

# Rhode Island Stormwater Design and Installations Standards Manual

Public Workshop  
Stormwater Minimum Standards and  
Performance Criteria  
January 13, 2011

# Minimum Standard 1: LID Site Planning and Design Strategies

*Objective - to provide a process by which LID is considered at an early stage in the planning process to prevent stormwater impacts rather than mitigate them.*

- LID site planning and design strategies must be used to the maximum extent practicable.
- All projects must include a completed Stormwater Management Checklist (Appendix A) for review that shows compliance with this standard.
- If full compliance is not provided, an applicant must document why key steps in the process could not be met and what is proposed as mitigation.



**AVOID**

**REDUCE**

**MANAGE**

# LID Site Planning and Design Criteria

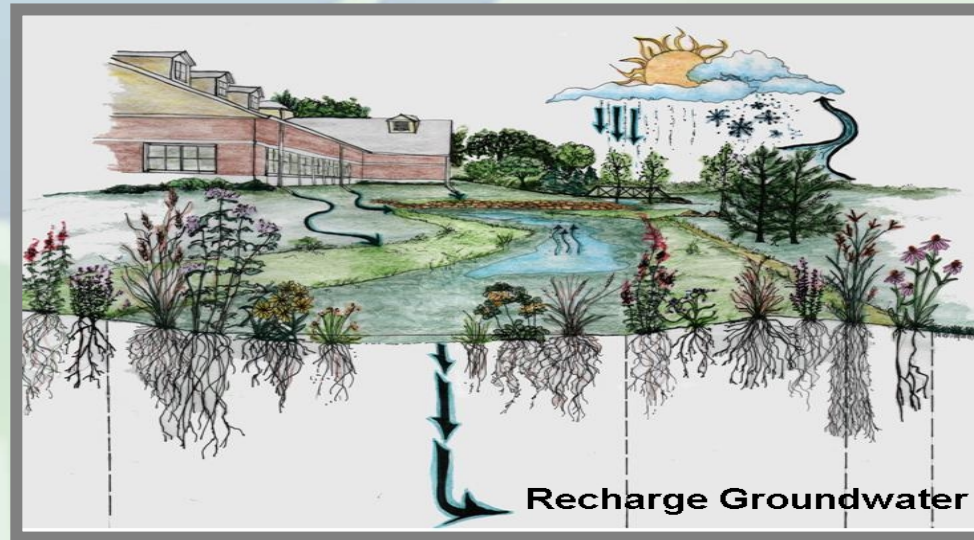
- A Protect undisturbed open space;
- A Maximize the protection of natural drainage areas, streams, surface waters, wetlands, and buffers;
- A Minimize land disturbance, locate disturbances in less sensitive areas;
- A/R Minimize the decrease in the "time of concentration" from pre-construction to post-construction;
- A/R Minimize soil compaction;
- R Minimize impervious surfaces;
- M Provide vegetated conveyance and treatment systems;
- M Provide low-maintenance landscaping;
- M Break up or disconnect runoff over impervious surfaces;
- M Provide source controls to prevent / minimize the release of pollutants into stormwater runoff.



# Minimum Standard 2: Groundwater Recharge

*Objective - to protect water table levels, stream baseflow, wetlands, and soil moisture levels.*

- Stormwater must be recharged to maintain baseflow at pre-development levels to the maximum extent practicable.
- Recharge may be achieved by both structural and nonstructural practices (Stormwater Credit)



# Recharge Criteria, Rev

Requires that the following volume of stormwater be recharged:

$$Re_v = (1") (F) (I) / 12$$

where:

$Re_v$  = recharge volume (in acre-feet)

$I$  = impervious area in acres

<u>HSG</u>	<u>Recharge Factor (F)</u>
A	0.60
B	0.35
C	0.25
D	0.10



# Minimum Standard 3: Water Quality

*Objective - to reduce the water quality impacts from stormwater on downstream waters.*

- Stormwater runoff from a site must be adequately treated to achieve the following minimum pollutant removal requirements at each discharge location:
  - 85% of total suspended solids (TSS),
  - 60% removal of pathogens, and
  - either 30% removal of total phosphorus (TP) for discharges to sensitive freshwater systems, or 30% removal of total nitrogen (TN) for discharges to saltwater systems.
- May need to achieve higher pollutant removal efficiencies for other conditions such as: impaired waters, SAMPs, or TMDLs.
- Structural BMPs in Chapter Five can be assumed to meet these standards when designed for all 11 Standards.



