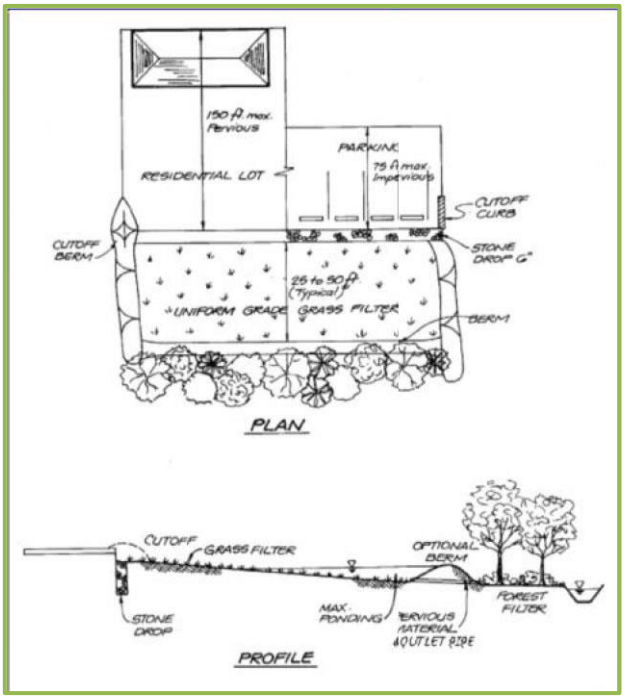
VEGETATED FILTER STRIP AREAS

*** AMENDED SOIL OR BERM OPTIONS ARE AVAILABLE IN THIS SECTION**

A vegetated filter strip can be an attractive and functional addition to your home landscape. Vegetated filter strip areas (including amended soil) are uniformly graded, vegetated areas of land designed to receive rainwater as sheet flow and to slow and filter stormwater runoff from roof downspouts or parking areas. Vegetated filter strips can provide significant reductions in stormwater runoff and pollutant loads in your local watershed.

LOCATION



- **Ideal Location.** Observe the drainage patterns to determine the best location for a vegetated filter strip area. Assess the drainage area flow paths on your property, and the slope of the drainage area. Ideal locations are places where there is a gentle slope away from the structure or paved area, the area is relatively flat, and where the flow can be evenly distributed along the top of the filter area.
- **Ideal Slope.** The ideal slope of the vegetated filter strip area shall be between 1% (100:1) and 5% (20:1). Greater slopes would encourage the formation of concentrated flow within the filter strip area; lesser slopes would encourage unintended ponding. If the slope is greater, terracing can be used by installing level spreaders between each terrace.

Use vegetated filter strip (VFS) designed to infiltrate in these instances:

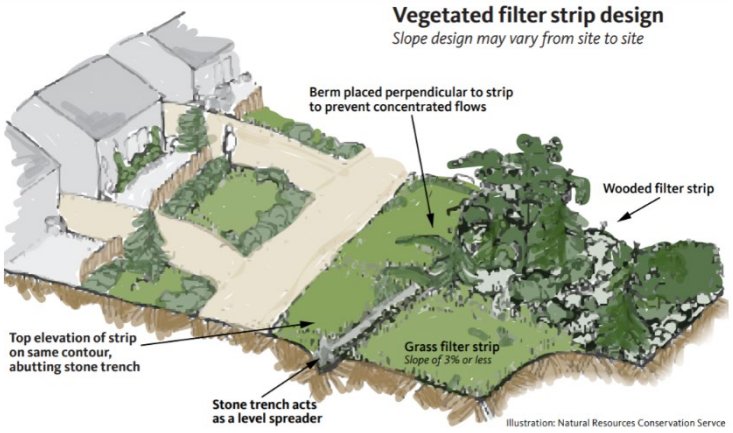
- Where the seasonal-high groundwater table is lower than 24 inches from the bottom of VFS;
- Where the bedrock is lower than 18 inches from the bottom of the VFS;
- 10 feet from a building with a basement or swimming pools;
- **Sump.** Vegetated filter strip sized to treat a minimum of 175 square feet of contributing area and sump pump discharge located a minimum of 20’ from any property line;
- 2 feet from a building without a basement (that is, slab on grade, crawl space, pier, or post foundations);
- Downhill of pervious areas with a maximum flow path of 150 feet;
- In existing forested areas, with some exceptions. Note that additional volumes of water can harm the health of established trees, especially Oregon white oak. Some species that can tolerate additional water after establishment include willow, ash, alder, poplar, and some maples. Consult with an International Society of Arboriculture Certified Arborist® if you have questions about tree species’ water tolerance level; and
- In any location designated by a qualified licensed engineer or geologist who has signed and stamped a geotechnical report, site plan, or letter.

