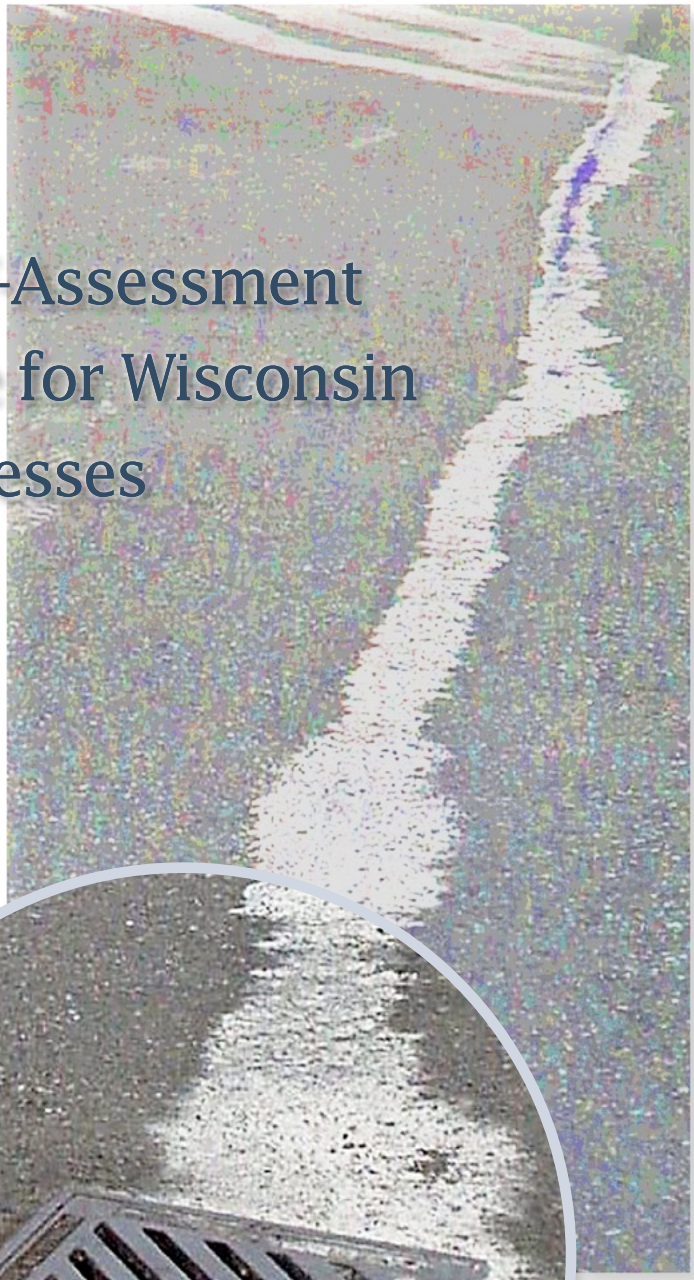
Managing Storm Water Runoff

A Self-Assessment Guide for Wisconsin Businesses



Storm water runoff is coming under increasing scrutiny as both a source of pollutants to our lakes and streams, and as a cause of depleted groundwater resources. Commercial parcels typically create more runoff per square foot than other land uses, due mostly to large areas of impervious surfaces such as roofs and parking lots.

This guide provides businesses with the ability to evaluate and improve their existing storm water management practices, and ultimately lead to improved water quality. It begins with a brief description of the extent of the problem, and information on storm water management, with an emphasis on how you as a business can contribute to solving this problem.

After working through the runoff self-assessment process, you will be able to evaluate the options available for improving storm water management activities, making sound business decisions about improving your property, and adding value to your enterprise.

