

2.3.5 Private Simplified Stormwater Facility Typical Details

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- DRAWING NOT TO SCALE -

STORMWATER MANAGEMENT TYPICAL DETAILS

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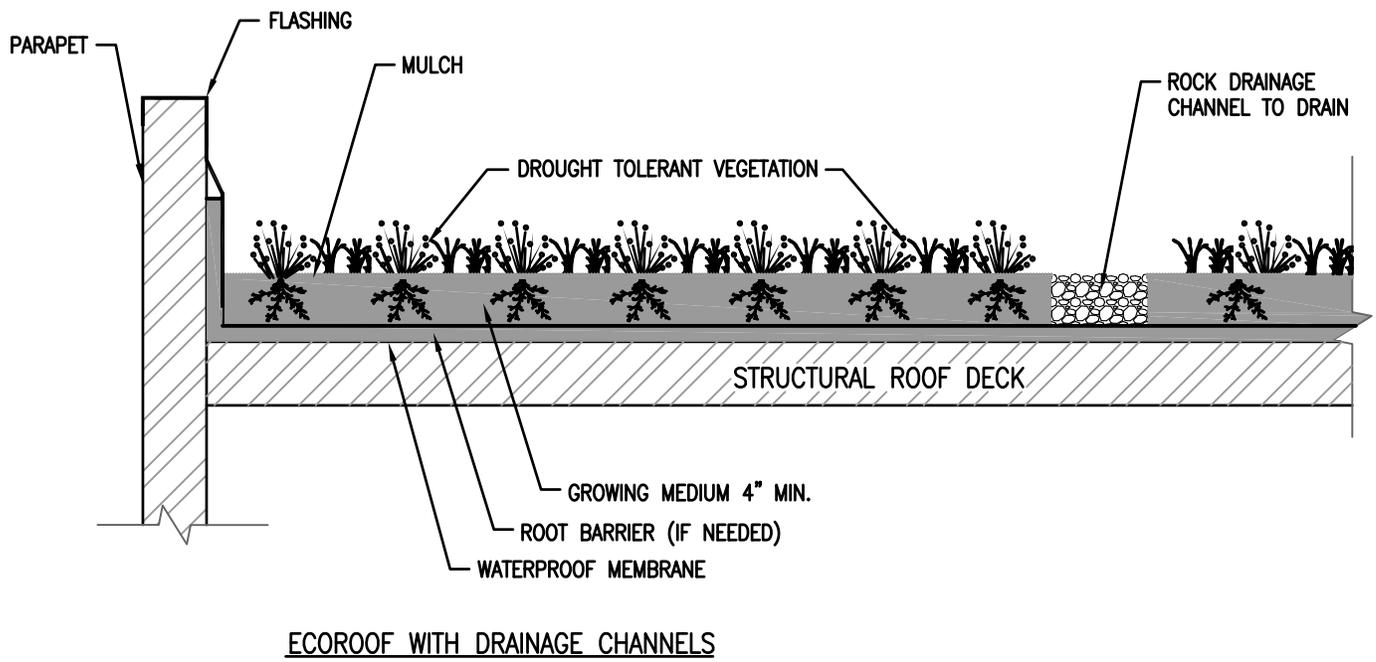
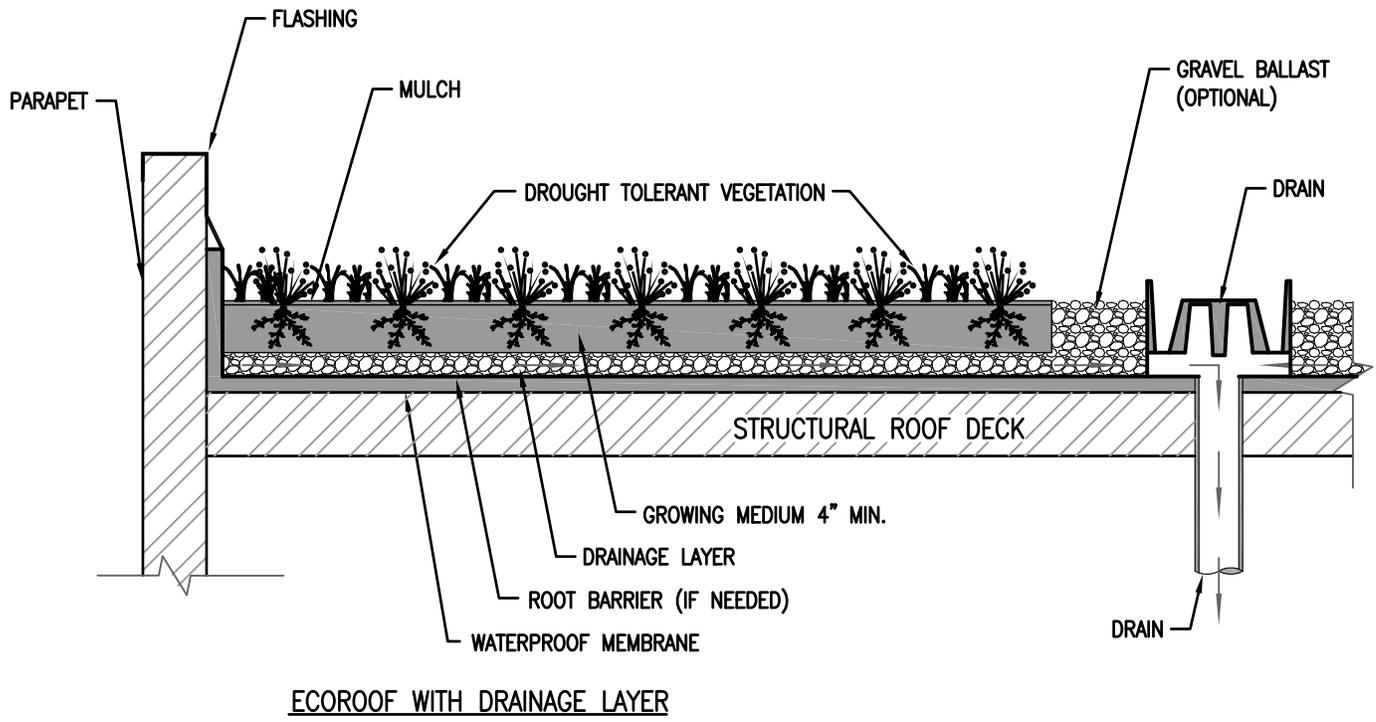
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STORMWATER MANAGEMENT TYPICAL DETAILS

