Green Infrastructure for New Jersey's Regulations

Advance Stormwater Management

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Virtual Presentation – Muddy Run Focus Area

June 16, 2021

RUTGERS
New Jersey Agricultural
Experiment Station

Rutgers Cooperative Extension Water Resources Program

Our mission is to identify and address water resources issues by engaging and empowering communities to employ practical science-based solutions to help create a more equitable and sustainable New Jersey.

NJDEP Green Infrastructure Definition

A stormwater management measure that manages stormwater close to its source by:

1. Treating stormwater runoff through infiltration into subsoil
2. Treating stormwater runoff through filtration by vegetation or soil
3. Storing stormwater runoff for reuse

What do the updated Stormwater Management Regulations require of “Major Development” ?

N.J.A.C. 7:8 - Stormwater Management Regulations

- Soil Erosion and Sediment Control
- Maintain groundwater recharge (1)
- Protect waterways from pollution carried in stormwater runoff (water quality) (2)
- Reduce runoff peak flows (water quantity) (3)

Major Development

"Major development" means an individual "development," as well as multiple developments that individually or collectively result in:

1. The disturbance of one or more acres of land since February 2, 2004;
2. The creation of one-quarter acre or more of "regulated impervious surface" since February 2, 2004;
3. The creation of one-quarter acre or more of "regulated motor vehicle surface" since March 2, 2021; or
4. A combination of 2 and 3 above that totals an area of one-quarter acre or more. The same surface shall not be counted twice when determining if the combination area equals one-quarter acre or more.

Groundwater Recharge Performa tandards (Table 5-1)

– Maintain 100% of averag undwater recharge volume

or

– Infiltrate i volum ear s

Must be achieved with green infrastructure shown in Table 5-1

And limits on how much land can drain to these green infrastructure systems

Water Quality Performance S rds (Table 5-1)

- Reduce at least 80% of total olids (TSS) loads with green infrastr
- Reduce nutrients lo maximum extent feasible

Must be achieved with green infrastructure shown in Table 5-1

And limits on how much land can drain to these green infrastructure systems

Water Quantity Performance Standards (Table 5-1 and Table 5-2)

– Demonstrate that post-development 2-year storm event hydrographs do not exceed pre-development hydrographs

or

– Demonstrate that hydrographs will not increase and that increase in volume from new development won't increase flood damage downstream

or

– Demonstrate that 2-year, 10, and 100-year pre-development hydrographs are reduced to 50%, 75%, and 80%, respectively

- 2-year rainfall (3.3 inches)
- 10-year rainfall (5.0 inches)
- 100-year rainfall (8.3 inches)

Must be achieved with green infrastructure shown in Table 5-1 or Table 5-2

Table 5-1: Green Infrastructure BMPs for Groundwater Recharge, Stormwater Runoff Quality, and/or Stormwater Runoff Quantity

Best Management Practices	Stormwater Runoff Quality - TSS Removal Rate (%)	Stormwater Runoff Quantity	Groundwater Recharge	Minimum Separation from Seasonal High Water Table (feet)
Cistern	0	Yes	No	-
Dry Well (a)	0	No	Yes	2
Grass Swale	50 or less	No	No	2 (e) 1 (f)
Green Roof	0	Yes	No	-
Manufactured Treatment Device (a) (g)	50 or 80	No	No	Depends on the device
Vegetative Filter Strip	60 - 80	No	No	-

Table 5-1: Green Infrastructure BMPs for Groundwater Recharge, Stormwater Runoff Quality, and/or Stormwater Runoff Quantity (cont'd)

Best Management Practices	Stormwater Runoff Quality - TSS Removal Rate (%)	Stormwater Runoff Quantity	Groundwater Recharge	Minimum Separation from Seasonal High Water Table (feet)
Pervious Paving System (a)	80	Yes	Yes (b) No (c)	2 (b) 1 (c)
Small-Scale Bioretention System (a)	80 or 90	Yes	Yes (b) No (c)	2 (b) 1 (c)
Small-Scale Infiltration Basin (a)	80	Yes	Yes	2
Small-Scale Sand Filter (a) (b)	80	Yes	Yes	2

Table 5-2: Green Infrastructure BMPs for Stormwater Runoff Quantity

(or for Groundwater Recharge and/or Stormwater Runoff Quality with a Waiver or Variance from N.J.A.C. 7:8-5.3)

Best Management Practice	Quality TSS removal rate (percent)	Quantity	Recharge	Minimum separation from seasonal high water table (ft)
Bioretention Systems	80 or 90	Yes	Yes No	2 1
Infiltration Basins	80	Yes	Yes	2
Standard Constructed Wetlands	90	Yes	No	N/A
Wet Ponds	50-90	Yes	No	N/A

Table 5-3: BMPs for Groundwater Recharge, Stormwater Runoff Quality, and/or Stormwater Runoff Quantity

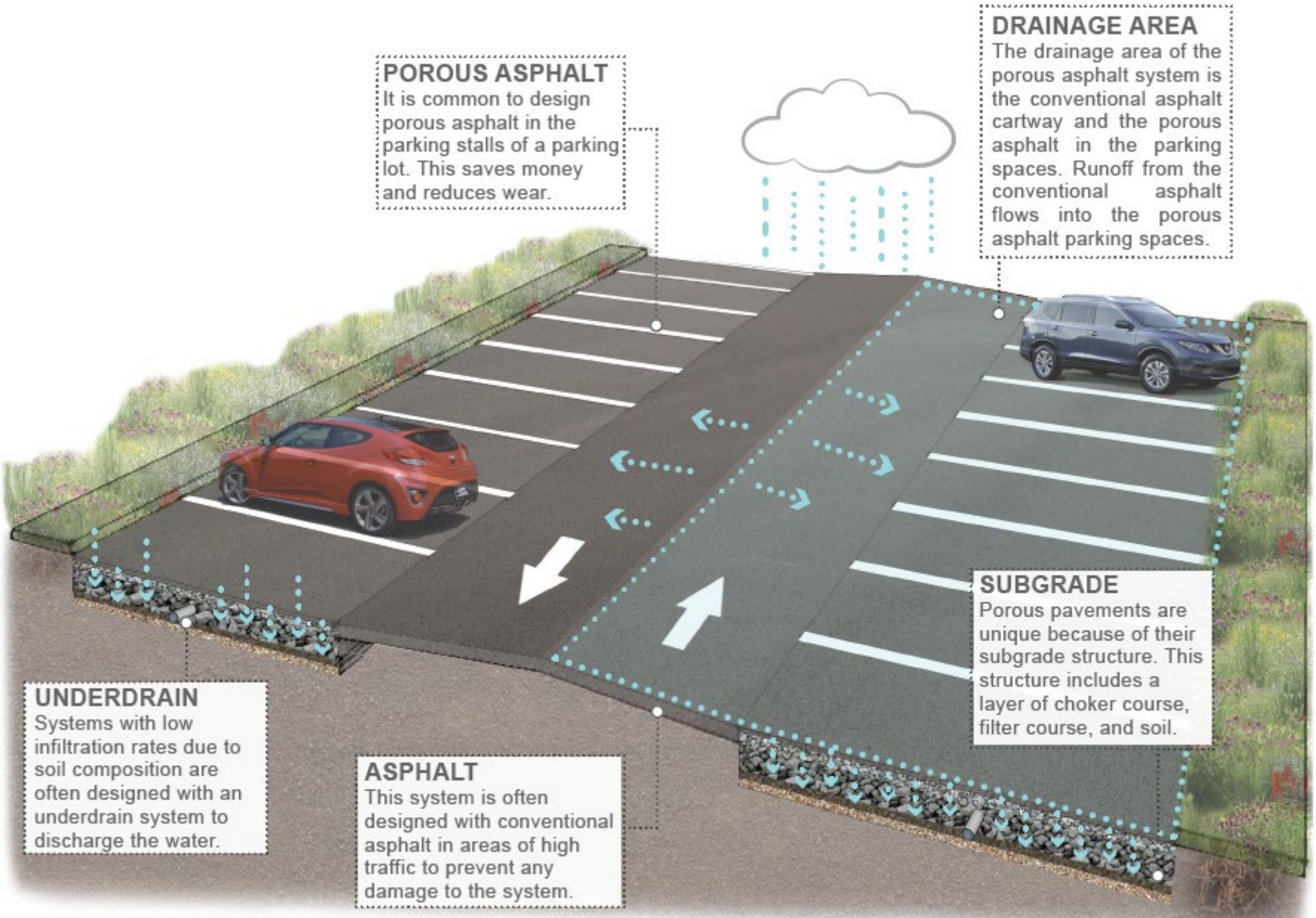
(only with a Waiver or Variance from N.J.A.C. 7:8-5.3)

Best Management Practice	Quality TSS removal rate (percent)	Quantity	Recharge	Minimum separation from seasonal high water table (feet)
Blue Roofs	0	Yes	No	N/A
Extended Detention Basins	40-60	Yes	No	1
Manufactured Treatment Device	50 or 80	No	No	Dependent upon the device
Sand Filters	80	Yes	No	1
Subsurface Gravel Wetlands	90	No	No	1
Wet ponds	50-90	Yes	No	N/A

If you need to recharge groundwater and reduce TSS by 80%, your options are:

- Pervious Pavement Systems
- Small-Scale Bioretention Basins
- Small-Scale Infiltration Basins
- Small-Scale Sand Filter

Pervious Paving Systems



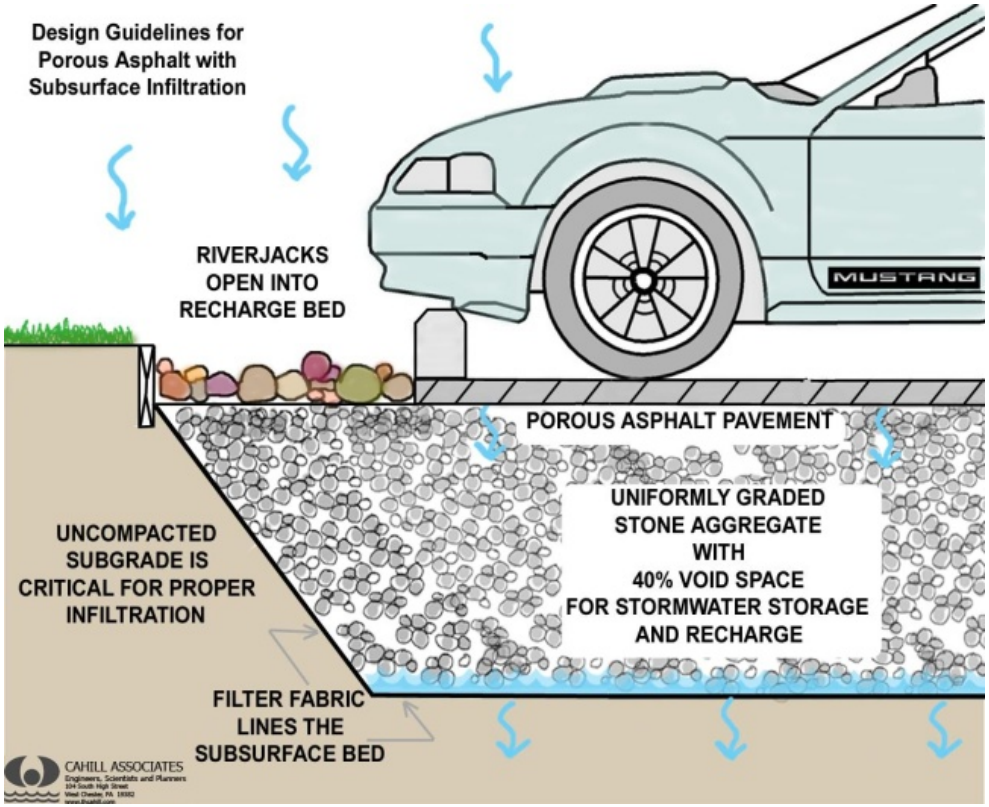
Permeable Pavements

- Underlying stone reservoir
- Porous asphalt and pervious concrete are manufactured without "fine" materials to allow infiltration
- Grass pavers are concrete interlocking blocks with open areas to allow grass to grow
- Ideal application for porous pavement is to treat a low traffic or overflow parking area

