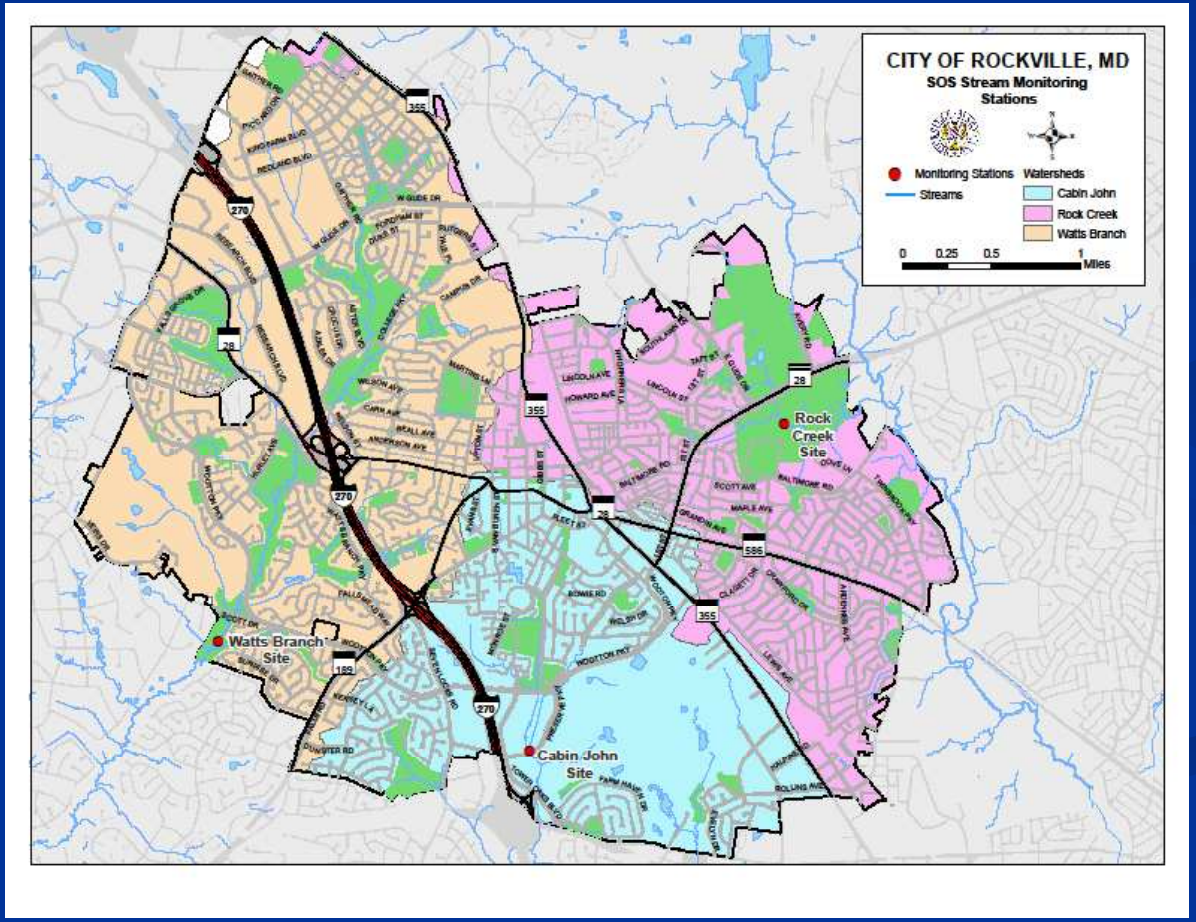
Water Chemistry Training

City of Rockville SOS

Why Collect Water Chemistry Data?

- The objective is to establish baseline data for water quality parameters in the permanent streams located within watersheds of Rockville



Why Collect Water Chemistry Data?