- Simplified Design Approach -
Ecoroof

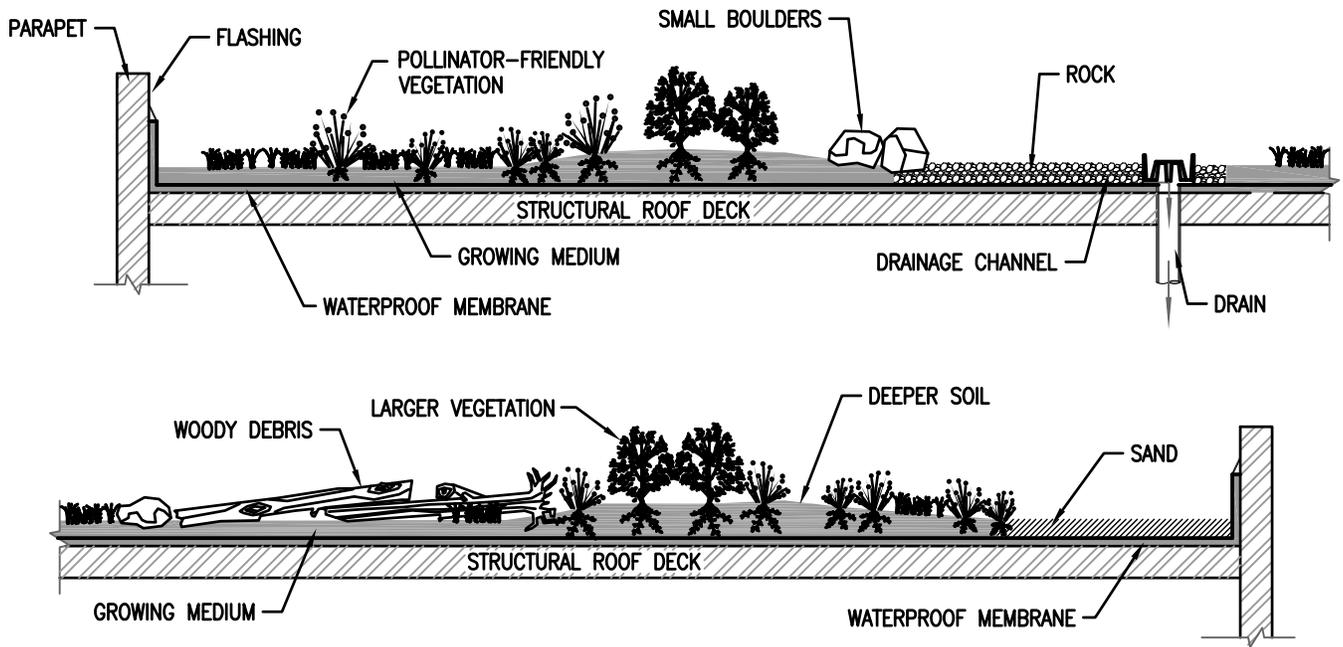


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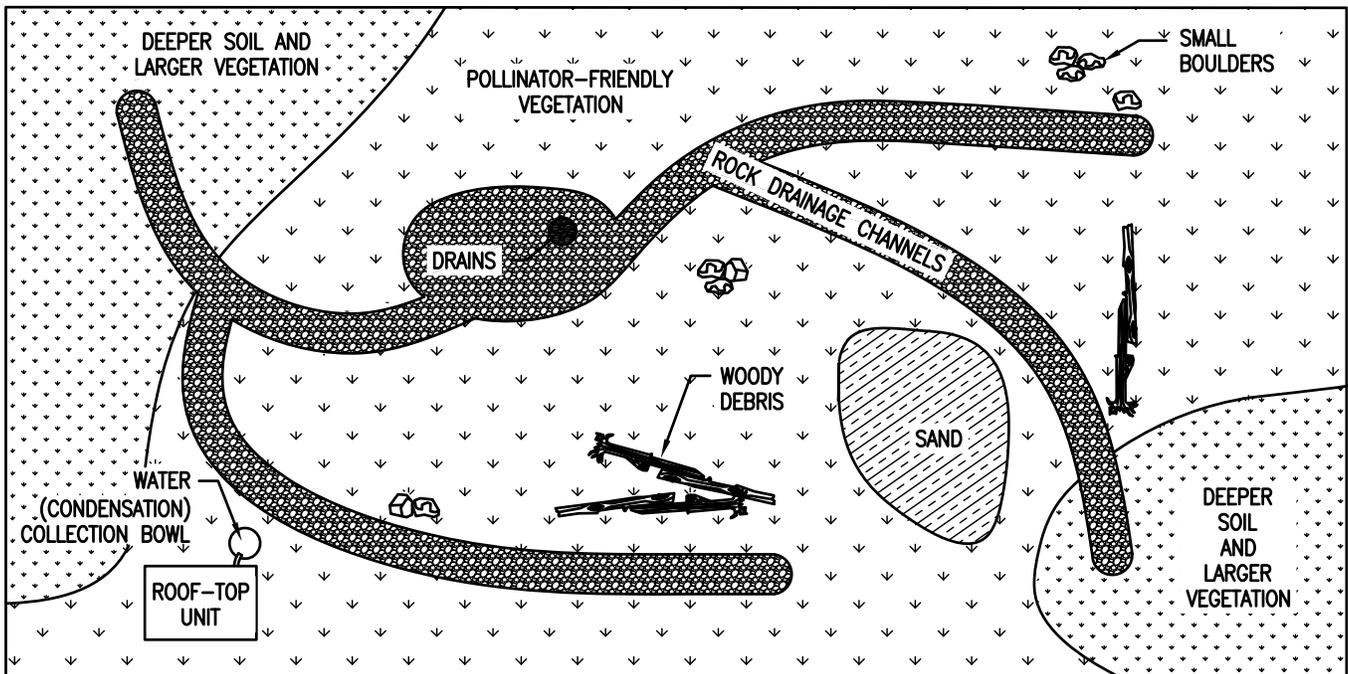
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SW-100
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HABITAT ECOROOF EXAMPLE SECTIONS

NOTE: Building elements such as glass and lighting placed near ecoroofs have the potential to exacerbate bird-strike mortality. BES recommends designs comply with Portland's Resource Guide for Bird-Friendly Building Design: <http://www.portlandoregon.gov/bps/article/446308>



HABITAT ECOROOF WITH DRAINAGE CHANNELS - EXAMPLE PLAN

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STORMWATER MANAGEMENT TYPICAL DETAILS

- Simplified Design Approach -
Habitat Ecoroof

NUMBER

SW-101
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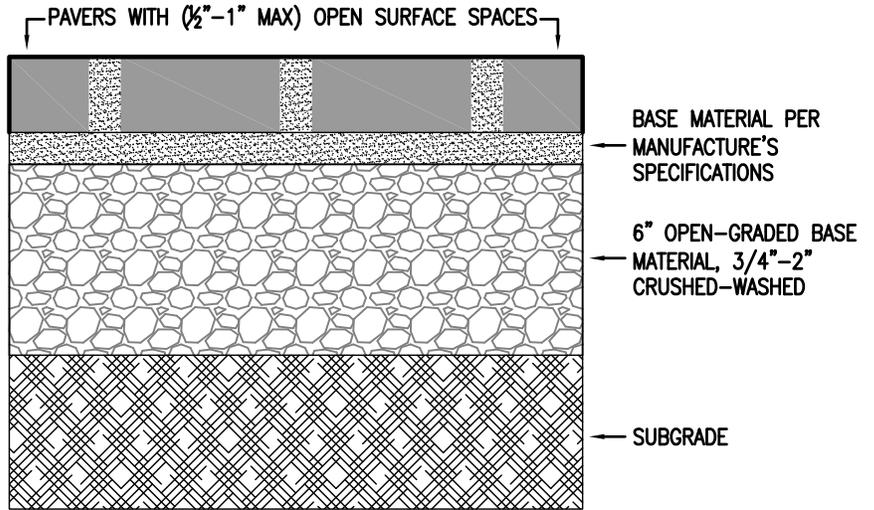
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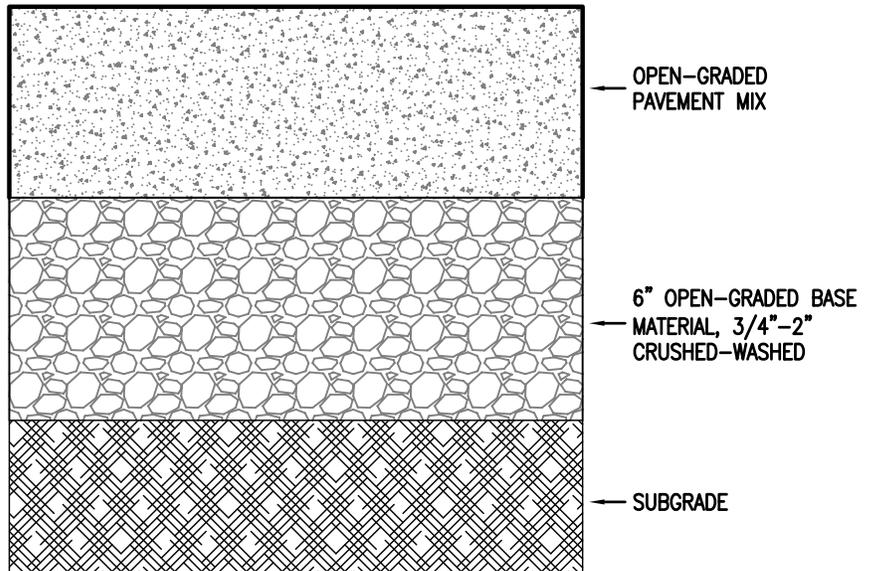
	RESIDENTIAL DRIVEWAY OR PEDESTRIAN ONLY
CONCRETE	4"
ASPHALT	2 1/2"
PAVERS	2 3/8"
ENGINEERING REQ'D	NO
COMPACTION REQ'D	NO

EXHIBIT 2-8

DESIGN REQUIREMENTS FOR TOP LIFT DEPTH



PERMEABLE CONCRETE BLOCK OR "PAVER" SYSTEMS



PERVIOUS (OPEN GRADED) CONCRETE AND ASPHALT SYSTEMS

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STORMWATER MANAGEMENT TYPICAL DETAILS

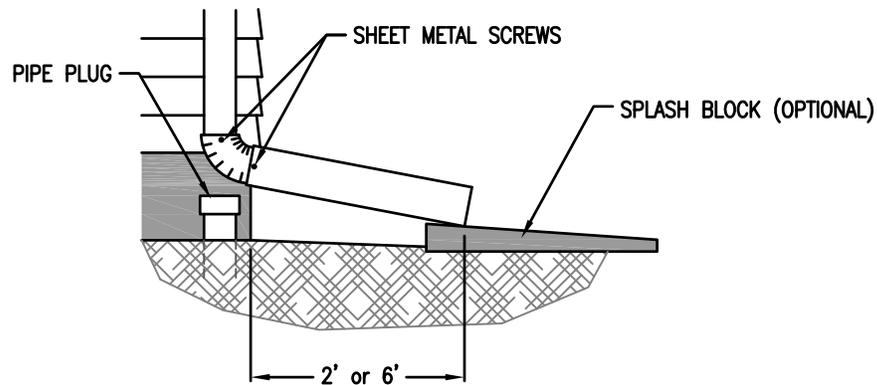
- Simplified Design Approach -
Pervious Pavement
Pedestrian and Residential Driveway Only



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NUMBER
SW-110
7-1-16



1. Site Suitability: Downspout extensions are suitable for sites that have well draining soils, >2" per hour, and have an overall slope of 10% or less.
2. Sizing: Area of discharge must be 10% of the contributing roof area. A maximum of 500 sf of roof area is allowed to drain to each downspout.
3. Downspouts must drain at least 6 feet from basement walls and at least 2 feet from crawl spaces and concrete slabs.
4. The end of the downspout must be at least 5 feet from the property line, and possibly more if the landscape slopes toward the neighbor's property.
5. Do not discharge onto driveways, hardscape or other impervious areas including public sidewalks and streets.
6. Using a splash block at the end of the extension is optional, but it will help prevent soil erosion.

