POLLUTION PREVENTION/GOOD HOUSEKEEPING FOR MUNICIPAL OPERATIONS: MANUAL OF BEST MANAGEMENT PRACTICES

Genesee County Drain Commissioner
Surface Water Management

November 2010

POLLUTION PREVENTION/GOOD HOUSEKEEPING
FOR MUNICIPAL OPERATIONS:
A GUIDANCE DOCUMENT OF BEST MANAGEMENT PRACTICES

Introduction

This Manual of Pollution Prevention/Good Housekeeping Best Management Practices is intended to minimize the effects that municipal operations have on stormwater (see Table 1 and 2). The information contained in the manual is intended as guidance material for implementing measures to comply with a Stormwater Phase II Municipal Separate Storm Sewer System (MS4) Permit and is not designed to be comprehensive in all aspects of each topic. Municipalities should be "flexible" in their use of this information as pertains to their own unique municipal operations.

Glossary of Terms

Biochemical oxygen demand – Depletion of dissolved oxygen in water caused by decomposition of biologic matter or chemical oxidation.

Catch Basin – A unit that is installed to capture and retain debris, particulate matter, or other solid materials, but allows stormwater to "flow through" to its discharge location

Drip Irrigation –irrigation via a perforated device (i.e. hose) that allows for a slow watering method with reduced evaporation and runoff losses

Hydraulic – Referring to water

(IPM) Integrated Pesticide Management – An environmentally sensitive approach to pest management (**not** elimination) that uses the least toxic control method – a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools.

Loading – Term used in conjunction with *sediment* and *hydraulic* to describe excessive amounts (of the term that is described)

Naturescaping – An alternative landscaping technique that incorporates native plants and creates beneficial wildlife habitat – also conserves water and energy, reduces soil/water pollution.

Oil/Water Separator – A unit that is installed "in line" to a wastewater discharge pipe which is devised to capture petroleum derived materials that float on water

Pesticides – Products that are toxic and are used to kill pests - can be classified as insecticides, rodenticides, biocides, aquacides.

POTW – Publicly Owned Treatment Works -- a municipal wastewater treatment plant

Scupper – an opening (in a bridge deck) to allow water drainage – it does not capture debris, particulate matter, or other solid materials

Sediments - Small particles of matter that settle to the bottom of a body of water

Silt – Material consisting of mineral soil particles ranging in diameter from 0.02 millimeters to 0.002 millimeters

Stormwater -rainwater runoff or snow melt waters – these waters can interact with different types of materials, transporting contaminants to surface waters (i.e. streams, creeks, rivers)

Toxicity –The relative degree of being poisonous

Xeriscaping – An alternative landscaping technique that conserves water and protects the environment through planting native vegetation.

Zero input, low input (lawns) - minimal need for care (i.e. addition of fertilizers/pesticides, water)

1.0 Pollution Prevention through BMPs

What are BMPs?

BMPs are the practices, procedures, policies, prohibitions, schedules of activities, structures or devices that are implemented to prevent or minimize pollutants coming in contact with precipitation, storm water runoff, or non-storm water flows. Table 1 illustrates the pollutants associated with Municipal *facilities* while Table 2 presents the pollutants associated with municipal *activities*. BMPs are also structures or devices that remove pollutants from storm water runoff before the runoff enters a storm water drainage system or surface water. Therefore, BMPs are often categorized as either "source control" BMPs or "treatment control" BMPs.

Source control BMPs include all types of measures designed to prevent pollution at the source, that is, to keep storm water from contacting pollutants in the first place. Source control BMPs are generally simple, low-maintenance, cost-effective and are broadly applicable. They may be categorized as either non-structural or structural. Good housekeeping is an example of a non-structural source control BMP; a canopy is an example of a structural source control BMP. Preventative maintenance may be required for both non-structural and treatment controls.

Treatment control BMPs are methods of treating storm water runoff to remove pollutants and are frequently more costly to design, install, and operate than source control BMPs. More importantly, treatment control BMPs are typically not as effective as source control BMPs, and the effectiveness is highly dependent on regular maintenance. Nevertheless, they can be appropriate and effective under certain conditions. However, treatment controls typically do not remove all pollutants from storm water runoff and should not be regarded as disposal systems.

The Manual is divided into two sections: 1) Good Housekeeping and 2) preventative maintenance of Treatment Controls.

1.2 Pollutants Associated with Municipal Facilities

Table 0-1: Potential pollutants likely associated with specific municipal facilities

Municipality Facility Activity	Potential Pollutants								
	Sediment	Nutrients	Trash	Metals	Bacteria	Oil & Grease	Organics	Pesticides	Oxygen Demanding
Building and Grounds Maintenance and Repair	X	X	X	X	X	X	X	X	X
Parking/Storage Area Maintenance	X	X	X	X	X	X	X		X
Waste Handling and Disposal	X	X	X	X	X	X	X	X	X
Vehicle and Equipment Fueling			X	X		X	X		
Vehicle and Equipment Maintenance and Repair				X		X	X		
Vehicle and Equipment Washing and Steam Cleaning	X	X	X	X		X	X		
Outdoor Loading and Unloading of Materials	X	X	X	X		X	X	X	X
Outdoor Container Storage of Liquids		X		X		X	X	X	X
Outdoor Storage of Raw Materials	X	X	X			X	X	X	X
Outdoor Process Equipment	X		X	X		X	X		
Overwater Activities			X	X	X	X	X	X	X
Landscape Maintenance	X	X	X		X			X	X

Table 0-2: Potential pollutants likely associated with municipal activities

Municipal Program	Activities	Potential Pollutants								
		Sediment	Nutrients	Trash	Metals	Bacteria	Oil & Grease	Organics	Pesticides	Oxygen Demanding
Roads, Streets, and Highways Operation and Maintenance	Sweeping and Cleaning	X		X	X		X			X
	Street Repair, Maintenance, and Striping/Painting	X		X	X		X	X		
	Bridge and Structure Maintenance	X		X	X		X	X		
Plaza, Sidewalk, and Parking Lot Maintenance and Cleaning	Surface Cleaning	X	X			X	X			X
	Graffiti Cleaning	X	X		X			X		
	Sidewalk Repair	X		X						
	Controlling Litter	X		X		X	X			X
Fountains, Pools, Lakes, & Lagoons Maintenance	Fountain and Pool Draining		X					X		
	Lake and Lagoon Maintenance	X	X	X		X			X	X
Landscape Maintenance	Mowing/Trimming/Planting	X	X	X		X			X	X
	Fertilizer & Pesticide Management	X	X						X	
	Managing Landscape Wastes			X					X	X
	Erosion Control	X	X							
Drainage System Operation and Maintenance	Inspection/and Cleaning of Stormwater Conveyance Structures	X	X	X		X		X		X
	Controlling Illicit Connections and Discharges	X	X	X	X	X	X	X	X	X
	Controlling Illegal Dumping	X	X	X	X	X	X	X	X	X
	Maintenance of Inlet and Outlet Structures	X		X	X		X			X
Waste Handling and Disposal	Solid Waste Collection		X	X	X	X	X	X		X
	Waste Reduction and Recycling			X	X					X
	Household Hazardous Waste Collection			X	X		X	X	X	
	Controlling Litter			X	X	X		X		X
	Controlling Illegal Dumping	X		X		X	X		X	X
Water and Sewer Utility Operation and Maintenance	Water Line Maintenance	X				X	X			
	Sanitary Sewer Maintenance	X				X	X			X
	Spill/Leak/Overflow Control, Response, and Containment	X	X			X		X		X