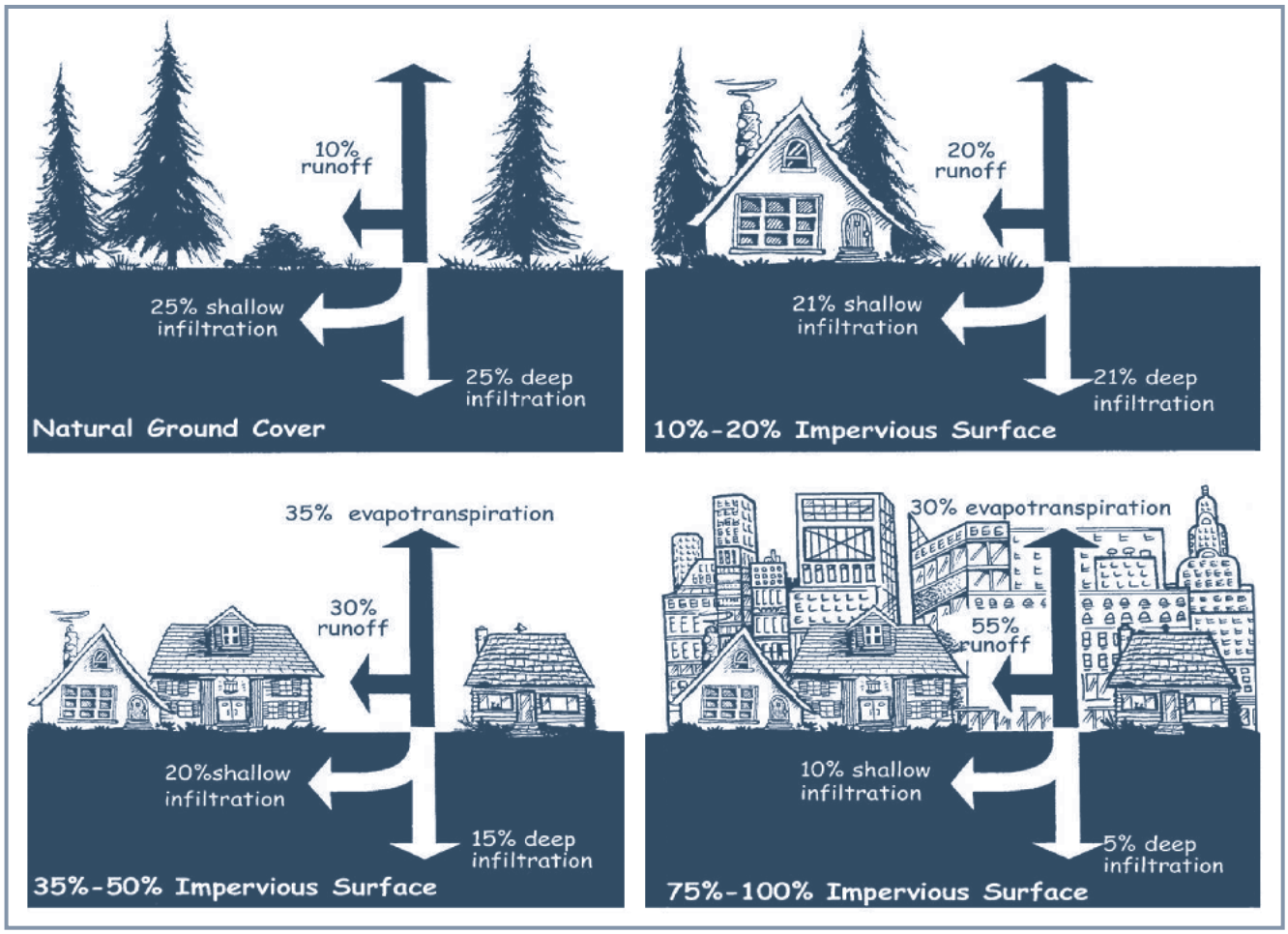
Urban Growth and the Storm Water Problems

Under natural, undeveloped conditions, storm water filters into the soil through openings created by plants and soil animals. In most areas, erosion was stabilized by plant roots, and the water that reached lakes and rivers was cool and clear. As urbanization progressed, the increase of impervious surfaces such as roofs and roadways combined with soil disturbance and compaction to interrupt natural infiltration by diverting runoff directly to surface waters. This resulted in increased flows, eroded soils, and runoff that carried nutrients and other pollutants to lakes and steams.