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STORMWATER MANAGEMENT TYPICAL DETAILS

- Simplified Design Approach -
Downspout Extension



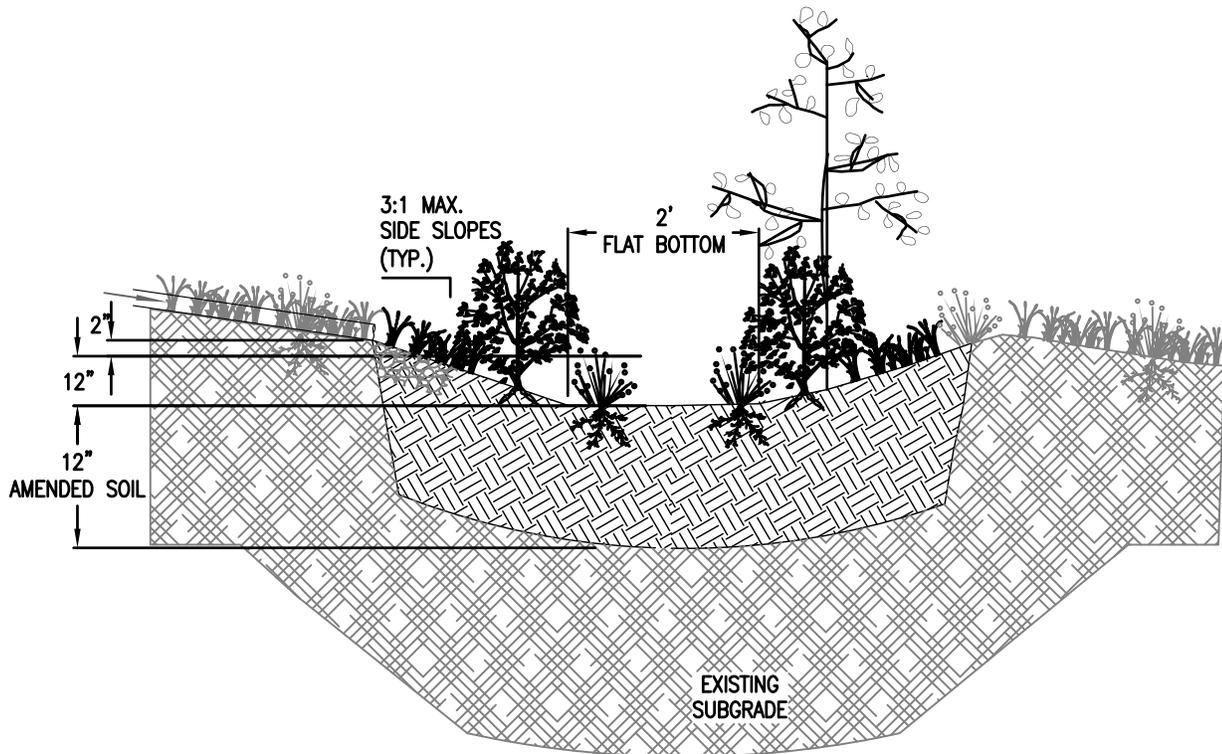
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NUMBER

SW-120

7-1-16



1. Provide protection from all vehicle traffic, equipment staging, and foot traffic in proposed infiltration areas prior to, during, and after construction.
2. Dimensions:
Ponding depth (from top of growing medium to overflow elevation): 12".
Flat bottom width: 2'x2' min.
Side slopes of swale: 3:1 maximum.
3. Setbacks:
A ten foot setback required from buried oil tanks or retaining walls over 36 inches high. The deepest point of a rain garden should be at least 10 ft from all structures. It is recommended to avoid installation over water service lines.
4. Overflow:
Each rain garden design needs to include an escape route that allows stormwater to drain to a safe disposal point in periods of heavy rainfall, away from building foundations and adjacent properties. Escape routes should be planted or rocked to assist with potential erosion issues.
5. Piping: must be composed of cast iron or Schedule 40 ABS per 2.3.4 and the Uniform Plumbing Code. Flexible downspout extensions are not approvable materials.
6. Growing Medium: Amend native soils with 3 inches of compost blended 12 inches into native soil.
7. Vegetation: Follow landscape plans otherwise refer to plant list in SWMM section 2.4.1. Minimum container size is #1. # of plantings per 100sf of facility area:
80 herbaceous plants OR 72 herbaceous plants and 4 shrubs.
Consider adding a tree if the rain garden is over 200 sf.
8. Splash Block: Splash blocks, rock, or flagstone must be utilized for erosion control and flow dispersal at the point of discharge.
9. Mulch: Rain gardens may be topped with 2" of compost
10. Inspections: Call BDS IVR Inspection Line, (503) 823-7000, request 487. 3 inspections required.

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STORMWATER MANAGEMENT TYPICAL DETAILS

- Simplified Design Approach -
Rain Garden



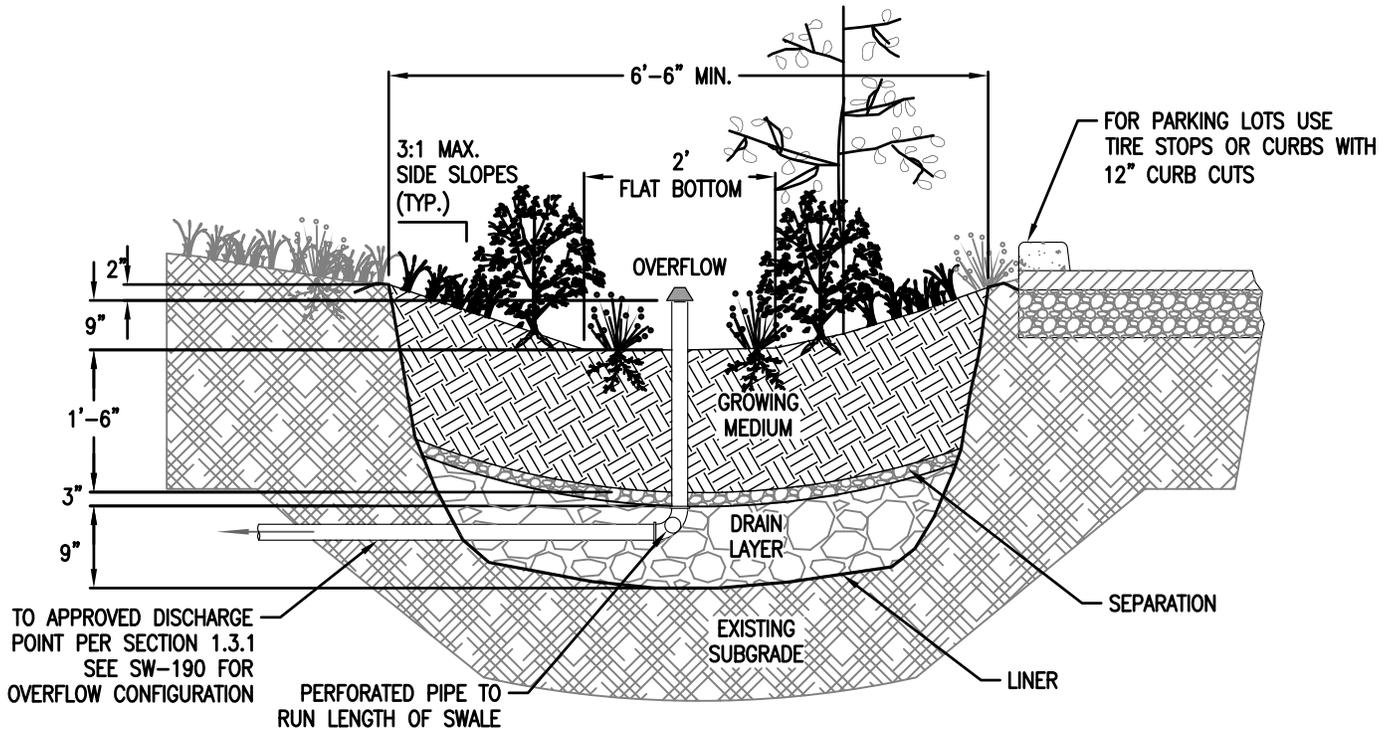
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NUMBER

SW-121

7-1-16



1. Dimensions:
Width of swale: 6'-6" minimum
Depth of swale (from top of growing medium to overflow elevation): 9".
Longitudinal slope of swale: 6.0% or less.
Flat bottom width: 2' recommended.
Side slopes of swale: 3:1 maximum.
2. Overflow: Swales must connect to approved discharge point according to SWMM Section 1.3.1 and detail SW-190.
Inlet elevation must allow for 2" of freeboard, minimum.
Protect from debris and sediment with strainer or grate.
3. Piping must be cast iron, ABS or PVC. 3" pipe required for facilities draining up to 1500 s.f., otherwise 4" minimum pipe. Uniform Plumbing Code also applies.
4. Drain Layer:
3/4" - 1 1/2" washed round rock. Depth: 9".
Separation between drain rock and growing medium:
Pea gravel lens, 2 to 3 inches deep.
5. Growing Medium:
18" minimum depth. Use sand/loam/compost 3-way mix, or approved mix that will support healthy plants.
24" minimum depth is required if the lined facility is also meeting BDS landscape requirements.
6. Vegetation: Follow landscape plans otherwise refer to plant list in SWMM section 2.4.1. Minimum container size is #1. # of plantings per 100sf of facility area:
Zone A (wet): 80 herbaceous plants OR 72 herbaceous plants and 4 small shrubs.
Zone B (moderate to dry): 7 large or small shrubs AND 70 groundcover plants.
The delineation between Zone A and B must be either at the outlet elevation or the check dam elevation, whichever is lowest.
If project area is over 200sf consider adding a tree.
7. Check Dams: Must be placed every 10' where slope exceeds 4% and be equal to the width of the planter.
8. Waterproof Liner: 30 mil EPDM, HDPE or approved equivalent.
9. Splash Block: Install 4-6" washed river rock or splash pad for erosion control at inlets and downspout.
10. Inspections: Call BDS IVR Inspection Line, (503) 823-7000, request 487. 3 inspections required.