Source: California Stormwater BMP Handbook (http://www.cabmphandbooks.com/)

2.0 Good Housekeeping

Good housekeeping practices include activities that are intended to maintain a clean site and keep equipment in good working order to prevent storm water quality problems from occurring. Daily cleanup and inspections are the most effective means of achieving good housekeeping. For the most part, good housekeeping is a day-to-day activity that does not require a large expenditure of time or expense, and should be implemented on an ongoing basis. Examples of good housekeeping practices are:

- Tools and materials should be returned to designated storage areas after use;
- Waste materials should be collected and properly disposed after the completion of each job, shift, or day as appropriate;
- Indoor work areas should be neat, uncluttered, and well-ventilated to discourage outdoor work and to allow leaks and spills to be quickly detected and controlled;
- Outdoor work areas should be swept regularly (not hosed) and kept neat and clean;
- Occasionally outdoor work areas may need cleaning beyond sweeping. In such cases, all wash waters should be contained, collected, and properly disposed; and
- Outdoor waste or trash receptacles should be covered and emptied regularly and the adjacent areas inspected for misplaced or wind-blown litter.

Preventive Maintenance

Preventive Maintenance BMPs include regular inspections and maintenance intended to minimize storm water pollution by performing maintenance activities before problems arise. The NPDES Storm Water permit stipulates that municipalities must implement maintenance schedules for municipal sites and practices aimed at reducing the introduction of pollutants to waterways. Therefore, in addition to your good housekeeping practices it is necessary to periodically inspect the facilities and sites themselves. For example, an annual inspection of maintenance sheds for potential sources of pollutants is warranted as is inspection of municipal properties (e.g. city parks) to determine if BMPs are being kept up on site.

2.1 Landscaping and Lawn Care

1. Identify Impacts to/on Stormwater/Receiving Waters (Surface Waters)

- Nutrient loading (nitrogen and phosphorous) from fertilizer runoff can cause excessive aquatic plant growth

2. Problem Evaluation: Assess Impact on Receiving Waters, Prioritize

- Biochemical Oxygen Demand

3. Identify (and choose appropriate) Solutions (BMP's)

- Purchase only enough lawn care products necessary for one year – store properly to avoid waste generation (spills, leaks)
- Use slow release or naturally derived (organic) fertilizers
- Train employees in the proper application of lawn care products
- Develop zero input/low input lawns
- Consider alternative landscape techniques (i.e. naturescaping, xeriscaping)
- Plant trees away from sewer lines or other underground utilities
- Use drip irrigation techniques for landscaping

4. Inspection Procedures

- Routinely monitor lawns to identify problems during their early stages
- Identify nutrient/water needs of plants, inspect for problems by testing soils

5. Maintenance Procedures

- Minimize/eliminate fertilizer application. Either conduct soil tests to justify the use of Phosphorous fertilizer of use no-Phosphorous fertilizer.
- Leave grass clippings on lawn, or mulch clippings into lawn
- Limit watering as necessary to supplement rainwater (1 inch/week is adequate)
- Mow with sharpened blades set high (3 inches) – remove only the top 1/3 of the leaves
- Water plants in the early A.M.

6. Advisory

- Refer to Landscaping for Water Quality, and other resources at DEQ's NPS webpage: www.michigan.gov/deqnonpointsourcepollution, choose Information and Education.
- If contracting lawn care services, request the "Healthy Lawn Care Program for Watershed Protection", currently endorsed by the Michigan Green Industry Association (www.landscape.org).

2.2 Spill Response and Prevention

For spills, the old saying, "an ounce of prevention is worth a pound of cure" is appropriate. Spill clean-up can be labor-intensive and costly involving expenses to contain the spill, collecting the spilled substance, proper disposal of spill materials, and report filing to regulatory agencies, not to mention possible monetary fines. Spills and leaks are some of the most significant sources of water pollution and are, in most cases, avoidable.

Spill prevention and control procedures include:

- Placing bollards, berms and containment features around structures or areas where fluids are stored, so releases can be prevented, easily detected, and controlled;
- Using drip pans for maintenance operations involving fluids and under leaking vehicles and equipment waiting repair;
- Placing spill kits in areas where fluids are stored or in areas where activities may result in a spill;
- Providing training for proper use of materials and equipment used during operations and maintenance activities;
- Providing training for proper use of spill response equipment and supplies; and
- Conducting outdoor maintenance activities on paved surfaces to allow for easy detection, control, and cleanup of spills.

Spill prevention, control, and cleanup applies to all materials and wastes—not only hazardous substances. The toxic water quality effects from spills of hazardous substances (e.g., acids, oils, greases, fuels, solvents, pesticides) are commonly understood. However, non-hazardous materials—for example, sand, litter, corn oil, sweeteners, soaps, and milk, among others—can also greatly impact water quality.

Identify Materials That Impact Stormwater/Receiving Waters (Surface Waters)

- Liquids associated with vehicle/equipment maintenance products (oils, fuels, antifreeze, etc.)
- Rock salt
- Chemicals (fertilizers, pesticides)

2. Problem Evaluation: Assess Impact on Receiving Waters, Prioritize

- Toxicity
- Biochemical oxygen demand

3. Identify (and choose appropriate) Solutions (BMP's)

- Keep all materials properly stored in closed, labeled containment systems
- Use secondary containment systems where appropriate
- Obtain spill recovery materials for immediate response to a spill

4. Inspection Procedures

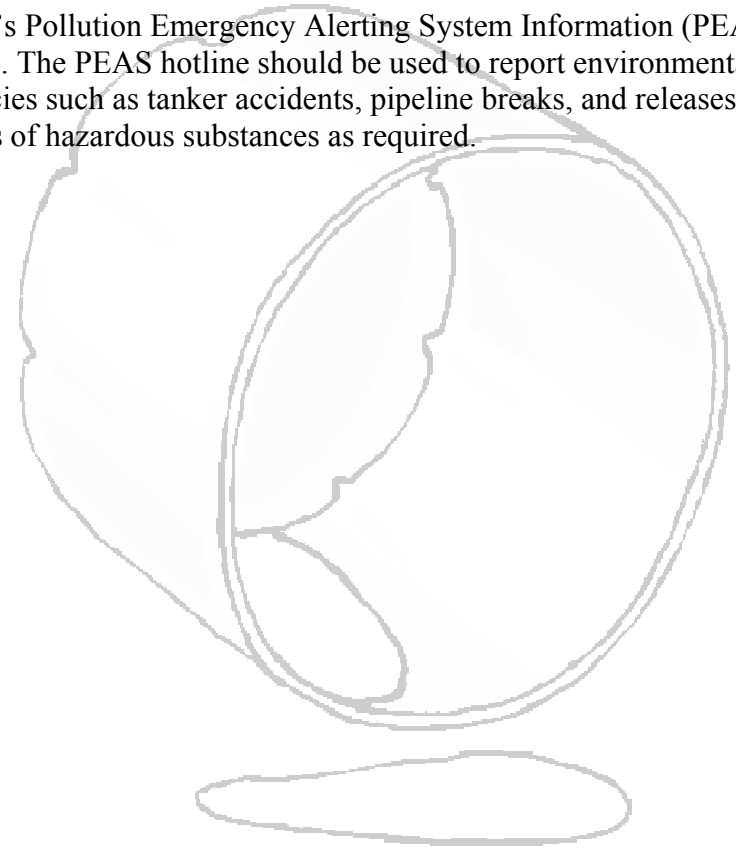
- Inspect secondary containment systems, oil/water separators periodically
- Inspect containers for leaks, areas near storm receiver inlets and outlets, floor drains for indications of spills

5. Maintenance Procedures

- Pump out oil water separators as needed
- Protect drains with oil absorbent materials
- Clean out receivers on regular schedule
- Remove spilled salt from salt loading area

6. Advisory

- Report petroleum spills to 911
- If the problems are related to sanitary please contact the Genesee County Health Department at (810) 257-3612.
- MDNRE's Pollution Emergency Alerting System Information (PEAS) hotline 1-800-292-4706. The PEAS hotline should be used to report environmental pollution emergencies such as tanker accidents, pipeline breaks, and releases of reportable quantities of hazardous substances as required.