Don't use an amended soil, bermed or conventional vegetated filter strip in these instances:

- Where it would slope over a contaminated groundwater plume;
- Where it would slope toward or flow over septic drain fields; and
- Where it would slope toward neighboring private properties.

Source: https://catalog.extension.oregonstate.edu/sites/catalog/files/project/pdf/em9208.pdf

- A filter strip area may be placed over utilities except when using the amended soil option. In that case, ensure utility locations are noted and care is taken to avoid them in soil amendment actions.
- The contributing drainage area (area of impervious surface) draining to any one discharge location cannot exceed 5,000 square feet.



Source: Center for Watershed Protection. 2009. Coastal Stormwater Supplement to the Georgia Stormwater Management Manual.

Minimum Length

- The length of the vegetated filter strip area should be no less than 25 feet. If there is a permeable berm at the lower end, the length of the vegetated filter strip area should be no less than 15 feet. Natural forested areas on site can be counted in the total length of the filter area.

CONSTRUCTION

Level Spreader

- **Definition.** An aggregate or prefabricated level spreader must be used at the upstream end of the filter area to evenly distribute stormwater runoff. A level spreader is a small trench filled with 1-inch clean stone installed along a level contour. Larger diameter stone may be required to stabilize entry points for larger contributing impervious areas.

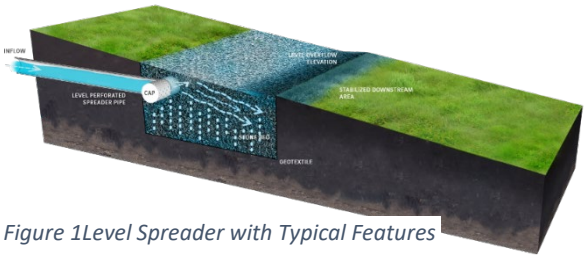


Figure 1Level Spreader with Typical Features

- **Restrictions.** The downstream side of the level spreader must be fully stabilized before the level spreader is installed. The minimum distance between the level spreader and any downslope property boundary must be 15 feet. The first ten (10) feet downslope of the level spreader must not exceed a slope of 4%. It is critical that the edge over which flow is distributed is exactly level.
- **Dimensions.** Level spreaders must safely diffuse flows up to, and including, the 10-year, 24-hour storm event (5.0 inch rainfall). The level spreader should be a minimum of 18" wide and 24" deep depending on the amount of expected flow.
- **Pipe Ends.** Pipe ends shall be either end-capped or connected to a pop-up emitter.
- To help ensure more even distribution of flow into the filter area, notches can be cut in the level spreader at intervals allowing overflowing water to enter at several locations ahead of general overflow.
- The level spreader can be connected, with solid HDPE pipe, to the downspout via a T-connection to the perforated pipes embedded in the level spreader trench (see figure 1). Level spreader pipes must be either 4-inch or 6-inch diameter perforated HDPE or approved equal, wrapped with a polyester filter sock.
- Ensure the overflow points are protected from erosion and not blocked by vegetation.

- **Waiver of Level Spreader.** If the impervious drainage area to any one entry point (e.g. a downspout) is less than 1,000 square feet appropriate level spreaders may be waived if flow will flow as a sheet through the strip area. In this case simple splash blocks (see figure) can be used to introduce flow into turf (yard) areas.