- DRAWING NOT TO SCALE -

STORMWATER MANAGEMENT TYPICAL DETAILS

- Simplified Design Approach -
Swale - lined



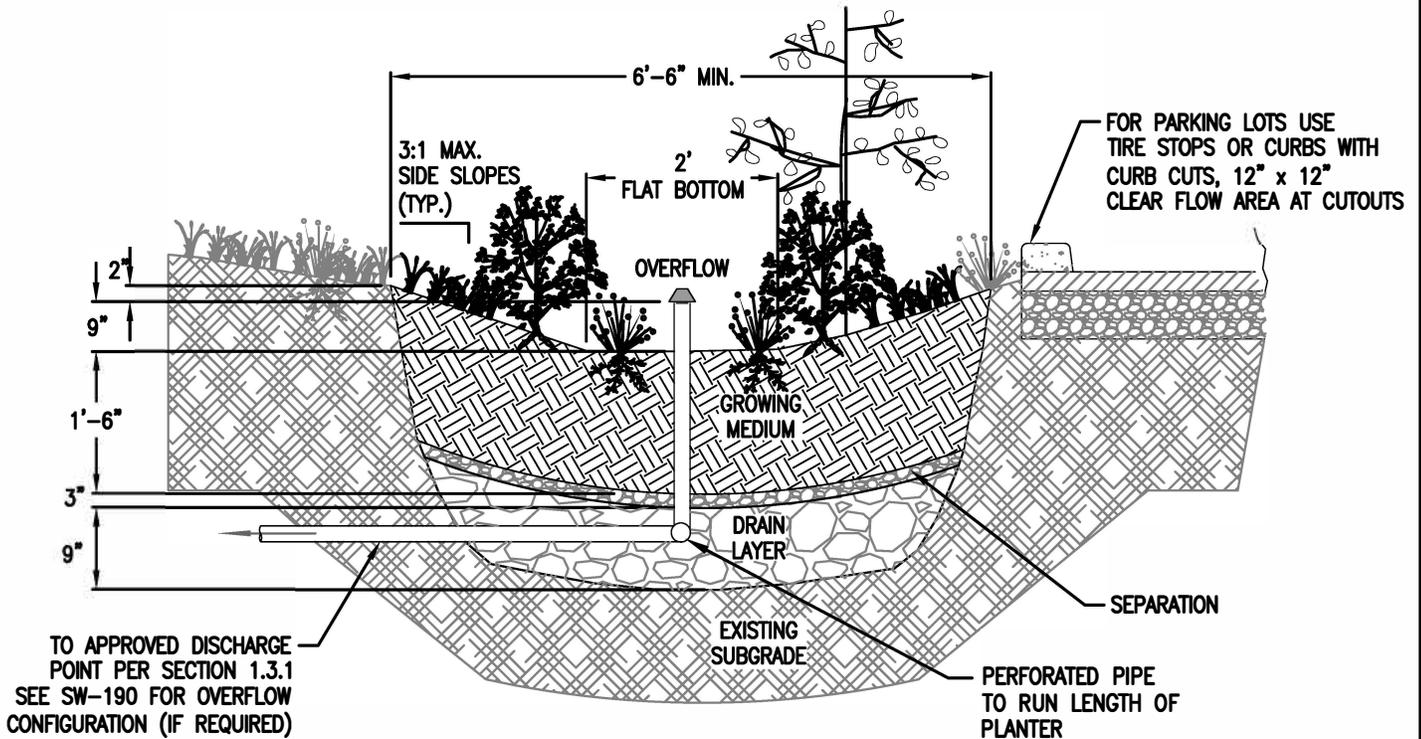
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NUMBER

SW-130

7-1-16



1. Provide protection from all vehicle traffic, equipment staging, and foot traffic in proposed infiltration areas prior to, during, and after construction.
2. Dimensions:
Width of swale: 6'-6" minimum
Depth of swale (from top of growing medium to overflow elevation): 9".
Longitudinal slope of swale: 6.0% or less.
Flat bottom width: 2' recommended.
Side slopes of swale: 3:1 maximum.
3. Setbacks:
Swale must be 10' away from foundation and 5' away from property lines.
4. Overflow:
Swales must connect to approved discharge point according to SWMM Section 1.3.1.
Inlet elevation must allow for 2' of freeboard, minimum.
Protect from debris and sediment with strainer or grate.
5. Piping must be cast iron, ABS or PVC. 3" pipe required for facilities draining up to 1500 s.f., otherwise 4" minimum pipe. Uniform Plumbing Code also applies.
6. Drain Layer:
3/4" - 1 1/2" washed rock. Depth: 12".
Separation between drain rock and growing medium:
Pea gravel lens, 2 to 3 inches deep.
7. Growing Medium:
18" minimum depth. Use sand/loam/compost 3-way mix, or approved mix that will support healthy plants.
8. Vegetation: Follow landscape plans otherwise refer to plant list in SWMM Section 2.4.1. Minimum container size is #1. # of plantings per 100sf of facility area:
Zone A (wet): 80 herbaceous plants OR 72 herbaceous plants and 4 small shrubs.
Zone B (moderate to dry): 7 large or small shrubs AND 70 groundcover plants.
The delineation between Zone A and B shall be either at the outlet elevation or the check dam elevation, whichever is lowest.
If project area is over 200sf consider adding a tree.
9. Check Dams: Shall be placed every 10' where slope exceeds 4% and be equal to the width of the planter.
10. Splash Block: Install 4-6" washed river rock or splash pad for erosion control at inlets and downspout.
11. Inspections: Call BDS MR Inspection Line, (503) 823-7000, request 487. 3 inspections required.

- DRAWING NOT TO SCALE -

STORMWATER MANAGEMENT TYPICAL DETAILS

- Simplified Design Approach -
Swale - unlined



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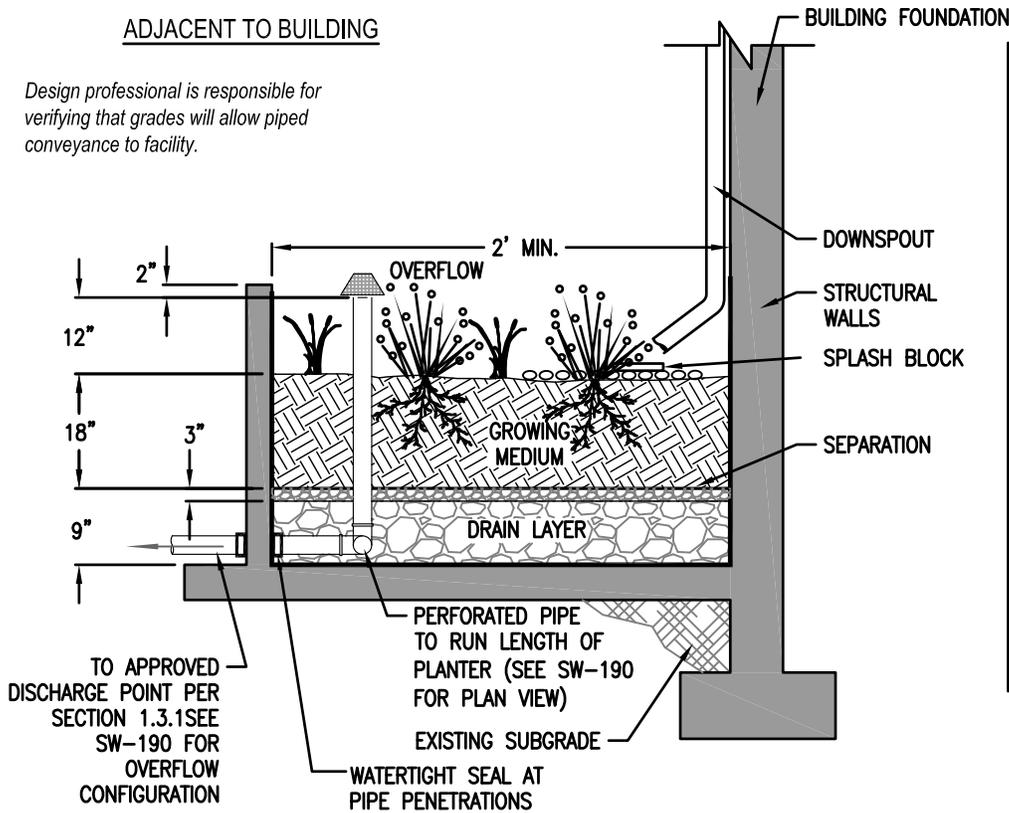


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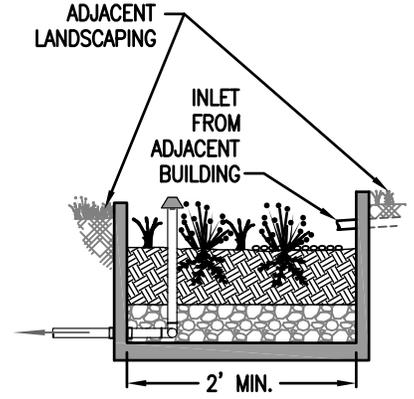
SW-131
7-1-16

ADJACENT TO BUILDING

Design professional is responsible for verifying that grades will allow piped conveyance to facility.



FREESTANDING PLANTER



1. **Dimensions:**
Width of planter: 24" minimum.
Depth of planter (from top of growing medium to overflow elevation): 12".
Longitudinal slope of planter: 0.5% or less.
2. **Setbacks:**
Planters must be less than 30" in height above finish grade if within 5-feet of property line.
3. **Planter Walls:**
Material must be monolithically poured concrete. Walls must be included on foundation plans.
4. **Waterproofing:**
Monolithically poured planter, without joints is required. Check state structural requirements for foundations.
5. **Piping must be cast iron, ABS or PVC. 3" pipe required for facilities draining up to 1500 s.f., otherwise 4" minimum pipe. Uniform Plumbing Code also applies.**
6. **Drain Layer:**
3/4" - 1 1/2" washed round rock. Depth: 9".
Separation between drain rock and growing medium:
Pea gravel lens, 2 to 3 inches deep.
7. **Overflow:**
Planters must connect to approved discharge point according to section 1.3.1 and detail SW-190.
Inlet elevation must allow for 2" of freeboard, minimum.
Protect from debris and sediment with strainer or grate.
8. **Growing Medium:**
18" minimum depth. Use sand/loam/compost 3-way mix, or approved mix that will support healthy plants.
24" minimum depth is required if the lined facility is also meeting BDS landscape requirements.
9. **Vegetation:** Refer to plant list in SWMM section 2.4.1. Minimum container size is #1. # of plantings per 100sf of facility area:
80 herbaceous plants OR;
72 herbaceous plants and 4 small shrubs.
10. **Splash Block:** Install 4-6" washed river rock or splash pad for erosion control at inlets and downspout.
11. **Inspections:** Call BDS IVR Inspection Line, (503) 823-7000, request 487. 3 inspections required.