Over time, cities established storm drain systems to prevent erosion and flooding and convey runoff directly to surface waters. This allowed further development, until the urban landscape was fully developed. Today, these storm drain systems carry runoff through and around natural drainage systems. Warmed by asphalt and concrete, loaded with soil and grime from parking lots and streets, this runoff water fouls our lakes and rivers and damages habitat for aquatic plant and animal species.

To offset these impacts, many municipalities have installed regional storm water runoff treatment ponds (detention ponds) to remove trash, sediment and nutrients before the storm water empties into to lakes and streams. However, in established urban areas not enough open land is available for these structures, and improvements in runoff water quality have to focus on individual urban parcels.

Figure 1



The Self Assessment Process for Businesses

More than 140,000 commercial businesses in Wisconsin contribute polluted storm water runoff to our lakes and streams. Commercial parcels frequently have greater than 80% impervious surface, and in a typical urbanized area, commercial roofs, parking lots and sidewalks account for about 35% of all runoff. By improving their management of storm water runoff, businesses can help reduce the environmental impacts of untreated runoff and help create a positive public image of the business.

Conducting a storm water runoff self assessment for your parcel requires following a few simple steps:

1. Estimate the sources of contamination and the amount of runoff from your property.
2. Identify the sources of contamination and create a site map showing sources of runoff and the paths it takes across the parcel (this is easiest to observe during a rainstorm).
3. Understand the different types of runoff management practices.
4. Choose the best management practices for your property.

A self assessment "checklist" in the back of this publication serves as a guide to compiling the information you need about your parcel, including size and percent impervious surface.

1 Estimate Storm Water Runoff from Your Business

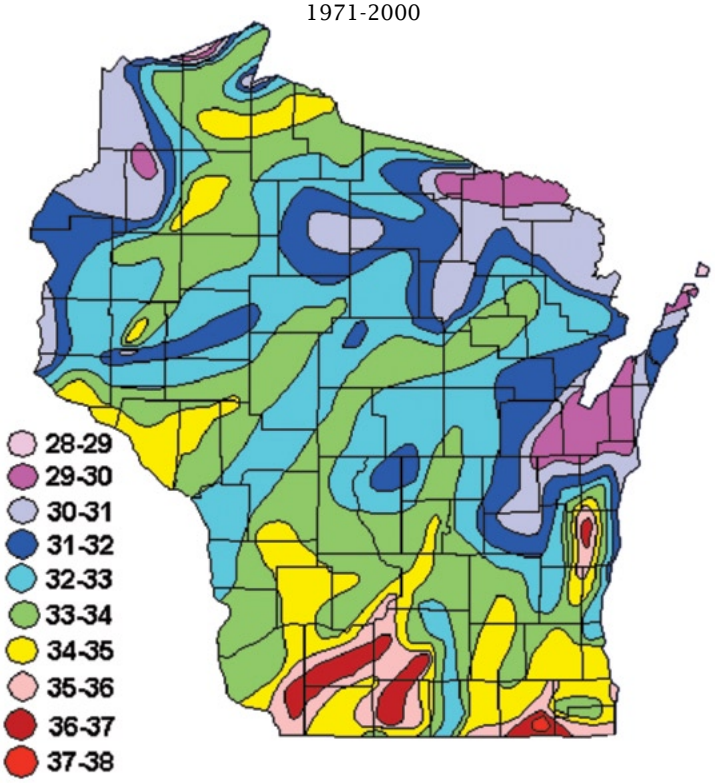
Storm water runoff can be described in two ways. The first is the total annual volume from a given parcel. Annual precipitation in Wisconsin varies from about 30" to 36" (fig.2). To visualize this, imagine a one acre parcel covered by three feet of water. Or put another way, the parcel will receive 3 acre-feet of precipitation per year (equal to about one million gallons).

