Name: ____________

Date: ____________

Water Quality Parameters

WQ Parameter	What is it?	Why does it matter?	How does it get in the water?
Fecal Coliform			
Temperature			
Dissolved Oxygen (DO)			
Total Phosphorous			
Nitrogen			
pH			
Turbidity			

Introduction to Water Quality Parameters

Directions:
Your group will be assigned on or two Water Quality (WQ) parameters to read about and present to the class.

1. Read the explanations for your assigned WQ parameter in the attached packet.
2. Fill in the chart for your assigned WQ parameter and answer all three questions.
3. Draw a picture of how your parameter gets into the water.
4. Present your picture and answers to the rest of the class. You will be filling in the chart for the remaining WQ parameters with information provided by your classmates.

Fecal Coliform

What is it?
Fecal Coliform bacteria are found in the feces of humans and other warm-blooded (endothermic) animals. By themselves, fecal coliform bacteria do not usually cause disease. In fact, they are already inside you. They occur naturally in the human digestive tract and aid in the digestion of food. However, when a human or other warm-blooded animal is infected with disease, pathogenic (disease causing) organisms are found along with fecal coliform bacteria.

Why does fecal coliform matter?
Think of high levels of fecal coliform bacteria as a warning sign that water can make you sick, rather than as a cause of illness. If fecal coliform counts are high (over 200 colonies/100mL of a water sample) in a body of water, there is a greater chance that disease-causing organisms are also present. If you are swimming in waters with high levels of fecal coliform, you have a greater chance of developing a fever, nausea or stomach cramps from swallowing disease-causing organisms, or from pathogens entering the body through cuts in the skin, the nose, mouth or ears. Some examples of diseases and illnesses that can be contracted in water with high fecal coliform counts include typhoid fever, hepatitis, gastroenteritis, dysentery and ear infections.

Fecal coliform bacteria are living organism, unlike the other conventional water quality parameters. The fecal coliform bacteria multiply rapidly when conditions are good for growth and die in large quantities when conditions are unfavorable.

How does fecal coliform get in the water?
Untreated sewage, poorly maintained septic systems, un-scooped pet waste, and farm animals with access to streams can cause high levels of fecal coliform bacteria to appear in a water body.

Temperature

What is it?
Temperature is a measure of how much heat is present in the water.

Why does temperature matter?
Water temperature indicates many things about the health of a river. Temperature affects:

1) *Dissolved oxygen levels in water-* Cold water can hold more oxygen then warm water.

2) *Photosynthesis-* As temperature increases, the rate of photosynthesis and plant growth also goes up. More plants grow and more plants die. When plants dies, decomposers eat them and use up oxygen in the process. So when the rate of photosynthesis increases, the amount of oxygen required by aquatic organisms and decomposers also increases, lowering the dissolved oxygen levels in the water.

3) *Animal survival-* Many animals need certain water temperatures to live. For example, stonefly nymphs and trout need cool water temperatures. Dragonfly nymphs and carp can live in warmer water. If water temperatures change too much, many organisms can no longer survive.

4) *Sensitivity to toxic wastes and disease-* Waste in the water often raises water temperatures. This leads to lower oxygen levels and weakens many fish and aquatic insects. Weakened animals get sick and die more easily.

How does water get warmer?
In the summer, the sun heats up sidewalks, parking lots and streets. When rain falls on these heated paved surfaces, it warms up and runs into creeks and rivers increasing the water temperature. Factories and some types of industry that use water to cool their operations may send heated water back into rivers and creeks. When warm water enters rivers, it raises the temperature downstream and may decrease oxygen levels since warmer water cannot hold as much dissolved oxygen as cooler water. These human activities are forms of thermal pollution, which is one of the most serious ways humans affect rivers.

Cutting down trees along the banks of a river or pond also raises water temperatures. Trees help shade the river from the sun and keep the water cooler. When the trees are cut down, the sun shines directly on the water and warms it up. Cutting down trees also leads to erosion. When soil from the riverbank washes into the river during erosion, the water becomes muddy (turbid). The darker, turbid water captures more heat from the sun than clear water. Murky green or brown water with lots of algae will be warmer than clear water.

Dissolved Oxygen (DO)

What is it?
Like people, aquatic organisms need oxygen to survive and stay healthy. Dissolved oxygen is oxygen that is completely dissolved in the water, which is necessary for fish and other aquatic organisms to breathe.

Why does DO matter?
Imagine living in a place with polluted air. As the air quality becomes worse, the health of the people who live there declines. The same is true for water. Clean, healthy water has plenty of dissolved oxygen. When water quality decreases, DO levels drop and it becomes impossible for many animals to survive. Some fish species, such as trout, require high levels of oxygen to live; when the oxygen levels drop, these fish get sick or die. Other organisms, such as carp, can live in water with lower levels of DO and are not as vulnerable to changing oxygen levels.