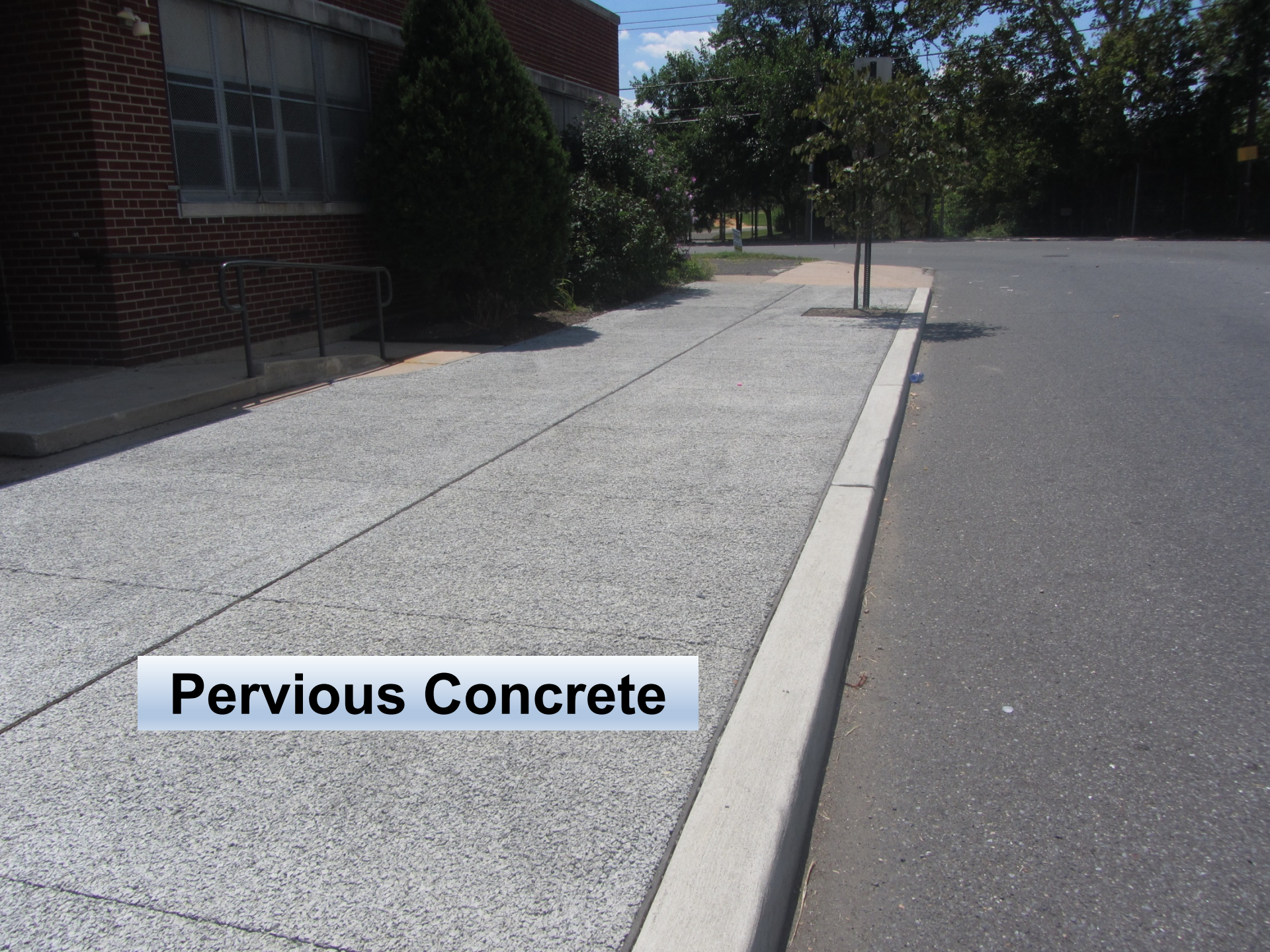
ADVANTAGES

- Manage stormwater runoff
- Minimize site disturbance
- Promote groundwater recharge
- Low life cycle costs, alternative to costly traditional stormwater management methods
- Mitigation of urban heat island effect
- Contaminant removal as water moves through layers of system

