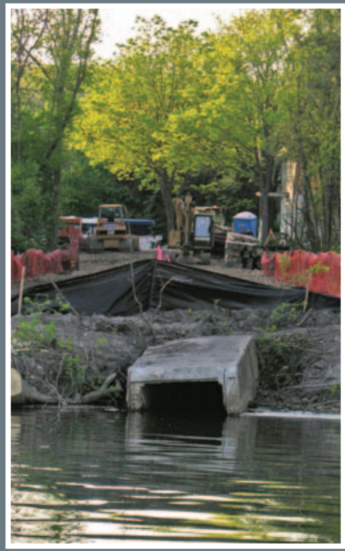
New State Storm Water Rules:

WHAT MUNICIPALITIES NEED TO KNOW

Total Suspended Solids: The Hows & Whys of Controlling Runoff Pollution



Stormwater management by Wisconsin municipalities is under scrutiny. Regulations passed in 2002 (e.g. NR 151) require more than 200 Wisconsin communities to reduce pollutants entering our lakes and streams. As a result, communities across Wisconsin are investing in new and improved infrastructure to manage stormwater runoff.

The goal of this brochure is to explain:

- the importance of reducing pollutants in stormwater runoff,
- how these pollutants are measured and controlled,
- the seriousness of stormwater pollutants and why communities need to invest in stormwater Best Management Practices (BMPs).

Many communities with storm sewer systems are now required to obtain state permits to discharge storm water to streams and lakes. These permits are required by federal and state laws, and are administered by the Wisconsin Department of Natural Resources. The permit program has been phased in over time. Federal rules that require storm water permits are referred to as Phase I or Phase II rules. Phase I mainly affected large communities such as Milwaukee and Madison. Phase II is now affecting many more communities.

This brochures provides information on the minimum control measures for Post-construction stormwater management.

Communities must meet the requirements of six "minimum control measures." These are:

- Public outreach and education
- Public participation and involvement
- Illicit discharge detection and elimination
- Construction site pollution control
- **Post-construction** storm water management
- Pollution prevention (municipal good housekeeping)

The state rule is found in Chapter NR 216 of the WI Administrative Code. This fact sheet refers specifically to Wisconsin's NR 216 rule, but be aware that the "Phase II" term is often used to refer to required permit programs.

If it's only rainfall, why is it polluted?

Rain and snow (while not completely free of pollutants) do not pose a serious threat to the health of our lakes, streams and groundwater. However, when rainfall and snowmelt run off the landscape they can carry along dirt, chemicals and other pollutants that do pose a threat.

Toxic Chemicals – Zinc, lead, copper, cadmium and polyaromatic hydrocarbons (PAHs) found around our buildings and paved areas are carried by stormwater into our lakes and streams, where they become concentrated in plants and animals. Over time, levels of these chemicals can imperil wildlife and be toxic for human consumption. Salt used for de-icing roadways and sidewalks easily dissolves in snowmelt and rain. Runoff from heavily salted roadways contaminates groundwater, and can reach levels that are toxic to plants and animals living in streams and lakes.

Photo: WDNR

Nutrients – Phosphorus (P) and nitrogen (N) from soil, lawns, and pet waste contribute to the growth of algae and noxious aquatic plants. Toxic blue-green algae thrive in warm, nutrient-rich waters, and threaten human and animal health.

Oxygen Demand – Biological and chemical oxygen demand (BOD and COD) occur when oils, greases, and organic material take oxygen from water as they decompose. This process can severely reduce the available oxygen so that fish and other aquatic life are suffocated.

Dirt – Airborne dust, urban debris, and eroded soils are carried by runoff. Stormwater runoff slows as it reaches a lake or stream and large particles drop out, creating sediment. The fine particles stay suspended in the water and create cloudy or "turbid" water. When large amounts of dirt enter lakes and streams, fish and aquatic habitat are degraded, navigation is impaired, flooding is increased, and water quality suffers. Total suspended solids (TSS) is a way to measure dirt and some other pollutants in runoff.

Stormwater runoff

Stormwater runoff is the water associated with a rain or snow storm that can be measured in a downstream river, lake, ditch, gutter, or pipe shortly after the precipitation has reached the ground."

U.S. EPA

The management of stormwater that passes through an engineered conveyance (e.g. a swale, gutter, street, pipe, concrete channel) is regulated by U.S. EPA and Wisconsin DNR.

Hot runoff?

If you have been caught out in a rainstorm you know that rainfall is cold and cools the surfaces it wets. When that surface is a hot roof, parking lot or roadway, runoff can absorb significant heat that is carried to lakes and streams.