2.3 Pest Control

1. Identify Impacts to/on Stormwater/Receiving Waters (Surface Waters)

- Runoff of pesticides may harm aquatic life, may contaminate water/sediment

2. Problem Evaluation: Assess Impact on Receiving Waters, Prioritize

- Toxicity to aquatic plants and animals

3. Identify (and choose appropriate) Solutions (BMP's)

- Purchase only enough pesticides necessary for one year – store properly to avoid waste generation (spills, leaks, product deterioration)
- Minimize/eliminate pesticide application, use lowest toxicity pesticides
- Do not apply pesticides immediately prior to or during rain events
- Ensure that employees are properly trained and certified in pesticide application techniques and safety
- Develop zero input, low input lawns
- Eliminate food, water, and shelter for pests
- Adopt integrated pest management (IPM) techniques
- Adopt alternatives to pesticides options (use physical, mechanical, or biological controls)

4. Inspection Procedures

- Identify pests – are levels acceptable or must action be taken to control pests?
- Inspect pesticide inventory – properly dispose of out-of-date pesticide materials

5. Maintenance Procedures

- Inspect pest traps (i.e. bait boxes) regularly – remove (and properly dispose of) dead pests
- Block/eliminate access to buildings/structures for pests
- Remove pests (insects) by hand

6. Advisory

- Refer to MSU's Integrated Pest Management site: IPM: www.ipm.msu.edu

2.4 Pet Waste Collection

1. Identify Impacts To/On Stormwater/Receiving Waters (Surface Waters)

- Municipal animal shelters

2. Problem Evaluation: Assess Impact on Receiving Waters, Prioritize

- Biochemical oxygen demand
- Solids loading

3. Identify (and choose appropriate) Solutions (BMP's)

- House all animals in an enclosed, roofed structure
- ID/utilize "permitted" waste disposal facilities for animal wastes

4. Inspection Procedures

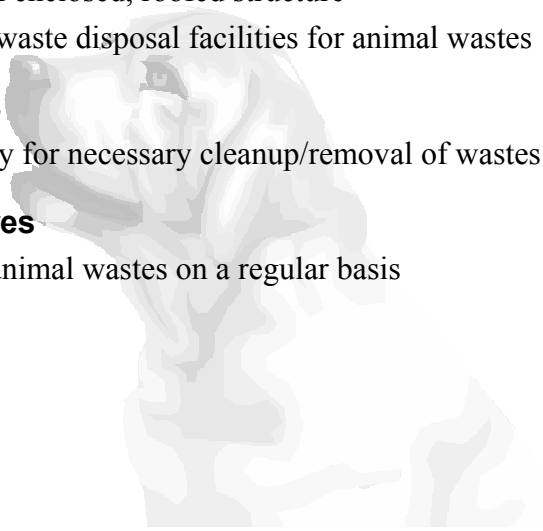
- Inspect shelter regularly for necessary cleanup/removal of wastes

5. Maintenance Procedures

- Remove spilled food, animal wastes on a regular basis

6. Advisory

- None



2.5 Septic System Management

1. Identify Impacts to/on Stormwater/Receiving Waters (Surface Waters)

- Ponding of improperly treated wastewaters (on the surface of a leach field or a sand filter system) can increase the biochemical oxygen demand of receiving waters.
- Excessive amounts of disinfectant (i.e. chlorine) applied to a wastewater discharge from a sand filter system can cause toxicity to aquatic plants and animals

2. Problem Evaluation: Assess Impact on Receiving Waters, Prioritize

- Biochemical oxygen demand

3. Identify (and choose appropriate) Solutions (BMP's)

- Divert stormwater runoff (i.e. from roof drains) away from septic system
- Divert groundwater (sump pump) discharges away from septic system
- Locate swimming pools away from the septic system (at least 20' from the septic tank, at least 35' from the closest edge of the leach field or sand filter system)
- Prevent problems caused by vegetation - growth of woody plants on the system
- Prevent hydraulic loading - "Spread out" the use of devices which use large volumes of water across the entire day – clothes washing, dish washing, bathing, repair leaky fixtures
- Minimize water usage by using flow restrictors on potable water distribution devices (i.e. shower heads, water faucets)

4. Inspection Procedures

- Physical evidence of problems:
  - "back up" of wastewater in sewer lines
  - sewage odors
  - leach field/sand filter - wetness/ponding on surface
  - overflow of wastes from system components
  - heavy vegetation (woody plants) growth on system components

5. Maintenance Procedures

- "Pump out" the septic tank as needed (recommended once/year)
- Mow surface vegetation regularly
- Prevent "heavy equipment" from driving on top of the system components

6. Advisory

- Obtain site plan/site sketch of system, and retain for reference.

2.6 Vehicle/Equipment Maintenance

1. Identify Impacts to/on Stormwater/Receiving Waters (Surface Waters)

- Trace amounts of metals/hydrocarbons are found in materials (e.g. fuels, antifreeze, batteries, motor oils, grease, parts cleaning solvents) that are typically used in maintenance operations

2. Problem Evaluation: Assess Impact On Receiving Waters, Prioritize

- Toxicity
- Biochemical oxygen demand

3. Identify (and choose appropriate) Solutions (BMP's)

- Conduct maintenance work indoors – if work must be performed outside, guard against spillage of materials that could discharge to storm receivers
- Seal floor drains that discharge directly to the environment, if possible
- Initiate single purpose use of vehicle bays – dedicate one (or more) bays that have no (or sealed) floor drains for repairs/maintenance
- Clean up spilled materials immediately, using "dry" methods
- Install pretreatment systems (oil/water separators) where necessary in sewer lines to capture contaminants (oil, grit), and maintain as needed
- Never leave vehicles unattended while refueling
- Identify appropriate recycling/disposal options for wastes

4. Inspection Procedures

- Inspect (for maintenance purposes) floor drain systems, oil/water separators
- Monitor "parked" vehicles/equipment for leaks

5. Maintenance Procedures

- Maintain a clean work area – remove contaminants from floors, drains, catch basins, using "dry" methods
- Use non-hazardous cleaners. Use non chlorinated solvents instead of chlorinated solvents
- Repair or replace any leaking containers
- Use steam cleaning /pressure washing instead of solvent for parts cleaning
- Store waste fluids in properly capped, labeled storage containers
- Store batteries in leak-proof, compatible (i.e. non reactive) containers
- Rinse grass from lawn care equipment on permeable (grassed) areas
- Protect against pollution if outside maintenance is necessary (cover storm receivers, use secondary containment vessels, etc.)

6. Advisory

- Report petroleum spills to 911

- MDNRE's Pollution Emergency Alerting System Information (PEAS) hotline 1-800-292-4706. The PEAS hotline should be used to report environmental pollution emergencies such as tanker accidents, pipeline breaks, and releases of reportable quantities of hazardous substances as required.
- See MDNRE for http://www.michigan.gov/deq/0,1607,7-135-3313_3682_3716-24366--,00.html (Pollution Prevention and Good Housekeeping Activities) and http://www.michigan.gov/documents/deq/wb-sw-FleetMaintenance_Guidance_304720_7.pdf additional information.

