Rhode Island Stormwater Design and Installations Standards Manual

Public Workshop

Acceptable Water Quality BMPs and Selection Criteria

January 13, 2011

Horsley Witten Group, Inc.

Water Quality BMPs

Community Planning

LID Site Design

LID BMPs

Larger Conventional BMPs

Receiving Waters

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3.2.3 Minimum Standard 3: Water Quality

- The WQv must be treated by at least one of the structural BMPs listed in Chapter Five at each location where a discharge of stormwater will occur.
- Minimum average pollutant removal efficiencies: 85% removal of total suspended solids (TSS), 60% removal of pathogens, 30% removal of total phosphorus (TP) for discharges to freshwater systems, and 30% removal of total nitrogen (TN) for discharges to saltwater or tidal systems.
- Excludes LID credits allowed under Section 4.6

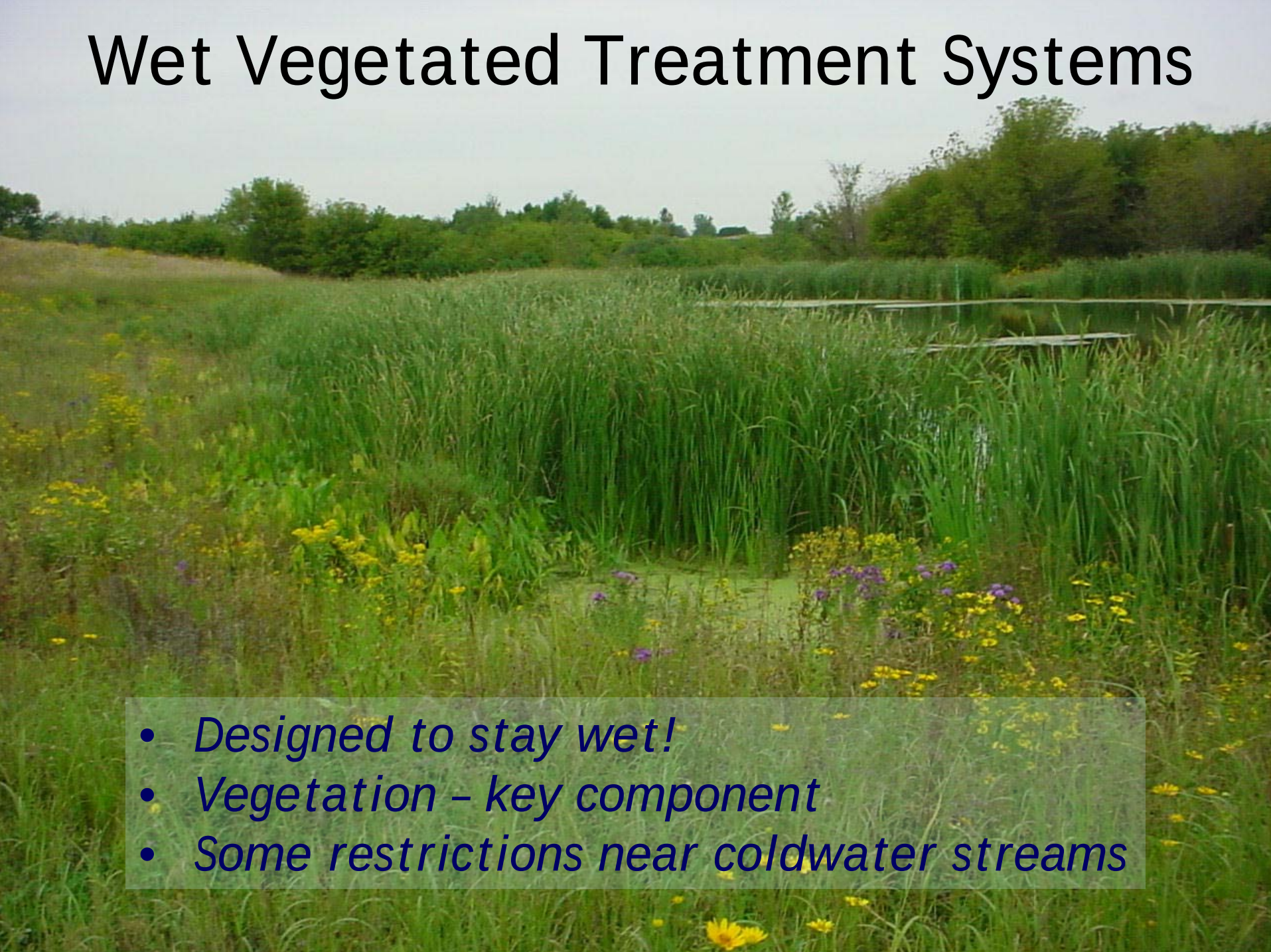
Acceptable BMPs

- 5.2 Wet Vegetated Treatment Systems (WVTS)
- 5.3 Stormwater Infiltration Practices
- 5.4 Permeable Paving
- 5.5 Filtering Systems
- 5.6 Green Roofs
- 5.7 Open Channel Systems