This heat changes the environment for the fish, plants and other animals that live there. Fish in cold water streams are especially affected by these temperature increases.

Managing runoff to control pollutants

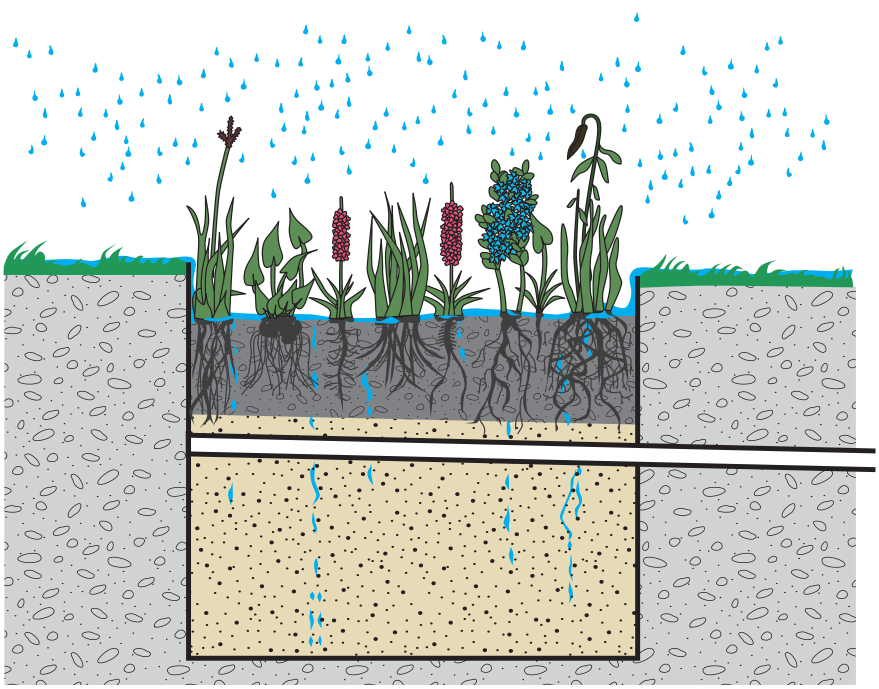
Infiltrate first

If rainfall soaks into the ground where it falls, it will not pick up additional pollutants. Rain that falls on rooftops, sidewalks and driveways (where pollutant levels are lower) can be directed to rain gardens to infiltrate, protect surface waters, and recharge groundwater.

By trapping the small dirt particles in runoff water we control the pollutants attached to the particles as well. Several different kinds of control measures, or best management practices (BMPs), use sedimentation, infiltration, or biofiltration as the mechanism for removing pollutants.

Biofiltration – Rain falling on parking lots and roadways can carry heavier pollutant loadings. Engineered biofiltration devices are designed to remove these pollutants before infiltrating or discharging the runoff. This approach also captures heat and reduces flows of runoff downstream, thereby reducing flooding.

Engineered Conveyances – Streets, gutters, swales, channels, and storm drains are all designed to carry stormwater runoff to lakes and streams without causing erosion and flooding. With the exception of some grassed swales, conveyances are not considered BMPs eligible for municipal TSS removal credit under state rules (Wisconsin administrative rule NR 151). Despite that, proper maintenance of conveyances to avoid erosion and remove sediment is essential to maintaining good water quality.



Biofiltration devices are designed with special soils, storage areas and drains.

Ponds and Catch Basins – Swiftly flowing runoff drops its load of pollutants when it is slowed by a basin or pond. These devices are designed to temporarily hold runoff until the pollutants settle to the bottom, and then discharge the cleaner water downstream. The accumulated sediment must be removed periodically to maintain the pond's effectiveness. Ponds and basins also dissipate the energy of flowing water, minimizing erosion of wetlands and other landscapes.

Measuring effectiveness

Many Wisconsin municipalities are required to reduce the TSS in runoff from the developed urban area by 40%. The processes that reduce TSS levels will also reduce the other pollutants that typically are found with TSS. The amount of reduction required is calculated using the amount of pollutants that would be discharged if no runoff pollution controls were in place.

Actually measuring the amount of pollutants for every stormwater discharge in every municipality would be extremely expensive. Instead, stormwater runoff in several communities around the country has been closely studied, and the information from those studies has been used to create computer models that can simulate runoff in any community.