A second way to think about runoff is by storm intensity. Every ten years on average, any location in Wisconsin will experience four inches of rainfall in a single day (this is known as the 10-year, 24-hour storm). For a one-acre parcel, this equals a total of 0.3 acre feet (100,000 gal) of precipitation sometime during that 24-hour period.

The asphalt parking lots, concrete sidewalks and metal roofs on your property prevent this rainfall from naturally infiltrating into the soil. Instead, the precipitation runs off site into storm drains. Calculating how much storm water runoff leaves your parcel is

Figure 2

Wisconsin
Normal Annual Precipitation (inches)
1971-2000



simply a matter of multiplying the percent impervious surface times either the annual precipitation or amount of an individual storm event.

Example:

For the one-acre example above:

Annual Runoff:

	1 millions gallons per one-acre parcel
X	80% impervious area
=	800,000 gallons runoff per year

Four Inch/24 hour Rainfall:

	100,000 gallons per one acre parcel
X	80% impervious area
=	80,000 gallons runoff per 10-year, 24-hour storm

For larger or smaller parcels (or storm events), multiply the number of acres times these answers accordingly, and modify the percent impervious surface if necessary.

JEFFREY J STROBEL PHOTO

Parking lot runoff during a cloudburst in West Bend, Wisconsin.

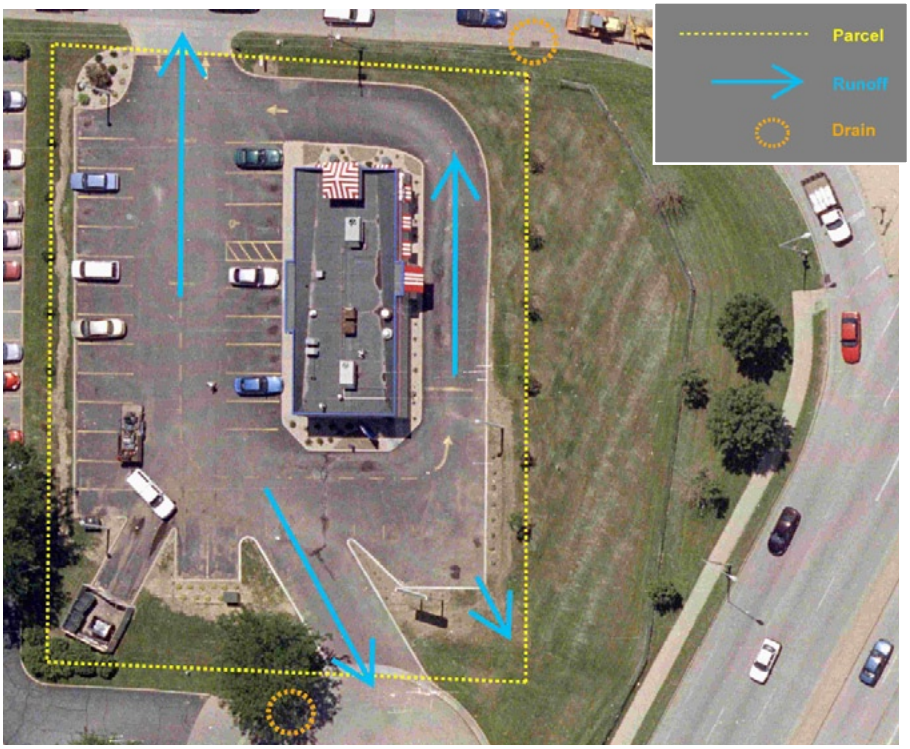
2 Identify Sources and Types of Contaminants

Knowing the sources of runoff and how it enters the storm drains is essential to evaluating your runoff management options. Runoff from urban commercial parcels is usually conveyed to surface waters via municipal storm drains. These storm drain systems are connected to commercial parcels through drains in parking lots, or along adjoining roadways. Water from roof drains and sidewalks usually runs across paved parking areas and driveways, and then along curbs or swales, to reach the storm drains.