Minimum Design Criteria

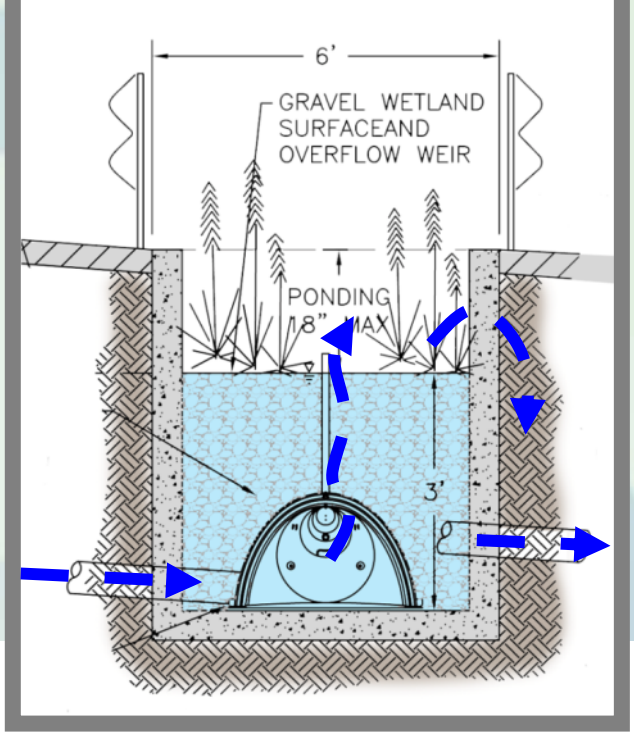
- Required Elements and Design Guidance
  - If required elements can't be met, select a different BMP
- Six Categories
  - Feasibility
  - Conveyance
  - Pretreatment
  - Treatment
  - Landscaping
  - Maintenance

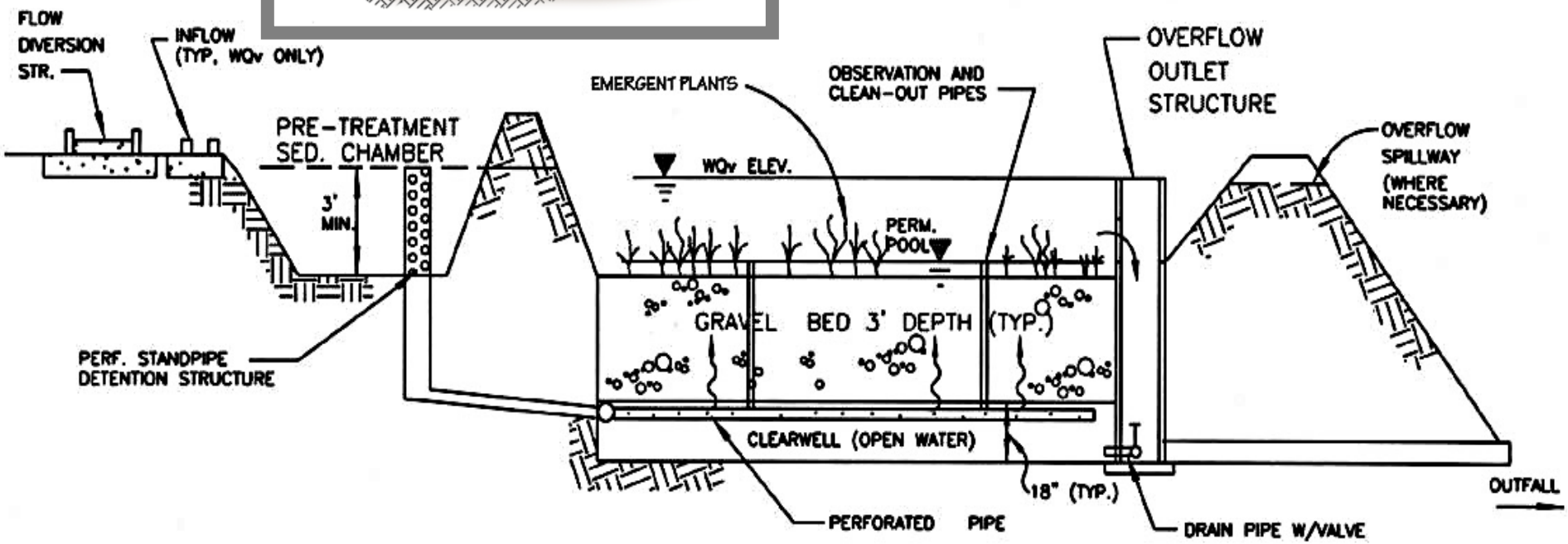
Wet Vegetated Treatment Systems



- *Designed to stay wet!*
- *Vegetation – key component*
- *Some restrictions near coldwater streams*

