Monongahela River Water Quality Study

The West Virginia Water Research Institute is undertaking a comprehensive water quality monitoring and reporting project for the Monongahela River. Bi-weekly samples are being collected and lab-analyzed with the resultant water quality data organized and presented via a website utilizing a Geographic Information System map and database.

Water Quality Study

The West Virginia Water Research Institute began monitoring the water quality in the Monongahela River Basin in July of 2009. Initially, 8 tributary and 4 mainstem stations were sampled bi-weekly. Three additional tributary stations were added to the sampling regime on March 1, 2010.

As a means of displaying the water quality data to the public, a website was developed to provide easy to understand visualizations of the water quality in the Mon River basin. Geographic Information System (GIS) mapping also provides users of the site with the ability to see the Mon River watershed and specific sampling locations.

Water quality analysis consisting of 19 different field and lab determined parameters are available on the website, along with easy to understand descriptions of each measured parameter.

Many users of the Monongahela River such as recreationists, anglers, industry, policy makers and regulators will benefit from having accurate and current information about water quality conditions.

For more information,
or to view the map and sampling results, visit:

www.MonWQ.net

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The West Virginia Water Research Institute is a program of the National Research Center for Coal & Energy at West Virginia University.

Monongahela River

Known locally as “The Mon,” the Monongahela River originates in north-central West Virginia and flows through south-western Pennsylvania to Pittsburgh where it meets the Allegheny River to form the Ohio River. It is 128 miles long and has a drainage basin of 7,340 square miles. The Native American word “Monongahela,” means “falling banks,” in reference to the geologic instability of the river’s banks.

Formed by the confluence of the West Fork River and the Tygart Valley River at Fairmont, WV, the Mon is navigable for its entire length. A series of locks and dams maintain a minimum depth of 9 feet to accommodate barge and tow boat traffic. In Pennsylvania the Mon is met by two major tributaries: the Cheat River which joins in Pt. Marion, and the Youghiogheny River which joins in McKeesport.

West Virginia Water Research Institute
385 Evansdale Dr. NRCCE Building
PO Box 6064
Morgantown, WV 26506
Telephone: (304) 293-2867
Fax: (304) 293-7822
www.wvwri.nrcce.wvu.edu

Dedicated to the preservation and restoration of the natural environment through research and outreach with industry, government agencies, academia, and the public.

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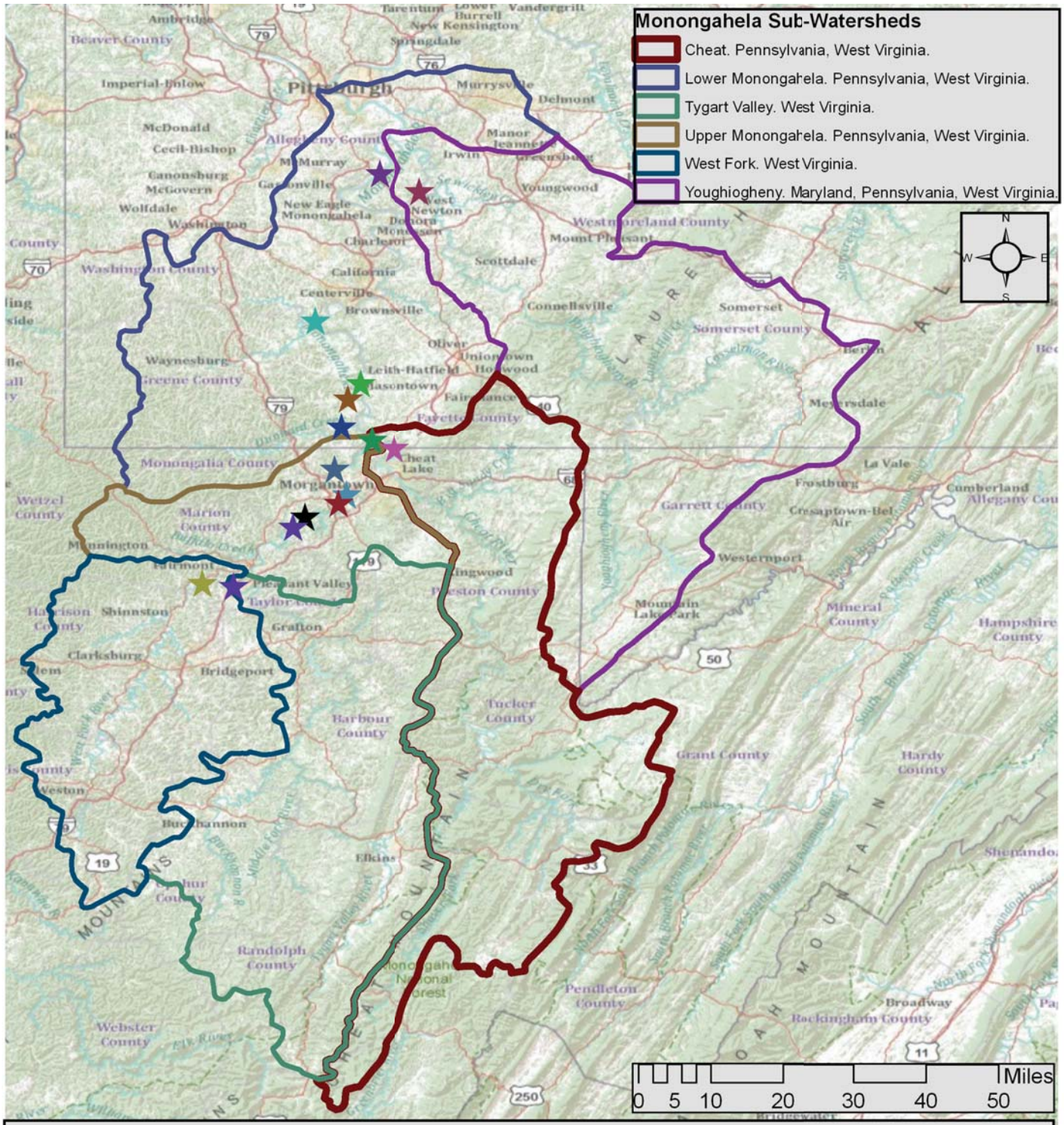