Example

A site map showing these features, and verified through observation during a storm event, can help to identify opportunities to improve runoff management. Figure 3 illustrates this approach for a typical fast food outlet.

Figure 3



Site without runoff management.

This parcel is 30,000 square feet (0.7 acre) and about 80% impervious surface. Based on the one acre example above, it contributes about 560,000 gallons of runoff per year [0.7 X 800,000 gallons/acre]. In this case, roof drains convey rainwater to the parking lot. Parking lot runoff drains to the street through both driveways, and through a small curb-cut (lower right) onto the lawn. A dumpster storage area (lower left) also drains to the parking lot. Street drains near each driveway collect the runoff into the municipal storm sewer system, which drains to a nearby wetland.

The types of potential runoff contamination in this example include:

- Dust and debris
- Oils and grease from roof vents
- Fluids from motor vehicles
- Litter
- Dumpster drainage
- Chloride from de-icing

3 Understand the Different Types of Runoff Management Practices

Managing storm water on urban parcels typically includes one or more of the following management practices:


CHICAGO CENTER FOR GREEN TECHNOLOGY

Roof water cistern.

Temporarily detaining storm water helps to reduce peak flows by spreading the release rate over a time period longer than the storm event. Reducing peak flows helps to reduce downstream erosion, and allows runoff treatment devices to work more effectively. Cisterns and on-site detention ponds are typical ways to detain water. Under certain conditions, parking areas can also accumulate water temporarily, but they must be designed to prevent flooding of parked vehicles.

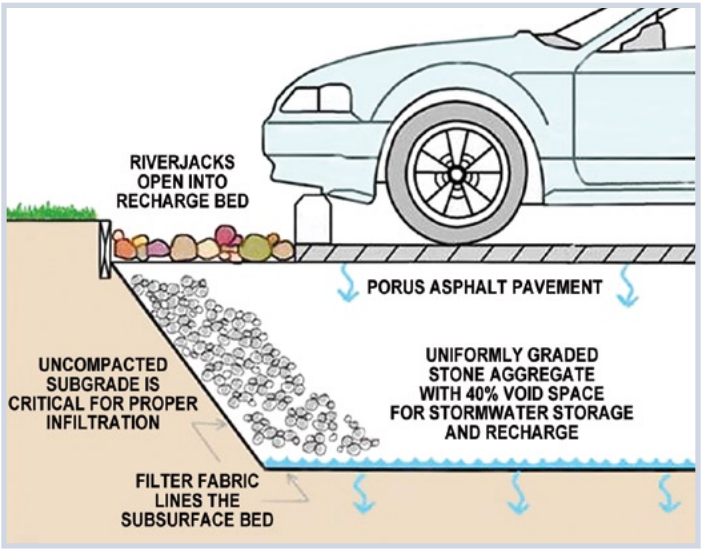
Green roofs are trays of drought-tolerant plants placed atop the existing roofing material. The plant trays absorb storm water, holding it in the soil until plants can transpire it. This prevents rainwater from entering the storm drains, and has the added benefit of further insulating the roof, reducing building heating and cooling costs. Green roofs are low maintenance, but an engineering evaluation of the roof support is recommended prior to installation.


Green roof – before.


Green roof – after.

Infiltration of runoff on pervious areas of the parcel may be feasible if soil characteristics are favorable and slopes are moderate. Runoff can often be directed to grassy areas or rain gardens from walkways, and rooftops.

Porous pavement surfaces (either pavers, asphalt, or concrete) used for walkways and parking areas also infiltrate runoff, but should not be used when grease, oils, salt or other chemicals could enter the groundwater. Paving contractors are gaining experience with porous pavement, and can provide accurate estimates for the feasibility and cost of installation on individual parcels.