- DRAWING NOT TO SCALE -

STORMWATER MANAGEMENT TYPICAL DETAILS

- Simplified Design Approach -
Planter - lined

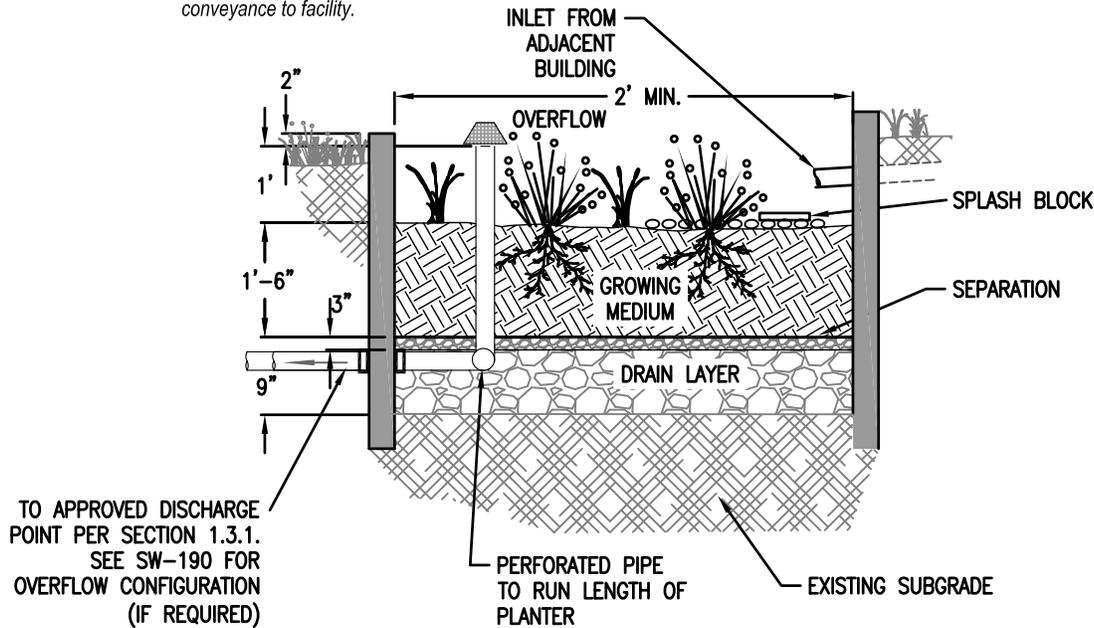


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NUMBER
SW-140
7-1-16

Design professional is responsible for verifying that grades will allow piped conveyance to facility.



1. Provide protection from all vehicle traffic, equipment staging, and foot traffic in proposed infiltration areas prior to, during, and after construction.
2. Dimensions:
Width of planter: 24" minimum.
Depth of planter (from top of growing medium to overflow elevation): 12".
Longitudinal slope of planter: 0.5% or less.
3. Setbacks:
Planters must be 5-feet from property line and 10-feet from building foundations.
4. Planter Walls:
Material must be concrete, unless otherwise approved. Walls must be included on foundation plans.
5. Piping must be cast iron, ABS or PVC. 3" pipe required for facilities draining up to 1500 s.f., otherwise 4" minimum pipe. Uniform Plumbing Code also applies.
6. Drain Layer:
3/4" - 1 1/2" washed. Depth: 9".
Separation between drain rock and growing medium:
Pea gravel lens, 2 to 3 inches deep.
7. Overflow:
Planters must connect to approved discharge point according to section 1.3.1 and detail SW-190.
Inlet elevation must allow for 2" of freeboard, minimum.
Protect from debris and sediment with strainer or grate.
8. Growing Medium:
18" minimum depth. Use sand/loam/compost 3-way mix, or approved mix that will support healthy plants.
24" minimum depth is required if the lined facility is also meeting BDS landscape requirements.
9. Vegetation: Refer to plant list in SWMM Section 2.4.1. Minimum container size is #1. # of plantings per 100sf of facility area:
80 herbaceous plants OR;
72 herbaceous plants and 4 small shrubs.
10. Splash Block: Install 4-6" washed river rock or splash pad for erosion control at inlets and downspout.
11. Inspections: Call BDS I/R Inspection Line, (503) 823-7000, request 487. 3 inspections required.

- DRAWING NOT TO SCALE -

STORMWATER MANAGEMENT TYPICAL DETAILS

- Simplified Design Approach -
Planter - unlined

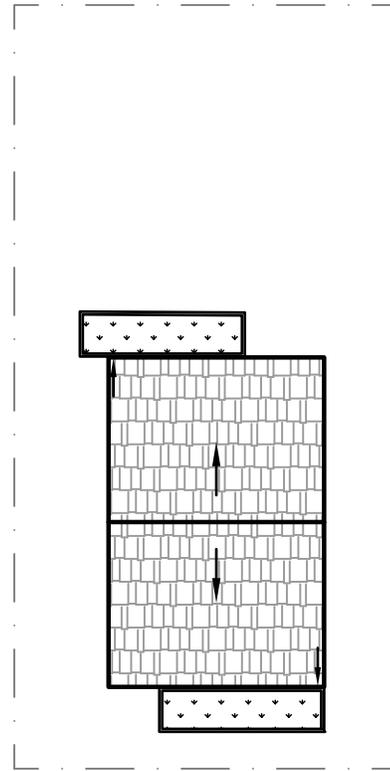
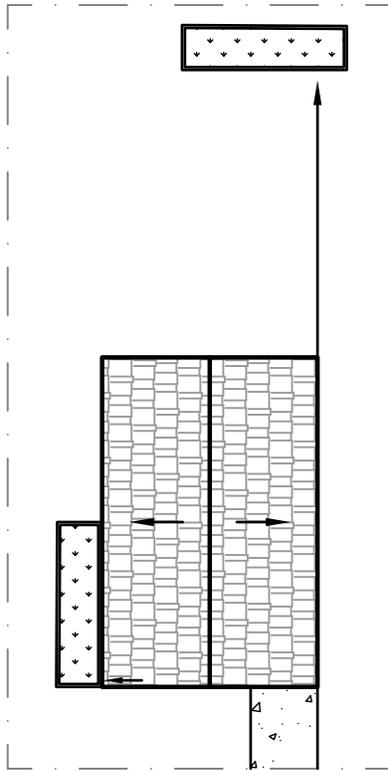


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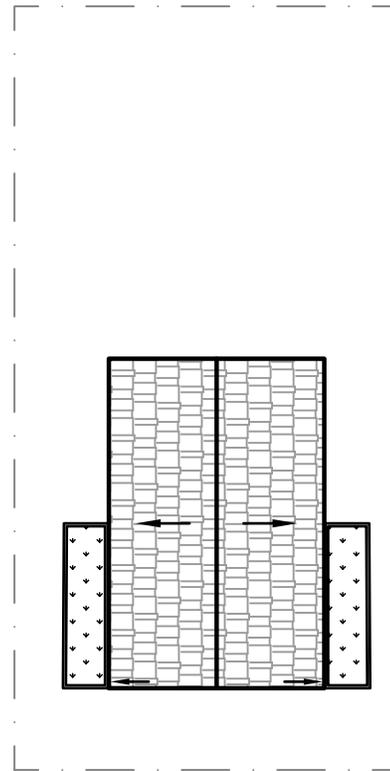


NUMBER

SW-141
7-1-16



1. Drainage areas and corresponding planters can be divided to accommodate site and building configuration. Configurations shown are for example.
2. Design professional is responsible for verifying that grades will allow piped conveyance to facility.