COMPONENTS



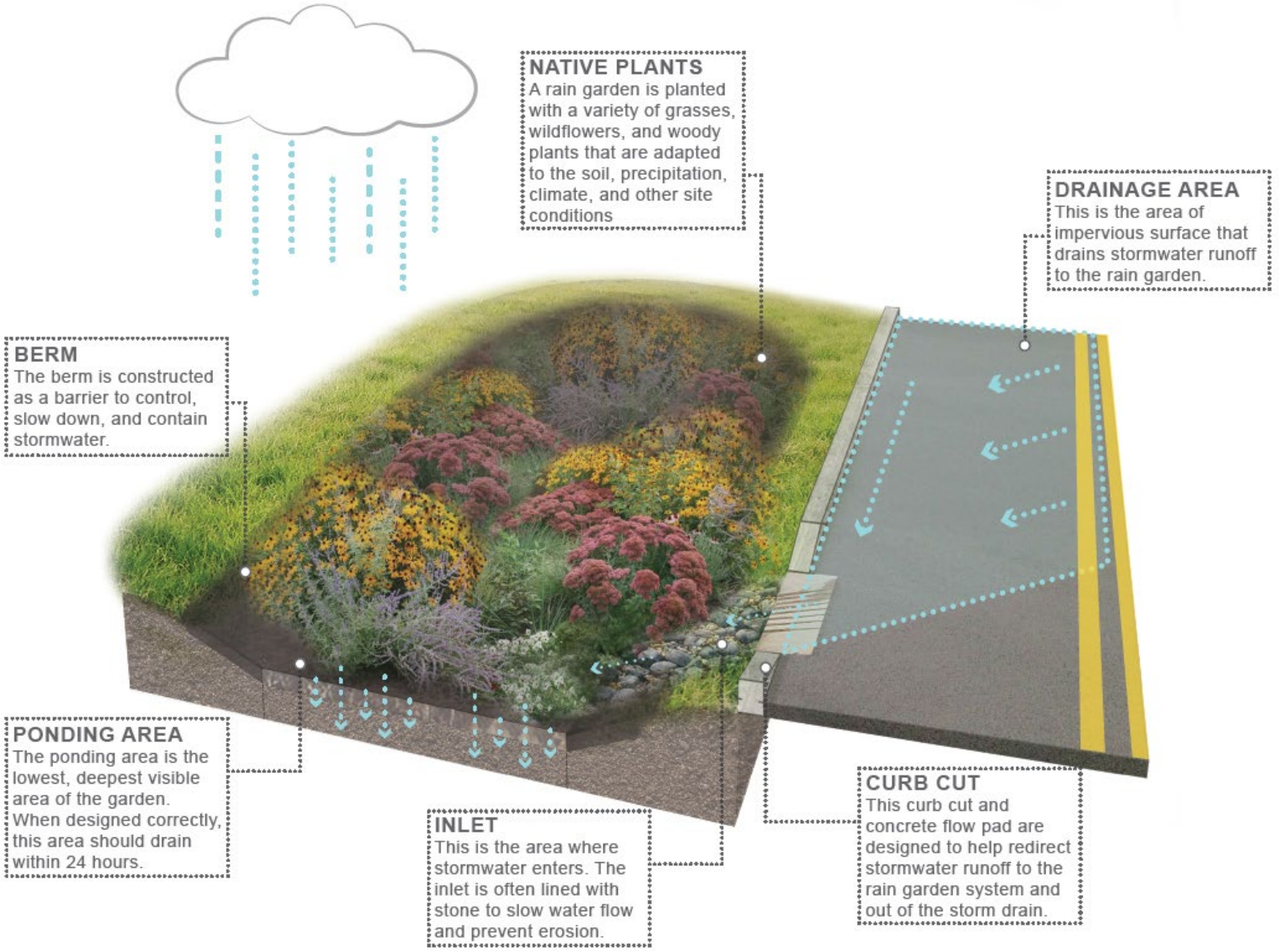
Porous Asphalt


Pervious Concrete


Permeable Pavers

Grass Pavers

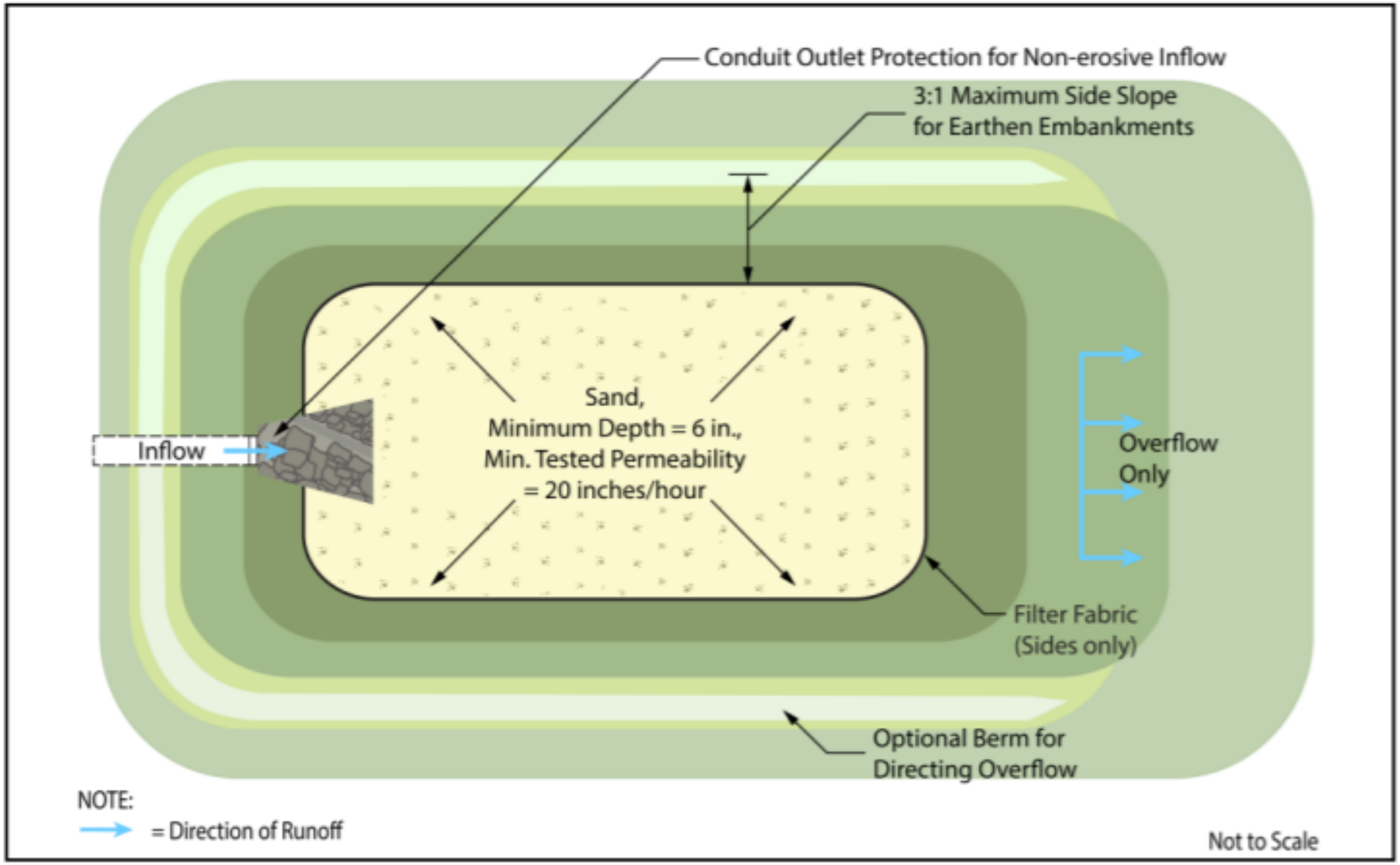
Small-Scale Bioretention Systems



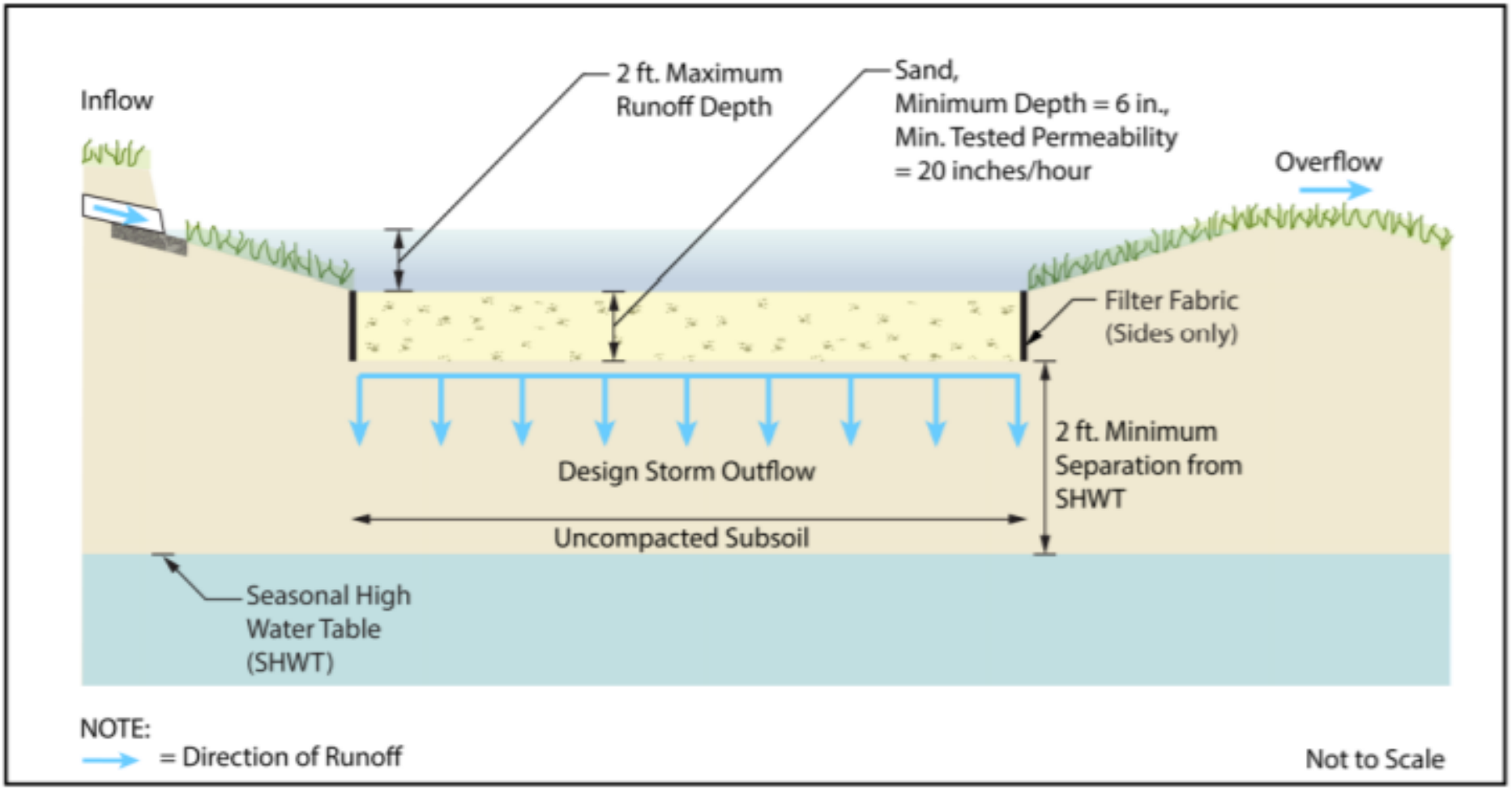
Lots of Bioretention Systems

Small-Scale Infiltration Systems

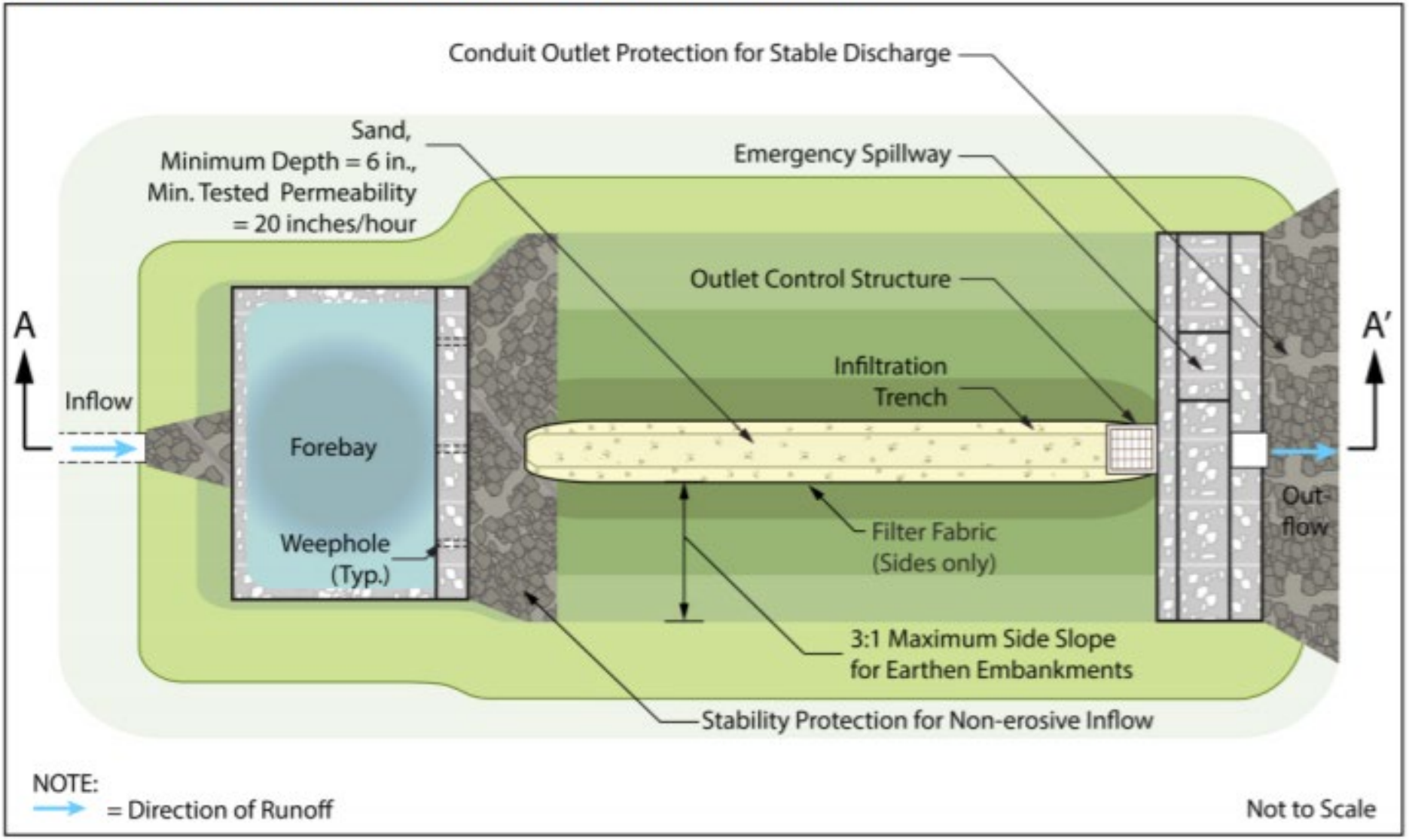
Surface Infiltration Basin – Plan View



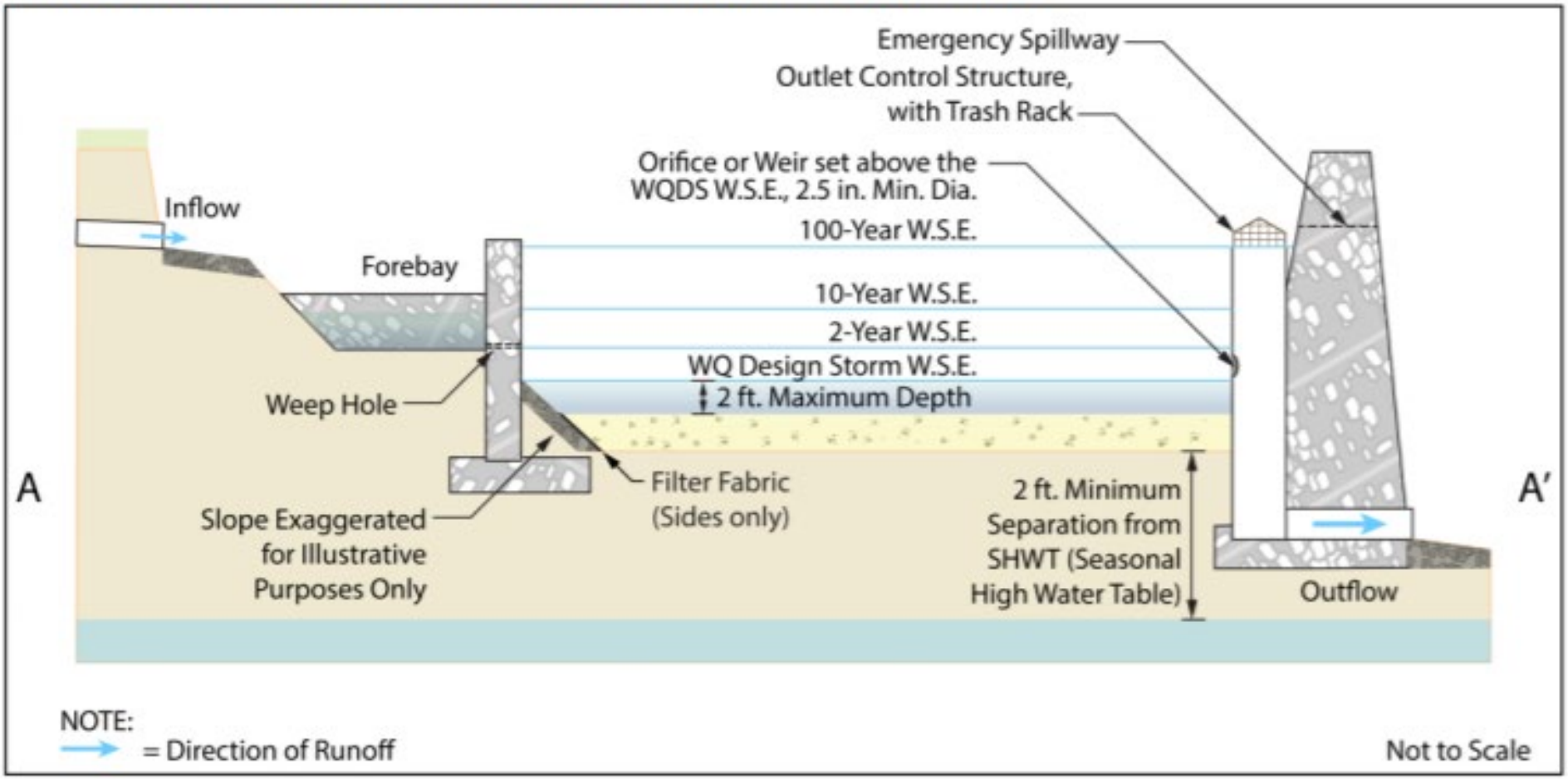
Surface Infiltration Basin – Profile View