Porous asphalt.

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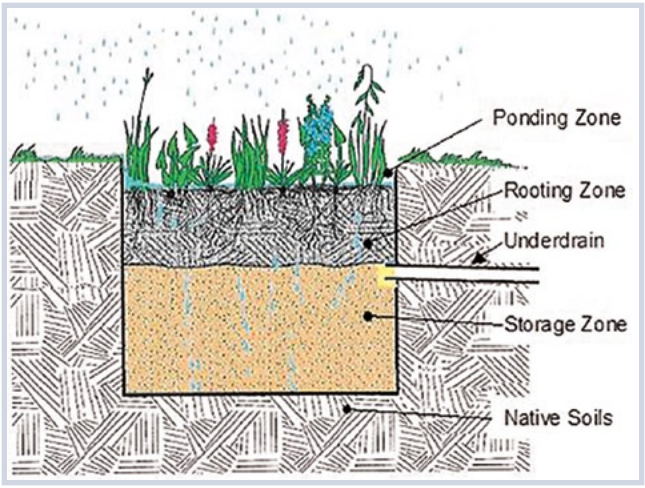
Information about the soils on a site can be very important in selecting appropriate management practices. Infiltration practices will work only if the soils allow water to filter in. Generally, silt loams, sandy loams and sand are suitable for infiltration, while clay soils and heavy muck soils are not.

Soil surveys maps and descriptions are available online from the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS).

(See the references section.)

Biofiltration structures treat runoff prior to infiltration. These engineered devices can accept runoff from high traffic areas and other runoff sources where simple infiltration using rain gardens or porous pavement is not advisable.



Biofiltration cross-section.


Biofiltration installation.

Good housekeeping practices are simple, inexpensive ways to limit the amount of pollutants entering the storm drains. These include:

- Frequent sweeping of impervious surfaces to collect dirt and litter;
- Limiting the use of deicing salt;
- Prohibiting vehicle and equipment maintenance and washing in areas that drain to the storm sewers;
- Abandoning the use of asphalt sealants that contribute pollutants to runoff;
- Covering loading docks, fueling areas and outdoor material storage to prevent spills from contaminating runoff.

These low-cost management techniques can have a substantial effect on reducing the amount of storm water pollution from commercial and industrial parcels.

4 Choose the Best Management Options for Your Business

Choosing the best storm water management practices for your business requires evaluating both physical conditions and business factors. Having calculated your total storm water runoff and determined how runoff flows across your parcel, you will need to take into consideration:

- The steepness at which your property slopes, and in what directions, to determine the location of any management options;
- The location and size of pervious and impervious surfaces, to estimate the amount of runoff that can be managed at a given location;

- Whether underlying soils are adequate (loams and sands) for infiltrating water;
- The suitability and strength of roofs for installing green rooftops.
- Any plans new construction, landscaping, or re-paving.

Example

Figure 4 illustrates how the typical fast food establishment described in Figure 3 might evaluate these factors and develop a plan for improving storm water runoff management.

A self-assessment of this parcel would reveal the following options:

Figure 4

Site with runoff management plan.

1. The NRCS web soil survey shows the site overlies Plano Silt Loam soil, which is adequate for infiltration. Creating three additional curb cuts along the service lane would allow runoff to spread over the adjoining lawn and infiltrate into the soil;
2. A rain garden to the right of the lower driveway could infiltrate more concentrated runoff from the parking area that now drains to the street;
3. An engineered biofiltration device next to the dumpsters could collect and treat runoff that might be contaminated by dumpster leakage;
4. A section of porous asphalt down the middle of the main parking area could collect and infiltrate runoff that now drains to the street via the upper driveway;
5. While the building cannot support a green rooftop, improved maintenance of roof vents would prevent oil and grease deposits on roof surface from contaminating roof water;

Rain garden.

