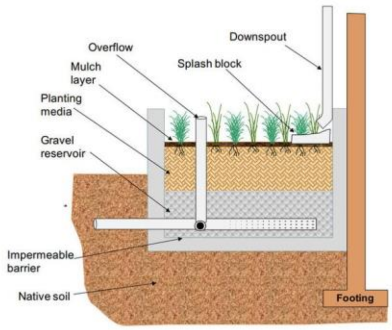
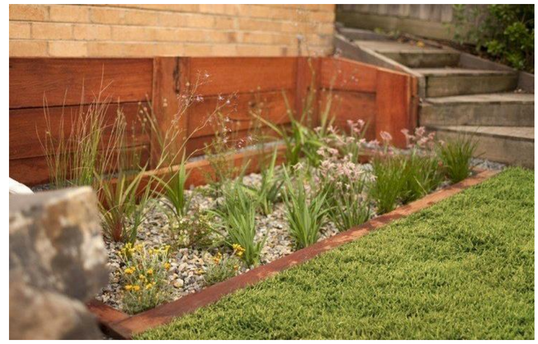
5.3 Planter Boxes





Open bottom planters shall not be installed next to structural foundations.

Advantages:

Planter boxes are intended to be constructed in and around impervious areas. This approach is great for the perimeters of sidewalks and driveways, or along a house directly connected to roof gutters and other impervious areas. Planters next to foundations need to have an enclosed bottom with piping which leads away from the structure. Planter boxes provide a proactive method of reducing stormwater sheet flow and can easily enhance outdoor spaces. Planters improve water quality by filtering out impurities and reducing the total volume of stormwater runoff. Typically, they consist of impermeable sides such as concrete or natural stone with either open or closed bottoms depending on the location. Cutouts can be strategically placed along the top of the container to allow sheet flow (stormwater runoff) to be collected and stored within the planter. The raised edges of the planter provide additional capacity to store excess stormwater. Plants use the water collected in the planter as it passes through the soil while excess water infiltrates into the ground below (if it is an open bottom planter). In extreme rain events, excess water can be conveyed through an overflow to another planter or different LID SWMF.

Limitations:

Planters are generally limited by height. High sediment loads tend to clog the voids in the soil and reduce the capacity of the system. Therefore, they work well when suspended sediment is allowed to settle out of the water before it enters the system.

Design Considerations:

- Soil types A and B are best suited for this application. Closed bottom applications are suitable for any soil types.
- The planter can be directly connected to roof drains and gutters through a downspout. Several planters around the property can be connected in series allowing a wide variety of placement options.
- Any planters placed near the foundation of a structure should not be open to the soil below, instead they should be a closed bottom design that is connected to additional planters throughout the

property. The additional planters can be designed with open bottoms that will allow infiltration into the ground.

- Planters nearest the structure should be fitted with a perforated (slotted) PVC pipe installed near the bottom to collect the rainwater as it infiltrates to the bottom. Once the water reaches the bottom of the container, water is conveyed to another planter that is located further from the structure through a PVC underdrain.
- The pipe diameter of the underdrain leading to additional planters should be greater than the perforated pipe diameter used to initially collect the water.
- A PVC riser can be installed which acts as an emergency drain should the water rise beyond the desired height. The riser will establish the maximum depth of water that will be contained in the planter network.
- The ratio associated with impervious area to planter area should be a minimum of 7%.[8]
- Design aspects for this LID SWMF will take in to account the height of the curb or confining walls and the surface area allotted for the planter box(es).
- The minimum depth of the system should be 12 inches and the recommended width is 30 inches or greater to optimize infiltration into the soil.
- The shape of your planter box will be determined by the space available on your property. Planter boxes can be constructed in any shape, but the easiest shape to calculate volume capacity for is a cube. If complex shapes are desired, it is recommended to separate the planter area into several easily definable shapes such as circles, squares, and rectangles in order to determine an equivalent area. Once the equivalent area is determined, the required depth can be calculated based on the required storage capacity.
- Typical filter media starting from the bottom and moving up includes the following:
    - Geotextile fabric separating the native soil from a layer of sand;
    - Followed by another layer of geotextile fabric separating the sand from a layer of 3/8 inch to 5/8 inch diameter gravel;
    - A final layer of geotextile fabric to separate the gravel from approximately 18 inches of topsoil.
    - Add desired plants from the approved plant list provided in **Appendix A**.
- Layer depths associated with sand and gravel are dependent on the overall depth of the planter and generally range between 1 and 2 feet for each media. The sand and gravel filter the water while the topsoil provides nutrients for the plants.
- Plants that are native to northwest Florida generally require little to no pesticides or maintenance. It is best not to apply pesticides to the area due to the fact that the planter is intended to purify water.