Infiltration - Extended Detention Basin: Plan View

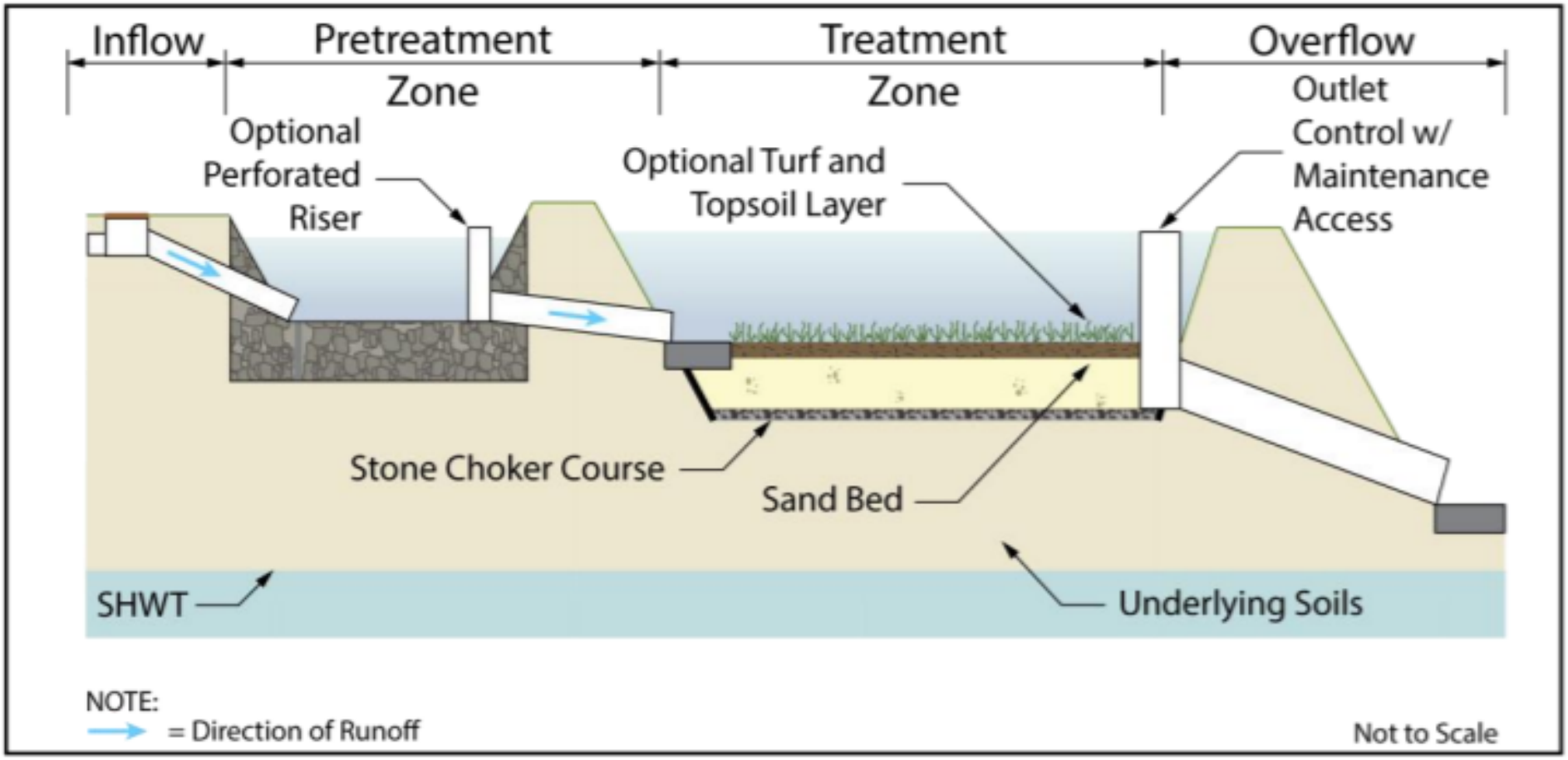


Infiltration – Extended Detention Basin: Profile View

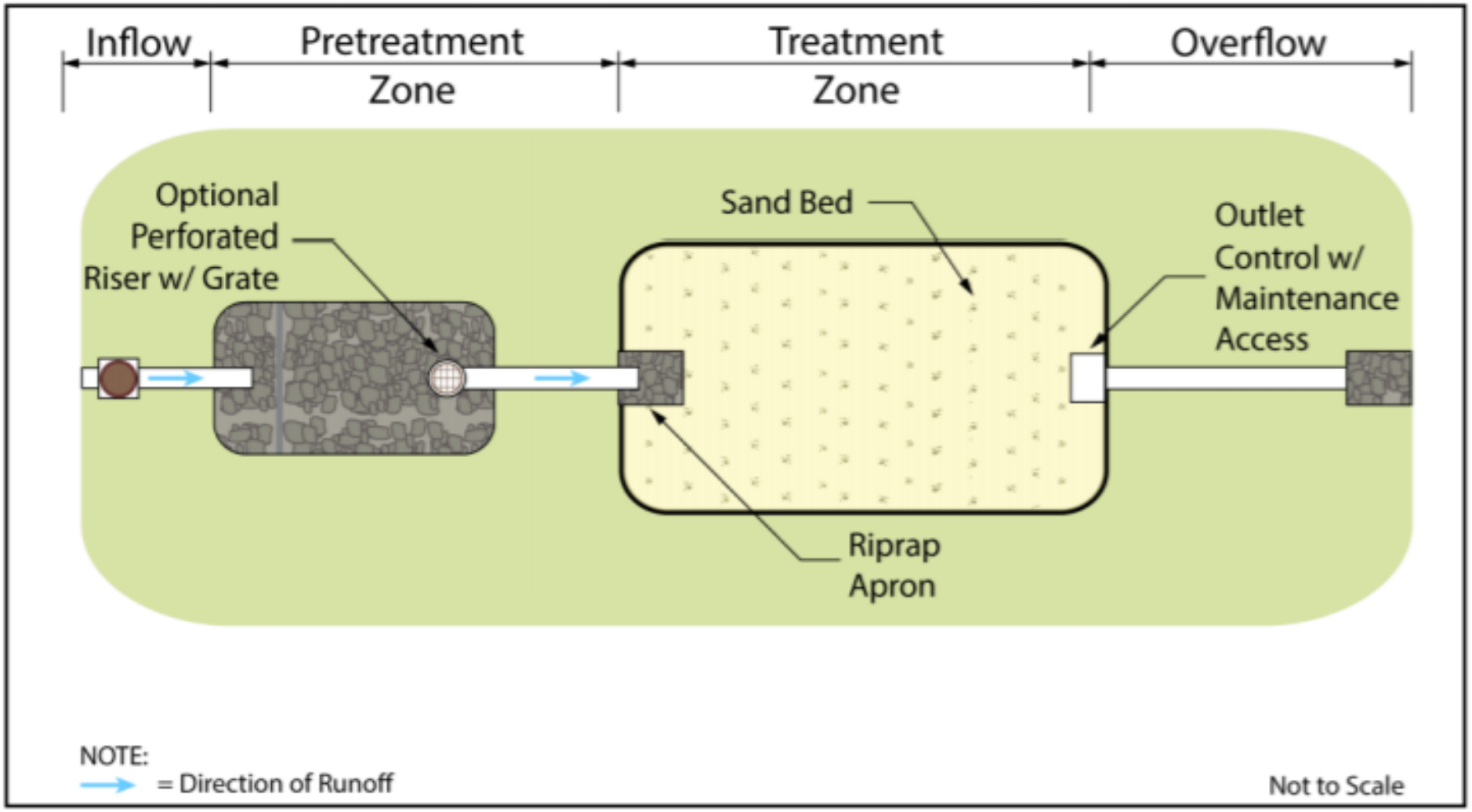


Small-Scale Sand Filter

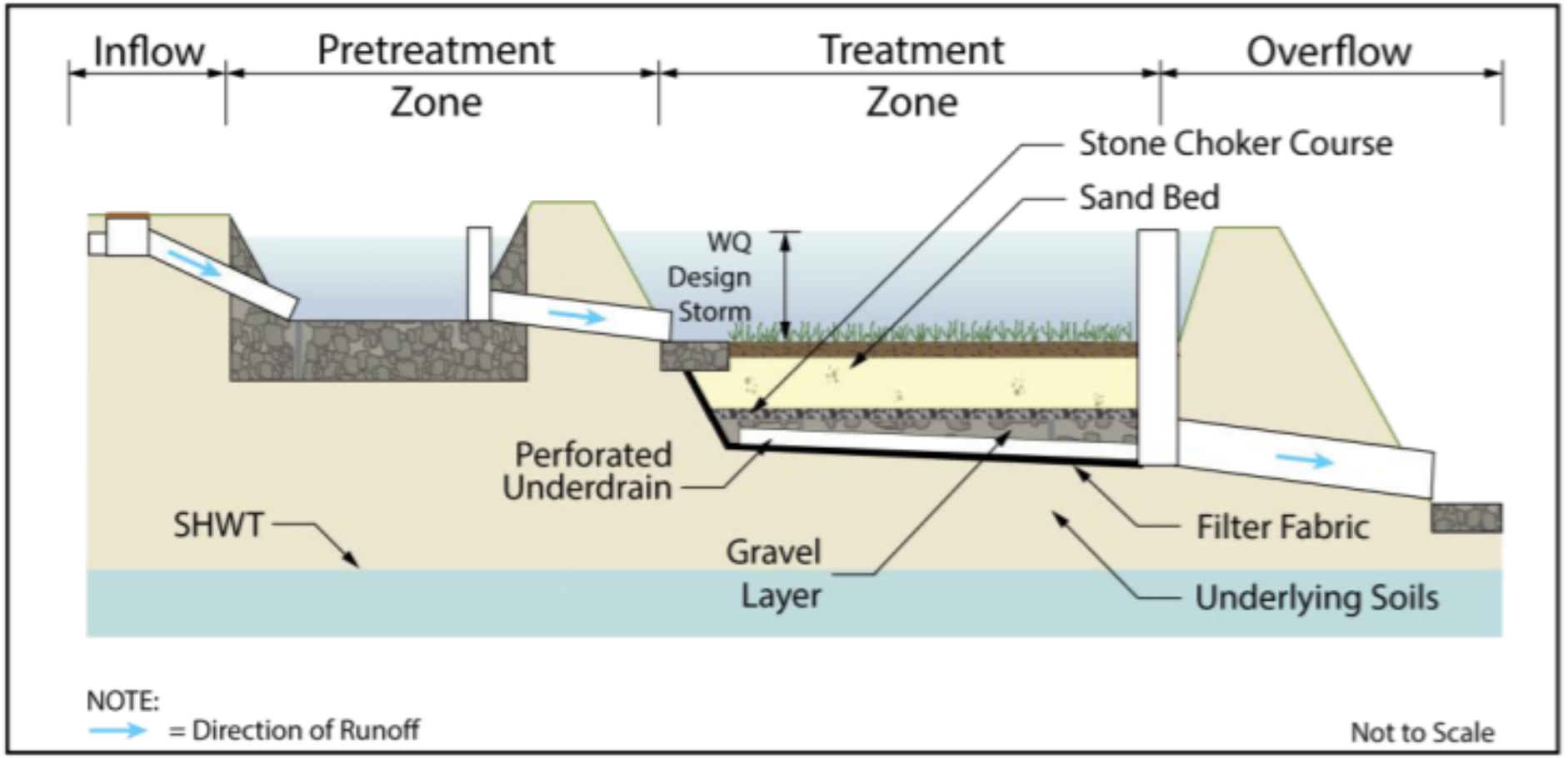
Profile View – Sand Filter Basics



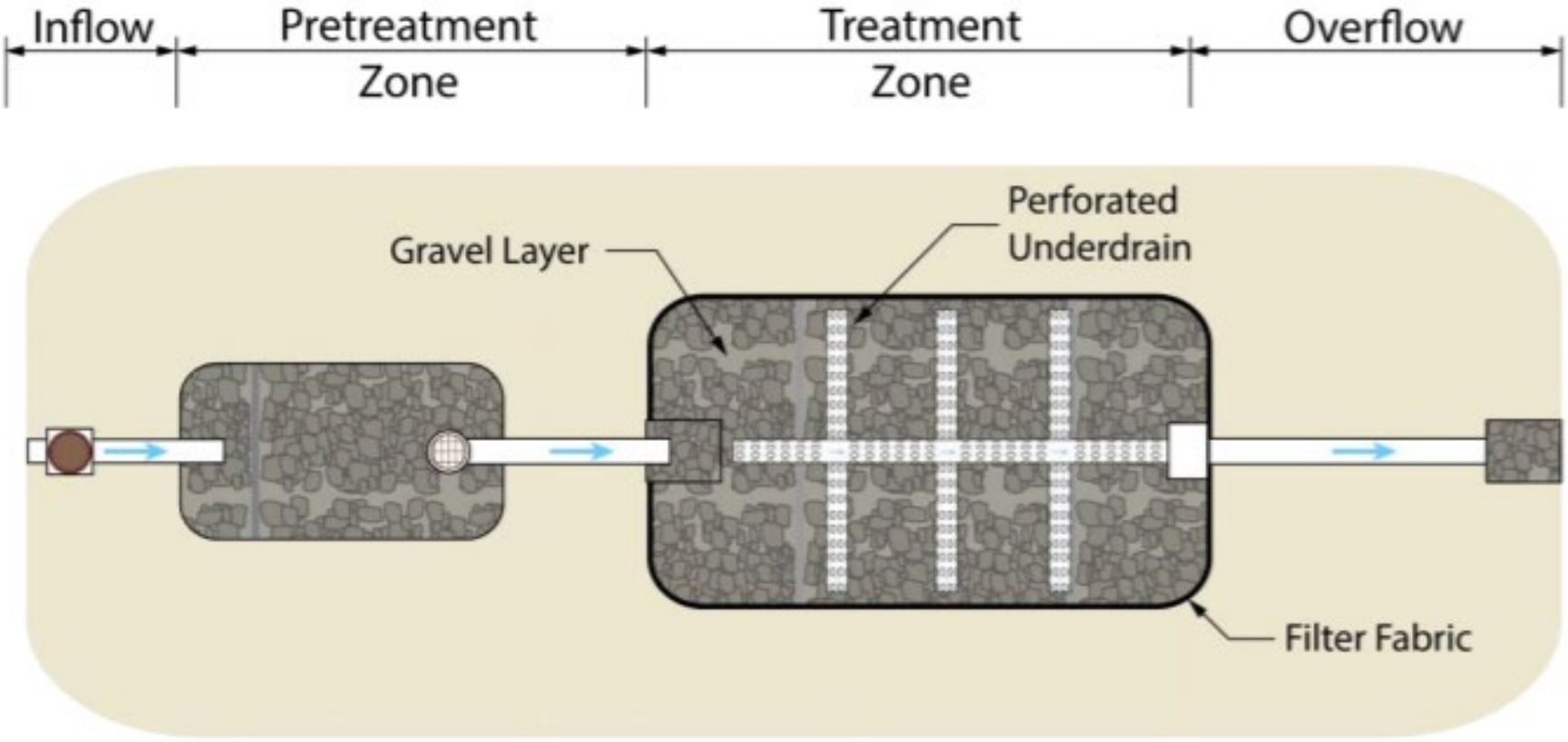
Plan View – Sand Filter Basics



Profile View – Sand Filter with Underdrain



Plan View – Sand Filter with Underdrain



NOTE:
→ = Direction of Runoff
Surface Vegetation, Topsoil, Sand Layer & Stone Choker Course Not Shown

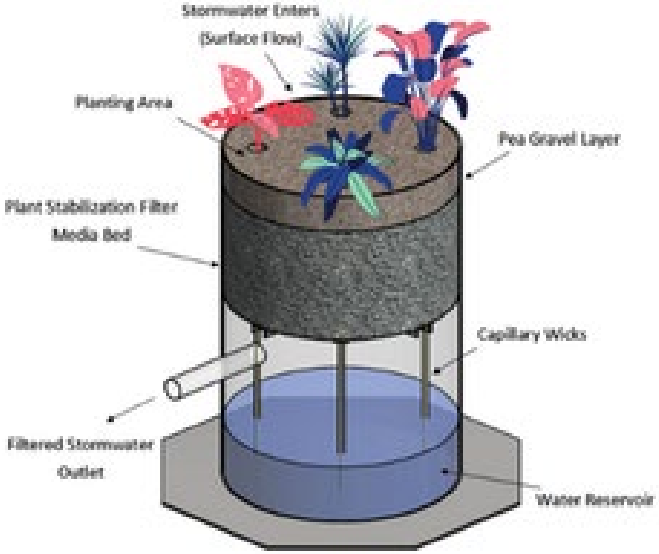
Not to Scale

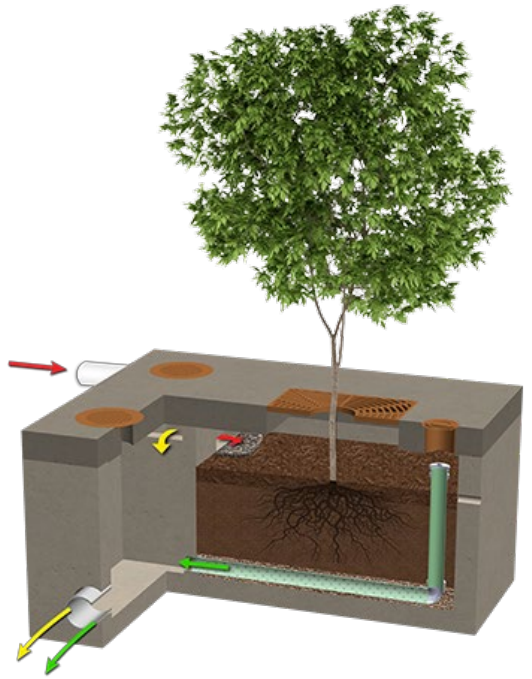
If you only need to reduce TSS by 80%, your options includes:

- Pervious Pavement Systems
- Small-Scale Bioretention Basins
- Small-Scale Infiltration Basins
- Small-Scale Sand Filter
- **Manufactured Treatment Device**

https://www.nj.gov/dep/stormwater/treatment.html

Devices Certified by NJDEP	MTD Laboratory Test Certifications	Superseded Certifications	Certified TSS Removal Rate	Maintenance Plan
Aqua-Ponic™ Stormwater Biofiltration System	Certification		80%	Plan
Biopod™ Biofilter with StormMix Media by Oldcastle Infrastructure	Certification	Superseded	80%	Plan
EcoPure BioFilter by Advanced Drainage Systems, Inc.	Certification		80%	Plan
Filterra Bioretention System by Contech Engineered Solutions	Certification	Superseded	80%	Plan
Filterra® HC Bioretention System by Contech Engineered Solutions	Certification		80%	Plan
StormScape™ Filter by Hydro International	Certification		80%	Plan
StormVault BioFiltration with Sierra Blend by Jensen	Certification		80%	Plan


Stormwater Enters
(Surface Flow)
Planting Area
Pea Gravel Layer
Plant Stabilization Filter
Media Bed
Capillary Wicks
Filtered Stormwater
Outlet
Water Reservoir



March 2021 – Major Development will mostly use these GI Practices

- Pervious Paving Systems
- Bioretention Systems
- Infiltration Basins
- Sand Filters

To satisfy groundwater recharge, stormwater quantity, and stormwater quality requirements.