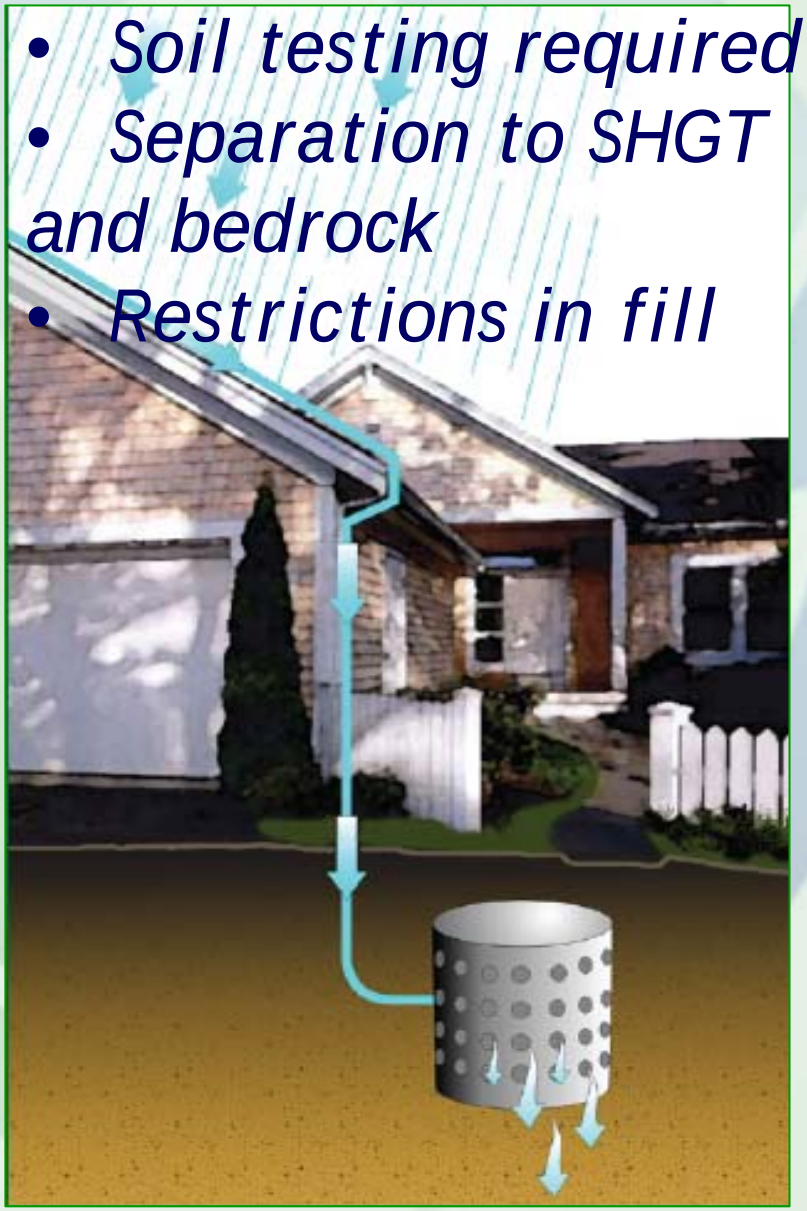
Gravel WVTS


6'
GRAVEL WETLAND
SURFACEAND
OVERFLOW WEIR
PONDING
3'


FLOW
DIVERSION
STR.
INFLOW
(TYP. WQv ONLY)
PRE-TREATMENT
SED. CHAMBER
3'
MIN.
EMERGENT PLANTS
OBSERVATION AND
CLEAN-OUT PIPES
OVERFLOW
OUTLET
STRUCTURE
OVERFLOW
SPILLWAY
(WHERE
NECESSARY)
WQv ELEV.
PERM.
POOL
GRAVEL BED 3' DEPTH (TYP.)
PERF. STANDPIPE
DETENTION STRUCTURE
CLEARWELL (OPEN WATER)
18" (TYP.)
OUTFALL
PERFORATED PIPE
DRAIN PIPE W/VALVE
PROFILE

Infiltration

- *Soil testing required*
- *Separation to SHGT and bedrock*
- *Restrictions in fill*