How do DO levels in the water drop?
In water bodies with waves, or where water tumbles over rocks, falling water traps oxygen from the atmosphere and mixes it into the water. Oxygen from photosynthesis can also enter the water from aquatic plants.

The main reason DO levels might fall is due to the presence of organic waste. Organic waste comes from living organisms or occurs when once living organisms die. It comes from raw or poorly treated sewage, runoff from farms and animal feedlots, as well as natural sources like decaying aquatic plants and animals or leaves that have fallen in the water.

Microscopic organisms, called decomposers, break down the organic waste and use up oxygen in the process. Two common types of decomposers are bacteria and protozoa. More organic waste in the water means more decomposers and thus more oxygen is being used.

Dissolved Oxygen levels can also fall due to any human activity that heats up the water since warm water cannot hold as much dissolved oxygen as cold water.

Total Phosphorous

What is it?

Phosphorous is a nutrient found in all living things. It's a chemical element and a mineral found in nature. Plants and animals have phosphorous in their bodies and it's in most of the food we eat. When people buy fertilizer for their lawns and gardens, they use nutrients including phosphorous to help their plants grow.

Why does total phosphorous matter?

When too much phosphorous enters a river or lake, aquatic plants use the phosphorous to grow. When plant growth is excessive, the water turns green and becomes cloudy from the chlorophyll content of the tiny floating plants and algae.

Too many plants living in the water can lead to some bad results. When these plants die, which in the case of algae occurs very frequently, they sink to the bottom of the lake or river. There, bacteria decompose the dead plants, which uses up most of the oxygen in the water. The decomposers actually use up more oxygen than was added to the water by the abundant plant growth. Therefore, too many plants in the water from high phosphorous levels reduce the amount of oxygen in the water.

This is what happens when too much phosphorous enters the water:

1) Phosphorous enters the water
2) Plants take up the phosphorous and grow excessively
3) Plants (algae) die and sink to the bottom of the lake
4) Bacteria at the bottom decompose the dead plants, using up oxygen in the process
5) Oxygen levels drop, killing fish and aquatic insects
6) Phosphorous stored in the plants is released back into the water
7) The cycle continues

How does too much phosphorous get in the water?

Phosphorous enters the water from a number of places. It is found when human and animal wastes are flushed into waterways, either from poorly treated sewage, broken pipes or runoff when people don't pick up after their pets. Some industrial wastes also carry phosphorous into the water.

Whenever trees and grass are removed from an area, soil erodes into waterways, carrying phosphorous found naturally in the soil. Fertilizers used at home on lawns and on farm fields carry much of the phosphorous in waterways during rain events. The phosphorous entering streams and rivers is carried downstream. Since lakes do not flow like rivers, they trap the nutrients, therefore high levels of phosphorous in lakes and reservoirs is a more serious problem.

Nitrogen

What is it?
Nitrogen is one of the most common elements on the planet. It's a nutrient that all living plants and animals need in order to build proteins.

Why does nitrogen matter?
Since nitrogen is a nutrient like phosphorous, the effects of this nutrient on water are almost the same. Like phosphorous, extra nitrogen in water leads to excessive and rapid plant growth. When these plants die, which occurs very frequently with tiny aquatic plants like algae, they sink to the bottom of the water body. There, bacteria decompose the dead plants and use up large quantities of oxygen in the process. The decomposition of the dead plants actually uses up more oxygen than the plants added to the water through photosynthesis. Therefore, too many plants in the water from too much nitrogen leads to lowered oxygen levels.

This is what happens when too much nitrogen enters the water:
1) Nitrogen enters the water
2) Plants take up the nitrogen and grow excessively
3) Plants (algae) die and sink to the bottom of the lake
4) Bacteria at the bottom decompose the dead plants, using up oxygen in the process
5) Oxygen levels drop, killing fish and aquatic insects
6) Nitrogen stored in the plants is released back into the water
7) The cycle continues

How does too much nitrogen get in the water?
Nitrogen enters the water from a number of places. It is found when human and animal wastes are flushed into waterways, either from poorly treated sewage, broken pipes or runoff when people don't pick up after their pets. In some cases, home septic systems in rural areas may leak waste into the ground, contaminating groundwater sources. Runoff from large animal feedlots may contribute nitrogen when the animal waste runs off into the river.

Nitrogen is an essential ingredient in most fertilizers. If too much fertilizer is applied to lawns, farms or gardens, excess nitrogen will runoff the landscape during a rainstorm and contaminate water sources.

pH

What is it?

pH is the measurement of the acidity or basic quality of water. Lemons, oranges and vinegar, for example, are high in acid ("very acidic"). Acids can sting or burn, which is what you feel when you eat some kinds of fruit with a sore in your mouth. The pH scale ranges from a value of 0 (very acidic) to 14 (very basic), where a pH of 7 is considered neutral. The pH scale is logarithmic which means a substance with a pH of 5 is ten times more acidic than something with a pH of 6. The pH of natural water is usually between 6.5 and 8.2.