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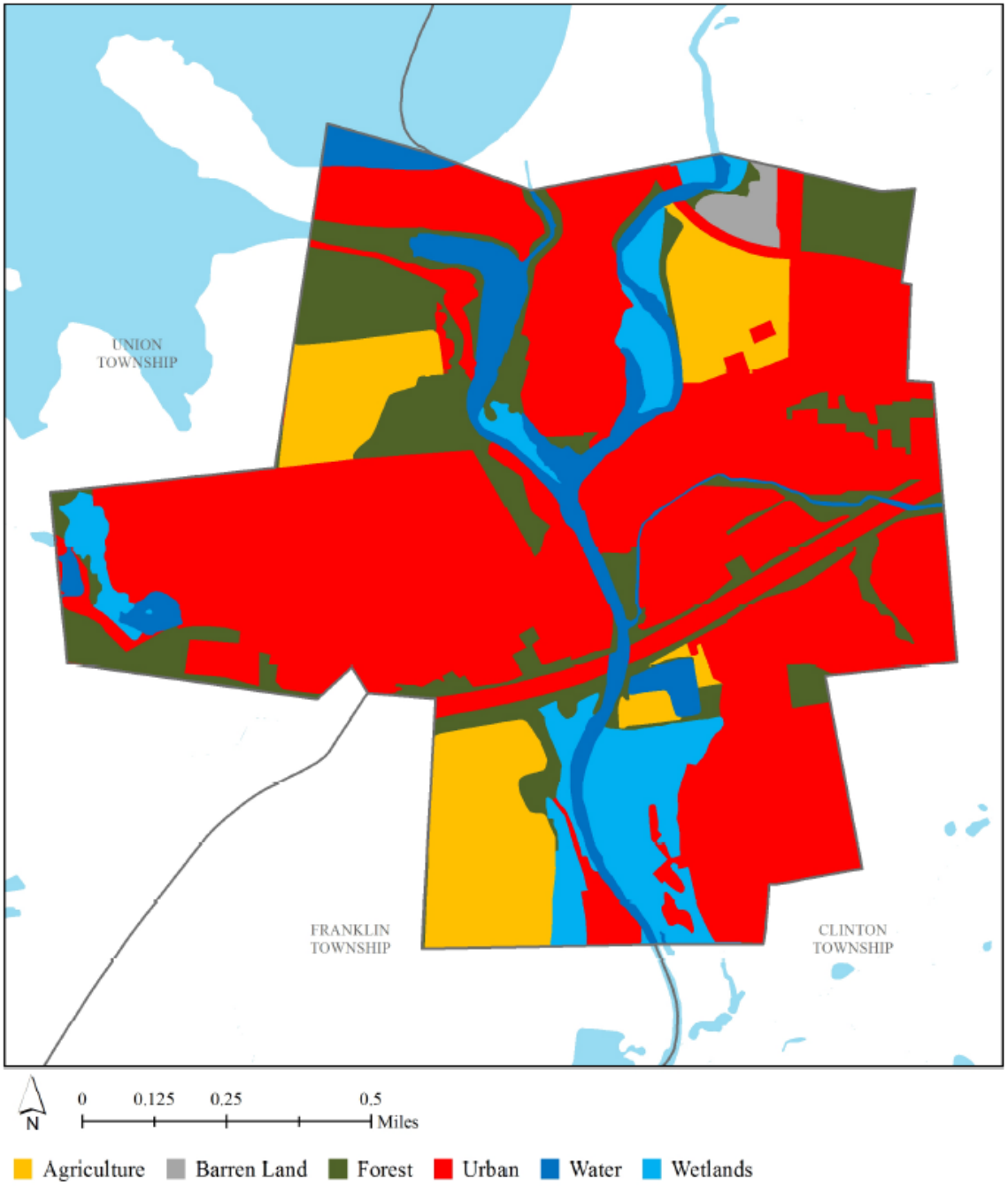
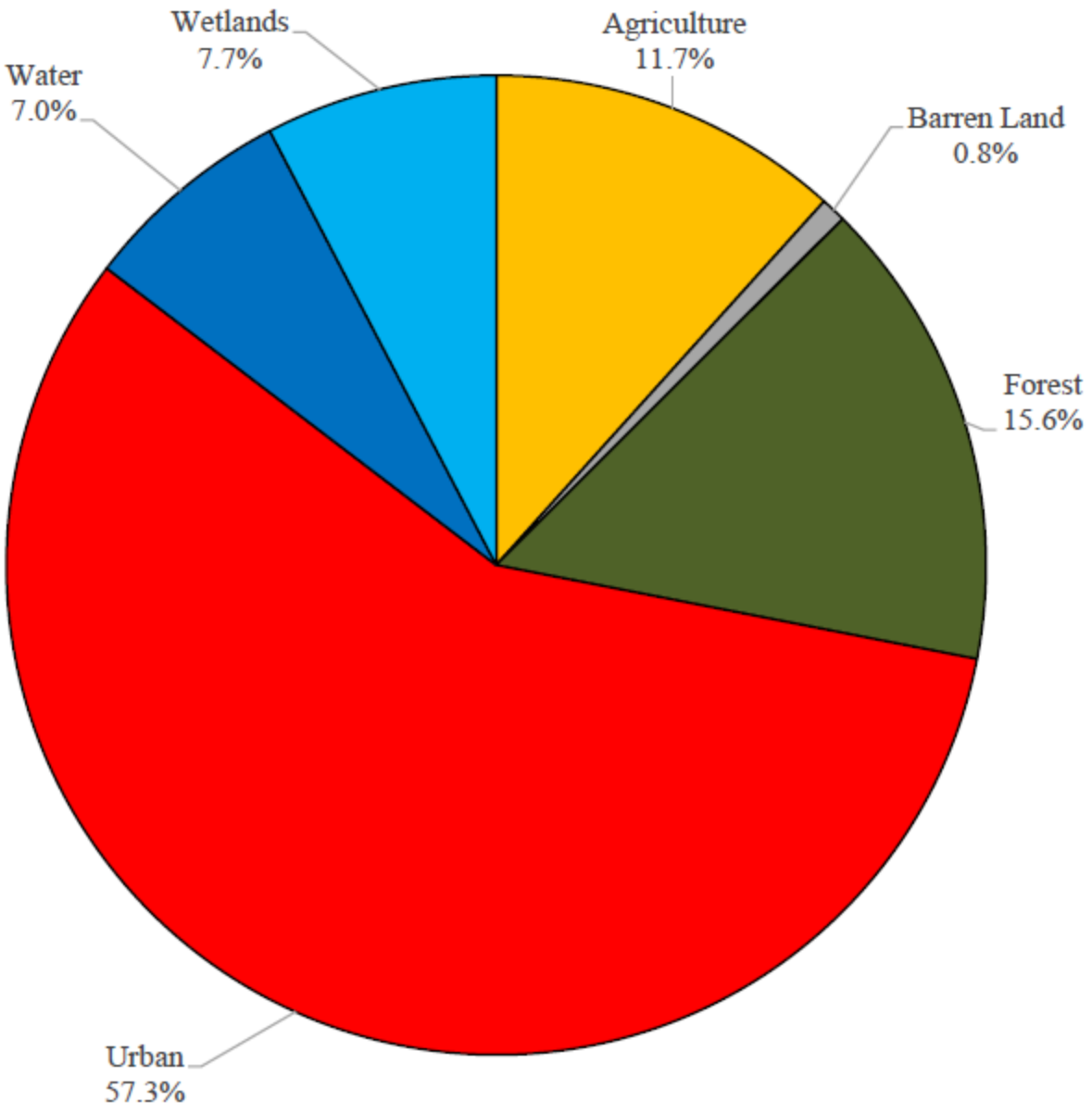
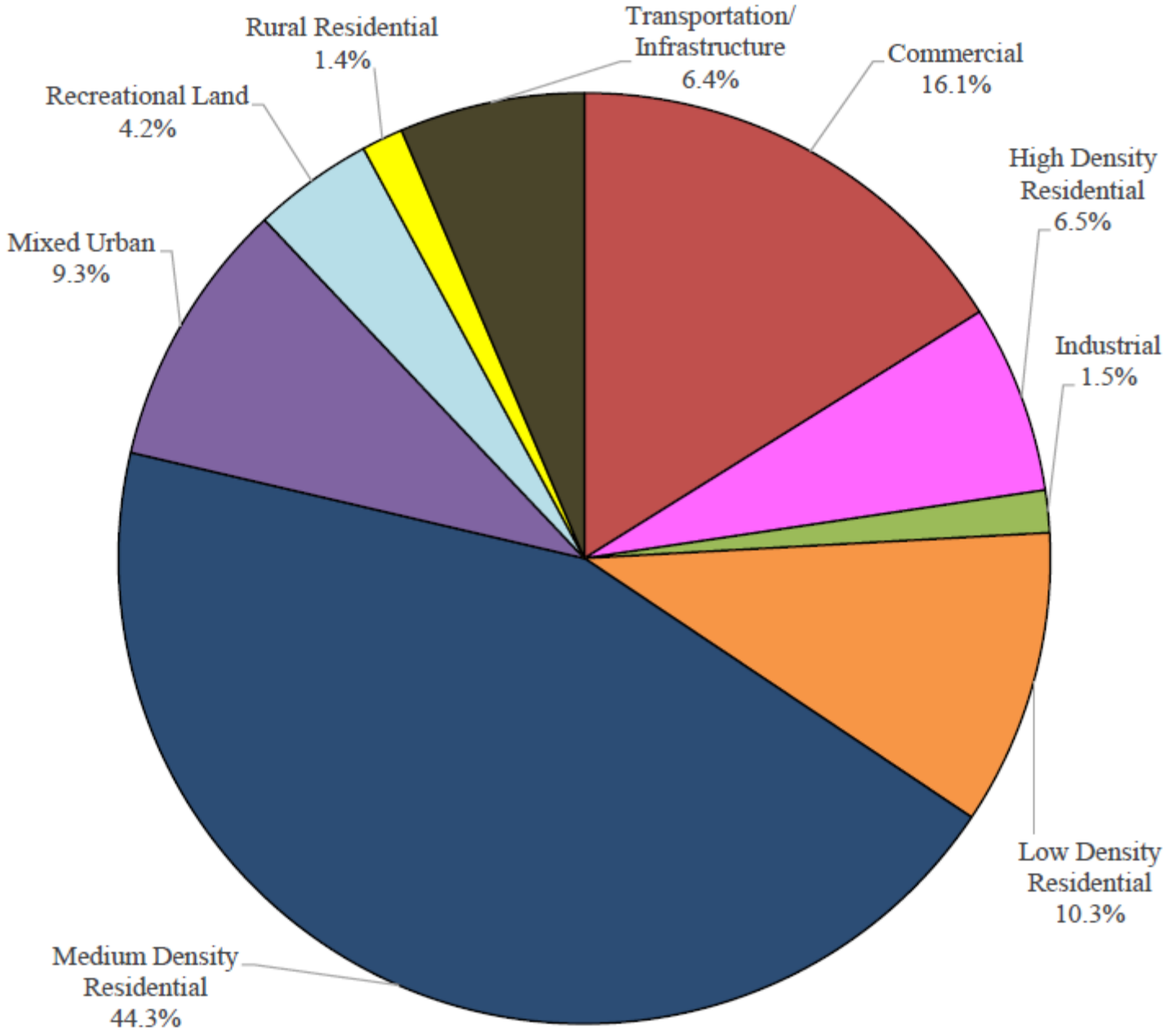
Green Infrastructure for Addressing Existing Development

