



Environmental  
Outcomes and  
Analysis  
Division

# Using Transparency Tube and Total Suspended Solids Data to Assess Stream Turbidity

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## What is Minnesota's Process for assessing waters of the state?

Since 1975, MPCA has been assessing the quality of its waters (whether meeting standards or impaired) and reporting to Congress as required under 305(b) of the Clean Water Act. In addition, since 1992, the Agency has developed a list of impaired waters, as required by Section 303(d) of the Clean Water Act. Beginning in 2004, Minnesota integrated its 305(b) reports and 303(d) water body impairment list into one process. Minnesota assesses its waterbodies every two years. This fact sheet describes changes made during the 2006 assessment to the process for determining stream impairments caused by high turbidity.

## What is Turbidity?

Turbidity is the cloudiness or murkiness of water caused by soil, algae, and other suspended particles that scatter light in the water column. Excess turbidity can significantly degrade the aesthetic qualities of streams and rivers. People are less likely to fish or swim in waters degraded by excess turbidity. Turbidity can also make the water more expensive to treat for drinking or food processing. Turbidity may make it hard for fish and other aquatic animals to find food, breathe through gills, and reproduce when spawning beds are clogged with deposited sediment. Turbidity is measured in nephelometric turbidity units (NTU). The standards are shown below:

- 10 NTU, Class 2A waters
- 25 NTU, Class 2Bd, B, C, D

## How are Transparency Tube and Total Suspended Solids Data Used to Assess Turbidity?

Large data sets indicate that total suspended solids (TSS) and transparency values reliably predict turbidity. Correlations allow the MPCA to use TSS and transparency as surrogates for turbidity at sites where there are not enough turbidity observations. The TSS values selected as surrogate thresholds are 58 and 66 milligrams per liter in the Western Corn Belt Plains and Northern Glaciated Plains ecoregions, respectively. These are the 75<sup>th</sup> percentile values in the distribution of TSS values measured at the less impacted sites in the two ecoregions. The MPCA has used this concept of comparing monitoring data to "ecoregion expectations" in assessments for a variety of pollutants.

Transparency tube (T-tube) data were used for determining turbidity impairments for the first time during the 2006 stream assessments. Stream water clarity, measured with a T-tube, is recorded by volunteers in the Citizen Stream-Monitoring Program. The two-foot, clear plastic transparency tube has a stopper with a black and white symbol on it, and a release valve on one end. To measure clarity, the tube is filled with water collected from a stream or river. While looking down into the tube, the user releases water 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. For transparency, a water body is in violation of the 25 NTU turbidity standard if a T-tube value is less than 20 centimeters.



The MPCA feels that by applying these TSS and transparency thresholds, only a few truly impaired waters will be missed, while minimizing the number of waterbodies falsely identified as impaired.

### What Criteria are Applied for Using T-tube and TSS Data in Turbidity Assessments?

Turbidity is a highly variable water quality measure. Because of this variability, and the use of TSS and transparency as surrogates, a total of 20 independent observations (rather than 10) are now required for a turbidity assessment. If sufficient turbidity measurements exist, only turbidity measurements will be used to determine impairment. If there are insufficient turbidity measurements, any combination of independent turbidity, transparency, and total suspended solids observations may be combined to meet assessment criteria. If there are multiple observations of a single parameter in one day, the mean of the values will be used in the assessment process. If there are observations of more than one of the three parameters in a single day, the hierarchy of consideration for assessment purposes will be turbidity, then transparency, then TSS.

For a water body to be listed as impaired for turbidity, at least 3 observations **and** 10% of observations must be in violation of the turbidity standard. This is an increase in the number of violations required, which was previously 10% of 10 required observations.

Assessments that rely on volunteer collected transparency tube observations must be corroborated by

the judgment of MPCA staff, and by local resource and/or watershed project staff, if available.

### Designated Trout Streams – Class 2A Waters

The MPCA has not analyzed enough data on designated trout streams (Class 2A waters) to determine transparency or TSS thresholds for the 10 NTU standard. If T-tube data indicate impairment on a Class 2A water (based on the 25 NTU standard), the water body is assessed as impaired for turbidity. If T-tube data indicate a Class 2A water is in full support, the water body is considered “not assessed” because it is based on the transparency threshold for the 25 NTU, not the 10 NTU standard.

### What is the Impact of T-tube Data on Assessments?

For the 2006 assessments, a total of 88 stream segments were assessed using T-tube data. Of these, 55 new segments are proposed to be listed as impaired for turbidity based entirely or in-part on T-tube data. Another 28 segments are proposed to be listed as fully supporting of the turbidity standard. An additional 190 segments had enough data to meet assessment criteria, but corroboration by MPCA staff or a local resource professional was not available.

### What’s Next?

The 303(d) list is available for public comment during fall 2005. The MPCA will hold public meetings around the state to discuss the list and receive public comment during the fall. The list and assessment guidance document will be available on MPCA’s website at that time at:

<http://www.pca.state.mn.us/water/tmdl.html>

For more information on the Citizen Stream Monitoring Program, or using T-tube data in assessments, contact Laurie Sovell at the MPCA:

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