Legend

Sample Locations

- Indian Creek
- Flaggy Meadow Run
- Robinson Run
- West Fork
- Tygart Valley River
- Monongahela River (mile 102)
- Deckers Creek
- Monongahela River (mile 89)
- Cheat River
- Dunkard Creek
- Whiteley Creek
- Monongahela River (mile 82)
- Tenmile Creek
- Monongahela River (mile 23)
- Youghiogheny River

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Sampling Parameters and Descriptions

To determine the baseline quality of a water body, water sampling must be performed. The sampled parameters vary depending on the goals of the project team. In the case of the Monongahela River Water Quality Study, Total Dissolved Solids and its constituents were the parameters of interest. Because of this, the following parameters are sampled for this study:

pH
Values of pH in surface water outside acceptable ranges can indicate human impacts such as agricultural runoff, mining, or infiltration of untreated wastewater. Low pH is acidic and can cause corrosion of pipes, as well as increased dissolved metals concentrations in surface water. High pH is alkaline and can cause scale buildup in fixtures, bad taste, and reduce the effectiveness of chlorine disinfection, as well as increased metal concentrations in stream sediments.

Acidity
Low pH values indicate that surface water is acidic. High acidity values in surface water may come from several sources, such as mining and acid precipitation. Acid precipitation may cause the dissolution of aluminum in soils with poor buffering capacity, which in turn causes acidity to increase in surface water when the soil enters the stream as runoff. As acidity increases, dissolved metal concentrations increase, which in turn may cause problems for aquatic life in streams and rivers.

Alkalinity
High pH values indicate that surface water is alkaline in nature and that the water has a greater neutralization capacity. Typically, a small to moderate amount of alkalinity in water is also important to have for the well-being of the organisms that live in the water body. However, too much alkalinity can be toxic to wildlife. High alkalinity can also cause impacts to humans, including scale buildup in fixtures, bad taste, and reduce the effectiveness of chlorine disinfection. Alkaline water may also impact irrigation if the alkalinity of the water is greater than the alkalinity of the surrounding soil.

Electrical Conductivity
Electrical conductivity is an indicator of dissolved metals. Some common metals that may be found in surface water include: iron, aluminum, calcium, magnesium, and others. High conductivity levels may be due to several different factors, including: untreated wastewater infiltration, mining, and agricultural runoff. High conductivity concentrations can be damaging to aquatic life because of increased salinity in the stream and possible smothering of the stream bottom.

Oxidation-Reduction Potential (ORP)
ORP is the potential of a chemical species to acquire (reduction) or lose (oxidation) electrons. An oxidizing substance, such as chlorine, will have a positive ORP value, while a reducing agent, such as hydrogen sulfide, will have a negative ORP value. High or low ORP values could indicate the presence of large amounts of certain chemical species, such as chlorine or hydrogen sulfide, which may affect aquatic life.

Temperature
Temperature has a large impact on the biological activity of aquatic organisms. All aquatic organisms have a preferred temperature range. If the water temperature gets too far above or below this range, then the biological community becomes stressed and may have difficulty maintaining a stable population.

Temperature is also important because of its influence on water chemistry. The rate of chemical reactions generally increases at higher temperature, which in turn affects biological activity. Another important example of the effects of temperature on water chemistry is its impact on oxygen. Warm water holds less oxygen than cool water, so it may be saturated with oxygen but still not contain enough for survival of aquatic invertebrates or certain fish.

Total Dissolved Solids (TDS)
TDS is a general indicator of overall water quality. It is a measure of inorganic and organic materials dissolved in water. High levels of TDS in surface water may be due to factors such as sedimentation, mining, or storm water runoff. Increased TDS may impart a bad odor or taste to drinking water and cause scaling of pipes and corrosion.

Total Suspended Solids (TSS)
TSS, or turbidity, is the measure of the suspended particles in the water column. High levels of turbidity can come from many sources, such as urban runoff, soil erosion, wastewater discharges, agriculture, and removal of riparian zones. Increased levels of turbidity may cause water to darken, which in turn leaves less light for aquatic plants to perform photosynthesis. This in turn decreases the amount of dissolved oxygen being added to the water, which can affect aquatic organisms that are higher on the food chain. Extreme levels of TSS can also clog fish gills.