- DRAWING NOT TO SCALE -

STORMWATER MANAGEMENT TYPICAL DETAILS

- Simplified Design Approach -
Planter - site configurations

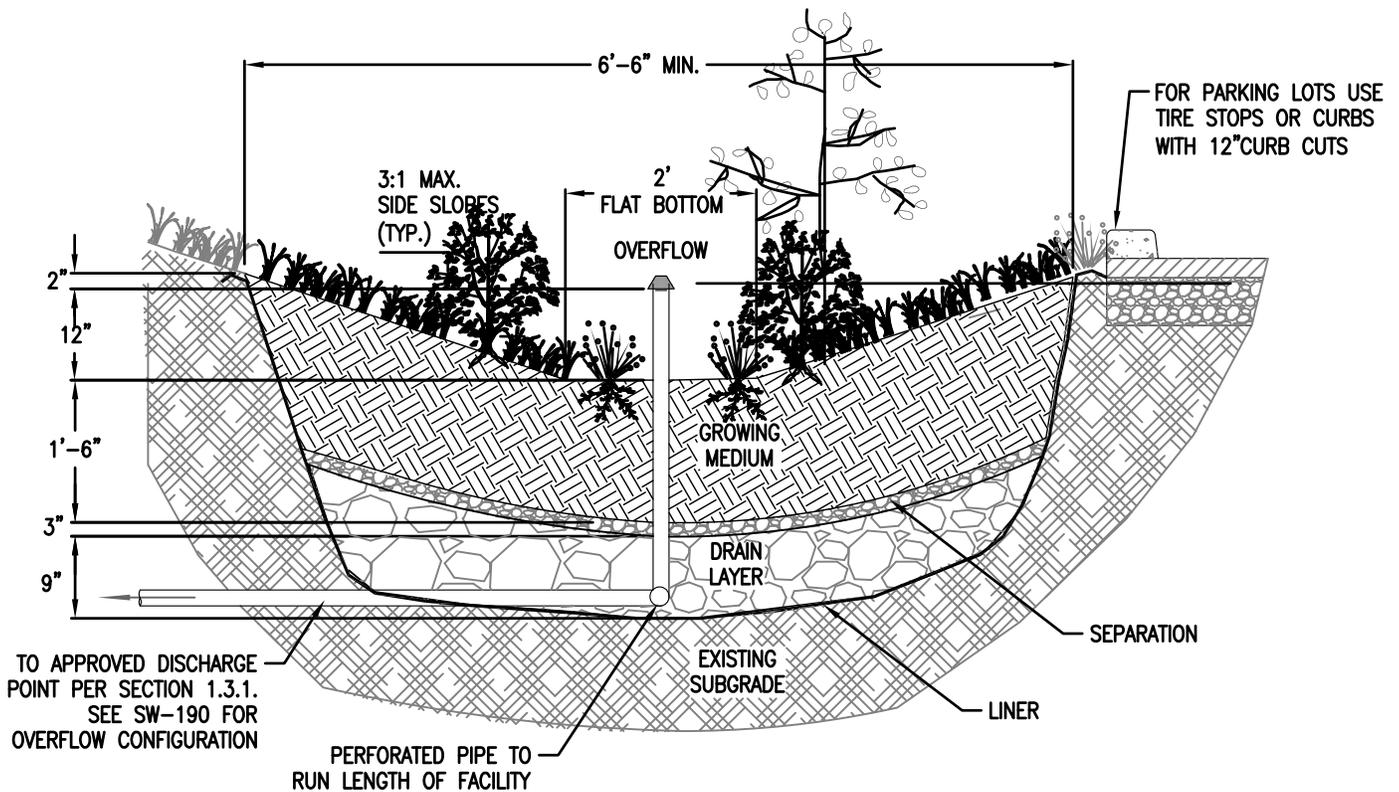


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NUMBER

SW-142
7-1-16



1. Dimensions:
 Width of basin: 6'-6" minimum
 Depth of basin (from top of growing medium to overflow elevation): 9"
 Flat bottom width: 2' recommended.
 Side slopes of swale: 3:1 maximum.
2. Setbacks: None required.
3. Overflow:
 Basins must connect to approved discharge point according to SWMM Section 1.3.1.
 Inlet elevation must allow for 2" of freeboard, minimum.
 Protect from debris and sediment with strainer or grate.
4. Piping must be cast iron, ABS or PVC. 3" pipe required for facilities draining up to 1500 s.f., otherwise 4" minimum pipe. Uniform Plumbing Code also applies.
5. Drain Layer:
 3/4" - 1 1/2" washed round rock. Depth: 9".
 Separation between drain rock and growing medium:
 Pea gravel lens, 2 to 3 inches deep.
6. Growing Medium:
 18" minimum depth. Use sand/loam/compost 3-way mix, or approved mix that will support healthy plants.
 24" minimum depth is required if the lined facility is also meeting BDS landscape requirements.
7. Vegetation: Follow landscape plans otherwise refer to plant list in SWMM Section 2.4.1. Minimum container size is #1. # of plantings per 100sf of facility area:
 Zone A (wet): 80 herbaceous plants OR 72 herbaceous plants and 4 small shrubs.
 Zone B (moderate to dry): 7 large or small shrubs AND 70 groundcover plants.
 The delineation between Zone A and B must be either at the outlet elevation or the check dam elevation, whichever is lowest.
 If project area is over 200sf consider adding a tree.
8. Waterproof Liner: 30 mil EPDM, HDPE or approved equivalent.
9. Splash Block: Install 4-6" washed river rock or splash pad for erosion control at inlets and downspout.
10. Inspections: Call BDS IVR Inspection Line, (503) 823-7000, request 487. 3 inspections required.

- DRAWING NOT TO SCALE -

STORMWATER MANAGEMENT TYPICAL DETAILS

- Simplified Design Approach -
 Basin - lined



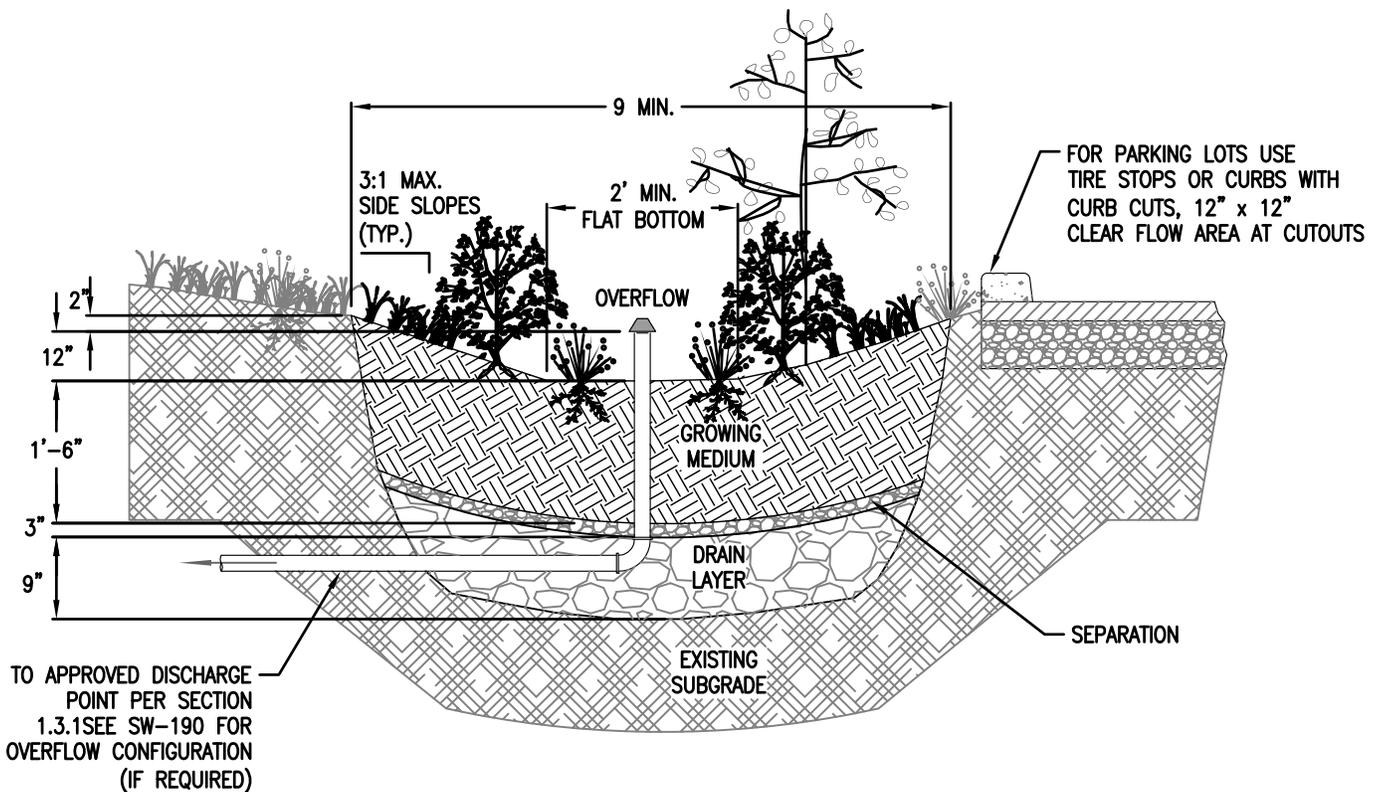
Bureau of Environmental Services



NUMBER

SW-150

7-1-16



1. Provide protection from all vehicle traffic, equipment staging, and foot traffic in proposed infiltration areas prior to, during, and after construction.
2. Dimensions:
Width of basin: 9' minimum
Depth of basin (from top of growing medium to overflow elevation): 9".
Flat bottom width: 2' minimum.
Side slopes of swale: 3:1 maximum.
3. Setbacks:
Basin must be 10' away from foundations and 5' away from property lines.
4. Overflow:
Basins must connect to approved discharge point according to SWMM Section 1.3.1 and detail SW-190.
Inlet elevation must allow for 2" of freeboard, minimum.
Protect from debris and sediment with strainer or grate.
5. Piping must be cast iron, ABS or PVC. 3" pipe required for facilities draining up to 1500 s.f., otherwise 4" minimum pipe. Uniform Plumbing Code also applies.
6. Drain Layer:
3/4" - 1 1/2" washed rock. Depth: 9".
Separation between drain rock and growing medium: Pea gravel lens, 2 to 3 inches deep.
7. Growing Medium:
18" minimum depth. Use sand/loam/compost 3-way mix, or approved mix that will support healthy plants.
8. Vegetation: Follow landscape plans otherwise refer to plant list in SWMM section 2.4.1. Minimum container size is #1. # of plantings per 100sf of facility area:
Zone A (wet): 80 herbaceous plants OR 72 herbaceous plants and 4 small shrubs.
Zone B (moderate to dry): 7 large or small shrubs AND 70 groundcover plants.
The delineation between Zone A and B must be either at the outlet elevation or the check dam elevation, whichever is lowest. If project area is over 200sf consider adding a tree.
9. Splash Block: Install 4-6" washed river rock or splash pad for erosion control at inlets and downspout.
10. Inspections: Call BDS IVR Inspection Line, (503) 823-7000, request 487. 3 inspections required.