Permeable Paving

- *Two main categories*

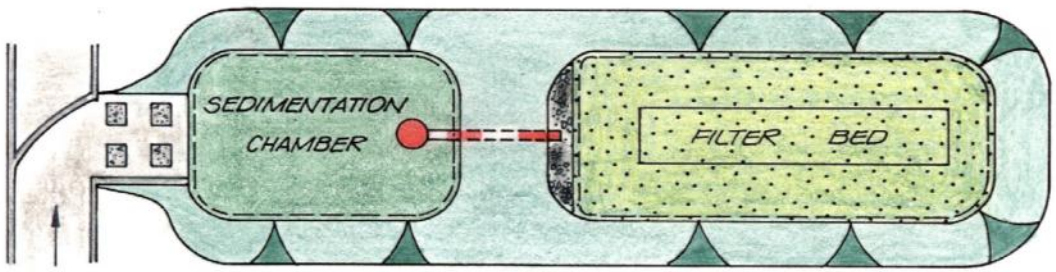
Porous Pavements

Permeable Pavers

Filtering Practices

- Sand/organic filters
- Bioretention areas/Tree filters

PROFILE



PLAN

Sand Filters

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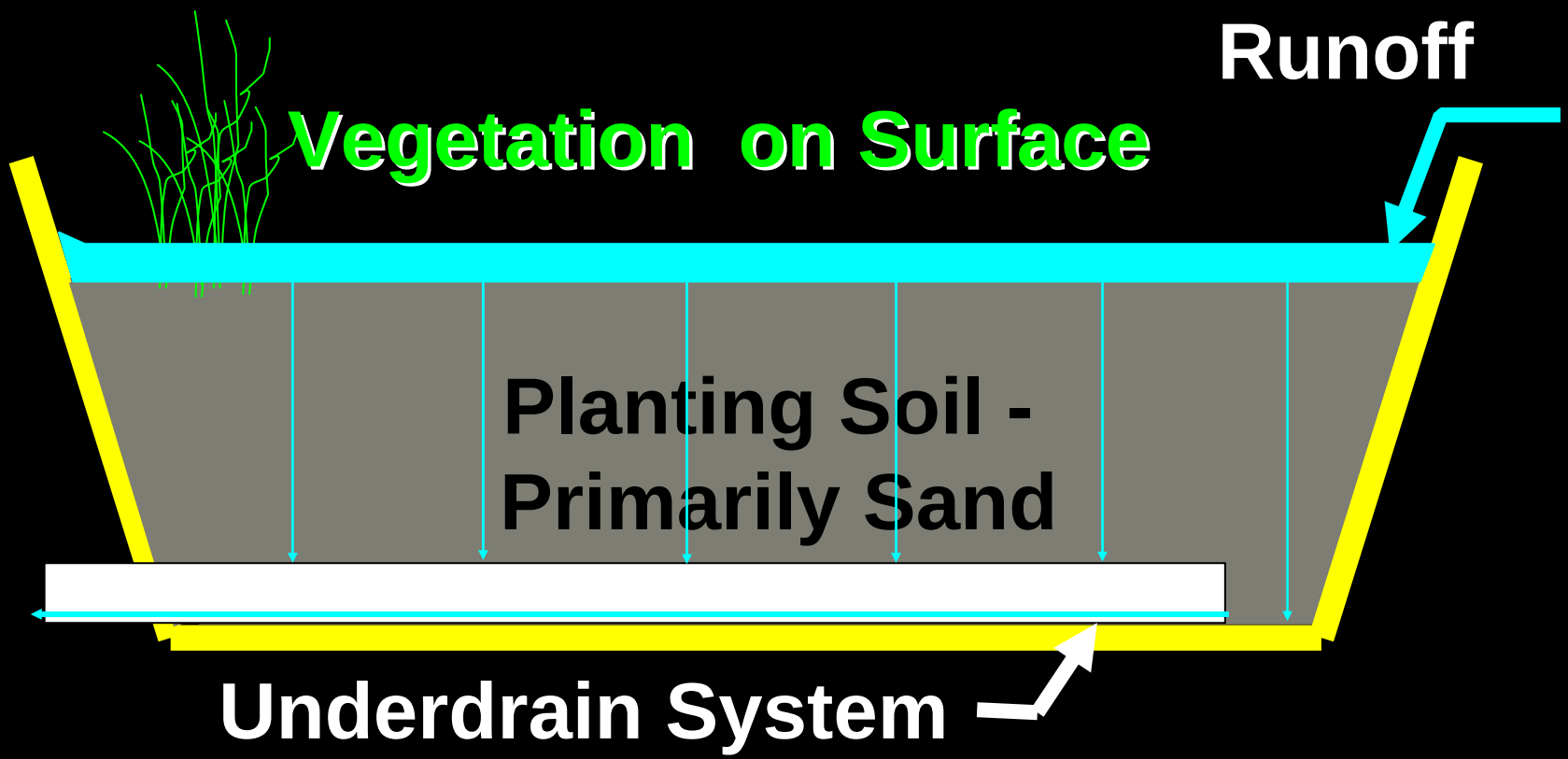
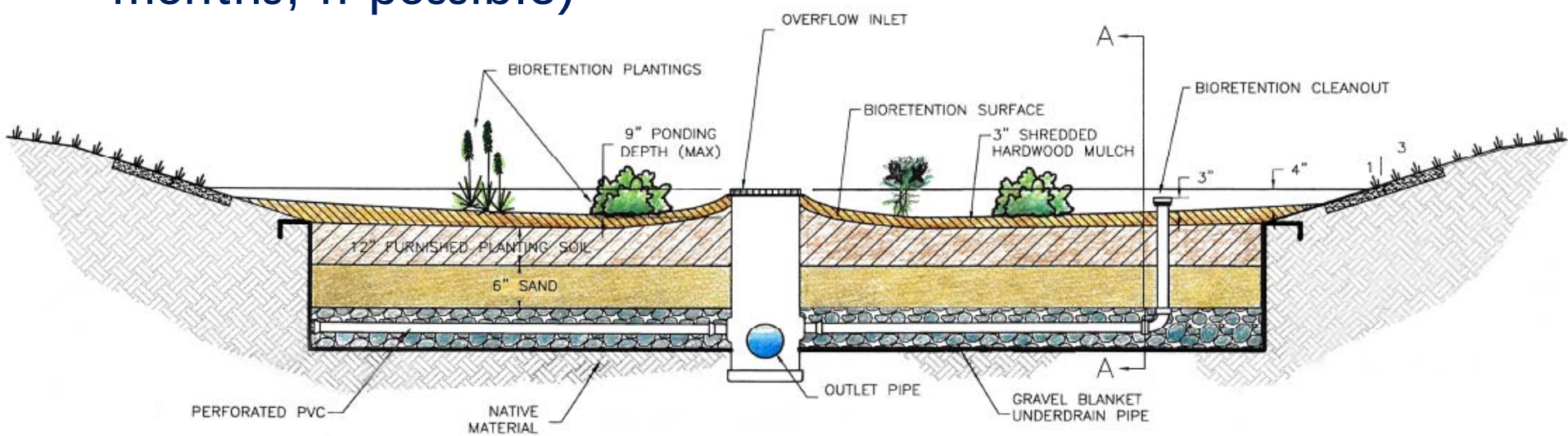
Bioretention