2.7 Vehicle/Equipment Washing

1. Identify Impacts to/on Stormwater/Receiving Waters (Surface Waters)

- Nutrients (biodegradable soaps)
- Metals
- Hydrocarbons

2. Problem Evaluation: Assess Impact On Receiving Waters, Prioritize

- Biochemical oxygen demand from nutrient sources
- Toxicity
- Hydraulic loading

3. Identify (and choose appropriate) Solutions (BMP's)

- Initiate single purpose use of vehicle bays - dedicate only one bay for washing (with floor drain system)
- Rinse with hoses that are equipped with automatic shutoff devices and spray nozzles
- Steam clean (without soap) where wastes can be captured for proper disposal (i.e. oil/water separator)

4. Inspection Procedures

- Inspect floor drain systems regularly - use only those that discharge to a sanitary sewer, identify the need for cleaning of catch basins, oil/water separators

5. Maintenance Procedures

- Map storm drain locations accurately to avoid illegal discharges
- Perform steam cleaning or pressure washing where wastes can be captured for proper disposal
- Take precautions against excess use of/spillage of detergents

6. Advisory

- Require all facilities to connect floor drain systems to sanitary sewers (if available)
- See MDNRE for http://www.michigan.gov/deq/0,1607,7-135-3313_3682_3716-24366--,00.html and http://www.michigan.gov/documents/deq/wb-sw-FleetMaintenance_Guidance_304720_7.pdf additional information.

2.8 Roadway and Bridge Maintenance

1. Identify Impacts to/on Stormwater/Receiving Waters (Surface Waters)

- Road salt components - sodium, calcium, and chlorides
- Hydrocarbons
- Particulates – such as dry paint or abrasive compounds
- Debris

2. Problem Evaluation: Assess Impact On Receiving Waters, Prioritize

- Particulate matter
- Toxicity

3. Identify (and choose appropriate) Solutions (BMP's)

- Incorporate preventive maintenance and planning for regular operations & maintenance activities
- Pave in dry weather only.
- Stage road operations and maintenance activity (patching, potholes) to reduce spillage. Cover catch basins and manholes during this activity.
- Clean up fluid leaks or spills from paving equipment/materials immediately
- Restrict the use of herbicides/pesticide application to roadside vegetation
- Sweep and vacuum paved roads and shoulders to remove debris and particulate matter
- Maintain roadside vegetation; select vegetation with a high tolerance to road salt
- Control particulate wastes from bridge sandblasting operations
- Use calcium magnesium acetate for deicing around bridges to minimize corrosion
- Clean out bridge scuppers and catch basins regularly
- Direct water from bridge scuppers to vegetated areas
- Mechanically remove (i.e. sweep) debris from bridge deck and structure prior to washing

4. Inspection Procedures

- Inspect paving, sweeping, vacuuming, and all other maintenance vehicles/equipment as appropriate
- Inspect roads and bridges for implementation of applicable BMP's

5. Maintenance Procedures

- Clean bridge scuppers routinely and keep free of debris
- Direct runoff water from bridges to vegetated areas
- Install catch basins in place of bridge scuppers
- Use tarps, booms, and vacuums during painting or blasting activities (refer to reference information to control/capture particulate matter)
- Repair leaking/defective containers or equipment on paving equipment

6. Advisory

- See MDNRE for http://www.michigan.gov/deq/0,1607,7-135-3313_3682_3716-24366--,00.html (Pollution Prevention and Good Housekeeping Activities) and http://www.michigan.gov/documents/deq/wb-sw-FleetMaintenance_Guidance_304720_7.pdf additional information.

2.9 Hazardous and Waste Materials Management

1. Identify Impacts to/on Stormwater/Receiving Waters (Surface Waters)

- Lube oils
- Coatings and their compatible solvents (paints, thinners, etc.)
- Anti freeze
- Cleaning agents
- Fuels (gas, diesel, kerosene)

2. Problem Evaluation: Assess Impact on Receiving Waters, Prioritize

- Biochemical oxygen demand
- Toxicity to aquatic plants and wildlife
- Particulate loading

3. Identify (and choose appropriate) Solutions (BMP's)

- Ensure that all materials are stored in closed, labeled containers – if stored outside, drums should be placed on pallets, away from storm receivers – inside storage areas should be located away from floor drains
- Eliminate floor drain systems that discharge to storm drains, if possible
- Use a pretreatment system to remove contaminants prior to discharge
- Reduce stock of materials "on hand" – use "first in/first out" management technique
- Use the least toxic material (i.e. non hazardous) to perform the work
- Install/use secondary containment devices where appropriate
- Eliminate wastes by reincorporating coating/solvent mixtures into the original coating material for reuse
- Recycle materials if possible, or ensure proper disposal of wastes

4. Inspection Procedures

- Physical on-site verification of sealed floor drains (or redirected to sanitary sewer)
- Regular inspection of material storage areas (inside and outside)
- Regular inspection and cleaning of oil/water separators by qualified contractor
- Inspect stormwater discharge locations regularly (for contaminants, soil staining, plugged discharge lines)

5. Maintenance Procedures

- Repair or replace any leaking/defective containers, and replace labels as necessary
- Maintain caps and/or covers on containers
- Maintain aisle space for inspection of products/wastes

6. Advisory

- None

2.10 Operational By-products/Wastes

1. Identify Impacts to/on Stormwater/Receiving Waters (Surface Waters)

- Potential for leaching of toxic and biologic contaminants to receiving waters

2. Problem Evaluation: Assess Impact on Receiving Waters, Prioritize

- Toxicity
- Biochemical oxygen demand

3. Identify (and choose appropriate) Solutions (BMP's)

- Post "no dumping" signs
- Illuminate area if possible
- Prevent access – erect barriers
- Identify the by products/wastes that should be recycled (i.e. paper, cardboard) or can be legally disposed of on municipal lands (i.e. deer carcasses).