Design Steps - Example:

Stormwater design is an iterative process, meaning that there are several viable solutions to the same problem. The final design is going to depend on available space and the homeowner's vision, along with the requirements established by this manual. The depth and area of the planter will be dependent on each other; for example, the

[8] City of Murfreesboro Tennessee. Planter Boxes Structural Stormwater Control. http://www.murfreesborotn.gov/DocumentCenter/View/2748/Planter-Boxes-2214-?bidId=

chosen depth will dictate the required area of the planters or if the area is predetermined then it will dictate the required depth. The calculations to design a planter box are as follows:

1. Determine the site conditions and required storage treatment volume using the approach presented in **Section 2** and **Section 3**. For this example, we will use 421 ft^3 for the storage requirement.

2. Porosity is the ratio of void volume to total volume, in other words it relates to the amount of water that can be stored between the sand and gravel. In order to get a representative volume for the capacity of the planter you will need to take into account the average porosity of the filter media (sand and gravel), for this we will use 40% (0.4). This means that the sand and gravel take up approximately 60% (0.6) of the planter box.

Required Volume of Stormwater to Be Retained (ft^3)	***Ratio of Space Allotted for Filter Media***
421 ft^3	*0.6*

Required Volume of Stormwater to Be Retained (ft^3)	***Space Allotted for Filter Media (%)***	***Required Volume of Stormwater to Be Retained (ft^3) / Porosity of Soil***	***Total Required Volume (ft^3)***
421 ft^3	*60 %*	$\frac{421\ ft^3}{0.4}$	*= 1,053 ft^3*

From this calculation, we can see that we need to increase the planter volume to accommodate the space that the sand, gravel, and topsoil occupy.

3. Next, determine the area required for a planter with a height of 2 feet. You will aslo want to determine the total required volume associated with the filter media.

Total Required Planter Volume - Required Water Volume = Filter Media Volume (ft^3)	***Height of Planter (ft)***
1,053 ft^3 - 421 ft^3= 632 ft^3	*2 ft*

Required Area of Planter (ft^2)
$\frac{1,053\ ft^3}{2\ ft} = 527\ ft^2$

4. Now we will determine the required length of the planters if they are the minimum width of 30 inches.

Required Area of Planter (ft^2)	*Width of Planter (ft) Convert Inches to feet*			*Total Required Length of Planter (ft)*	
527 ft^2	*30 in **	$\frac{1\ ft}{12\ in}$	*= 2.5 ft*	$\frac{527\ ft^2}{2.5\ ft}$	*= 211 ft*

The total linear feet of the planters should be 211 feet, this could be split up anyway that makes sense for your property or you could increase the width or height of the planters to reduce the length. For example, you could install 3 – 71 foot planters or 6 -35 foot planters. You could even add 2 - 25 foot planters and implement a different type of LID SWMF on the property. The options are endless.

Refer to Calculation Sheet 5.3 included at the end of this section for assistance in designing planter boxes.

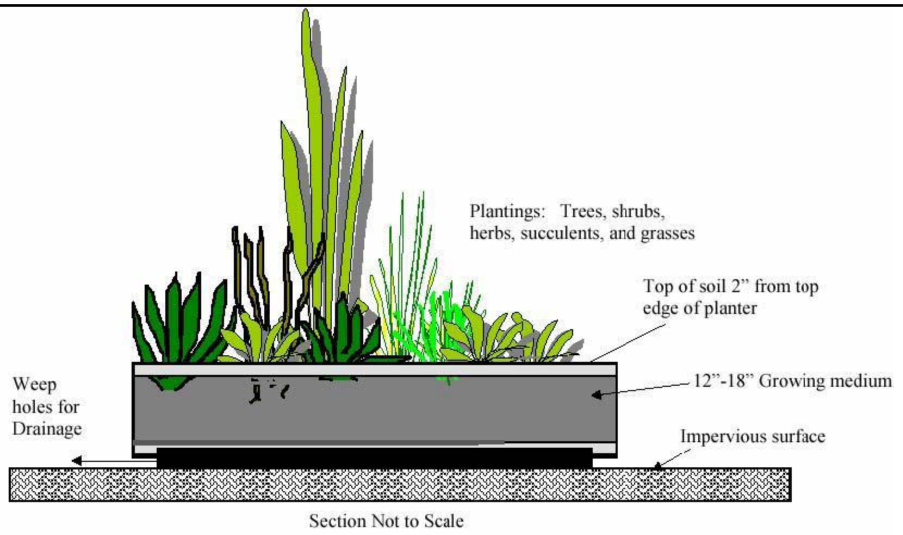
Operation and Maintenance:

The desired recovery time for a planter box should be around 3 to 4 hours. The best time to inspect the system to see if it is working properly is during a rain event and shortly after the event. This type of system requires frequent maintenance to ensure that it does not become clogged with plant debris or sediment. Accumulated sediment should be removed on an as-needed basis. The pipe diameter associated with the system should be large enough to account for sediment and organic material build up. Additionally, the system should have a means to back flush the pipes and isolate individual planters for maintenance. The vegetation will require seasonal maintenance to ensure optimal filtering capabilities and may require water during times of drought. Mulch or topsoil will need to be replenished seasonally. It the planter cracks it should be patched or replaced.

Maintenance Form 5.3 – Planter Box:

Planter Box LID SWMF		
Owner:		
Address:		
Phone:		
E-mail:		
Parcel Number:		
Date of Last Inspection:		
List any additional LID SWMF on site:		
List any previous concerns:		
Inspection List	Yes	No
Does water drain freely through the system?	☐	☐
Does the planter drain within 3 to 4 hours?	☐	☐
Is the vegetation thriving?	☐	☐
Are there any areas with stressed or dying plants?	☐	☐
Has the soil settled?	☐	☐
Is there an excess of plant debris in the planter?	☐	☐
Is there a buildup of sediment in the planter?	☐	☐
If the planter drains to another area, are fittings tight?	☐	☐
Are pipes free from clogs?	☐	☐
Is the system over flowing?	☐	☐
Last time soil was replenished in the planter box.		
Last time sediment was removed from the planter box.		
- Please attach pictures		
Maintenance Items To be Completed:		
By signing this form, I certify that I have inspected this system.	**Owners Signature**	**Date**

Planter Box Examples:



http://www.murfreesborotn.gov/DocumentCenter/View/2748/Planter-Boxes-2214-?bidId=

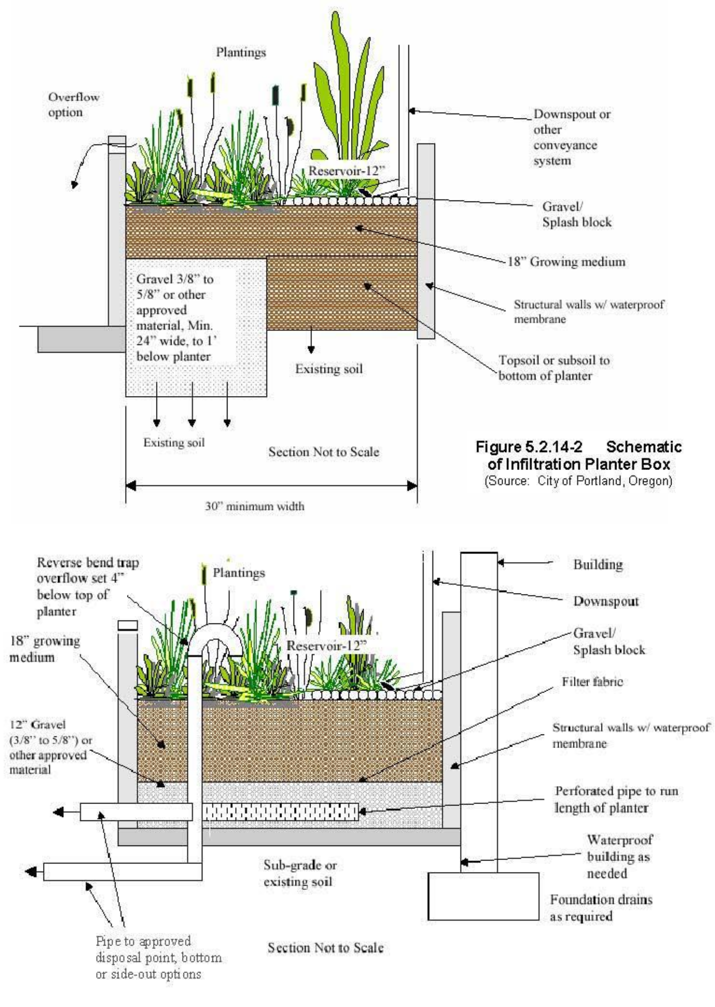


Figure 5.2.14-2 Schematic of Infiltration Planter Box
(Source: City of Portland, Oregon)