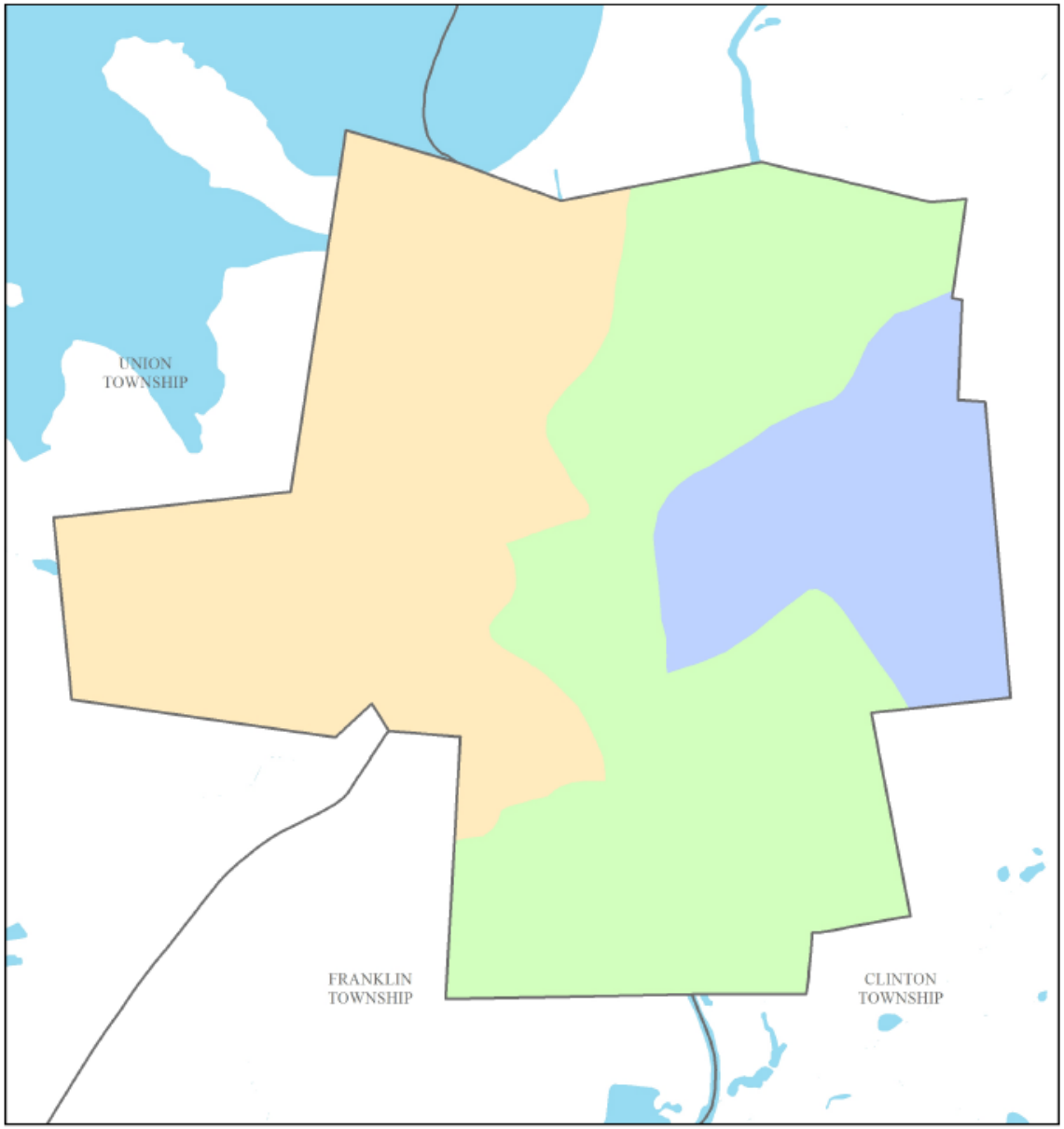
Land Use for Clinton Town




Wetlands
7.7%
Agriculture
11.7%
Water
7.0%
Barren Land
0.8%
Forest
15.6%
Urban
57.3%


Rural Residential
1.4%
Transportation/
Infrastructure
6.4%
Commercial
16.1%
Recreational Land
4.2%
High Density
Residential
6.5%
Mixed Urban
9.3%
Industrial
1.5%
Low Density
Residential
10.3%
Medium Density
Residential
44.3%

Subwatersheds of Clinton Town



Watershed	Total Area (ac)	Impervious Cover (ac)	%
Beaver Brook	152.3	70.8	47.4%
Raritan River South Branch	408.5	78.6	20.9%
Spruce Run Reservoir	357.1	60.7	18.5%
Total	917.9	210.2	24.6%

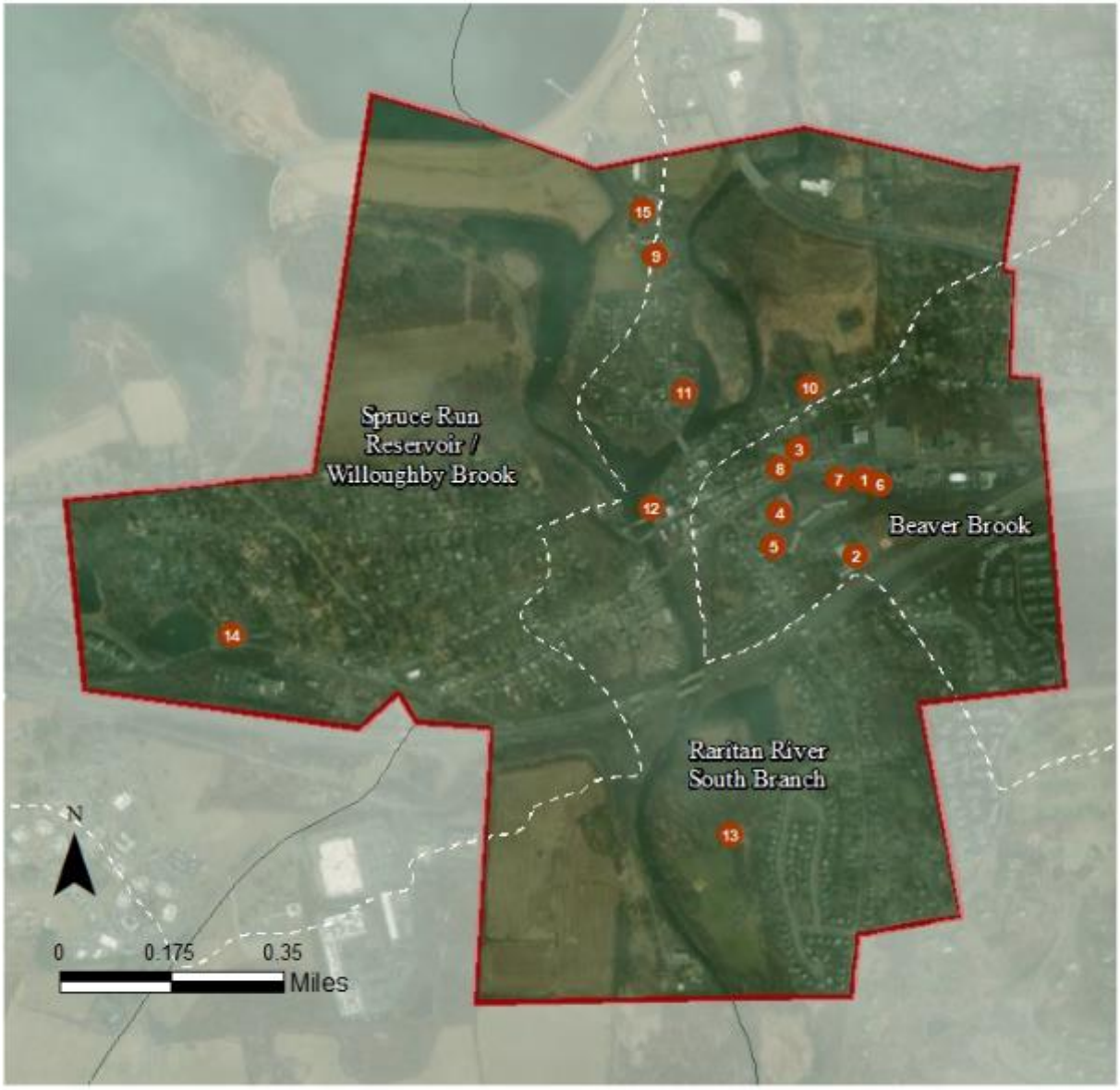
Subwatershed	NJ Water Quality Storm (MGal)	Annual Rainfall of 44" (MGal)	2-Year Design Storm (3.38”) (MGal)	10-Year Design Storm (5.00”) (MGal)	100-Year Design Storm (8.03”) (MGal)
Beaver Brook	2.4	84.6	6.5	9.6	15.4
Raritan River South Branch	2.7	93.9	7.2	10.7	17.1
Spruce Run Reservoir	2.1	72.5	5.6	8.2	13.2
Total	7.1	251.1	19.3	28.5	45.8

WE LOOK HERE FIRST:

- ✓Schools
- ✓Places of Worship
- ✓Libraries
- ✓Municipal Building
- ✓Public Works
- ✓Firehouses
- ✓Post Offices
- ✓Elks or Moose Lodge
- ✓Parks/ Recreational Fields

- 20 to 40 sites are entered into a PowerPoint
- Site visits are conducted

TOWN OF CLINTON: GREEN INFRASTRUCTURE SITES



SITES WITHIN THE BEAVER BROOK SUBWATERSHED

1. Basil Bandwagon
2. Clinton Elementary School
3. Clinton Fire Department
4. Clinton Municipal Offices
5. Evangel Chapel
6. Neo Sushi
7. Tirpok Cleaners
8. United States Postal Service

SITES WITHIN THE RARITAN RIVER SOUTH BRANCH SUBWATERSHED

9. Clinton Community Center
10. Clinton Presbyterian Church
11. Clinton United Methodist Church
12. Hunterdon Art Museum
13. Hunts Mills Park

SITES WITHIN THE SPRUCE RUN RESERVOIR /WILLOUGHBY BROOK SUBWATERSHED

14. Pediatric Surgical Associates
15. North County Library

PEDIATRIC SURGICAL ASSOCIATES

Subwatershed: Spruce Run Reservoir/Willoughby Brook

Site Area: 27,148 sq. ft.

Address: 122 West Main Street Clinton, NJ 08809

Block and Lot: Block 1, Lot 1

A proposed rain garden can be installed in the front of the building to aid in infiltration of stormwater from the roof top. A downspout planter box can be installed at the northwestern corner of the building to prevent rooftop stormwater from flowing across the pavement. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
69	18,661	0.9	9.4	85.7	0.015	0.51

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention system	0.016	3	1,200	0.05	155	$775
Planter box	n/a	1	n/a	n/a	1 (box)	$1,000

GREEN INFRASTRUCTURE RECOMMENDATIONS

Pediatric Surgical Associates

- planter box
- bioretention system
- drainage area
- property line
- 2015 Aerial: NJOIT, OGIS

0 20' 40'


