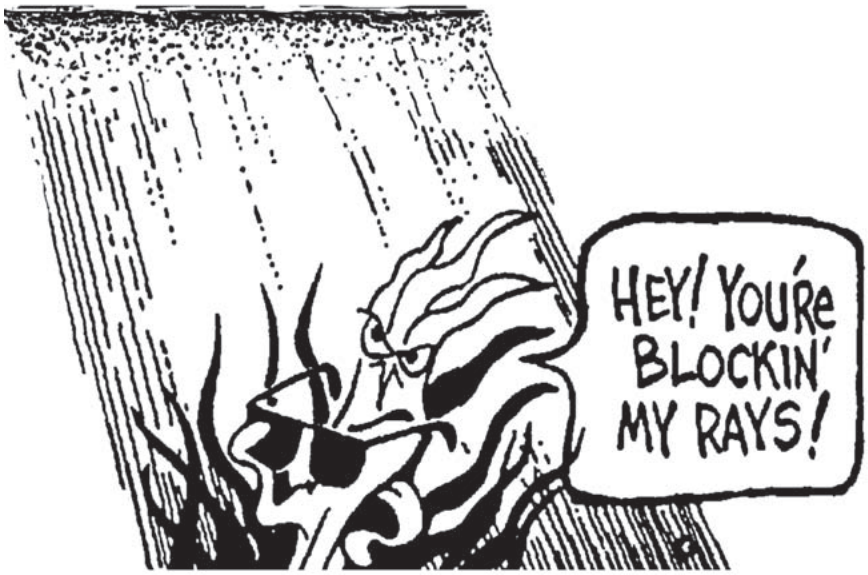
Transparency:
A Water Clarity Measure

Volunteer Monitoring Factsheet Series 2023

Why are we concerned?

- Water clarity is one of the most obvious measures of water quality.
- Water clarity can be a useful indicator of runoff from construction sites fields, logging activity, industrial discharges and other sources.
- Monitoring transparency before, during and immediately after rain can provide a useful picture of potential runoff problems.



Time Needed:
10-20 minutes

When to Measure:
Monthly from May to October

Equipment Needed:
- Hipboots (if wading)
- 120cm transparency tube
- Datasheet
- Pen/pencil
- Bucket (optional)

Definition of Terms

Turbidity: The amount of suspended particles in the water.

Transparency: A measure of water clarity.

Transparency Tube: A tube with a black and white disc in the bottom, which is marked in centimeters or inches along its side. It is used for assessing the clarity of stream water

Suspended Material: Small particles floating in the water.

Sediment: Soil or other bits of eroded material that run off land and settle in still water.

NTU: Nephelometric Turbidity Units, which is a measure of the amount of light scattered by suspended material in the sample.

Background on Turbidity / Transparency

Murky water is easily seen as unhealthy. However, natural substances which are not harmful to the water can sometimes make water appear brown and murky. How do we know if the murky water is a cause for concern? Scientists have found a way to quantify the cloudiness of water by measuring its turbidity, which refers to the amount of suspended particles in the water. These small particles of soil, algae or other materials generally range in size from the microscopic level to about one millimeter, (about as thick as a pencil lead). More free-floating particles cause greater turbidity, resulting in less light penetration through the water. This hinders photosynthesis, necessary for healthy aquatic plant growth and production of dissolved oxygen. The water also becomes warmer because the suspended particles absorb heat, and warmer water holds less dissolved oxygen than cold water. The faster a stream flows, the more energy it has and the more sediment it can carry. Sources of turbidity include:

- erosion from fields, construction sites
- urban runoff from rainstorms and melting snow
- large number of bottom feeders (such as carp) which stir up bottom sediments
- excessive algal growth

Think Like a Scientist!

Follow the directions VERY CAREFULLY! Accuracy is a must for valid data comparisons.

Since we assess water clarity visually, we don't directly measure how many suspended particles are in the water. Instead we measure the transparency of the water, which takes into account both color and suspended particles. We do, however, have you use a conversion chart to estimate the turbidity measurement in nephelometric turbidity units (NTU) as well as recording in cm or inches.

Collecting the Sample

In general, collect the sample away from the river bank in the main flow area. Be careful not to collect water that has sediment from bottom disturbances (toss out the sample and try again if you get bottom sediment in your sample).

Wading Streams

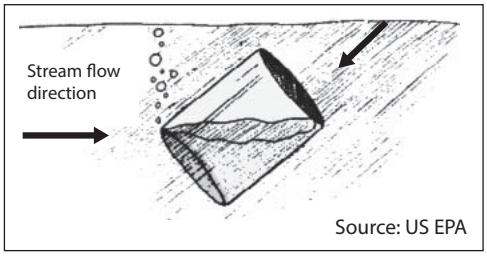
- Walk into the water downstream from the sampling location. Be careful not to stir up the bottom sediment upstream of your sampling location.
- Face upstream (into the current) in the middle of the stream.
- Collect your water sample by plunging your transparency tube or collection bucket 8-12 inches beneath the surface or halfway down from the surface. Scoop away from your body and into the current.
- Scoop water into the tube so it is filled to the top, or use a bucket to collect additional water from the stream at the site to fill the tube to the top.
- Return to shore with the sample.

From Shore

- To collect a sample from the shore, use a bucket or sample bottle attached to a pole. Scoop from below the surface in the upstream direction. Be careful not to stir up the sediment upstream of your sample.