- This data will be used as a standard of measure for aquatic ecosystem functioning and as a basis of comparison for future water quality monitoring
- Identify contamination
- Gather data to be used for outreach
- Evaluate the success of water quality programs

Water Quality Parameters Collected

The SOS Team water chemistry monitoring program examines the following parameters:

- Water temperature
- pH
- Dissolved oxygen (DO)
- Clarity (Suspended Solids)
- Conductivity (Total Dissolved Solids)
- Nitrates and Phosphates (sampling instructions will be provided at a later date)

Water Temperature

- Temperature of the water directly affects biological and chemical processes. Warm water speeds up chemical and metabolic reactions.
- Fish and benthic macroinvertebrates will move in the stream in order to find their optimal temperature.
- Cooler water contains more dissolved oxygen than warm water.

pH

- pH is measured on a scale from 1.0 to 14.0. Neutral pH = 7.0; pH < 7.0 is acidic and pH > 7.0 is alkaline.
- The pH of a stream affects the ability of plants and wildlife to function and live. A wide variety of aquatic animals prefer a range of 6.5-8.0 pH.
- The pH of rain is naturally 5.5 Causes of increased acidity of water include: acid rain and industrial wastes.
- Alkaline industrial wastes are the primary cause for high pH values.

Dissolved Oxygen (DO)

- In water, oxygen is in a dissolved form. Water temperature and altitude, time of day, and seasons can all affect the amount of dissolved oxygen. Aquatic organisms rely on the presence of oxygen in streams.
- Oxygen is both produced and consumed in a stream. Churning, running water, especially in riffles, creates DO. Green plants release oxygen underwater during photosynthesis. Maximum amounts of DO are produced with the energy of the late afternoon sun. DO levels are lowest at early morning.
- Organic materials in water require oxygen to decompose. Too much organic materials from wastewater treatment plant discharges, industrial discharges, runoff of livestock wastes and septic systems may deplete DO.

Transparency

- In streams, soil particles (predominantly silts and clays) are suspended as water flows downstream, carrying and depositing sediment with it. A good example of suspended material that affects transparency is the tea color of some forest surrounded streams, which is caused by dissolved organic material.
- Suspended sediment reduces light penetration needed for the growth of beneficial aquatic plants. When sediment is deposited on stream bottoms it can smother fish eggs, keeping them from getting the oxygen needed to survive. Deposited sediment clogs spaces between rocks where benthic marcoinvertibrates like to live. This in turn can lead to fewer fish that depend on them as food.
- Finally, sediment may have pollutants attached to it such as phosphorous and petroleum products.

Turbidity

- Transparency is related to another measure of water quality known as turbidity.
- Turbidity describes how suspended particles affect water transparency. Turbidity does not actually measure the concentration of materials in water, but their scattering and shadowing effect on light shining through the water. Sources of turbidity include soil erosion, waste discharge, urban runoff, eroding stream banks and excessive algal growth.
- Excess soil material is a significant pollutant itself, whether it is suspended in the water column or deposited as sediment on stream bottoms.

Conductivity

- Conductivity measures the ability of water to pass an electrical current.
- Conductivity indirectly measures the presence of inorganically dissolved solids such as chloride, nitrate, sulfate, phosphate, sodium, magnesium, calcium, iron, and aluminum. Inorganic materials are good conductors of electricity. Failing septic tanks, sewage spills, and agricultural runoff containing phosphates and nitrates are indicated by high conductivity measurements.
- Conversely, organic substances like oil, alcohol, and grease are poor conductors of electricity and will yield low conductivity measurements.
- Conductivity is affected by temperature: the warmer the water, the higher the conductivity.
- Conductivity is also directly affected by the substrate or stream bottom material. In general conductivity is higher in areas with clay soils (vs sand) because these soils tend to dissolve in water.

Total Dissolved Solids (TDS)

- As water interacts with the atmosphere, rocks, and soil in a watershed, many materials are dissolved and carried away. These total dissolved solids (TDS) include all suspended solids that may or may not pass through a filter.
- Concentrations of TDS that are too high or too low may limit growth and lead to the death of many aquatic organisms.
- Sources: runoff from urban areas; road salts used on streets; fertilizers and pesticides used on lawns and farms; wastewater from sewage treatment plants; decayed plant and animal matter; construction that disturbs the soil.
- Relates to Conductivity: Conductivity increases as the amounts of salts and other dissolved solids increase in the water. Our probe measures both using a fixed multiplier.