Before

After

TYPES OF BIORETENTION

Bioretention Cells

- Single-family lots
- Commercial areas
- Parking lots

Rain Gardens

- Single-family lots
- Small commercial areas

Bioretention Swales/ Bioswales/Vegetated Swales

- Typically in right-of-way

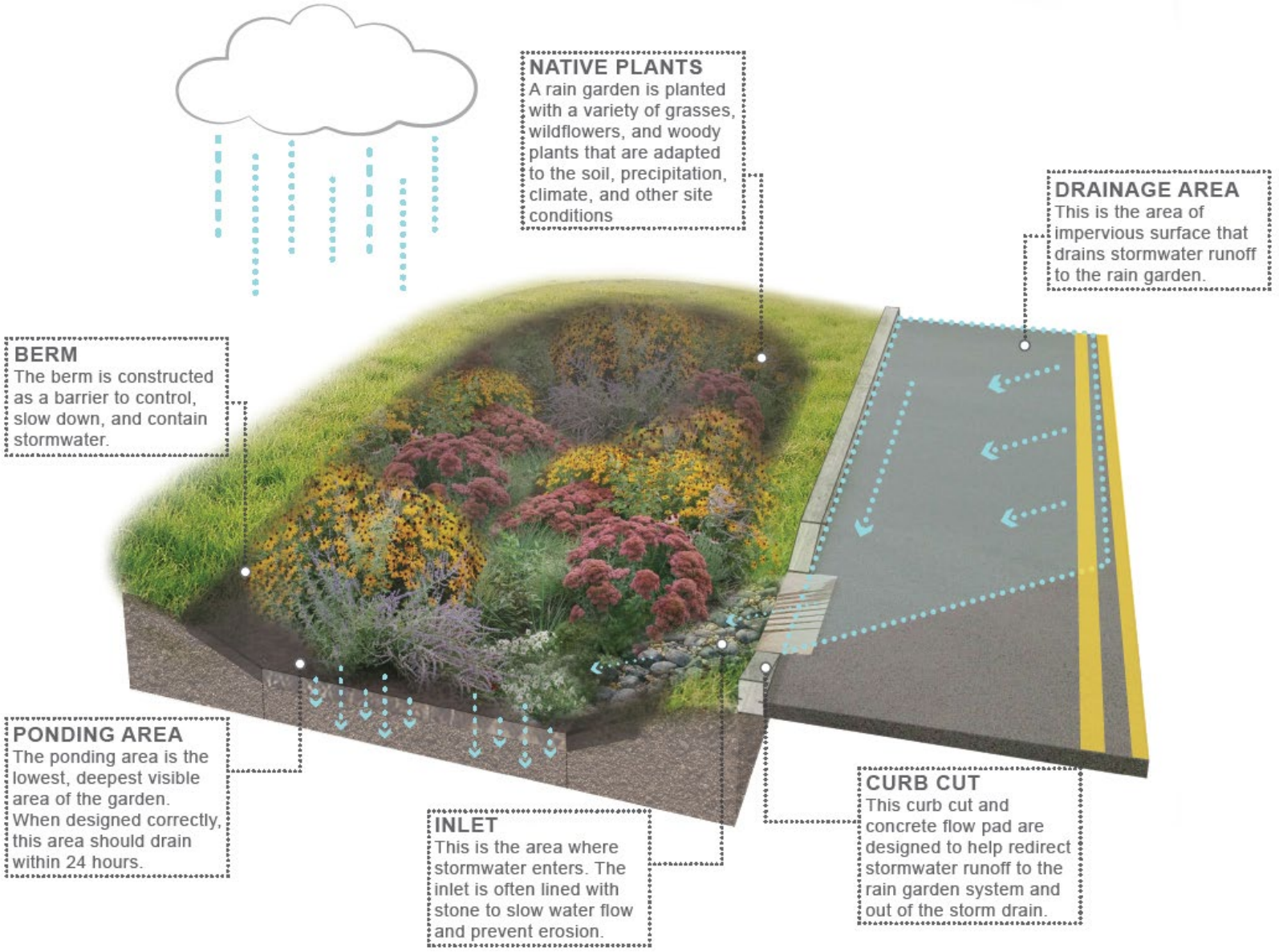
Planters & Planter Boxes

- Highly urban areas
- Right-of-way and adjacent to buildings

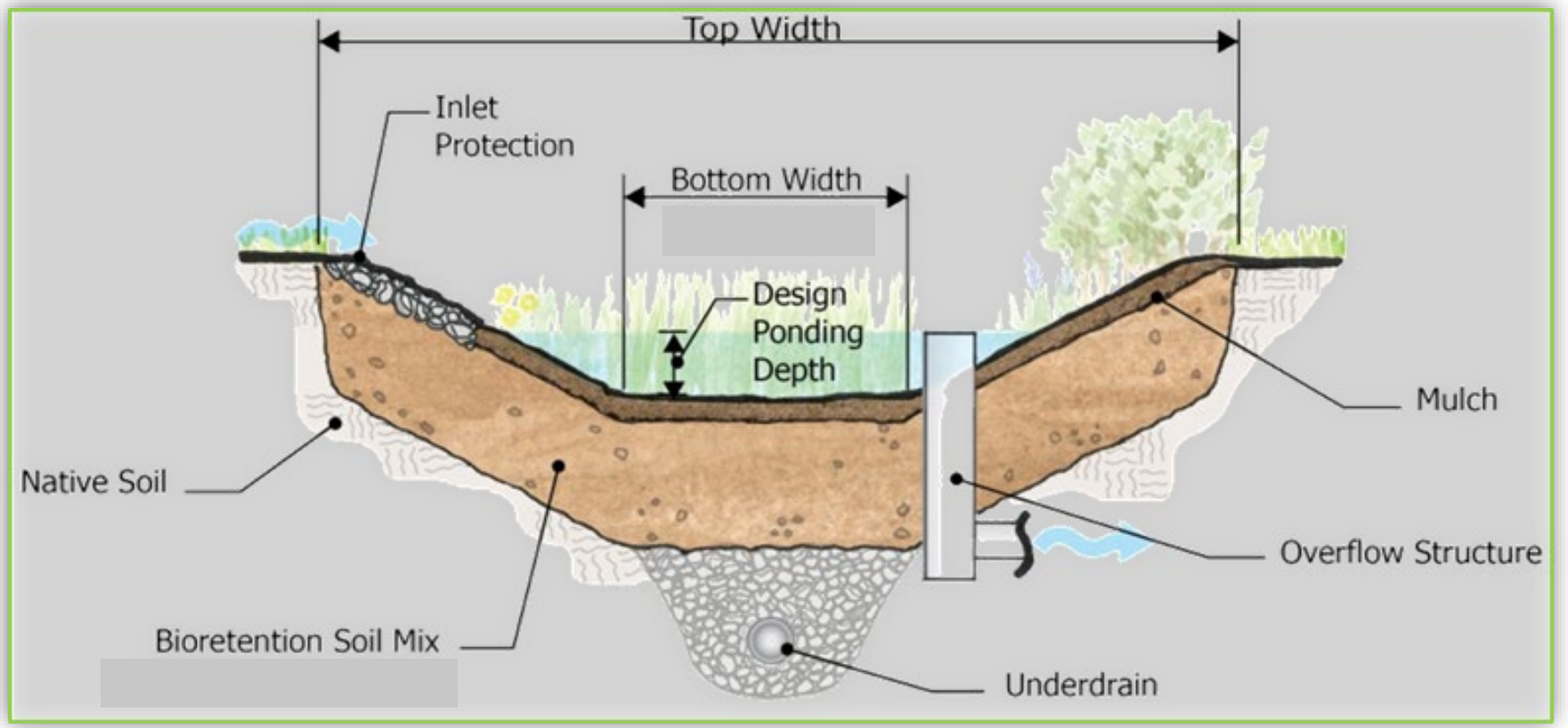
Vegetated Curb Extensions

- Bioretention incorporated into right-of-way in urban and suburban areas

Rain Gardens

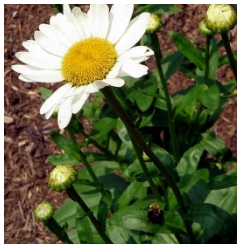


Rain Garden Cross-Section




8.2.2004

Lots of Rain Gardens

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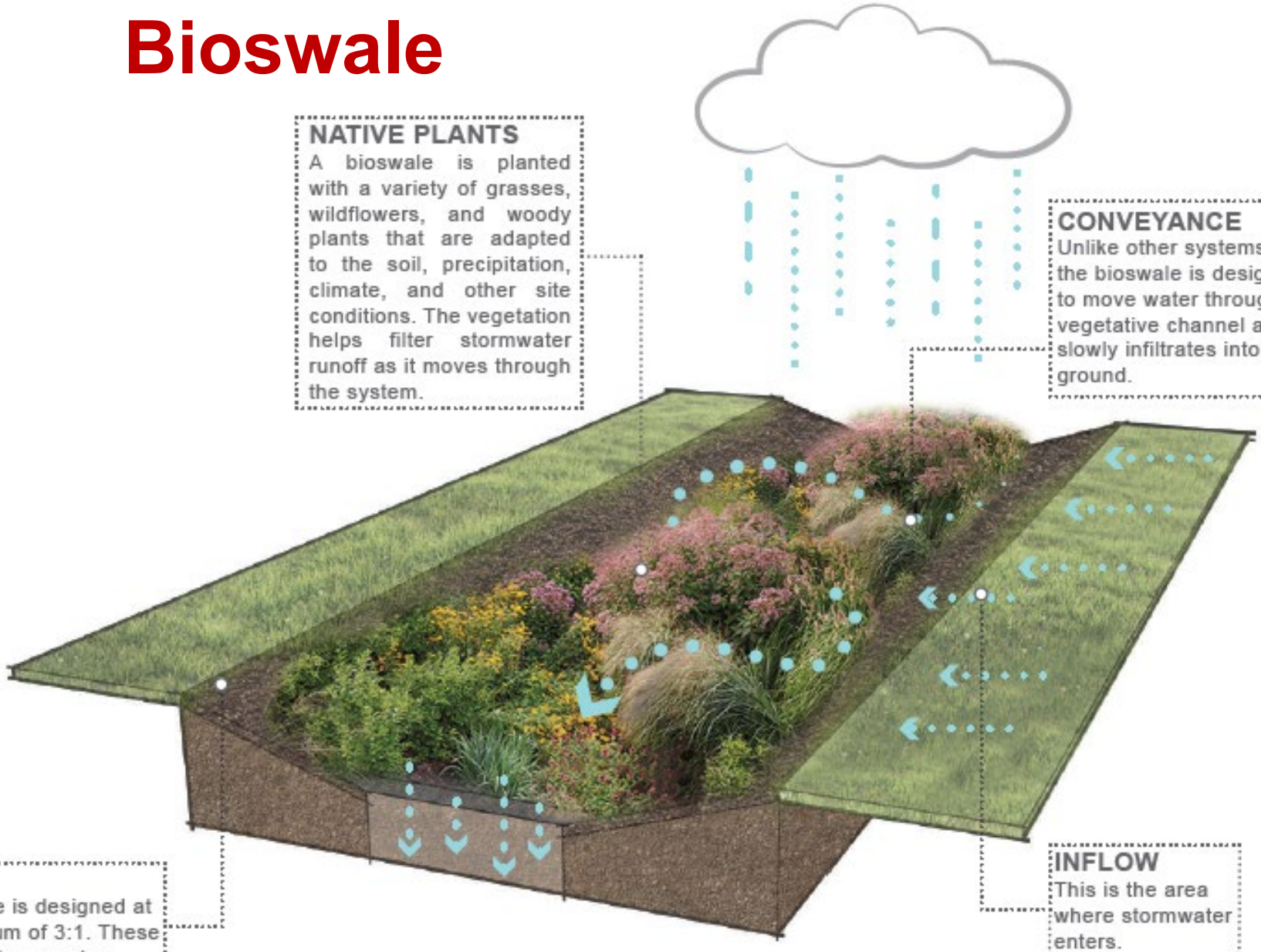
Bioswale



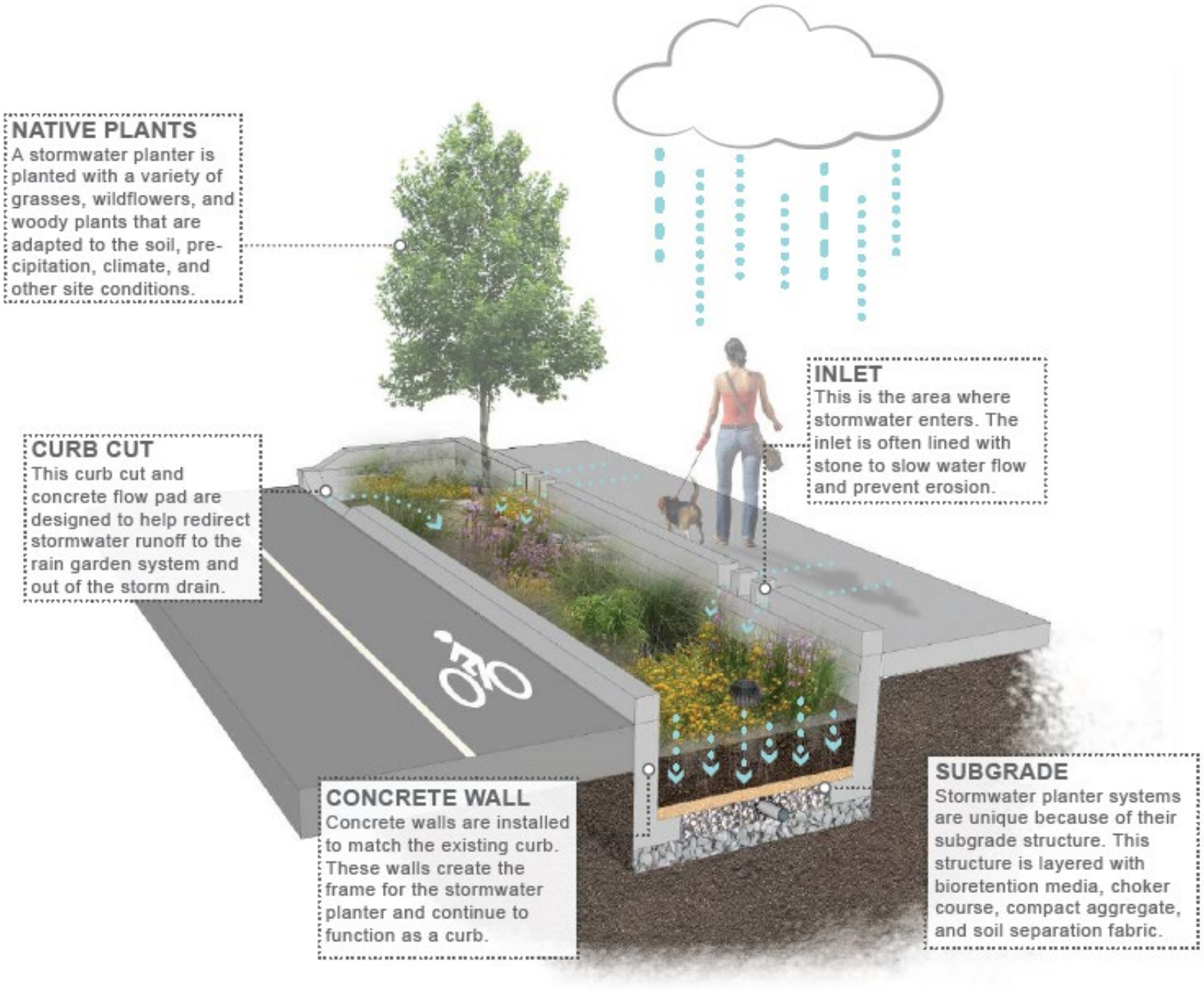
NATIVE PLANTS
A bioswale is planted with a variety of grasses, wildflowers, and woody plants that are adapted to the soil, precipitation, climate, and other site conditions. The vegetation helps filter stormwater runoff as it moves through the system.

CONVEYANCE
Unlike other systems, the bioswale is designed to move water through a vegetative channel as it slowly infiltrates into the ground.