- DRAWING NOT TO SCALE -

STORMWATER MANAGEMENT TYPICAL DETAILS

- Simplified Design Approach -
Basin - unlined



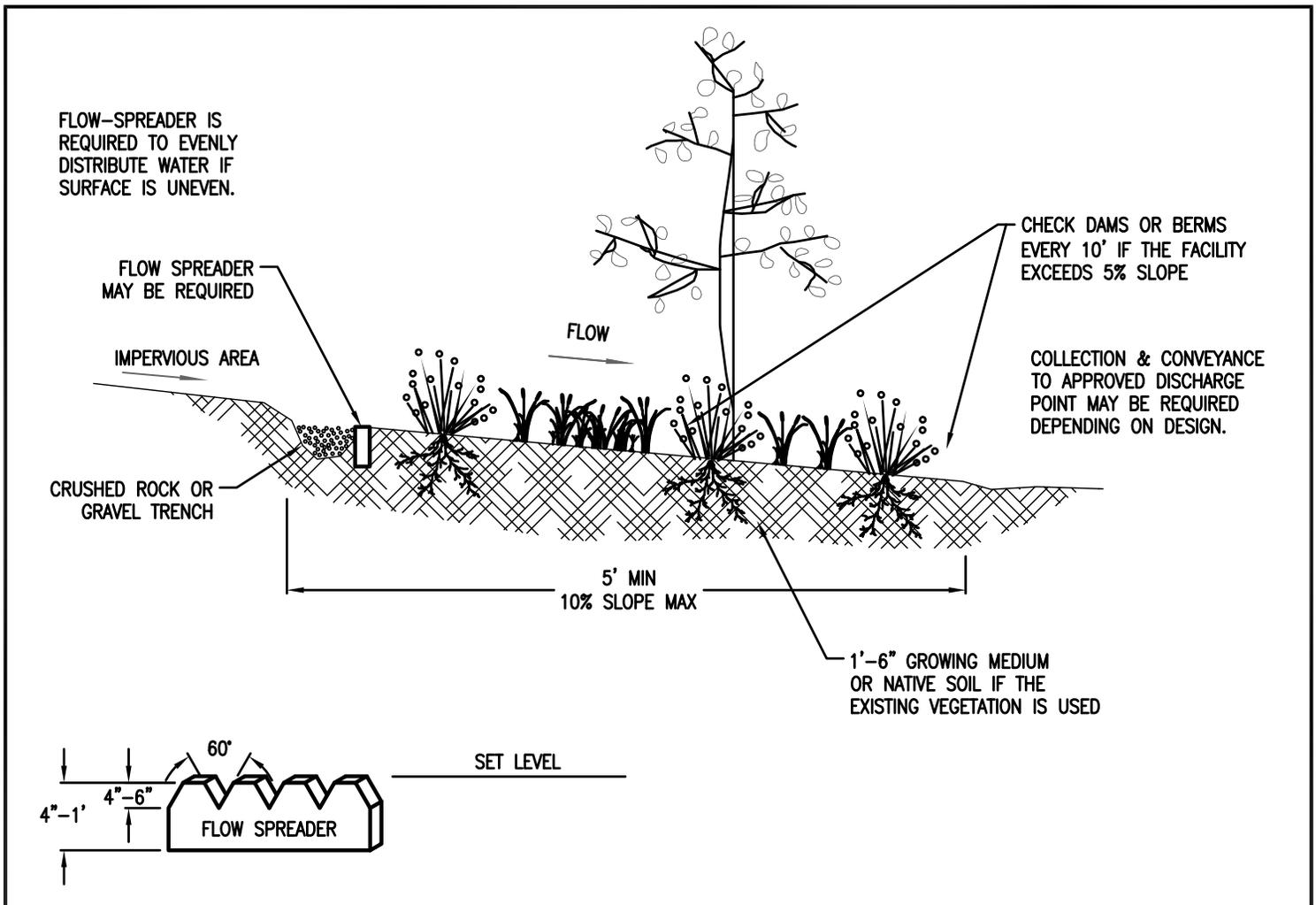
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NUMBER

SW-151

7-1-16



1. Provide protection from all vehicle traffic, equipment staging, as well as foot traffic for proposed infiltration areas prior to and during construction.
2. Dimensions:
 - a. Flow line length: 5' minimum.
 - b. Slopes: 0.5 - 10%
3. Setbacks (from beginning of facility):
 - a. 5' from property line
 - b. 10ft from buildings
 - c. 50ft from wetlands, rivers, streams, and creeks where required.
4. Overflow: Collection from filter strip shall be specified on plans to approved discharge point according to SWMM Section 1.3.
5. Growing Medium: Unless existing vegetated areas are used for the filter strip, growing medium shall be used within the top 18" (Use sand/loam/compost 3-way mix or approved mix that will support healthy plants).
6. Vegetation: The entire filter strip must have 100% coverage by native grasses, native wildflower blends, native ground covers, or any combination thereof.
7. Flow Spreaders: A grade board or sand/gravel trench may be required to disperse the runoff evenly across the filter strip to prevent a point of discharge. The top of the level spreader must be horizontal and at an appropriate height to provide sheetflow directly to the soil without scour. Level spreaders shall not hold a permanent volume of runoff. Grade boards can be made of any material that will withstand weather and solar degradation. Trenches used as level spreaders can be filled with washed crushed rock, pea gravel, or sand
8. Check Dams: shall be placed according to facility design otherwise:
 - a. 12" in length
 - b. Equal to the width of the filter
 - c. 3 to 5" in height
 - d. Every 10' where slope exceeds 5%.
9. Inspections: call BDS IVR Inspection Line, (503) 823-7000, for appropriate inspections.

- DRAWING NOT TO SCALE -

STORMWATER MANAGEMENT TYPICAL DETAILS

- Simplified Design Approach -
Filter Strip

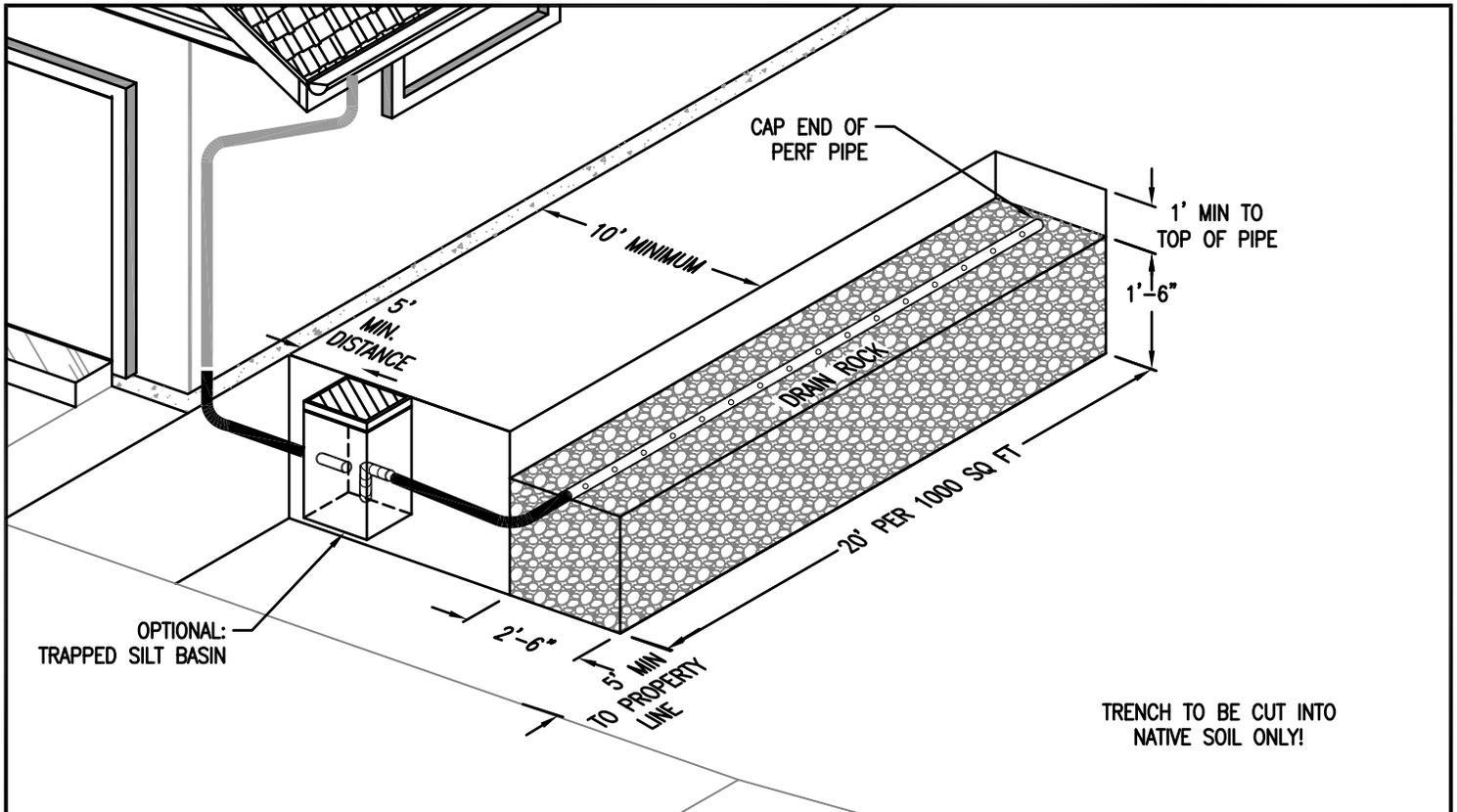


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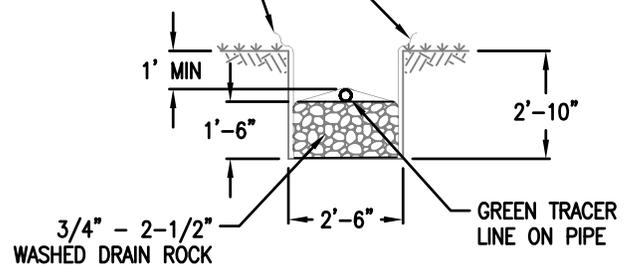
SW-160
7-1-16



TRENCH TO BE CUT INTO NATIVE SOIL ONLY!

DETAIL B: SOAKAGE TRENCH CONSTRUCTION

FILTER FABRIC TO BE PLACED ON SIDES AND ENDS. TO FOLD OVER AND COVER PERF PIPE AND DRAIN ROCK.



LINE TRENCH SIDES WITH PERMEABLE FILTER FABRIC AS SHOWN, ADD 18" OF DRAIN ROCK. PLACE PERF. PIPE AND COVER ALL.

1. Provide protection from all vehicle traffic, equipment staging, and foot traffic in proposed infiltration areas prior to, during and after construction.
2. Siting Criteria: Infiltration rate must be 2" per hour minimum. Soakage trench shall not be placed where base of facility has less than 5' of separation to water table.
3. Sizing: 2'-6" wide x 1'-6" tall x 20' long per 1000 square feet of impervious surface.
4. Setbacks: Soakage trench must be 10' from foundations, 5' from property lines, and 20' from cesspools.
5. Piping must be cast iron, ABS or PVC. 3" pipe required for facilities draining up to 1500 sf, otherwise 4" minimum pipe. Uniform Plumbing Code also applies.
6. Trapped Silt Basin: Optional for roof runoff or pedestrian only paved areas.

