – metals such as mercury, nickel, zinc and lead are toxic to human organisms because they can accumulate and become concentrated in the body. The metals can originate from cars, industry and pesticide misuse.

Changes in land use and increases in population correlate to declines in water quality. The loss of open space, buffer zones, increases in impervious surfaces, contaminants from identified and unidentified sources, decreases in water supply and increases in wastewater treatment all contribute to the health of our waterways. Monitoring the streams and rivers becomes the first step in protecting this valuable resource. Monitoring can be accomplished in a variety of ways; physically, biologically and chemically.

The stream or river itself, along with the riparian banks and surrounding area may be visually or physically monitored. Stream watch groups may observe erosion or vegetative buffers along the banks to determine health of the stream. If there is substantial erosion along the river banks, then there may be a higher turbidity level in the water way.

Vegetative buffers along stream banks provide protection by controlling soil erosion, filtering pollutants at potential access points, supplying habitats for aquatic and land life, and keeping water temperatures lower with shade. Unchecked stream bank erosion can lead to excess sedimentation and disturb the macroinvertebrates and spawning fish

Monitoring the diversity of plant and animal life are biological or biotic indicators. Macroinvertebrates are indicators of the stream health because of their high oxygen requirement. Streams and rivers that are swift moving have higher levels of oxygen compared to stagnant ponds. Temperature also influences the health of the stream as cool waters are able to hold onto dissolved oxygen longer than warm water does.

Macroinvertebrates are a good measure of water quality since many are pollution sensitive. Samples of insects are best taken in riffles, where water is flowing over rocks, and is well-aerated with higher dissolved oxygen levels .The most sensitive to water quality are caddisfly, mayfly and stonefly.

Since aquatic plants and animals require oxygen to live, dissolved oxygen tests are conducted to measure the amount of oxygen in the water. Chemical testing are abiotic indicators of the health of the stream. Measuring pH, dissolved oxygen, nitrates and phosphorous levels are all ways to monitor the stream health.