4. Inspection Procedures

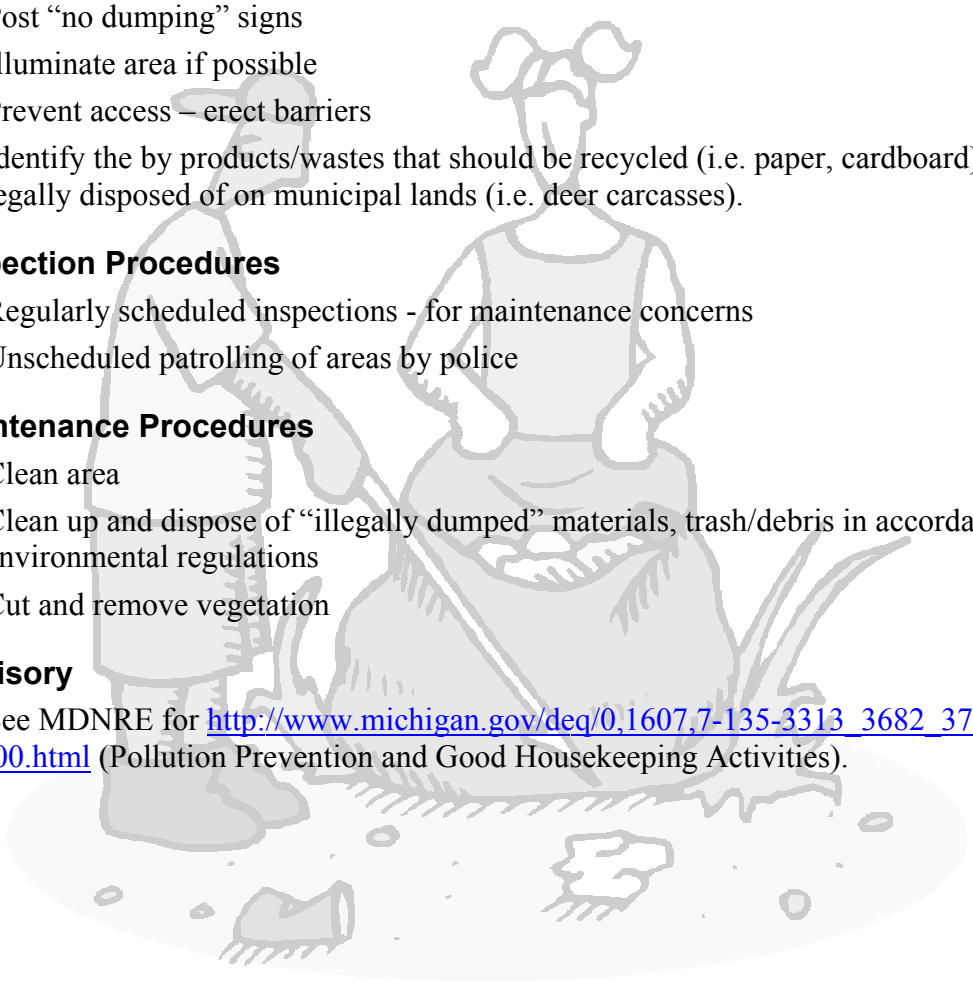
- Regularly scheduled inspections - for maintenance concerns
- Unscheduled patrolling of areas by police

5. Maintenance Procedures

- Clean area
- Clean up and dispose of "illegally dumped" materials, trash/debris in accordance with environmental regulations
- Cut and remove vegetation

6. Advisory

- See MDNRE for http://www.michigan.gov/deq/0,1607,7-135-3313_3682_3716-24366--,00.html (Pollution Prevention and Good Housekeeping Activities).



2.11 Catch Basin and Storm Drain System Cleaning

1. Identify Impacts to/on Stormwater/Receiving Waters (Surface Waters)

- **Catch basins** capture grit and debris, which, if not removed in a timely fashion, can discharge toxic and biological pollutants during rain and/or snow melt events
- **Storm drainage** systems, while not designed for capture of solid materials, can perform in the same manner with similar results.
- **Storm ditches**, if stripped of vegetation during cleaning, can result in silt deposition in receiving waters

2. Problem Evaluation: Assess Impact on Receiving Waters, Prioritize

- Toxicity – heavy metals, organic compounds, etc.
- Biochemical oxygen demand
- Sediment loading

3. Identify (and choose appropriate) Solutions (BMP's)

- Address:
  - storm drain receivers and (below grade) storm sewer systems
  - parking lot receivers
  - open ditches
  - catch basins and floor drain systems inside of buildings should be either:
    - sealed to prevent discharge
    - "permitted" by if required
    - discharged to sanitary sewers
- Contaminated wastewaters should not be discharged to a catch basin/street receiver
- Increase frequency of cleaning, as necessary
- Repair/replace storm drain receiver and catch basin receiver grates as necessary

4. Inspection Procedures

- Physical inspection – prioritize storm drain systems and catch basins – catch basins on steep grades may need more frequent cleaning
- Clean catch basin when depth of deposits are >1/3 the depth from the bottom of the basin to the invert of the lowest pipe/opening into or out of basin – Institute temporary street parking bans to facilitate access to catch basins
- Ditch inspections – ID problems while traveling to job site
- Storm event inspection – identify pollution problems (i.e. sediments) to determine the need for additional protective measures
- Post storm event inspection – ID problems (i.e. blockages)

5. Maintenance Procedures

- Catch basins/storm sewer pipe – cleaning in spring to remove sand/grit/salt from winter road maintenance, cleaning in fall to remove leaves/silt/debris

- Established ditch:
  - Maintain proper slope
  - Maintain vegetation by cutting (to capture sediment) – Do not allow vegetation to grow to a height that would impair sight lines of drivers of motor vehicles
  - Remove obstacles/ debris – (i.e. trash, tree branches, brush, cut vegetation)
  - Excavation/ditch scraping – if necessary, use devices (i.e. hay bales, silt fence) to capture sediment prior to stormwater discharge into receiving waters, reseed ditch
- New installation – capture particulate matter – install sediment basins/other devices in ditch
- Proper disposal of debris

6. Advisory

- For more information please see: http://www.michigan.gov/documents/deq/wb-stormwater-catchBasinGuidance_216198_7.pdf

2.12 Street Cleaning and Maintenance

1. Identify Impacts to/on Stormwater/Receiving Water (Surface Waters)

- Poorly maintained streets allow for a "build up" of trash, grit, and debris, from which sediment and toxic/biological pollutants can be "washed out" during rain and/or snow melt events.
- Street repair/paving processes use materials that can contaminate receiving waters if they interact with stormwater.

2. Problem Evaluation: Assess Impact on Receiving Waters, Prioritize

- Particulate matter – can cause sediment loading
- Biochemical oxygen demand
- Toxicity to aquatic plants and wildlife

3. Identify (and choose appropriate) Solutions (BMP's)

- Street sweeping/vacuuming - at regular intervals, and "as needed"
- Perform operations such as paving in dry weather only.
- Prior to road reconstruction, consider the use of "shouldered roads" instead of "curbed roads"
- Maintain roadside vegetation; select plants/trees that can withstand the action of road salt and direct runoff to these areas.

4. Inspection Procedures

- Inspect streets, and plan (as needed) for maintenance/repairs
- Prioritize – some streets (i.e. those on flat grades/with many trees) may need more frequent cleaning

5. Maintenance Procedures

- Spring sweeping/vacuuming – remove salt/sand residues
- Fall sweeping, collection of leaves at appropriate time intervals
- Dry sweep or vacuum streets during dry weather
- Initiate temporary street by street parking bans to allow access for cleaning
- Maintain equipment - check for/repair fluid leaks
- Stage road operations and maintenance activity (patching, potholes) to reduce spillage of materials. Cover catch basins and manholes during activity

6. Advisory

- Also see: http://www.michigan.gov/deq/0,1607,7-135-3313_3682_3716-24366--,00.html (Total Suspended Solids Reductions for Roadways, Parking Lots, and Bridges (Draft)).

2.13 Road Salt Storage and Application

1. Identify Impacts to/on Stormwater/Receiving Waters (Surface Waters)

- In high concentrations it can have a harmful effect on plants and aquatic life.