# Water Quality Criteria, $WQ_v$

The  $WQ_v$  is calculated using the following equation:

$$\underline{WQ_v = (1") (I) / 12}$$

where:

$WQ_v$  = water quality volume (in acre-feet)

$I$  = impervious area in acres

- Often, calculation of a Water Quality Flow rate ( $WQ_f$ ) is also required.



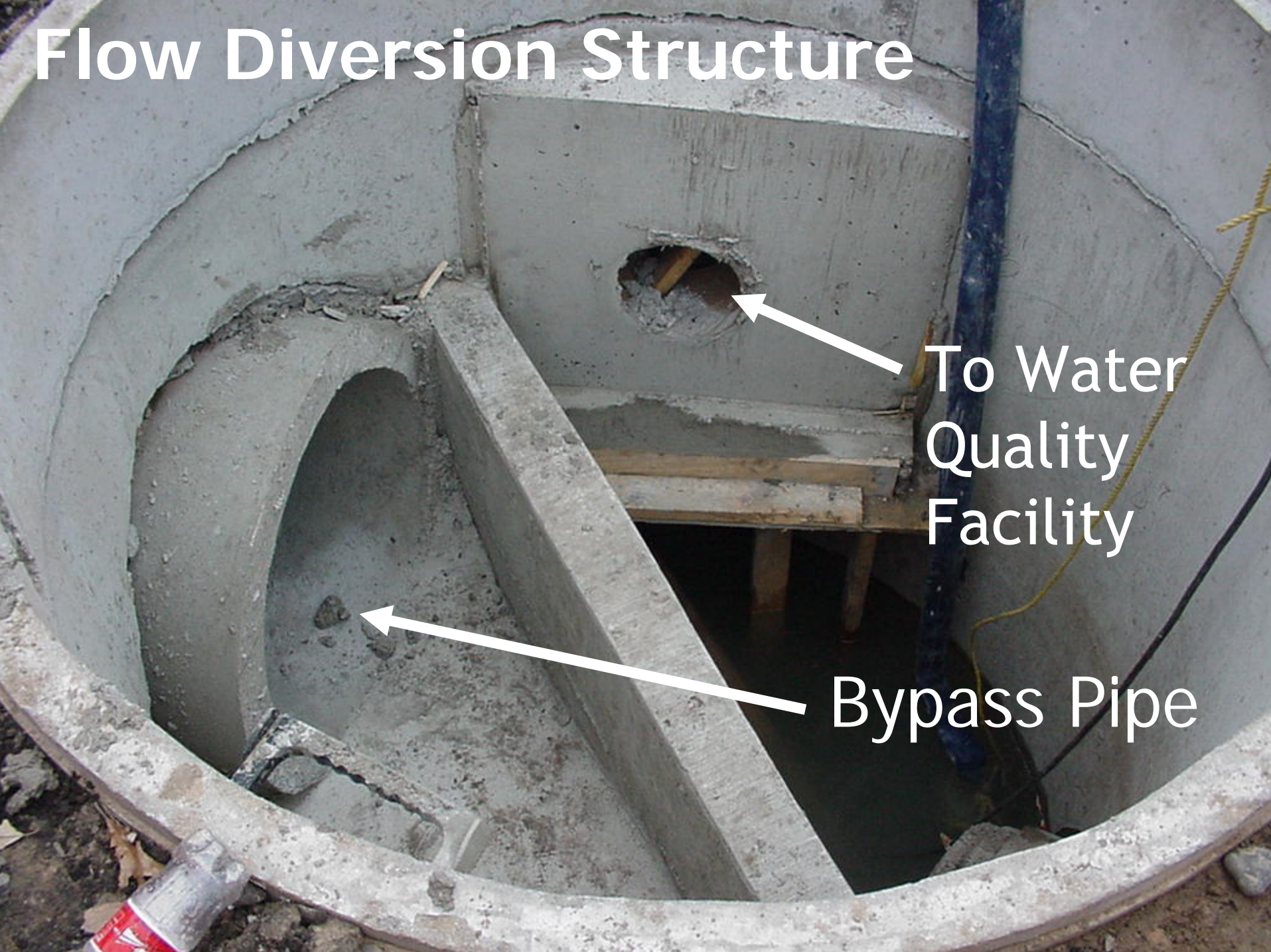
# $WQ_f$ vs. $WQ_v$

- Standard 3 is volume-based. Why would a corresponding  $WQ$  flow be necessary?
  - To ensure that the full  $WQ_v$  reaches an off-line BMP
  - Some proprietary devices are flow-based
- A Modified Curve Number (CN) is needed:
  - Traditional TR-55 CNs can lead to significantly underestimated runoff from small storm events
  - Used to calculate  $WQ_f$
  - Used to correctly model the  $WQ$  event

# Flow Diversion Structure

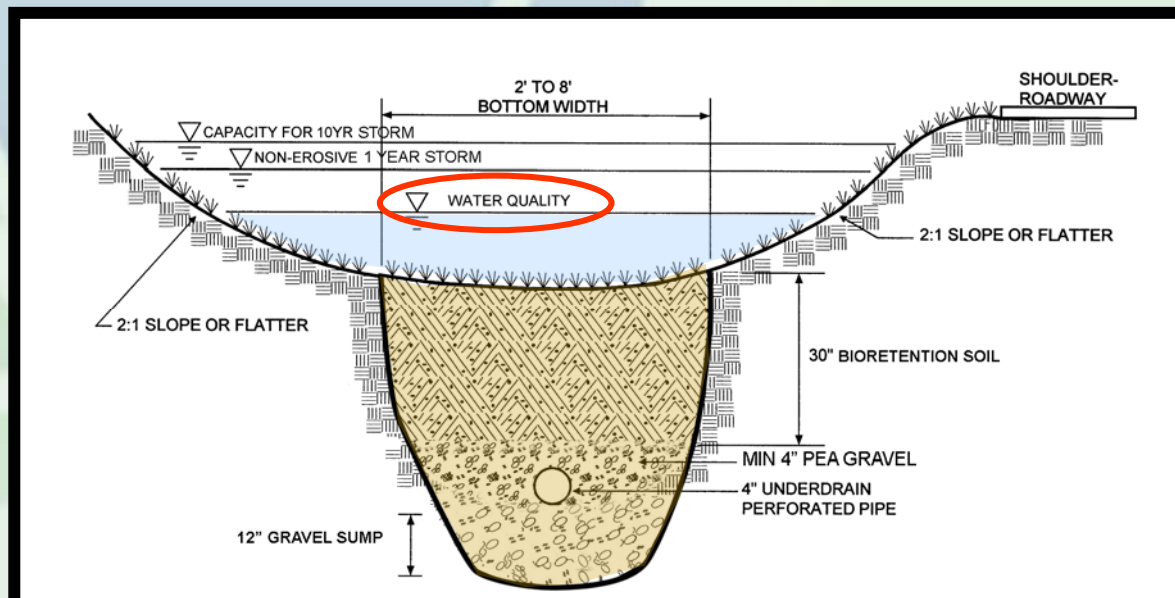
To Water  
Quality  
Facility

Bypass Pipe



# Hydrologic Basis for Design

- Impervious cover measured from site plan (for entire site);
- $WQ_v$  treated by an acceptable BMP;
- Non-structural practices can be used to reduce treatment volume (Stormwater Credit);
- Off-site areas treated as “pre-developed” (only on-site treatment is required - but flow must be accounted for if draining to a BMP).





# Minimum Standard 4: Conveyance and Channel Protection

*Objective - to prevent erosive flow within natural channels and drainage ways.*

- Conveyance systems must be designed for the 10-year, 24-hour design storm event.
- Channel protection must be supplied by providing 24-hour ED for the one-year 24-hour design storm event.
- If a stormwater discharge is to a coldwater fish habitat, surface detention practices have additional restrictions.