Calculation Sheet 5.3 – Planter Box Design:

Only Enter Information In To The Green Boxes - All Other Boxes Are Automatically Calculated

Low Impact Development Calculation Sheet

Owner			Line 1
Address			Line 2
Phone			Line 3
E-mail			Line 4
Parcel Identification Number			Line 5
Total Proposed Disturbed Area		ac	Line 6

Proposed Impervious Area Totals

House		ft^2	Line 7
Detached Garage		ft^2	Line 8
Shed		ft^2	Line 9
Driveway		ft^2	Line 10
Patio / Porch / Deck		ft^2	Line 11
Pool		ft^2	Line 12
Misc Description:		ft^2	Line 13

Is Your Property In The Following Locations:

		Yes	No
ICPAL	If "yes" see section 3.4	☐	☐
Dune Lake	If "yes" see section 3.5	☐	☐
Near a Mosquito Control Ditch	If "yes" see section 3.6	☐	☐

Area Totals

Total Impervious Area ______ ft^2 Line 14

Total Impervious Area (acres) ______ ac Line 15

Total Impervious Area (acres) = Total Area (ft^2) * (1 acre/ 43,560 ft^2)

Total Pervious Area ______ ac Line 16

Total Pervious Area (ft^2) ______ ft^2 Line 17

Total Pervious Area (acres) = Total Area (acres) - Total Impervious Area (acres)

Next Determine the Volume Required Per the LDC Section 5.06.00

Total Property (square feet) ______ ft^2 Line 18

Soils Characteristics

Depth to Seasonal High Groundwater Table		ft below ground surface		Line 19

Predominant Soil Type

Predominant Soil Type				Value Taken From USGS Soils Survey	Line 20
Infiltration	Actual K_{sat}		in/hr	Provided in Table 3	Line 21
Design Infiltration	Design K_{sat}		in/hr		Line 22

Stormwater Volume Requirements

0.5 in Rainfall Over Disturbed Area		ft^3		Line 23
1 in Runoff Over Proposed Impervious Surface		ft^3		Line 24
Attenuation Volume		ft^3	Find Largest Value Between Line 23, 24, and 25 And Enter The Value On Line 26	Line 25
Required Retention Volume		ft^3		Line 26

*****Special Circumstances Only - Verify Your Location****

Section 3.4 Stormwater Volume Requirements for ICPAL

0.5 in Rainfall Over Disturbed Area		ft^3		Line 27
1 in Runoff Over Proposed Impervious Surface		ft^3		Line 28
Attenuation Volume		ft^3	Find Largest Value Between Line 27, 28, and 29 And Enter The Value On Line 30	Line 29
Required Retention Volume		ft^3		Line 30

Section 3.5 Stormwater Volume Requirements for Dune Lake

0.5 in Rainfall Over Disturbed Area		ft^3		Line 31
1 in Runoff Over Proposed Impervious Surface		ft^3		Line 32
Attenuation Volume		ft^3	Find Largest Value Between Line 31, 32, and 33 And Enter The Value On Line 34	Line 33
Required Retention Volume		ft^3		Line 34

Section 3.6 Stormwater Volume Requirements for Mosquito Control Ditch

0.5 in Rainfall Over Disturbed Area		ft^3		Line 35
1 in Runoff Over Proposed Impervious Surface		ft^3		Line 36
Attenuation Volume		ft^3	Find Largest Value Between Line 35, 36, and 37 And Enter The Value On Line 38	Line 37
Required Retention Volume		ft^3		Line 38