Cations/Anions
Specific cations and anions will also be sampled as part of this project. Both dissolved and total concentrations will be determined for all species. Dissolved concentrations allow the researcher to infer more detailed water chemistry information, while total concentrations are used to promulgate and enforce water quality regulations.

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Sampling Parameters and Descriptions (Continued)

Aluminum (Al)
Aluminum is the third most common element on Earth. In most forms, aluminum is not very soluble in water. However, low pH waters, such as those associated with mine drainage, may contain large amounts of dissolved aluminum due to dissolution of aluminum-containing minerals within the local geology. When aluminum precipitates within the water column, it is in the form of an aluminum hydroxide. Aluminum hydroxide may be very harmful to aquatic life due to smothering of the stream bed of the water body. Aluminum may also clog the gills of aquatic organisms if the concentration is high enough.

Bromine (Br)
Bromine is a chemical element found in the halogen group. At room temperature, it is a reddish-brown liquid that is slightly soluble in water. Dissolved bromine comes from several sources, including surrounding geology, fluids used in gas well drilling, seawater infiltration, and industrial waste. Elevated levels of dissolved bromine may interfere with water treatment, as well as pose a possible increased cancer risk to humans and wildlife.

Calcium (Ca)
Calcium is an element that is found naturally in water due to its abundance in the Earth's crust. Large bodies of surface water, such as rivers, typically contain 1-2 mg/L of calcium. High levels of calcium in surface water mean that the water is hard, which helps aquatic life by buffering the pH of the water and protecting those organisms with gills from direct metal uptake. However, if calcium and hardness are too high, hardening of pipes and staining may occur.

Chlorine (Cl)
Chlorine occurs naturally as a green gas. It appears in many different compounds. The most important chlorine compound for many forms of life is NaCl, or salt. Chlorine (as the Cl- ion) is the most abundant dissolved ion in salt water, and is also found in freshwater in much smaller concentrations. Freshwater chlorine is usually derived from chlorine mineral dissolution. Other sources of chlorine in freshwater may include wastewater runoff and breakdown of chlorinated compounds. High amounts of dissolved chlorine can be very harmful to wildlife due to the oxidative properties of chlorine. When chlorine concentrations reach a certain level within the organism, it combines with the water and oxygen to create hydrochloric acid, which destroys animal tissues.

Iron (Fe)
Iron is the most abundant metal in the Earth's core and is found in a large range of compounds. It is also very important to humans and other organisms, as it is partially responsible for transporting oxygen through the bloodstream. Iron is easily dissolved in water and can be found naturally occurring in water bodies. High levels of precipitated iron oxides may cause smothering of stream bottoms and plugging of organism's gills.

Magnesium (Mg)
Magnesium is found in large concentrations in both the Earth's crust and the human body. It is highly soluble in water, and is the third most abundant element in sea water. Concentrations of magnesium in freshwater vary according to surrounding geology. Along with calcium, magnesium concentrations are used to determine water hardness. High concentrations of magnesium cause similar problems to high concentrations of calcium, including staining and hardening of pipes and fixtures.

Manganese (Mn)
Manganese is commonly found in soil in its oxide form (pyrolusite). It is used in the steel making process, and is also an essential nutrient for most organisms. High concentrations of manganese in humans can cause many different health problems, including Parkinson's disease and bronchitis. Manganese is also soluble in water, with large concentrations causing health problems in aquatic life. Manganese can also bioaccumulate through the food chain, causing top predators to have unhealthy levels of manganese in their bodies.

Sodium (Na)
Sodium is a very common element found in rocks and soils. It is needed for all life forms to aid in the transmission of nerve impulses. It is also highly soluble in water and will react violently with water to form lye and hydrogen gas. Sodium is found naturally in freshwater bodies. Concentrations of sodium vary greatly, and are dependent on the surrounding soil and geology. Too much sodium can raise the pH level of a water body to the point where it is too high for certain species of aquatic life to survive.

Sulfate (SO4 -2)
Sulfate is a salt consisting of one sulfur atom and four oxygen atoms with an oxidation number of -2. Sulfate is naturally occurring in almost all water bodies. It usually comes from oxidation of sulfite ores, dissolution of sulfate minerals, shale, and industrial wastes. High concentrations of dissolved sulfate may give water an unpleasant taste and may be corrosive to plumbing. It may also have health effects including nausea and diarrhea.

Sulfur (S)
Sulfur is a non-metal that is a yellow solid at room temperature. Sulfur is found in many different minerals and is extracted by melting the surrounding rock and collecting the molten sulfur. It may also be produced from hydrogen sulfide. It is a required nutrient for life on Earth and it is an essential building block of cells. It is insoluble in water. However, high concentrations of sulfur-containing compounds, such as sulfate, may be found in water due to human activities, such as mining.

For more information about the sampled parameters (including measurment units, ranges, and analysis techniques), visit our project website at www.MonWQ.net