# Hydrologic Basis for Design

- TR-55 or TR-20 (or equiv) used for determining peak discharge;
- Off-site areas modeled as “present condition”;
- Length of overland flow used in  $t_c$  limited to 100’ for post-developed conditions;
- 24-hour ED determined as 24 hour drawdown; and
- $Cp_v$  not required for:
  - discharges to a large river (i.e., 4<sup>th</sup>-order stream), surface water body > 50 acres (lake, pond reservoirs), estuary, or tidal waters.
  - small sites with impervious cover  $\leq 1$  acre
  - Sites where peak flow < 2 cfs



# Updated Precipitation Values

## Revised design rainfall amounts

RI County	24-hour (Type III) Rainfall Amount (inches)						
	1-Year	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Providence	<b>2.7</b>	<b>3.3</b>	<b>4.1</b>	<b>4.9</b>	<b>6.1</b>	<b>7.3</b>	<b>8.7</b>
	2.7	3.3	4.2	4.8	5.6	6.2	7.0
Newport	<b>2.8</b>	<b>3.3</b>	<b>4.1</b>	<b>4.9</b>	<b>6.1</b>	<b>7.3</b>	<b>8.6</b>
	2.7	3.4	4.3	4.9	5.7	6.3	7.1
Bristol	<b>2.8</b>	<b>3.3</b>	<b>4.1</b>	<b>4.9</b>	<b>6.1</b>	<b>7.3</b>	<b>8.6</b>
	2.7	3.4	4.3	4.9	5.7	6.3	7.1
Kent	<b>2.7</b>	<b>3.3</b>	<b>4.1</b>	<b>4.8</b>	<b>6.2</b>	<b>7.3</b>	<b>8.7</b>
	2.7	3.4	4.3	4.9	5.7	6.3	7.1
Washington	<b>2.8</b>	<b>3.3</b>	<b>4.1</b>	<b>4.9</b>	<b>6.1</b>	<b>7.2</b>	<b>8.5</b>
	2.7	3.4	4.3	4.9	5.7	6.3	7.1

- New values from Northeast Regional Climate Center
- Previous values



# Minimum Standard 5: Overbank Flood Protection

*Objective - to prevent an increase in the frequency and magnitude of overbank flooding and to protect downstream structures from flooding.*

- Downstream overbank flood protection must be provided by controlling the post development peak discharge rate to the predevelopment rate for the 10-year and 100-year, 24-hour design storm events.
- The  $Q_p$  criteria can be waived for sites that:
  - Discharge to a large river (i.e., 4th order stream), surface water body > 50 acres (lake, pond reservoirs), estuary, or tidal waters.
  - A downstream analysis indicates that peak discharge control is not necessary.



# Hydrologic Basis for Design

- TR-55 or TR-20 used for determining peak discharge;
- Pre-developed conditions for on-site areas will be woods, meadow, or rangeland;
- Off-site areas modeled as “present condition” for storage requirements;
- Off-site areas that drain to a facility must demonstrate safe passage of the 100-year storm based on actual conditions upstream;
- Length of overland flow used in time of concentration limited to 150’ for pre-developed conditions and 100’ for post-developed conditions; and
- Must demonstrate that flows from the 100-yr event will be safely conveyed to a practice.