- DRAWING NOT TO SCALE -

STORMWATER MANAGEMENT TYPICAL DETAILS

- Simplified Design Approach -
Soakage Trench



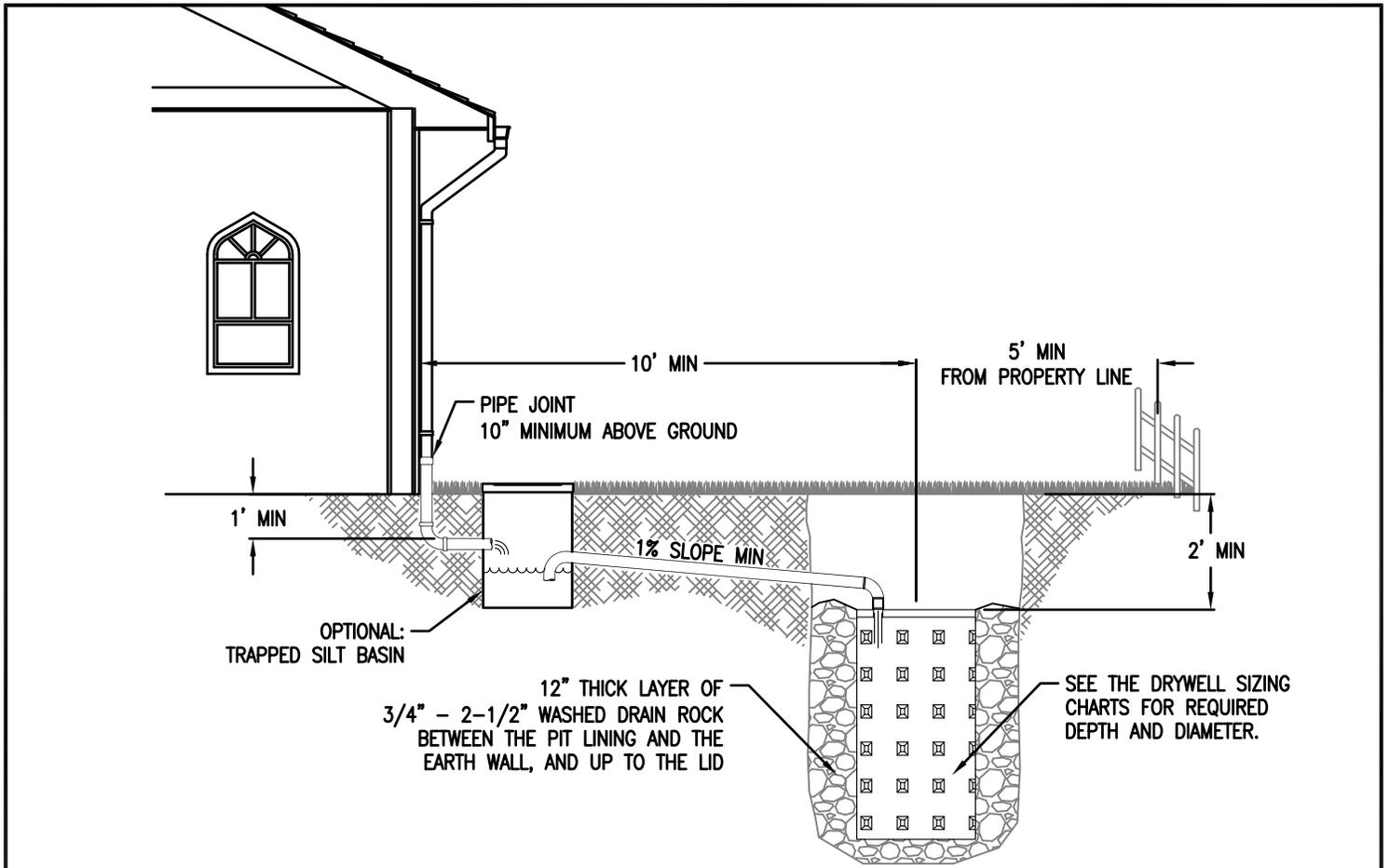
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NUMBER

SW-170

7-1-16



1. Provide protection from all vehicle traffic, equipment staging, and foot traffic in proposed infiltration areas prior to, during and after construction.
2. Siting Criteria: Gravelly sand, gravelly loamy sand or other equally porous material must occur in a continuous 5' deep stratum within 12' of the ground surface. Drywell shall not be placed where base of facility has less than 5' of separation to water table.
3. Sizing: Exhibit 2-36 is used to size the drywell(s) based on impervious area.
4. Top of drywell must be below lowest finished floor.
5. Setbacks: Drywell must be 10' from foundations, 5' from property lines, and 20' from cesspools.
6. Piping must be cast iron, ABS or PVC. 3" pipe required for facilities draining up to 1500 sf, otherwise 4" minimum pipe. Uniform Plumbing Code also applies.
7. Trapped Silt Basin: Optional for roof runoff or pedestrian only paved areas.

Exhibit 2-36: Drywell Sizing Table

Once approval has been given by BES for onsite infiltration of stormwater, the following chart shall be used to select the number and size of drywells. Gray boxes are acceptable.

IMPERVIOUS Area (sq-ft)	28" Diameter				48" Diameter			
	Drywell Depth							
	5'	10'	15'	20'	5'	10'	15'	20'
1000								
2000								
3000								
4000								
5000								
6000								
7000								
8000								
9000								
10000								

- DRAWING NOT TO SCALE -

STORMWATER MANAGEMENT TYPICAL DETAILS

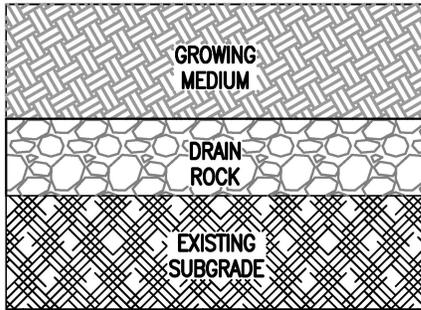
- Simplified Design Approach -
Drywell



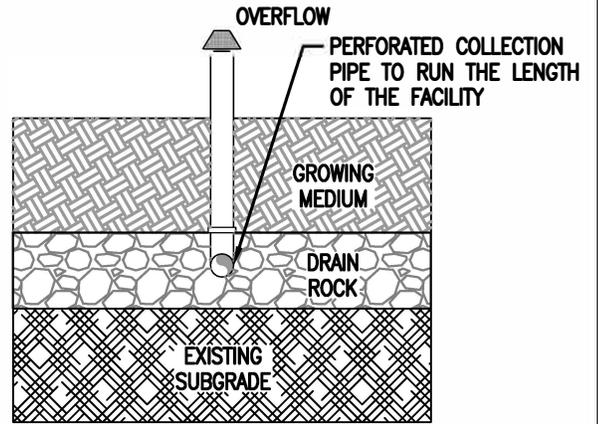
Bureau of Environmental Services



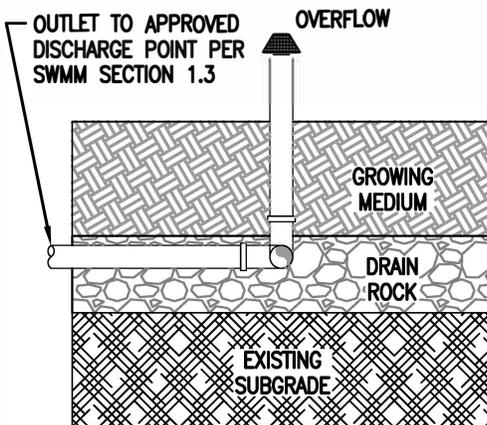
NUMBER
SW-180
7-1-16



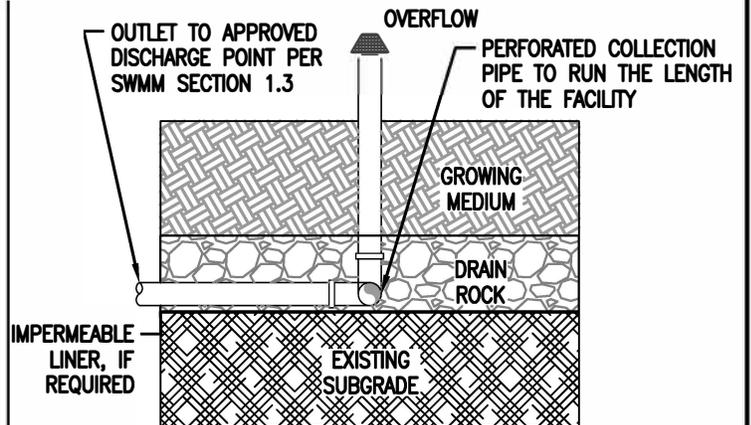
INFILTRATION
STORMWATER HIERARCHY CATEGORY 1



HYBRID
STORMWATER HIERARCHY CATEGORY 2
OVERFLOW DIRECTED TO DRAIN ROCK.

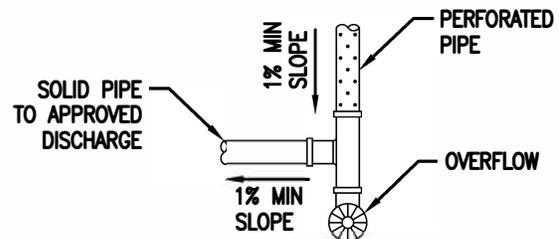


PARTIAL INFILTRATION
STORMWATER HIERARCHY CATEGORY 3 or 4
OVERFLOW AND UNDERDRAIN REQUIRED.
SET UNDERDRAIN WITHIN DRAIN ROCK



LINED
STORMWATER HIERARCHY CATEGORY 3 or 4
OVERFLOW AND UNDERDRAIN REQUIRED.
SET UNDERDRAIN AT BASE OF DRAIN ROCK LINER.

NOTE: Hybrid facilities must be registered as a UIC designed under the presumptive approach.



PLAN VIEW
PIPE W/ UNDERDRAIN & DISCHARGE POINT

- DRAWING NOT TO SCALE -

STORMWATER MANAGEMENT TYPICAL DETAILS

- Simplified Design Approach -
Facility Overflow Configurations



Bureau of Environmental Services



NUMBER

SW-190

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