Bioretention Schematic



Bioretention Planting Soil and Mulch

- Loamy Sand to a Sandy Loam
  - 85-88 % sand
  - 8-12 % silt
  - 0-2 % clay
- Well-aged graded compost (25% of soil mix)
- Layer of well-aged, shredded hardwood mulch (aged 6 months, if possible)

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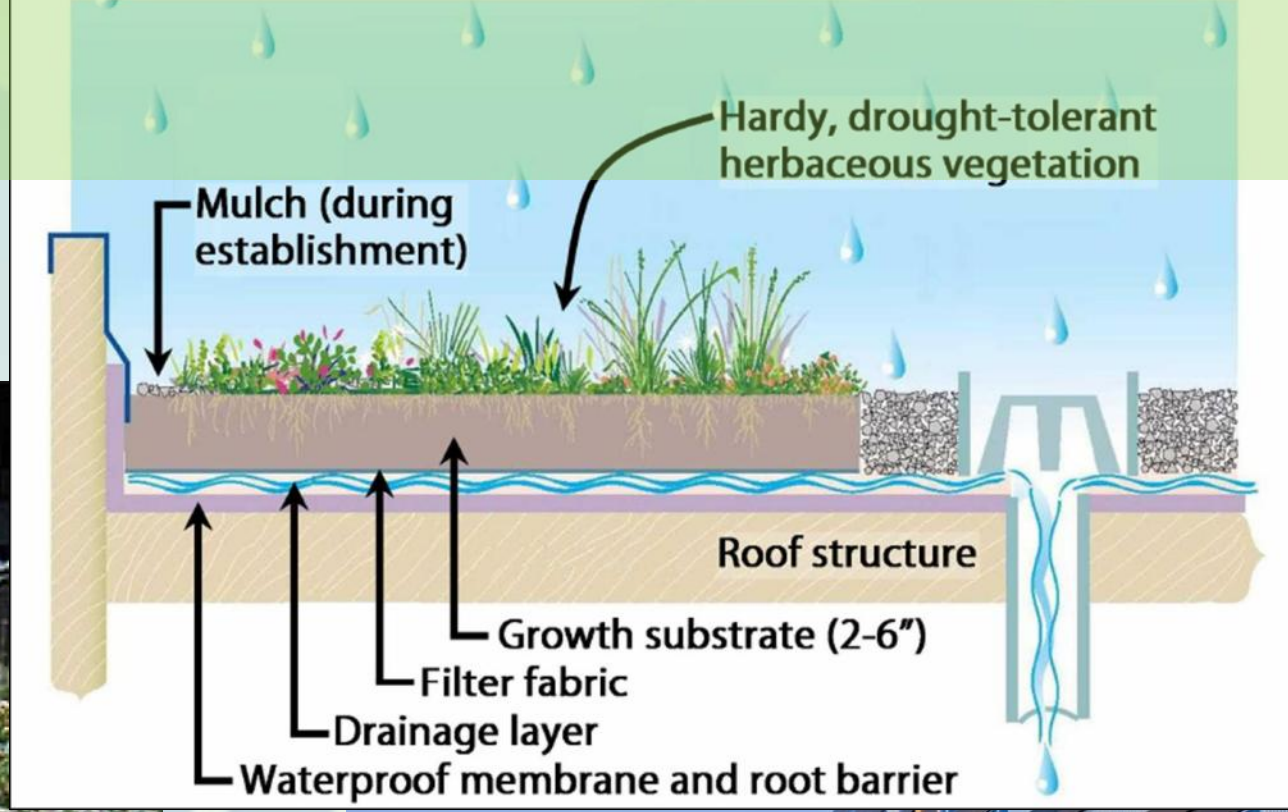
Bioretention – Many Applications