# Downstream Analysis

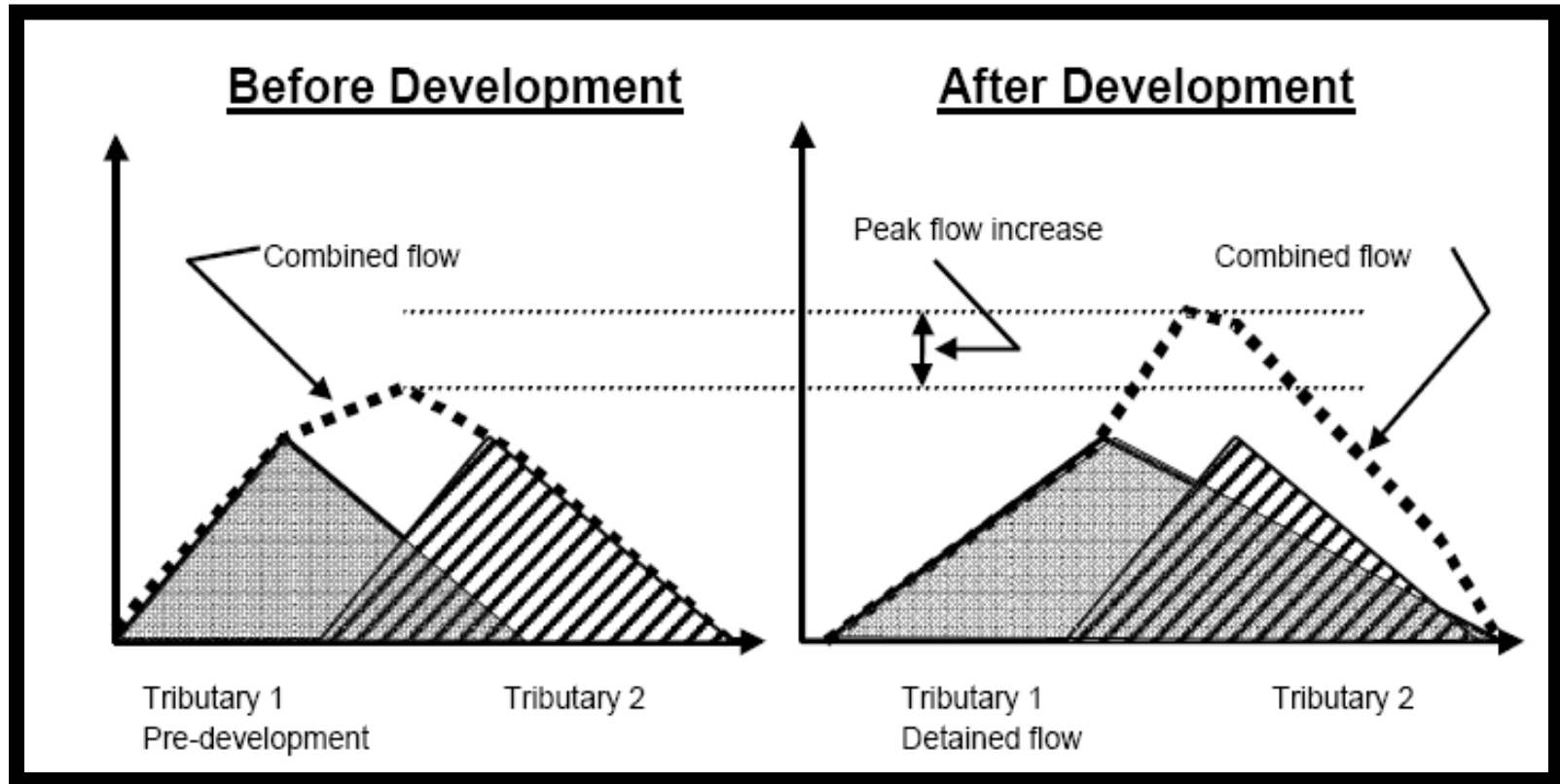
- Required for projects of certain size AND impervious cover (see table)
- Determine if peak flow impacts attenuated by controlling the 10- and 100-year events
- “10% rule” used for the limit of the downstream analysis

Area of Dist. (acres)	Impervious Cover (%)
>5 to 10	>75
>10 to 25	>50
>25 to 50	>25
>50	all projects



# Graphical Depiction of Coincident Peak Phenomena

## Two Downstream Combining Hydrographs



# Minimum Standard 6: Redevelopment and Infill

*Objective - to allow flexibility to meet the goals of improved water quality and channel protection to receiving waters while still promoting redevelopment and infill development.*

- Redevelopment is defined as any construction, alteration, or improvement that disturbs a total of 10,000 square feet or more of existing impervious area where the existing land use is commercial, industrial, institutional, governmental, recreational, or multifamily residential.
- Redevelopment sites with less than 40% impervious coverage must meet new development criteria. For sites ≥ 40%, requirements are based on 50% improvement.