6. Regular sweeping of the parking area, service lane and sidewalks to collect dirt and debris. Better management of dumpster use and storage would eliminate spills in that area.

The self-assessment suggests the following options for the business:

- Options 5 & 6 can be implemented immediately at no cost.
- Option 1 represents minor work that can be done by maintenance personnel.
- Options 2 & 3 will require hiring landscapers with expertise in storm water biofiltration.
- Option 4 will be deferred until the parking lot needs resurfacing.

If all options were implemented, this business would essentially eliminate off-site discharges of runoff from most storm events, and dramatically improve the water quality for the large storms that would continue to drain to the municipal system.

If this were new construction or an expansion, the architect and landscape designer could integrate these management techniques into the new plan at little or no additional cost. In fact, many communities require new commercial construction to treat and detain storm water runoff on-site.

Storm Water Regulations: Under direction from US Environmental Protection Agency and Wisconsin Department of Natural Resources, Wisconsin communities are rapidly adopting new storm water regulations that apply to new commercial development and construction. The DNR code of regulations governing municipal separate storm sewer systems is NR 216, while new commercial construction is also regulated under the Department of Commerce code Comm 82.36. Local municipalities may adopt regulations or codes in addition to these. It is advisable to coordinate with local building and zoning officials before undertaking major construction projects that include storm water management.

A final note:

Take Credit for Your Efforts!

Making storm water management improvements to your facility and operations should not go unnoticed. Communicating to customers, neighbors and the public can raise the profile of a business in the community, and deflect future criticism.

Consider developing a Business Storm Water Management Communication Plan to provide an accurate and consistent portrayal of the infrastructure and activities used by your business to minimize the impact of storm water runoff from the facility.

Elements of a Storm Water Communication Plan could include:

1. A statement by the company describing its commitment to minimizing impacts of storm water runoff;
2. A description of the facility, its activities and/or products and location;
3. A description of rainfall runoff from the property, including flows from design storm events (e.g. 1-year, 10-year);
4. A description of the connection to municipal system, or points of surface discharge;
5. A list of areas and activities with the potential for contaminating runoff;
6. A description the storm water management practices used to avoid contaminating runoff (what structures and/or treatment devices are in place, what management activities are used);
7. A summary how system performance is monitored (e.g. inspection log books, runoff monitoring results, employee training);
8. A company contact for storm water management information.

The communication plan, in combination with the storm water self assessment, provide a record of improvements, and can give management and employees pride in their work to protect the environment.

Business Storm Water Self-Assessment Checklist

Date _____ **Business Name** _____

Location _____

Person Conducting Self-Assessment _____

Parcel Area _____ **% Building Area** _____

% Parking & Sidewalk Area _____

% Pervious Area _____

Gallons Annual Runoff from Parcel _____

Site Diagram Showing Runoff _____

Underlying Soils _____

_____

Sources of contamination _____

_____

Management Options	Current	Possible	Not	Schedule/ Comments
Cistern or other temporary detention				
Green roof				
Simple Infiltration				
Porous pavement				
Biofiltration				
Equipment maintenance				
Sweeping				

JEFFREY J STROBEL PHOTO

Runoff control measures, such as this rain garden in Horicon, Wisconsin, can be a source of community pride.

Self Assessment Resources

NRCS Web Soil Survey – This interactive map allows you to zoom in on the parcel of land and determine the underlying soil type.
websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

EngNet Conversion Tool – the Volume option allows you to easily convert between acre-feet and gallons of runoff. *www.engnetglobal.com/tips/convert.asp*

UW-Extension RunoffInfo – Information on runoff management options, educational programs and rules and regulations. *runoffinfo.uwex.edu*

WI-DNR List of Municipal Storm Sewer Systems – This list show communities that are establishing or have established storm water management programs.
dnr.wi.gov/org/water/wm/nps/stormwater/permits/ms4

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