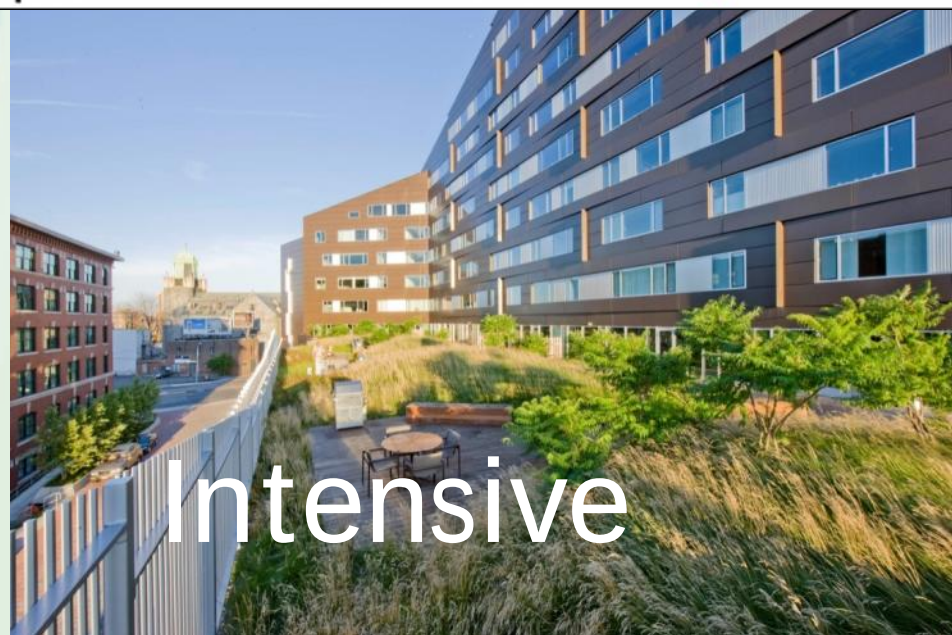
Tree pits

Green Roofs

Extensive



Intensive



Open Channels


10 YR. DESIGN STORM CAPACITY
NON-EROSIVE @ 2 YR. Qp
W.Q. TREATMENT VOL.(Vt)
DETAINED OR INFILTRATED
(c) DRY SWALE

Dry Swale

Wet Swale

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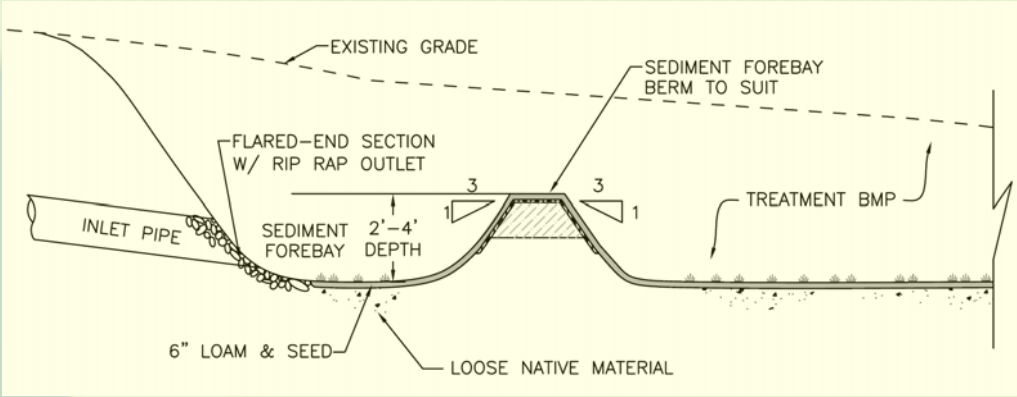
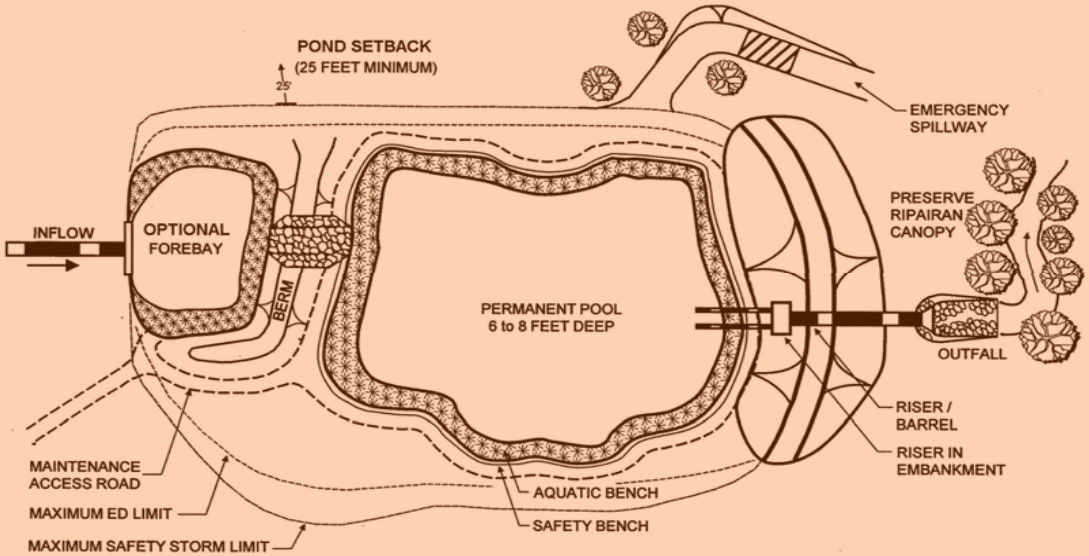
Practices Approved for Other Criteria