2. Problem Evaluation: Assess Impact on Receiving Waters, Prioritize

- Toxicity

3. Identify (and choose appropriate) Solutions (BMP's)

- Require covered facility for salt storage (prevents lumping and run-off loss), and size properly for seasonal needs
- Store salt on highest ground elevation to mitigate contact with stormwater
- Calibrate salt spreaders as necessary
- Consider alternative deicing materials (i.e. calcium chloride, magnesium chloride)
- Use a wetting agent with salt to minimize "bouncing" during application
- Cover salt loading area, or build into storage shed
- Unload salt deliveries directly into storage facility, or move inside immediately

4. Inspection Procedures

- Look for physical evidence of problems:
  - inspect salt storage shed for leaks, other problems
  - inspect salt piles for proper coverage, tarps for leaks or tears
  - inspect salt application equipment
  - inspect salt regularly for lumping or water contamination
  - inspect surface areas for evidence of runoff – salt stains on ground near and
  - around salt shelters, loading areas, or downslopes - inspect for excessive amounts of salt

5. Maintenance Procedures

- Service trucks and calibrate spreaders regularly to ensure accurate, efficient distribution
- Educate and train operators on hazards of over-salting to roads and environment
- Repair salt storage shed (leaks)
- Repair/replace tarps

6. Advisory

- See MDNRE for http://www.michigan.gov/deq/0,1607,7-135-3313_3682_3716-24366--,00.html (Pollution Prevention and Good Housekeeping Activities).

2.14 Road Kill/Composting Operations

1. Identify Impacts to/on Stormwater/Receiving Waters (Surface Waters)

- Potential for leaching of biologic contaminants to receiving waters

2. Problem Evaluation: Assess Impact on Receiving Waters, Prioritize

- Biochemical oxygen demand
- Bateria

3. Identify (and choose appropriate) Solutions (BMP's)

- Establish compost pile/windrow on a well drained, impervious surface that has minimal slope – segregate from other operations
- Identify the proper types of materials that should be composted
- Locate compost piles at least 200 ft. from receiving waters or wetlands
- Prevent access by vermin/scavengers – erect barriers (i.e. snow fence) around pile

4. Inspection Procedures

- Check for odors, temperature of compost, exposed carcasses
- Keep records (use a daily log)

5. Maintenance Procedures

- Monitor temperatures
- Take samples, analyze for pathogens
- Establish windrows
- Prevent erosion
- Recycle completely composted material

6. Advisory

- None

2.15 Construction and Land Disturbance

1. Identify Impacts to/on Stormwater/Receiving Waters (Surface Waters)

- Sediment runoff (i.e. silt, debris) can affect fish reproduction and habitat
- Removal of shade trees from stream banks can increase water temperature which can result in reduced dissolved oxygen content in streams

2. Problem Evaluation: Assess Impact on Receiving Waters, Prioritize

- Particulate matter – can cause sediment loading
- Biochemical oxygen demand – increases with temperature, depletes oxygen

3. Identify (and choose appropriate) Solutions (BMP's)

- Plan the construction and/or land clearing activities so that soil is not exposed for long periods of time
- Minimize compaction of soils and impervious cover
- Maximize opportunities for infiltration
- Install sediment control devices before disturbing soil
- Limit grading to small areas
- Stabilize site to protect against sediment runoff
- Protect against sediment flowing into storm drains
- Maintain native vegetation (especially near waterways)
- Install sediment barriers on slopes or divert stormwater

4. Inspection Procedures

- Regularly scheduled inspections (of erosion safeguards)
- Inspect during storm or snow melt events

5. Maintenance Procedures

- Check/repair all devices that have been installed to ensure protection against erosion

6. Advisory

- See MDNRE for http://www.michigan.gov/deq/0,1607,7-135-3313_3682_3716-24366--,00.html (Construction Storm Water Runoff Control (Draft).

2.16 Marina Operations

1. Identify Impacts to/on Stormwater/Receiving Waters (Surface Waters)

- Liquids associated with boat maintenance products (oils, fuels, antifreeze, wood preservatives, etc.) and particulate matter (i.e. boat bottom paint from hull sanding) can contain toxics
- Boat sewage can contain pathogenic bacteria that contribute increased biochemical oxygen demand to waterways
- Barren soils can contribute to sedimentation

2. Problem Evaluation: Assess Impact on Receiving Waters, Prioritize

- Biochemical oxygen demand
- Toxicity
- Sediment loading

3. Identify (and choose appropriate) Solutions (BMP's)

- Construct and maintain pump out stations (for sanitary wastes)
- Build and maintain fish cleaning stations
- Stabilize shoreline
- Designate locations for boat maintenance away from the water
- Minimize impervious areas – install vegetated buffer strips (i.e. grass, shrubs)
- Provide spill clean up kits at fueling stations, covered trash receptacles
- Educate (posters, signage) boaters and other marina users of potential problems

4. Inspection Procedures

- Identify areas of runoff that lack vegetation
- Regularly inspect fueling stations (including tanks and piping), maintenance areas for spills, other potential sources of pollution
- Regularly check (empty as necessary) fish cleaning stations, sewage pump out stations, trash cans

5. Maintenance Procedures

- Empty trash cans and pump out stations as needed
- Maintain vegetated areas between the water and work areas
- Replace spill clean up kits as necessary

6. Advisory

- Refer to: Shipshape Shores and Waters: A Handbook for Marina Operators and Recreational Boaters -http://www.epa.gov/owow/nps/marinashdbk2003.pdf

2.17 Calculating TSS Reductions

The simplest way to meet the 25% TSS reduction goal is to implement controls that are expected to provide that reduction. Most structural practices listed in the Center for Watershed Protection's National Pollutant Removal Performance Database perform better than 25% removal. The watershed general permit stipulates that permittees must reduce TSS from municipal sites to the maximum extent practicable.

Some permittees may not be able to implement BMPs at all sites, or use additional BMPs at some facilities. In this case, to show the reduction over the entire system, a simple calculation can be done. Calculations need to be understood in order to make the best decisions regarding BMPs to add, change, or upgrade so the TSS load reduction goal may be met. In addition, these calculations need to be reported to the Department.

It should be noted that removal efficiencies assume the controls are being utilized according to design criteria, or product specifications, and are adequately maintained.

To calculate TSS load(s):

1. Determine the uncontrolled load -- with the following formula – for each facility. Annual precipitation can be found in the LID manual, Chp 3, pg 16) and Mean TSS values in the Table below.

Gallons X MG X 3.785 L X 1 Pound

Example: First figure out the annual precipitation (runoff) in gallons from the facility's paved areas. If the Impervious area is 1,000,000 ft^2 and precipitation is 2.5 ft per year (calculate: area X precipitation X 7.48 gallons per ft 3) -- then total rainfall is 18,700,000 gallons/year.

Plug the rest of the numbers into the formula above. Using 77 mg/l TSS from the table below, the result (in bold) is the uncontrolled load for this site.

18,700,000 g/y **X** 77mg/l **X** 3.785l/g **X** 1lb/453600mg = **12,015 lbs/year**

Mean TSS runoff values for several land uses.

Land Use Category	% Imperviousness	Mean TSS (mg/l)
Forest/Rural Open	2	51
Urban Open	11	51
Agricultural /Pasture	2	145
Low Density Residential	19	70
Medium Density Residential	38	70
High Density Residential	51	97
Commercial	56	77
Industrial	76	149
Highways	53	141
Water/Wetlands	51	6

Taken from "Rouge River Wet Weather Demonstration Project, Selection of Stormwater Pollutant Loading Factors", RPO-MOD-TM34.00, October 1994, Table 3-13. (Another way to convert mg/l to lbs/ft^3 is to multiply the mg/l by 6.243 X 10).

2. Add up the uncontrolled load for each site that discharges to the same waterbody. This is the TSS loading for that system.