From a Bridge

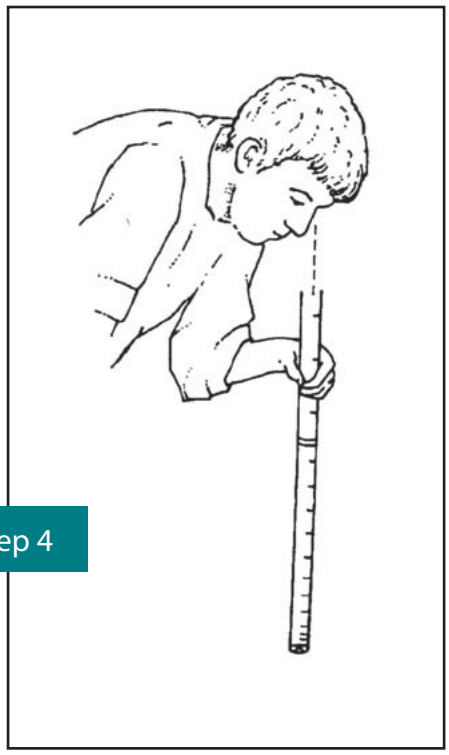
- If you are collecting a sample from a bridge, lower the bucket and get a sample from below the surface.



It's important to scoop your bucket down and into the current flow. Avoid sampling surface water.

Using the Transparency Tube

1. Walk upstream and lower the transparency tube into the water in the main part of the stream channel where water is flowing. Fill the tube, avoiding collecting only water from the surface. Tip the tube up slightly to release any air bubbles. Then, place your hand over the end of the tube and lift it out of the water. Carry the full tube to shore.
2. Stand out of direct sunlight. If you cannot get to a shady place, use your body to cast a shadow on the tube.
3. If you are wearing sunglasses, remove them. Then look for the black and white secchi disc on the bottom of tube. If the disc is immediately visible, record the max length of the tube (120 cm) on the datasheet.
4. If the secchi disc is not immediately visible, have your partner let water out a little at a time using the valve at the bottom of the tube until the disc is just visible. That is, have them stop letting water out immediately when you can just see the contrast between black and white on the disc.
5. Read the height of water using the measurements on the side of the tube.
6. Record the measurement on your datasheet.
7. Dump contents of the tube on the ground.
8. Collect a new sample then repeat steps 1 through 6.
9. Record the second measurement on your datasheet.
10. Add both readings, divide by 2, and record this average transparency on your datasheet.
11. (*Optional*) If you would like to compare your transparency value to a turbidity value, use the conversion chart on the next page.



US EPA

Try to stand out of sunlight when taking your measurements.

Transparency Conversion Chart

Centimeters	Inches	Turbidity Values*
<6.4	<2.5	<240
6.4 to 7.0	2.5 to 2.75	240
7.1 to 8.2	2.5 to 3.25	185
8.3 to 9.5	3.26 to 3.75	150
9.6 to 10.8	3.76 to 4.25	120
10.9 to 12.0	4.26 to 4.75	100
12.1 to 14.0	4.76 to 5.5	90
14.1 to 16.5	5.6 to 6.5	65
16.6 to 19.1	6.6 to 7.5	50
19.2 to 21.6	7.6 to 8.5	40
21.7 to 24.1	8.6 to 9.5	35
24.2 to 26.7	9.6 to 10.5	30
26.8 to 29.2	10.6 to 11.5	27
29.3 to 31.8	11.6 to 12.5	24
31.9 to 34.3	12.6 to 13.5	21
34.4 to 36.8	13.6 to 14.5	19
36.9 to 39.4	14.6 to 15.5	17
39.5 to 41.9	15.6 to 16.5	15
42.0 to 44.5	16.6 to 17.5	14
44.6 to 47.0	17.6 to 18.5	13
47.1 to 49.5	18.6 to 19.5	12
49.6 to 52.1	19.6 to 20.5	11
52.2 to 54.6	20.6 to 21.5	10
>54.7	>21.6	<10

*Roughly NTUs

Chart developed by Kevin Fermanich

What Do These Turbidity Values Mean?

All streams have background turbidity/transparency, or a baseline standard for a natural amount of turbidity/transparency. Fish and aquatic life that are native to streams have evolved over time to adapt to varying levels of background water clarity. For example, native fish and aquatic life in the Mississippi River are very happy with their murky environment. What causes problems in any stream or river are unusual concentrations of suspended particles and how long the water stays at a deviated level. When you collect transparency samples, it is important to note any fluctuations in values, which can help detect trends in water quality.

Time is probably the most influential factor in determining how turbidity affects the aquatic environment. The longer the water remains at unusually high values, the greater effect it has on fish and other aquatic life. Fish in particular become very stressed in waters that remain highly turbid for a long time. Signs of stress include increased respiration rate, reduced growth and feeding rates, delayed hatching and in severe cases, death. Fish eggs are ten times more sensitive to turbidity than adult fish. To further understand how time and turbidity impact fish, look at the graph that is included: "Relational Trends of Fresh Water Fish Activity to Turbidity Values and Time."

High turbidity levels affect humans, too. Acceptable turbidity levels for recreation is 5 NTU and acceptable levels for human consumption ranges from 1-5 NTU.

Extension
UNIVERSITY OF WISCONSIN–MADISON

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Water Action Volunteers is a cooperative program between the University of Wisconsin-Madison Division of Extension and the Wisconsin Department of Natural Resources. For more information, go to https://wateractionvolunteers.org/