Nitrates and Phosphates

- Nitrogen and Phosphorus are essential for plants and animals in an aquatic ecosystem. Naturally occurring sources include soils, eroding rocks, and terrestrial animal and plant waste washing into the streams.
- **Phosphates -** Possible anthropogenic sources of phosphates in streams: human wastes and detergents from wastewater treatment plants or septic systems, or fertilizer runoff from golf courses, lawns, and farming.
- **Nitrates -** Excessive amounts in water accelerate plant and algae growth. Nitrates enter water from: fertilizer runoff from lawns, golf courses, farm fields; sewage from septic systems or municipal wastewater treatment plants: industrial discharges; dairies; food-packing plant wastes; and livestock wastes.

Sample and Analysis Methodologies

- Temperature, pH, TDS, Conductivity will be measured using TRACER POCKETTESTOR®
- Clarity will be measured using a Transparency Tube
- Dissolved Oxygen will be measured using a Oxygen ULR CHEMets® Kit
- Nitrates and phosphates will be measured at a later date.

TRACER POCKETTESTOR®

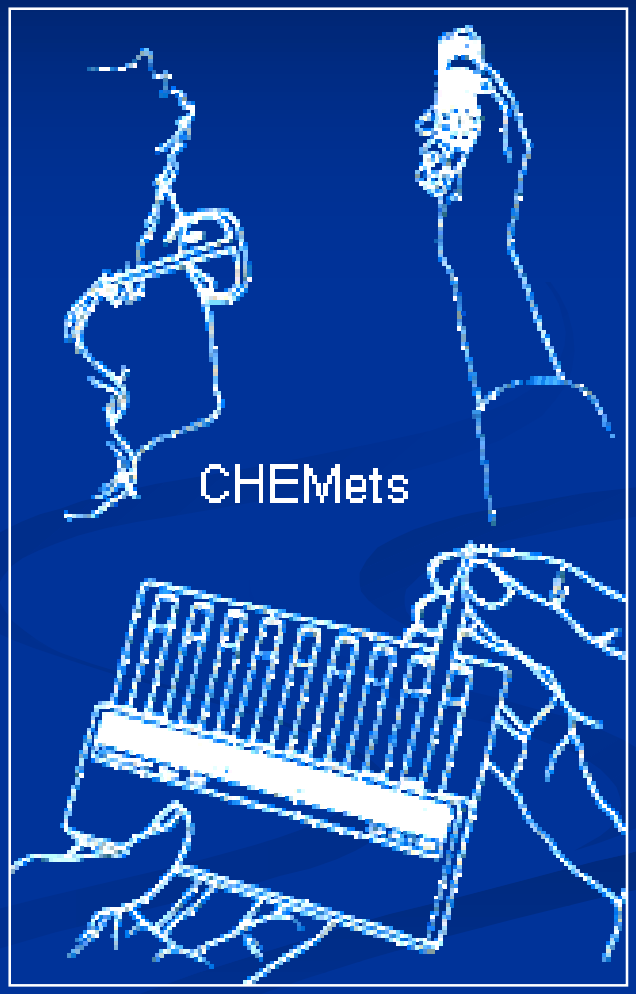
- A water quality meter used to analyze stream water for temperature, pH, TDS, and conductivity
- Measurements and methods of analysis will be followed from the product instructions.

Transparency Tube

- The tube is filled with water collected from a stream or river. Looking down into the tube, water is released through the valve until the black and white symbol is visible.
- The depth of the water when the symbol becomes visible is recorded in centimeters, which are marked on the side of the tube.
- A low transparency reading reflects a large amount of suspended materials in the water.

Oxygen ULR CHEMets® Kit K-7511:

- Oxygen oxidizes solution to form a highly colored blue dye. The resulting blue color is proportional to the DO concentration in the sample.
- Test results are expressed in ppm (mg/L) oxygen as O_2.
- Measurement of parameters will be conducted in accordance with product instructions.



SAFETY IS NO ACCIDENT ☺

- plastic gloves
  safety glasses
  plastic wash bottle (for eyes)
  first aid kit
  plastic bottle (to collect wastes from chemistry tests; pour down drain)

- **Read all Material Safety Data Sheets (MSDS) prior to using water chemistry kits and meters**