3. Select BMPs for each site (that are already in place or that you are considering) and calculate the TSS load, after implementation, for each site based on the chosen BMPs. The following references are approved for use in calculating reduction efficiencies for TSS load reduction controls:

    - The National Pollutant Removal Performance Database, at:
      www.cwp.org/Resource_Library/Center_Docs/SW/NPRPD_ver3.mdb
      The technical memo is at:
      www.cwp.org/Resource_Library/Center_Docs/SW/bmpwriteup_092007_v3.pdf

    - The Environmental Protection Agency's database of BMPs at:
      http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm

    - The Environmental Protection Agency's Urban BMP effectiveness tool at:
      http://cfpub.epa.gov/npdes/stormwater/urbanbmp/bmpeffectiveness.cfm

4. Add up the new loads for each site that discharge to the same water body. This is the TSS load for that system after BMPs are implemented.
5. Divide the sum of the TSS loading from the system, after BMPs are applied, by the sum of the loading from the same system, before BMPs are applied.
6. 1- The result, times 100, is the percentage reduction.

$$1 - \frac{TSSLoad1 \times BMPefficiency1 + ... + TSSLoadN \times BMPefficiencyN}{TSSLoad1 + ... + TSSLoadN} \times 100 = \%TSS\ reduced$$

Some BMPs may not be listed or detailed in these references. Therefore, the Department agrees that permittees – or their consultants – may use other acceptable literature, or their own studies, provided they are scientifically defensible and submitted to the Department for review.

Example Community

Using 30 inches (2.5 feet) for the annual precipitation for this community, calculate the uncontrolled loading, assuming all listed sites are located in one watershed (one system). Remember, the formula is:

Gallons X MG X 3.785 L X 1 Pound

Facility	Load rate	Impervious Area	Precipitation/year	lbs of TSS/year
TWP Hall	77 mg/l	150,000 ft2	2,805,000 gallons	1,802 pounds
Police/Fire Station 1	77 mg/l	250,000 ft2	4,675,000 gallons	3,004 pounds
Storage Yard	149 mg/l	150,000 ft2	2,805,000 gallons	3,487 pounds
Athletic Park	51 mg/l	220,000 ft2	4,114,000 gallons	1,751 pounds
Uncontrolled TSS Annual Loading				**10,044 pounds**

Then calculate the reduction in TSS with current and/or proposed BMP implementation for each site. Add up the TSS from each site.

Facility	Load rate	BMP	Reduction	New rate	lbs TSS/year
TWP Hall	77 mg/l	Detention Pond	35% from the EPA BMP database [1]	50.05 mg/l	1,171 pounds
Police/Fire Station 1	77 mg/l	Sweeping/CB Cleaning	Annual pounds collected = 500	NA	2,504 pounds
Storage Yard	149 mg/l	None	none	149 mg/l	3,487 pounds
Athletic Park	51 mg/l	Vegetated Swale	60% from the EPA BMP database[1]	20.4 mg/l	700 pounds
Controlled TSS Annual Loading					**7862 pounds**

1. BMP must meet the specifications of that design and for the same purpose, criteria, management, etc. Percent reduction cannot be used from the database simply because it is the best number found.

Using the formula for percent TSS reduction plug in the numbers:

1 – (7,862/10,044) X 100 = 22% reduction with the BMPs listed

This will give you the percentage of TSS reduction for all municipal facilities.

2.18 Identifying Illicit Discharges

1. Recognize Sources

- Dry Weather Flow (no rain event in the last 72 hours)
- Staining
- Smell – Sanitary, Surfactant, Other
- Pipes to Catch Basin or Drain
- Debris/Waste (e.g. foam, leaks)
- Sediment

2. Typical Examples

- Laundry Connections
- Leaky Dumpsters
- Car Washing
- Equipment Washing
- Construction Sites

For incident reporting, please use the Illicit Discharge Reporting Sheet.

3.0 Preventive Maintenance of Treatment Controls

Preventive Maintenance BMPs include regular inspections and maintenance intended to optimize the pollutant removal efficiency of existing treatment controls. Treatment control that fail or function poorly may result in the discharge of pollutants to the storm water drainage system. Therefore, to reduce the likelihood of breakdown or failure, treatment controls should have a preventive maintenance schedule for inspection, repair, or replacement of forebays, vegetation, and revetments. Paved areas and landscaping should not be allowed to degrade to the point where they erode and contribute pollutants to runoff. Cracked pavement and berms, and any other enclosure or structural defects that may impact the quality of storm water runoff should be promptly repaired. Structural BMPs and storm drains within facility boundaries also need to be inspected and maintained regularly.

3.1 Catch Basins

GOOD

Structurally Sound
Grate/Cover Free of Debris
Sump Clean or Less than 50% Full
No Evidence of Illicit Discharge

FAIR

Structure Slightly Damaged
Some Debris On/Around Grate/Cover
Sump Near 50% Full of Sediment
No Evidence of Illicit Discharge
Minor Construction Runoff Entering Sump

POOR

Surrounding Structure Failing
Not Functioning, Evidence of Flooding
Sump More Than 50% Full
Evidence of Illicit Discharge

Table 3.2: Catch Basins: Typical Maintenance

Activity	Schedule
• Stabilize Erosion • Repair Broken or Failing Concrete/Asphalt Around Structure • Repair Earth Scouring Around Structure • Replace Broken or Cracked Covers • Report Illicit Discharge • Protect Inlet from Construction Runoff	As needed
• Vactor Sump • Remove Debris	Semi-annually / Annually

3.2 Culverts

GOOD

No Erosion
Minimal Debris Accumulation
No Sedimentation
Pipes Structurally Sound
Minimal Scour Pool/Channelization

FAIR

Slight Erosion
Debris or Trash Accumulation
Slight Sedimentation
Pipe Slightly Crushed or Separated

POOR

Severe Erosion Around Pipe
Heavy Debris Accumulation
Heavy Sediment Buildup
Pipe Crushed, Settled or Separated

Table 3.2: Culverts: Typical Maintenance

Activity	Schedule
• Stabilize Erosion • Replace Crushed/Cracked Pipe • Fortify with Rip Rap • Re-grade Around Outfall and Replant as Needed	As needed
• Clean Up Trash and Debris • Remove Sediment	Semi-annually / Annually

3.3 Oil/Grit Separator

GOOD

Structurally Sound
Clean Outflow
No Trash or Debris Buildup
Unit Less Than 10% Full

FAIR

Structurally Sound
Clean Outflow
Minor Trash/Debris Buildup
Unit Less Than 30% Full

POOR

Structure Compromised
Outflow Carrying Debris or Solids
Excessive Trash/Debris Buildup
Unit More Than 50% Full

Table 3.3: Oil/Grit Separator: Typical Maintenance

Activity	Schedule
• Repair Structural Defects	As needed
• Pump Accumulated Oil • Vactor Grit/Sediment out of Chamber • Clean up Trash/Debris	Semi-annually / Annually

3.4 Stormwater Outfalls

GOOD

Structurally Sound
Pipe in Good Condition
No Sedimentation/Debris Buildup
Minimal Erosion

FAIR

Minor Structural Problems
Pipe Damaged but Functional
Minimal Sedimentation/Debris Buildup
Minimal erosion

POOR

Structure Severely Compromised
Pipe Crushed or Separated, not Functional
Sediment Constricting More than 30% of Pipe
Heavy Erosion
Deep Scour Pool

Table 3.4: Stormwater Outfall: Typical Maintenance

Activity	Schedule
• Reinforce Structure with Rip Rap as Needed • Replace Crushed/Broken Pipes • Repair/Install Energy Dissipater as Needed • Report Suspected illicit Discharges	As needed
• Remove Excess Sediment • Clean Trash Rack, Remove Accumulated Debris	Annually

3.5 Porous Pavement

GOOD

Pavement Clean of Dirt/Organic Debris
No Surface Ponding
No Settling
No Excessive Grass/Moss Growth