Table 3. NRCS Soil Data

Map Unit Symbol	Map Unit Name	HSG	SHGW Elevation (SHGW)	High Water Season	Permeability Rate (Ksat)
5	Chipley sand, 5 to 8 % slopes	A	-2 feet	Dec - Apr	6 in/hr
8	Dorovan-Pamlico association, frequently flooded	B/D	0 (at surface)	Jan – Dec	0.6 in/hr
12	Foxworth sand, 0 to 5 percent slopes	A	-3.5 feet	Jun – Oct	20 in/hr
16	Kureb sand, 0 to 8 percent slopes	A	-5 feet	----	6 in/hr
17	Lakeland sand, 0 to 5 percent slopes	A	-5 feet	----	6 in/hr
18	Lakeland sand, 5 to 12 percent slopes	A	-5 feet	----	6 in/hr
19	Lakeland sand, 12 to 30 percent slopes	A	-5 feet	----	6 in/hr
21	Leon sand, 0 to 2 percent slopes	A/D	0 (at surface)	Jun – Feb	0.6 in/hr
27	Rutlege fine sand, 0 to 2 percent slopes	A/D	0 (at surface)	Dec – May	6 in/hr
30	Tifton fine sandy loam, 5 to 8 percent slopes	B	-3.5 feet	Jan – Feb	0.6 in/hr
36	Pits	-	On-site test	On-site test	On-site test
45	Dirego muck, frequently flooded	A/D	0 (at surface)	Jan – Dec	6 in/hr
49	Eglin sand, 0 to 5 percent slopes	A	-5 feet	----	6 in/hr
50	Mandarin sand, 0 to 2 percent slopes	A	-1.5 feet	Jun – Dec	0.6 in/hr
51	Bigbee loamy sand, 0 to 5 percent slopes, occasionally flooded	A	-3.5 feet	Jan – Mar	6 in/hr
53	Arents, 2 to 8 percent slopes	A	-5 feet	----	20 in/hr
54	Newhan-Corolla sands, rolling	A	-5 feet	----	20 in/hr
55	Beaches	-	0 (at surface)	----	0 in/hr
56	Kureb sand, hilly	A	-5 feet	----	6 in/hr
57	Hurricane sand, 0 to 5 percent slopes	A/D	-2 feet	Nov – Apr	6 in/hr
58	Duckston muck, frequently flooded	A/D	0 (at surface)	Jan – Dec	6 in/hr
62	Resota sand, 0 to 5 percent slopes	A	-3.5 feet	Dec – Apr	20 in/hr
63	Pickney sand, depressional	A/D	0 (at surface)	Nov – Apr	6 in/hr
64	Pamlico muck	A/D	0 (at surface)	Dec – May	0.6 in/hr
69	Florala loamy fine sand, 2 to 5 percent slopes	C	-1.5 feet	Dec – Mar	0.06 in/hr
99	Water	-	-	-	-
100	Waters of Gulf of Mexico	-	-	-	-

Site Characteristics

Total Disturbed Area		ft^2	Line 1
Impervious Area		ft^2	Line 2
Impervious Surface Ratio (ISR)			Line 3

Soil Characteristics

Soil Type - Refer to Section 2.4			Line 4
Rainfall Intensity	0.43	in/hr	Line 5
Infiltration Rate - Refer to Table 3		in/hr	Line 6
Design Infiltration Rate (Divide By 2)		in/hr	Line 7
Rainfall Depth	8.73	in	Line 8
Reduced Rainfall Depth		in	Line 9

Attenuation Calculation

Design Factor - Choose One Based On The ISR Calculated In Line 3			Line 10
ISR Less Than 0.4	1		
ISR Between 0.4 and 0.7	1.2		
ISR Greater Than 0.7	1.4		
Design Rainfall Depth		in	Line 11
Design Rainfall Depth (Conversion)		ft	Line 12
Required Storage Volume		ft^3	Line 13

Site Characteristics

Total Disturbed Area		ft^2	Line 1
Impervious Area		ft^2	Line 2
Impervious Surface Ratio (ISR)			Line 3

Soil Characteristics

Soil Type - Refer to Section 2.4			Line 4
Rainfall Intensity	0.61	in/hr	Line 5
Infiltration Rate - Refer to Table 3		in/hr	Line 6
Design Infiltration Rate (Divide By 2)		in/hr	Line 7
Rainfall Depth	14.7	in	Line 8
Reduced Rainfall Depth		in	Line 9

Attenuation Calculation

Design Factor - Choose One Based On The ISR Calculated In Line 3			Line 10
ISR Less Than 0.4	1		
ISR Between 0.4 and 0.7	1.2		
ISR Greater Than 0.7	1.4		
Design Rainfall Depth		in	Line 11
Design Rainfall Depth (Conversion)		ft	Line 12
Required Storage Volume		ft^3	Line 13

Only Enter Information In To The Green Boxes - All Other Boxes Are Automatically Calculated

Site Characteristics

Total Disturbed Area		ft^2	Line 1
Depth To SHGW		ft	Line 2
Infiltration		in/hr	Line 3

Treatment Volume

Design Volume (largest value from Site Characteristics sheet)		ft^3	Line 4

Planter Box Design

Additional Volume Requirement		ft^3	Line 5
Total Required Volume of Planter		ft^3	Line 6
Height of Planter		in	Line 7
		ft	Line 8
Required Area		ft^2	Line 9
Width of Planter		in	Line 10
		ft	Line 11
Design Length		ft	Line 12
Recovery Time		hr	Line 13

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