The table gives examples of storm water pollutants measured in three cities in the upper Midwest:

Pollutant (concentration)	**Madison, WI**	**Marquette, MI**	**Minneapolis/St Paul**
TSS milligrams/liter (mg/L)	**262**	**159**	**184**
Phosphorus (mg/L)	**0.66**	**0.29**	**0.58**
Chemical Oxygen Demand (mg/L)	**N/A**	**66**	**169**
Biochemical Oxygen Demand (mg/L)	**N/A**	**15.4**	**N/A**
Nitrogen (mg/L)	**N/A**	**1.9**	**3.15**
Lead micrograms/liter (ug/L)	**32**	**49**	**60**
Zinc (ug/L)	**203**	**111**	**N/A**
Copper (ug/L)	**16**	**22**	**N/A**
Cadmium (ug/L)	**0.4**	**0.6**	**N/A**
Coliforms number/100 milliliters (#/100ml)	**175,000**	**10,200**	**N/A**

N/A = not available

Source: Brezonik & Stadelman 2002; Steuer et al 1997; Waschbusch et al 1999; U.S. EPA 1983

Using pollutant data like this, computer simulations or models (e.g. P8, SLAMM, TR55, SWMM) combine the data with information about each community's slopes, building density, street width, land use, etc. The computer models then estimate the amount, velocity and pollutant loading from stormwater runoff being discharged to lakes and streams. Finally, by simulating best management practices (BMPs) between where the rain falls and the discharge to surface water, the models estimate the percent of pollutant removal.

The advantages of using models are:

- ✓ The ability to estimate pollutant loadings without costly in-field measurement.
- ✓ The ability to estimate the effectiveness of BMPs before they are built.
- ✓ Consistent method among municipalities for estimating pollutant loads and reductions.

In Wisconsin, the DNR uses computer models as the basis for assessing the TSS load, and the effectiveness of stormwater BMPs when evaluating a municipality's progress toward reaching the 40% TSS reduction requirement.

Did you know?

A typical municipal sewerage treatment plant is allowed to discharge:

- TSS 30mg/L
- Phosphorus 1.0mg/L
- Coliforms 400/100ml

Using Total Suspended Solids (TSS) for community stormwater management

The agencies responsible for regulating stormwater runoff (U.S. EPA and the Wisconsin DNR) use TSS in two ways:

- ✓ as the regulatory criteria used to indicate the amount of pollutants in runoff,
- ✓ as a measure of effectiveness of BMPs in removing those pollutants.

TSS is not a measure of all pollutants carried by stormwater runoff. Coarse materials such as street sand and trash, and dissolved chemicals like chloride are not included in the definition of TSS. Only fine particles of sediment, and the pollutants that attach to them, are measured by TSS.

TSS is used as an indicator because its relationship with other pollutants is known, and it can be consistently simulated by computer models. While TSS is not a perfect measure for all types of stormwater pollution, we have ample experience with using TSS to design stormwater BMPs that will protect our lakes and streams.

TSS	1,500 lb
Phosphorus	2.6 lb
Nitrogen	31 lb
Toxic Metals	3.3 lb

Pounds of pollutant in every one-million gallons of runoff draining from typical commercial streets.

Pitt, Williams, Bannerman, Clark 2004

Samples of urban stormwater runoff.

Photo: USGS

Controlling Runoff Pollution: *Additional Information*

Municipalities are encouraged to take advantage of these and other resources available from local and national sources to identify BMPs for their stormwater management systems.

Links to detailed information on Wisconsin runoff management program
http://runoffinfo.uwex.edu

WI-DNR Municipal Storm Water Program
www.dnr.state.wi.us/org/water/wm/nps/stormwater/muni.htm

The U.S. EPA "National Menu of Best Management Practices" for municipal stormwater pollution prevention.
www3.uwm.edu/Dept/shwec/publications/cabinet/other/EPANationalBMPS.pdf

The U.S. EPA "Pollution Prevention & Good Housekeeping for Municipal Operations"
www3.uwm.edu/Dept/shwec/publications/cabinet/other/EPAMunicipalSWP2BMPs.pdf

U.S. EPA Urban Storm Water Best Management Practices
www.epa.gov/OST/stormwater

The Center for Watershed Protection
www.cwp.org

This publication is available from county UW-Extension offices, Cooperative Extension Publications 1-877-947-7827, and from DNR Service Centers.

References:

Pitt, Robert; D. Williams, R. Bannerman, S. Clark; in: *Effective Modelling of Urban Water Systems-Monograph 13*; Guelph, ON, 2004

Brezonik & Stadelman 2002; Steuer, et al 1997; Waschbusch, et al 1999; U.S. EPA 1983; in: *Assessment of Stormwater Best Management Practices;* University of Mn, 2007

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