FAIR

Minor Dirt/Debris Accumulation
No Surface Ponding
No Settling
Moderate Grass/Moss Growth

POOR

Excessive Dirt/Debris
Surface Ponding or Runoff
Pavement/Pavers Settling
Excessive Plant Growth

Table 3.5: Permeable Pavement: Typical Maintenance

Activity	Schedule
• Do Not Power Wash • Remove Excessive Grass, Weeds or Moss around Pavers • Clean Up Oil and Grease • Replace Gravel Fill Between Pavers	As needed
• Remove accumulated sediment and particulates from the permeable pavement void spaces with high efficiency vacuum sweepers	Annually

3.6 Detention Pond

GOOD

Inlets/Outlets clear of Debris and Trash
Minimal Sediment Buildup in Forebay
Minimal Scalping from Mowing
Surrounding Vegetation Healthy
Invasive/Non-Native Plants Absent

FAIR

Some Trash Present
Sediment Buildup in Forebay
Scalping/Improper Mowing
Dead/Dying Vegetation
Some Non-Native Plants Present

POOR

Excessive Trash Present
Forebay full of Sediment
Severe Bank Erosion
Inlets or Outlets Not Functional
Flooding

Table 3.6: Detention Pond: Typical Maintenance

Activity	Schedule
• Water plants as necessary during the first growing season • Mow High, Avoid "Scalping" when Mowing • Leave Un-Mowed Buffer Around Water	As needed
• Inspect pretreatment, inlet, and outlet for clogging • Remove Trash • Clean Inlet and Outlet Pipes and Trash Racks • Check and Clear Draw-Down Pipes • Remove Non-Native, Invasive Species • Check for Rodent Damage (Muskrat, Beaver)	Semi-annually
• Inspect device for winter salting damage • Check Weir Integrity • Check Fence and Security Integrity	Annually

3.7 Infiltration Basin

GOOD

Inlets Free From Debris
Vegetation Healthy, Covers Structure
No Scalping from Mowing
No Standing Water 1 Day After Rain
Small Amount of Trash or Debris

FAIR

Debris Around Inlet Pipe
Bare Spots in Vegetation Cover
Mowed Too Low (Scalping)
Limited Standing Water 1 Day After Rain
Small Amount of Erosion
Trash and Debris Present

POOR

Inlets Clogged with Debris
Vegetation Mostly Absent
Severe Scalping/Erosion
Evidence of Runoff or Excessive Ponding
Excessive Trash Present

Table 3.7: Infiltration Basin: Typical Maintenance

Activity	Schedule
• Mow at High Setting (Greater than 6 inches) • Inspect pretreatment area and trench and remove accumulated sediment and debris • Remove Trash • Check for Standing Water	As needed
• Remove Sediment from Inlet	Semi-annually
• Stabilize any eroded areas in pretreatment area • Check Inlet Integrity • Assess Plant Health and Abundance • Check Energy Dissipaters • Check for Channelization and Scouring	Annually

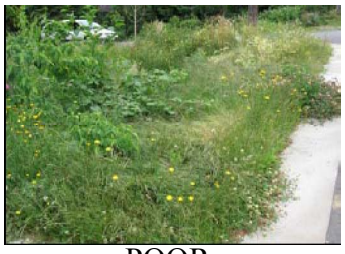
3.8 Rain Garden (Bioretention)

GOOD

Minimal Trash
Mulch Distributed Evenly
Vegetation Robust
Minimal Weeds
Minimal Sedimentation
Inlet/Overflow Clean

FAIR

Some Trash
Bare Spots in Mulch
Vegetation Unhealthy / Bare Areas
Weedy, Un-kept Appearance



POOR

Excessive Trash
Mulch Washed Away
Vegetation Sparse
Excessively Weedy/Wild Appearance
Excessive Sedimentation

Table 3.8: Bioretention: Typical Maintenance

Activity	Schedule
• Water plants as necessary during the first growing season • Prune and weed plants and remove and replace unsuccessful or diseased plants • Remove trash and debris • Mulch replacement and/or seeding when erosion is evident	As needed
• Inspect pretreatment, inlet, and outlet for clogging	Semi-annually
• Inspect device for winter salting damage	Annually
• Replace mulch 2 inches thick over entire area	2 to 3 years

3.9 Filter Strip

GOOD

Providing Good Filter Buffer Around Water Body

Minimal Sedimentation

Vegetation Healthy

Mowed High or Not at All

FAIR

Some Erosion, Sediment Runoff Reaching Water Body

Vegetation Sparse

Vegetation Mowed Too Low, Scalping

Poorly Protected from Construction

POOR

Severe Erosion, Sediment Reaching Water Body

Vegetation Dead or Missing

Severe Scalping from Mowing

Protection from Construction Activity Failing or Missing

Table 3.9: Filter Strip: Typical Maintenance

Activity	Schedule
• Water vegetation as necessary during establishment period • Repair Eroded Areas • Maintain Gravel Edging if Present • Protect from Construction Activities • Mow grass to 3 or 4 inches in height or do not mow	As needed
• Inspect and remove accumulated sediment from gravel diaphragm • Inspect filter strip for rill and gullies. Reseed or re-sod as needed • Clean Up Trash	Annually
• Remove accumulated sediment at the bottom of the filter strip	Every 2 to 3 years

3.10 Vegetated Swale

GOOD

Site Free of Trash and Debris

Tidy Appearance

Vegetation Healthy

Mowed to Minimum of 6 Inches

Minimal Erosion, Scouring and Sedimentation

FAIR

Some Trash or Debris

Unkempt Appearance

Some Bare Spots in Vegetation

Mowed Too Low, Some Scalping

Some Erosion or Scouring Sedimentation

Compaction from Traffic

POOR

Excessive Trash or Debris

Weedy, Overgrown Appearance

Vegetation Sparse or Missing

Mowed Too Low, Scalping

Severe Erosion, Scouring or Sedimentation

Table 3.10: Vegetated swale: Typical Maintenance

Activity	Schedule
• Water plants as necessary during plant establishment • Prune and weed plants and remove and replace unsuccessful or diseased plants • Remove trash and debris • Mulch replacement and/or seeding when erosion is evident • If Mowing, Mow High	As needed
• Remove accumulated sediment and debris from the bioswale and its control structures	Semi-annually
• Replenish the mulch layer to maintain design depth • Stabilize any eroded areas within or that drain to the bioswale	Annually

3.11 Constructed Wetland

GOOD

Healthy Plant Life

Non-Native Plant Species Few or Absent

Minimal Litter or Trash

Inlet/Outlets Clean and free Flowing

Sediment in Forebay More Than one Foot

FAIR

Plants Unhealthy or Sparse

Some Non-Native, Invasive Plant Species

Litter or Trash Present

Inlets/Outlets Contain Sediment Buildup or Debris

Sediment in Forebay More Than one foot

POOR

Plants Dead or Missing

Excessive Non-Native, Invasive Plant Species

Excessive Litter or Trash

Inlets/Outlets Clogged or Not Functioning

Sediment in Forebay Less than One Foot From Water Surface

Table 3.11: Stormwater Wetland: Typical Maintenance

Activity	Schedule
• Remove and replace unsuccessful or diseased plants • Remove trash and debris • Inspect Security Fence/Gate and Repair as Necessary • Repair Erosion Damage • Mow Bank on High Setting	As needed
• Remove accumulated sediment and debris from the wetland and its control structures • Remove Debris/Sediment from Forebay	Annually