



Module 3 Water Quality Fact Sheet - Turbidity

Turbidity refers to how clear or how cloudy the water is; clear water has a low turbidity level and cloudy or murky water has a high turbidity level. Turbidity is often measured to provide a quick estimate of the total suspended solids or sediments (TSS) concentration (in milligrams dry weight/L). If the turbidity level of the water is high, there are many suspended particles in the water.

Measurement

There are several methods to measure turbidity. One method is with a Secchi disk. This disk has a black and white pattern on it – a “Secchi pattern”. The Secchi disk is slowly lowered into the water until it is no longer visible – then the depth at which it disappears from view can be used as a measure of turbidity. This “Secchi depth” is inversely proportional to turbidity – a large Secchi depth indicates a low turbidity and a small Secchi depth indicates a high turbidity. A Secchi disk is useful in deep water, but not very useful in shallow water because you might not be able to lower it deep enough for it to disappear from view.

For shallow waters it can be useful to measure turbidity with a transparency/turbidity tube. A turbidity or transparency tube is a graduated glass or plastic measuring cylinder, with a small black and white Secchi pattern at the bottom. Sample water is collected and added to the tube until the Secchi pattern on the bottom is no longer visible – the depth of water in the tube can now be used as a measure of turbidity. The tube is calibrated so that the turbidity can be read off the side in appropriate units.

Units of turbidity

There are a variety of different units that can be used to measure turbidity. Secchi depth is often used in deep water. Turbidity tubes are sometimes calibrated in Jackson Turbidity Units (JTU)-originally defined as a measure of how much water is needed to obscure a candle flame viewed through a turbidity tube. Electronic turbidity meters are typically calibrated in Nephelometric Turbidity Units (NTUs) which are a measure of how much light is scattered or reflected off particles suspended in the water.

A turbidity reading of 0-10 NTU is considered normal. A clear mountain stream might have a turbidity of around 1 NTU, whereas a large river like the Mississippi might have a dry-weather turbidity of around 10 NTUs. These values can jump into hundreds of NTUs during runoff events. Therefore, the turbidity meter used should be reliable over the range in which you will be working.

A Secchi depth less than 1 meter indicates a high concentration of suspended solids. In this project, turbidity is measured in milligrams/Liter (mg/L). A very high reading of turbidity would be 22 mg/L, and a very low reading would be 1 mg/L.

Electronic turbidity sensor

The sensor consists of two main components: a light source (light emitting diode or LED lamp) and a light sensitive device (photoresistor). The LED and the photoresistor are fixed a short distance apart in such a way that water can flow between them. The more turbid the water, the less light from the LED lamp will reach the photo-resistor. The photo-resistor is a device which changes its resistance depending how much light falls on it. Therefore, by measuring the resistance of the photo-resistor, you can measure how much or how little light reached it from the LED lamp, and therefore turbidity.

Turbidity is not generally constant from the water surface to the bottom. An aquatic ecosystems' turbidity is a function of:

- Depth
- Season (spring melt)
- Mixing due to wind, storms and tides (suspension of bottom sediments)
- Stratification in the system
- Turbidity of water flowing from the tributaries
- Human influences such as releases of pollution sources

Why is it important to measure turbidity? Turbidity can influence several water quality parameters and affects including:

- Submerged Aquatic Vegetation (SAV) and other biota
- Temperature
- Dissolved Oxygen (DO)

Causes

High turbidity levels can occur due to natural causes (soil, sediment, mixing due to storms, seasonal conditions like spring melt) and can be caused by human influences (sewage, over development of the land, pollution). Excess soil can enter a waterbody by erosion or runoff from nearby lands. Sediments can be stirred up by activity in the water, caused by organisms living in the water, humans, machinery, and powerful weather events.

These solid particles will block sunlight and can prevent aquatic plants from getting the sunlight they need for photosynthesis. The plants will produce less oxygen thereby decreasing the dissolved oxygen levels. The plants could die and decompose in the water, which will further reduce the dissolved oxygen levels.

Moderately low levels of turbidity may indicate a healthy, well-functioning ecosystem, where plankton can live and reproduce and support the food web in the ecosystem. Very clear water is typical of open ocean water and white sand/blue water vacation locations, but is capable of supporting minimal plant and animal life.

Temperature

Particles suspended in the water can absorb heat from sunlight which can result in warmer water and depending on conditions, could lead to thermal pollution.

Dissolved Oxygen

Warm water is not able to hold as much oxygen as cold water so dissolved oxygen levels will decrease.

Submerged Aquatic Vegetation (SAV) and other biota

Suspended particles are also destructive to many aquatic organisms. Excessive amounts can clog the gills of fish and interfere with their ability to find food. They can also bury bottom dwelling creatures and eggs. Suspended particles can transport pollutants through the water. Submerged Aquatic Vegetation (SAV) are important elements of an aquatic ecosystems' health, providing shelter and habitat for some species, food for other species, and contribute to the dissolved oxygen levels available in the system.