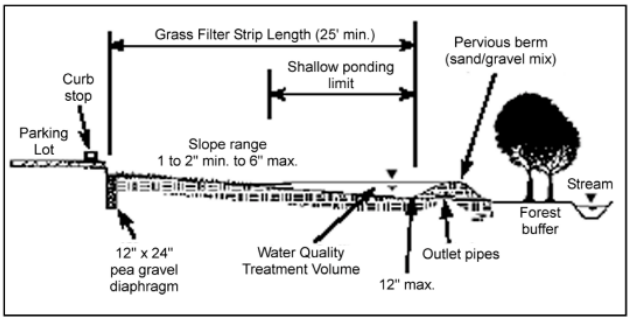
Conventional Design Option

- Conventional vegetated filter strip areas are uniformly graded BMP's that use an area of densely planted vegetation (typically grass) and a flat cross slope to maintain sheet flow and promote infiltration.
- **NOTE: This method cannot be used if the results of the soil infiltration test described in Appendix A are less than 0.50 inch per hour; the amended soil design option must be used instead.**

Berm Design Option

- A greater ability to meet the 1.14-inch rainfall standard can be achieved using a permeable berm at the bottom end of the filter strip. The permeable berm is used to temporarily store stormwater runoff within the filter area, which increases the infiltration and reduces the required width of the filter area.
- Permeable berms should be constructed of well-drained soils (sand, gravels, and sandy loams) that support plant growth, and should be no more than 12" high.

Source: www.neorsd.org



- Appropriately sized outlets should be provided within permeable berms to ensure that vegetated filter areas will drain within 24 hours following the end of a rainfall event.
- A stone-protected overflow area cut through the berm may be used to manage the stormwater runoff generated by large storm events. The overflow point must be at least ten feet from the property line if flow is directed onto an adjoining property. Erosion protection is critical.
- **NOTE: This method cannot be used if the results of the soil infiltration test described in Appendix A are less than 0.50 inch per hour; the amended soil design option must be used instead.**

Terracing (Benching, Slope Stepping, Steps)

- Terraces can be constructed by installing stone, concrete blocks, or other material at the base of the flatter section of a slope to help stabilize the soil above. This practice is similar to constructing a number of small retaining walls up the slope. When terracing is required it shall be in accordance with https://tahoebmp.org/Documents/BMPHandbook/Chapter%204/4.2/e_Terrac.pdf or an engineer-approved method.

Amended Soil Design Option

- Increased infiltration and a doubling of the ability to meet the 1.14-inch rain standard can be achieved by amending the soil within the filter area by tilling the existing soil to a depth of 12 inches and mixing in 4 inches of compost.
- **Compost**. A copy of the lab analysis, less than four months old, performed by a Seal of Testing Assurance Certified Laboratory verifying that the compost meets the physical requirements, shall be provided to the inspector at the time of initial inspection.

Compost Application Procedure.

- Clear surface of obstructions and properly dispose. The soil surface shall be reasonably free of all objects, including stone and rubble, greater than 2 inches, and other material which will interfere with planting and subsequent site maintenance.

- Rototill to a minimum depth of 12 inches for turf cover or deep rooted vegetation. If the soil is too dense for a rototiller, the soil should first be broken up into large aggregates using a soil ripper.
- If obstructions are unearthed during tilling, clear obstructions and properly dispose of. The soil surface shall be reasonably free of all objects, including stone and rubble, greater than 2 inches, and other material which will interfere with planting and subsequent site maintenance.
- Distribute compost evenly to a minimum depth of 4 inches over the soil surface.
    - Cubic Yards of Compost = [Filter Strip Area (square feet) *0.33 feet]/27cubic feet per cubic yard
        - Cubic Yards of Compost = 0.0122*Filter Strip Area (square feet)
        - i.e., for 905 square feet of filter strip you would need 11 cubic yards of compost
- Rototill several times in perpendicular directions to incorporate compost and other soil amendments.
- Complete with fine grading and sodding.
- Water thoroughly. Allow soil to settle for one week.