- Pretreatment Practices – Chapter 6
  - Grass Channel
  - Filter Strips
  - Sediment Forebay
  - Deep Sump Catch Basins
  - Proprietary Devices





- Storage Practices – Chapter 7
  - Stormwater Basins
  - Underground Storage Devices

Table 5-3 BMP Selection Matrix 1 – Land Use

BMP Group	BMP Design	Rural	Residential	Roads and Highways	Commercial/ High Density	LUHPPL	Ultra-urban
WVTS	Shallow WVTS	○	○	◗	◗	①	●
	Gravel WVTS	○	○	◗	◗	①	●
Infiltration	Infiltration Trench/Chambers	○	◗	○	○	●	◗
	Dry Wells	○	○	◗	◗	●	◗
	Shallow I-Basin	◗	◗	◗	◗	●	◗
	Pervious Pavement	○	○	◗	◗	②	◗
Roofs	Intensive	◗	◗	●	◗	○	○
Open Channels	Dry Swale	○	◗	○	◗	②	◗
	Wet Swale	○	◗	○	●	●	●

○: Yes. Good option in most cases.
◗: Depends. Suitable under certain conditions, or may be used to treat a portion of the site.
●: No. Seldom or never suitable.
①: Acceptable option, but may require a liner to reduce risk of groundwater contamination.
②: Acceptable option, if not designed as an exfilter. (An exfilter is a conventional stormwater filter without an underdrain system. The filtered volume ultimately infiltrates into the underlying soils.)

II. Selecting the Most Effective and Appropriate Stormwater Practices

Inc.

Five Selection Factors to Consider

1. Land Use
2. Physical Feasibility
3. Watershed
4. Stormwater Management Capability
5. Community and Environmental

#1. Land Use

The land use of the contributing drainage area influences the stormwater strategy:

- Rural areas
- Residential sites
- Roads/highways
- Commercial sites
- LUHPPLs
- Urban sites

  (e.g., redevelopment)


Cul-de-Sac Application


Commercial Application


Municipal Application

Retrofit Application

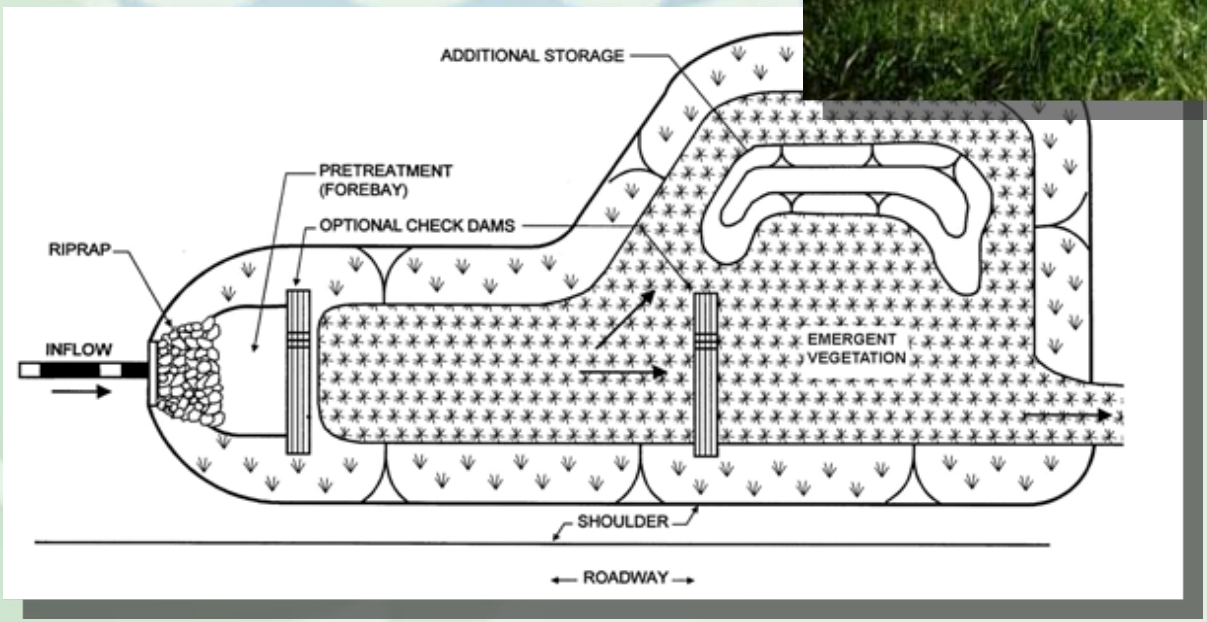
2. Physical Feasibility

Some Practices Cannot Be Used Because of Site Constraints:

- Soils
- Groundwater
- Drainage Area
- Minimum Surface Area
- Slope Restriction
- Head

