

## **Total Suspended Solids**

Total suspended solids (TSS) include all particles suspended in water which will not pass through a filter. Suspended solids are present in sanitary wastewater and many types of industrial wastewater. There are also nonpoint sources of suspended solids, such as soil erosion from agricultural and construction sites.

As levels of TSS increase, a water body begins to lose its ability to support a diversity of aquatic life. Suspended solids absorb heat from sunlight, which increases water temperature and subsequently decreases levels of dissolved oxygen (warmer water holds less oxygen than cooler water). Some cold water species, such as trout and stoneflies, are especially sensitive to changes in dissolved oxygen. Photosynthesis also decreases, since less light penetrates the water. As less oxygen is produced by plants and algae, there is a further drop in dissolved oxygen levels.

TSS can also destroy fish habitat because suspended solids settle to the bottom and can eventually blanket the river bed. Suspended solids can smother the eggs of fish and aquatic insects, and can suffocate newly-hatched insect larvae. Suspended solids can also harm fish directly by clogging gills, reducing growth rates, and lowering resistance to disease. Changes to the aquatic environment may result in a diminished food sources, and increased difficulties in finding food. Natural movements and migrations of aquatic populations may be disrupted.

For point sources, adequate treatment is necessary to insure that suspended solids are not present at levels of concern in waters of the state. Treatment typically consists of settling prior to discharge of the wastewater. Settling allows solids to sink to the bottom, where they can be removed. Some types of wastewaters, such as noncontact cooling water, are naturally low in suspended solids and do not require treatment.

For nonpoint sources, control measures should be implemented to reduce loadings of suspended solids to streams, rivers and lakes. Farming practices such as no-till minimize soil erosion and help protect water quality. For construction sites, controls such as silt fences and sedimentation basins are designed to prevent eroding soils from reaching surface waters. In urban areas, storm water retention ponds or a regular schedule of street sweeping may be effective in reducing the quantity of suspended solids in storm water run-off.

## **Water Quality Standards for Total Suspended Solids**

Rule 50 of the Michigan Water Quality Standards (Part 4 of Act 451) states that waters of the state shall not have any of the following unnatural physical properties in quantities which are or may become injurious to any designated use: turbidity, color, oil films, floating solids, foam, settleable solids, suspended solids, and deposits. This kind of rule, which does not establish a numeric level, is known as a "narrative standard."

Most people consider water with a TSS concentration less than 20 mg/l to be clear. Water with TSS levels between 40 and 80 mg/l tends to appear cloudy, while water with concentrations over 150 mg/l usually appears dirty. The nature of the particles that comprise the suspended solids may cause these numbers to vary.

## **Regulation of Total Suspended Solids in NPDES Permits**

Michigan's rules do not contain numerical limits for total suspended solids. The permit writer must take the "narrative standard" into consideration when deciding on appropriate limits.

In addition, the permit writer must also apply treatment technology based effluent limits when appropriate. The U.S. Environmental Protection Agency has promulgated treatment technology based limits for total suspended solids for municipal wastewater treatment plants and many industrial categories. Municipal wastewater treatment plants must provide treatment to meet TSS limits of 30 mg/l as a monthly average and 45 mg/l as a 7-day average. Some industrial categories have treatment technology based concentration limits. Others have production-based loading limits, which are expressed in lbs/day or lbs/year.

Federal treatment technology based limits do not exist for certain industries and for non-municipal wastewater treatment. In the absence of federal categorical standards, permit limits are derived based on best professional judgment.