# Infill Development

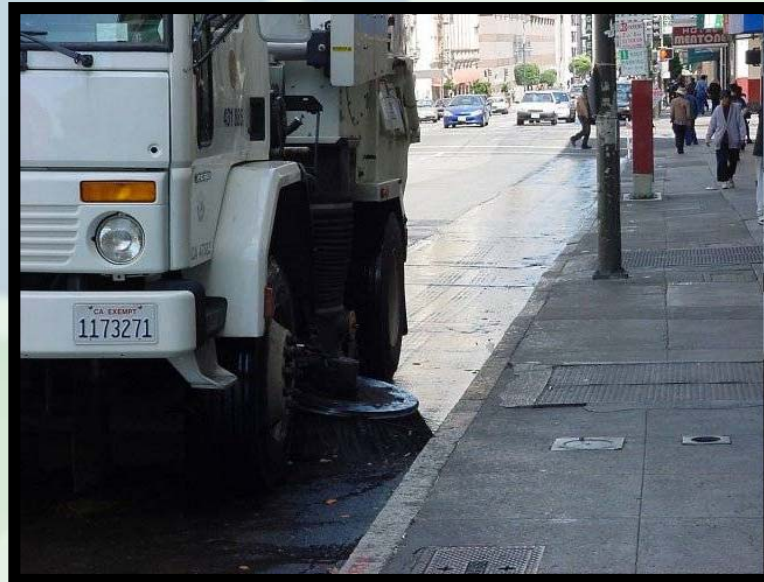
A development site that meets all of the following:

- Predominately pervious (<10,000 sq ft);
  - Surrounded by existing development;
  - Served by an existing network of infrastructure (no utility line extensions); and
  - Site is  $\leq 1$  acre.
- Requirements for Stds 2 and 3 same as new development **except** can comply with either on-site or at approved offsite location within same watershed.
  - Must demonstrate compliance with Std 1 to MEP.

# Minimum Standard 7: Pollution Prevention

*Objective - to prevent, to the maximum extent practicable, pollution from entering water resources.*

- All development projects must implement source control and pollutant prevention measures outlined in a stormwater pollution prevention plan.





# *Pollution prevention*





# Minimum Standard 8: Land Uses with Higher Potential Pollutant Loads (LUHPPLs)

*Objective - to prevent, to the maximum extent practicable, pollution from entering water resources.*

- Stormwater discharges from LUHPPLs require the use of specific source control/pollution prevention measures and BMPs approved for such use.
  - Industrial sites subject to RIPDES Multi-Sector General Permit
  - Auto fueling facilities
  - Exterior vehicle service, maintenance, and equipment cleaning areas
  - Road salt storage and loading areas (if exposed to rainfall)
  - Outdoor storage and loading/unloading of hazardous materials

# Minimum Standard 9: Illicit Discharges

*Objective - to prevent pollutants from being discharged into MS4s and Waters of the State, and to safeguard the environment and public health, safety, and welfare.*

- All illicit discharges to stormwater management systems are prohibited, including discharges from onsite wastewater treatment systems (OWTS), and sub-drains and French drains near OWTSs that do not meet the State's OWTS Rules.



# Minimum Standard 10: Construction Erosion and Sedimentation Control

*Objective - to prevent erosion and sedimentation from construction site runoff.*



- Erosion and sedimentation control (ESC) practices must be utilized during the construction phase as well as during any land disturbing activities.
  - temporary sediment trapping practices must be sized for 1 inch of runoff, and
  - temporary conveyance practices must be sized to handle flow from the 10-year, 24-hour design storm.
- ESC practices must be designed according to the guidelines in the most recent edition of the “Rhode Island Erosion and Sediment Control Handbook.”



# Minimum Standard 11: Stormwater Management System Operation and Maintenance

*Objective - to ensure that stormwater BMPs continue to function as designed.*

The stormwater management system must have an operation and maintenance plan that shall at a minimum include:

- Stormwater management system(s) owners;
- The party(ies) responsible for operation and maintenance;
- The routine and non-routine maintenance tasks and a schedule;
- A plan that shows the **location** of all stormwater BMPs and discharge points;
- A description and delineation of public safety features; and
- An **estimated budget** ; and
- The **funding source**.