Wet Swale

- Used when water table is close to surface



#3. Watershed Factors

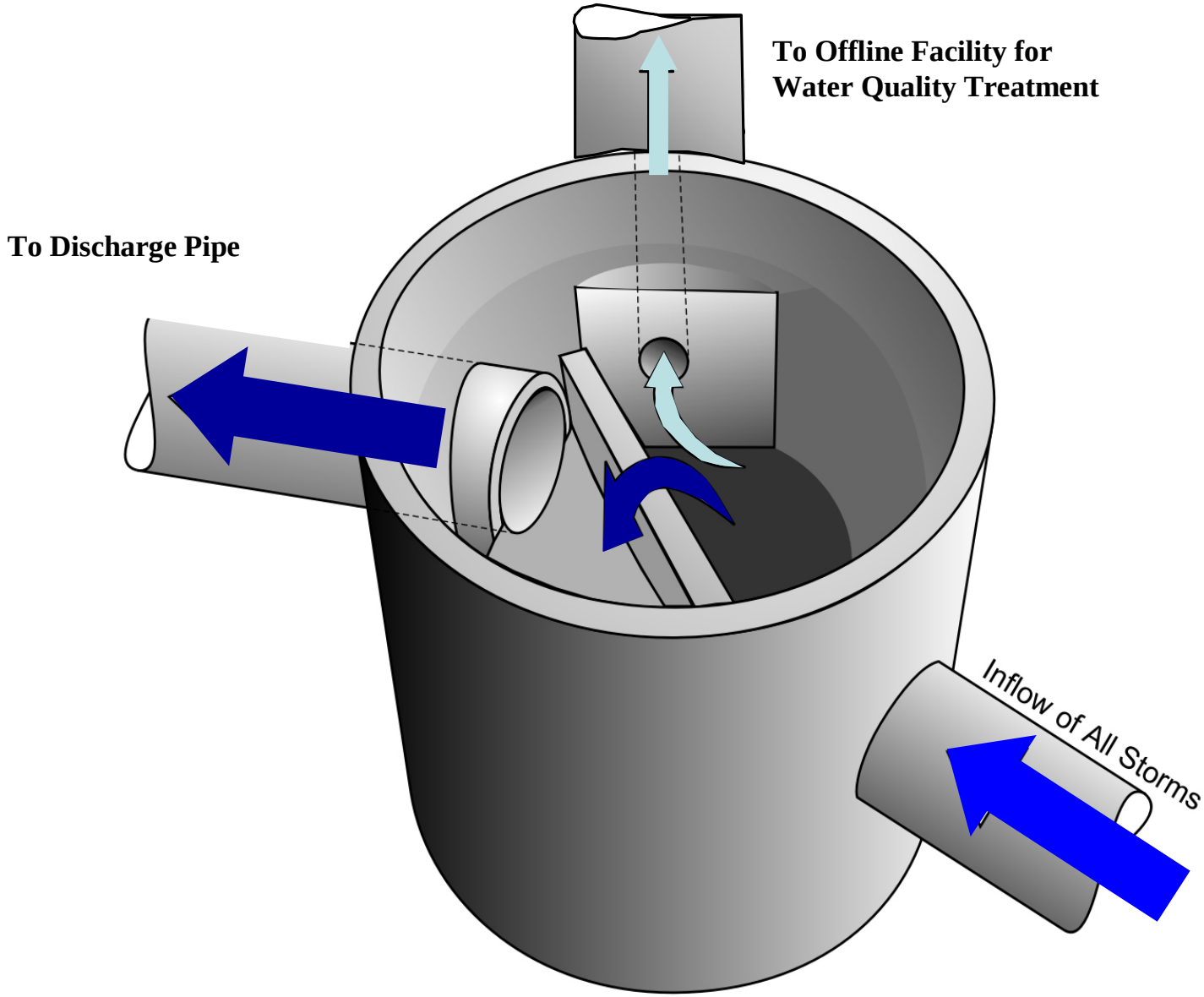
Different Receiving Water Management Objectives Shape Stormwater Strategies:

- Groundwater (Aquifer protection)
- Freshwater streams and Rivers
- Other Freshwaters (Ponds/Lakes/Wetlands)
- Coastal Waters (shellfish/beach areas

#4. Stormwater Management Capability

No single practice achieves all stormwater management objectives. A combination of practices is often needed to provide desired level of:

- Groundwater recharge
- Water quality treatment
- Channel protection
- Flood control
- Ability to treat LUHPPLs


To Offline Facility for
Water Quality Treatment
To Discharge Pipe
Inflow of All Storms

#5. Community and Environmental Impacts

Other community and environmental impacts should be considered when selecting BMPs:

- Ease of maintenance
- Affordability
- Community acceptance/ aesthetics
- Safety
- Habitat

Stormwater Practice Maintenance Burden

Maintenance Burden is a function of the type of facility as well as the design and implementation

- WVTS ---------- Medium to Easy
- Infiltration* --------- Medium to Difficult
- Filters ---------- Medium to Difficult
- Green Roofs --------- Medium
- Open Channels ---------- Medium to Easy

*Except drywells - Easy

Pollutant Removal Capability

Important when higher removals are required (see list in Section 3.2.3). **Table H-3/H-4** compares removal efficiencies for:

- Total Suspended Solids
- Total Phosphorus
- Total Nitrogen
- Bacteria

Questions?