Why does the pH level matter?

At extremely high or low pH levels (for example 9.6 or 4.5), the water becomes unsuitable for most organisms. Young fish and insects are also very sensitive to changes in pH. Most aquatic organisms adapt to a specific pH level and may die if the pH of the water changes, even slightly.

How do pH levels become too high or low?

pH can vary from its normal levels (6.5 to 8.2) due to pollution from cars and trucks or due to the emissions from coal-burning power plants. These sources of pollution can form acid rain in some circumstances. Acids form when chemicals in the air combine with moisture in the atmosphere and falls to earth as acid rain or snow. Many lakes in eastern Canada, the northeastern United States and northern Europe are becoming acidic because they are downwind of polluting industrial plants. Drainage from mines, especially in the western United States, can seep into streams and groundwater, making the water more acidic as well.

Turbidity

What is it?
Think of turbidity as the opposite of clarity. If clarity is the measurement of how clear the water is, then turbidity is a measure of how cloudy a water body is. Most people have seen how rivers can turn brown after a heavy rain. Soil particles carried by runoff into the river create this murky appearance, increasing the turbidity of the water.

Why does turbidity matter?
High amounts of soil in the water will block sunlight from reaching the bottom of a river or shallow lakes. When the water is turbid (cloudy), floating particles absorb heat from the sun and cause the water temperature to rise. Higher temperatures cause oxygen levels in the water to fall, limiting the ability of fish and insects to survive there.

Another problem associated with high turbidity is the floating particles that may clog fish gills. When these particles sink in slower moving water, they can smother and kill fish and aquatic insect eggs that lie on the bottom. Turbidity can also limit plant growth when the water is so cloudy that sunlight cannot reach the plants' leaves.

The combination of warmer water, less sunlight, and oxygen depletion make it impossible for some forms of aquatic life to survive.

When water goes to a drinking water treatment plant for purification, high turbidity can clog filters and may cause taste and odor problems.

How do turbidity levels rise?
Higher turbidity can be caused by human activities such as cutting down trees and removing vegetation in the riparian zone (the wetland area next to a stream or lake). Trees provide shade to keep the water cooler, and plant roots stabilize the soils preventing mud and soil from washing into the water during a rainstorm. When roads and parking lots are constructed without proper barriers such as silt fencing to prevent erosion, more soil and mud are likely to reach the water.

High levels of turbidity may also be caused by the overgrowth of tiny aquatic plants and algae, which can cloud the water, preventing sunlight from penetrating to the bottom where aquatic plants are trying to grow. Excessive plant growth from too much nitrogen and phosphorous in the water can lead to higher turbidity.

Water Testing Data Sheet

Location______________________

Date__________________________

	Water Quality Parameters	EXCELLENT	GOOD	FAIR	POOR
A	**BARE SOIL**	☐ 0-10%	☐ 11-40%	☐ 41-80%	☐ 80-100%
B	**BANK EROSION**	☐ stable bank	☐ small amount of erosion	☐ overall erosion	☐ extensive erosion
C	**WATER ODOR** Type: rotten egg, musky, harsh, chlorine	☐ no odor	☐ little odor ______	☐ some odor ______	☐ strong odor ______
D	**SOIL ODOR** Type: rotten egg, musky, harsh, chlorine	☐ no odor	☐ little odor ______	☐ some odor ______	☐ strong odor ______
E	**WATER APPEARANCE** Green, blue, brown, red, purple, shiny, foamy	☐ no color	☐ little color ______	☐ some color ______	☐ strong color ______
F	**BENTHIC MACROINVERTEBRATES**	☐ mayflies, caddisflies, etc.	☐ beetles,sowbugs dragonflies ,etc.	☐ midges,leeches, black flies	☐ earthworms, snails
G	**COLIFORM BACTERIA**	☐ negative			☐ positive
H	**DISSOLVED OXYGEN** ______	☐ 8ppm	☐ 6ppm	☐ 4ppm	☐ 0ppm
I	**NITRATE** ______	☐ none		☐ 5ppm	☐ 20 ppm or more
J	**pH** ______	☐ 7	☐ 6 or 8	☐ 8.5	☐ 4, 5 or 9, 10, 11
K	**PHOSPHATE** ______	☐ 1 ppm	☐ 2 ppm	☐ 4 ppm	☐ 5 ppm or more
L	**TEMPERATURE** ______				
M	**TURBIDITY** ______	☐ 0 JTU	☐ 1 to 40 JTU	☐ 41 to 100 JTU	☐ >100 JTU