SLOPE
The slope is designed at a maximum of 3:1. These slopes often require erosion control materials for stabilization.

INFLOW
This is the area where stormwater enters.

Stormwater Planters



OTES:

3 AND OTHER
CTIONS (E.G. SCUPPER,
RUNNEL) FROM BUILDING
GN PONDING ELEVATION.
E SAN FRANCISCO DBI
NCE CONNECTION

F EXISTING SUBGRADE
INFILTRATION FACILITIES.

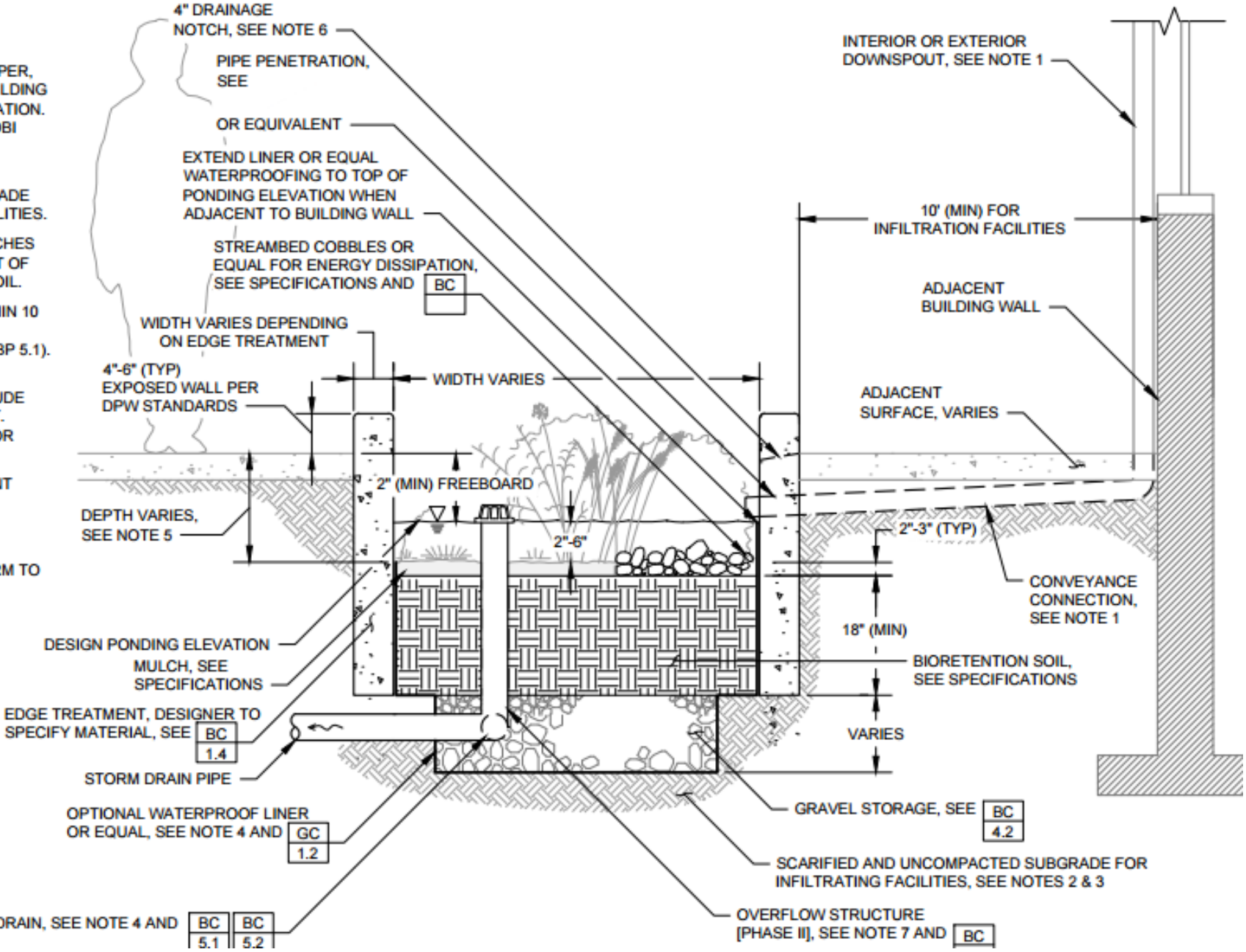
O A DEPTH OF 6 INCHES
IOR TO PLACEMENT OF
O BIORETENTION SOIL.

ER REQUIRED WITHIN 10
/ELOPE UNLESS
INER NOTE 8 (SEE BP 5.1).

TOP OF WALKING
MULCH SHALL INCLUDE
SOIL SETTLEMENT.
ISCO DBI CODES FOR
REQUIREMENTS.

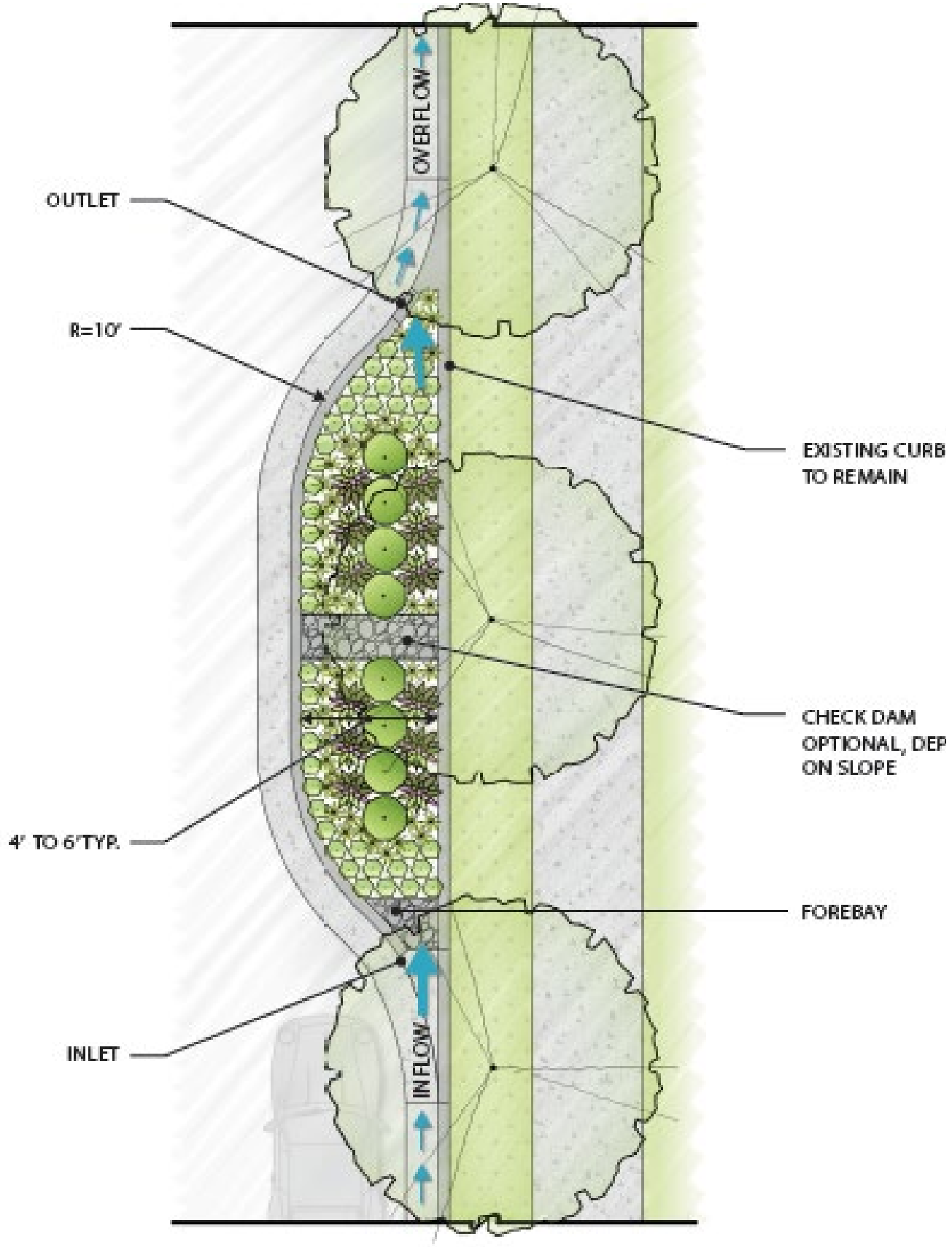
OTCHES TO PREVENT
NTER WALL. SLOPE
O PLANTER.

ORKMANSHIP FOR
RES SHALL CONFORM TO
NCISCO DBI CODES.

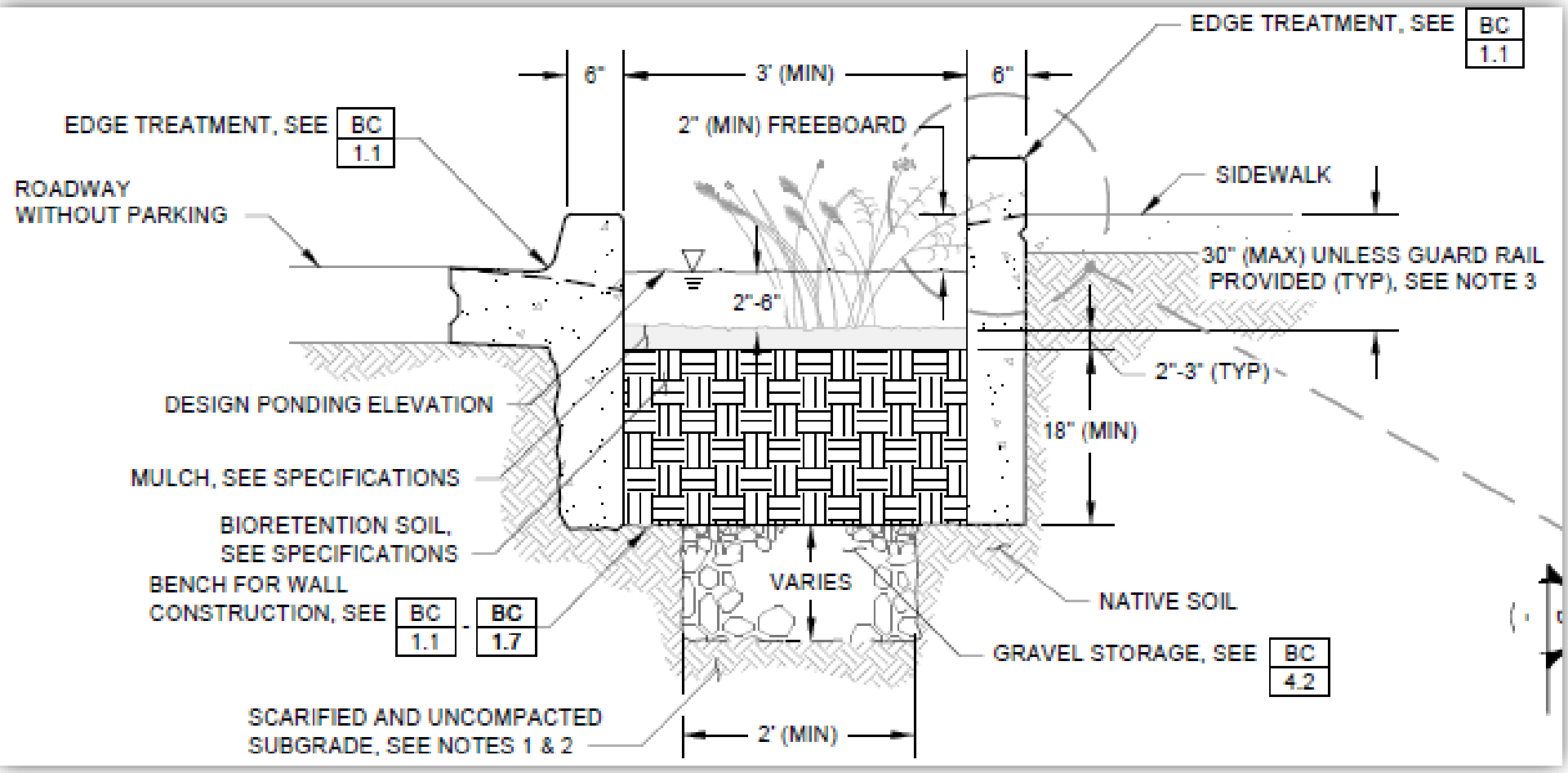


Stormwater Planter Cross-section

Curb Extensions



NOTE:
Graphic adapted fr
Portland, OR Storm
Manual Details


6"
3' (MIN)
6"
EDGE TREATMENT, SEE BC 1.1
2" (MIN) FREEBOARD
EDGE TREATMENT, SEE BC 1.1
ROADWAY WITHOUT PARKING
SIDEWALK
30" (MAX) UNLESS GUARD RAIL PROVIDED (TYP), SEE NOTE 3
2"-6"
2"-3" (TYP)
DESIGN PONDING ELEVATION
18" (MIN)
MULCH, SEE SPECIFICATIONS
BIORETENTION SOIL, SEE SPECIFICATIONS
BENCH FOR WALL CONSTRUCTION, SEE BC 1.1 - BC 1.7
VARIES
NATIVE SOIL
GRAVEL STORAGE, SEE BC 4.2
SCARIFIED AND UNCOMPACTED SUBGRADE, SEE NOTES 1 & 2
2' (MIN)


QUESTIONS?