NOTE: The soil infiltration rate suitable for the Amended Soil Design Option is 0.25 in/hr or greater. If the results of the soil infiltration test described in Appendix A are less than 0.25 in/hr, provide an underdrain leading to daylight or discharged with a popup emitter as described in Appendix D.

Design Table

Measure the rooftop and other areas to be directed to the filter strip area. Depending on the site layout select the size and type of filter strip area from the table at right to meet the 1.14-inch design standard rainfall. For example, for a 1,000 square foot rooftop, a conventional filter strip must have a surface area of at least 2,000 square feet and a minimum flow length of 25 feet. If built with a berm, it can have a surface area of 700 square feet and a minimum flow length of 15 feet.

Contributing Drainage Area (square feet)	Filter Strip Type		
	Conventional	Amended Soil	Berm
	Filter Strip Area (sq ft)		
100	200	100	75
500	1000	500	350
1000	2000	1000	700
2000	4000	2000	1500
3000	6000	3000	2000
4000	8000	4000	3000
5000	10000	5000	3500

VEGETATION

- Vegetation commonly planted on vegetated filter strip area includes turf, shrubs, trees, and other herbaceous vegetation.
- Choose grasses and other vegetation that will be able to tolerate the stormwater runoff rates and volumes that will pass through the vegetated filter strip area.
- Vegetation used in filter strip areas should be able to tolerate both wet and dry conditions.
- Refer to Appendix B for more guidance. **Designate vegetation plan on submitted site plan.**

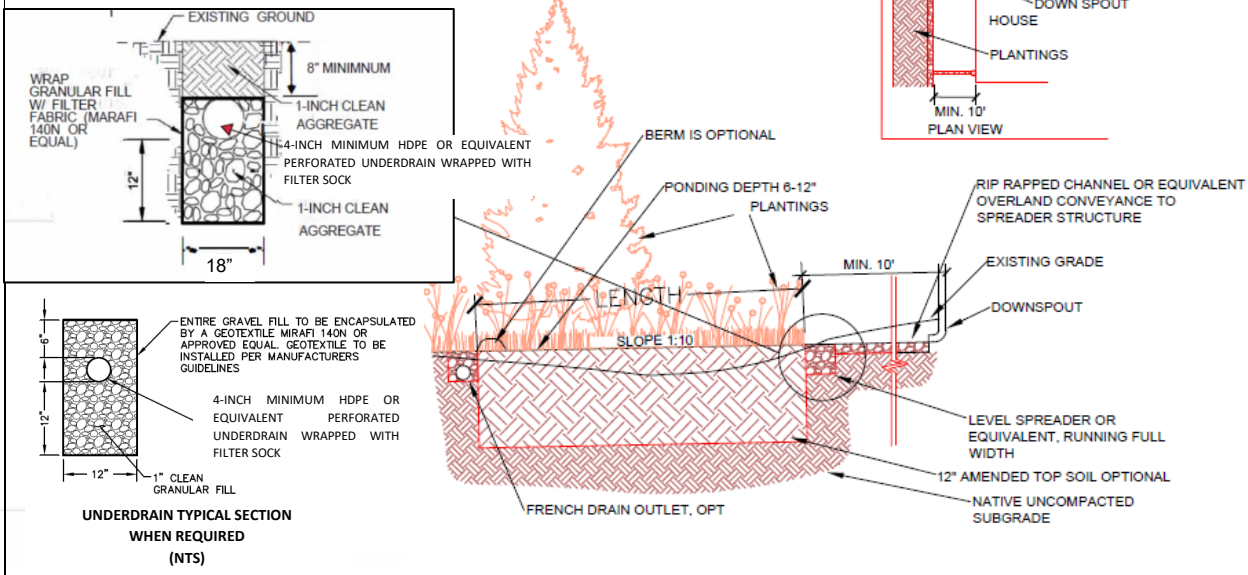
MAINTENANCE

Maintain the vegetated filter strip area so that it will continue to provide measurable stormwater management benefits over time.

- Water as needed to promote plant growth and survival especially in the first two seasons.
- Provide normal turf or garden maintenance - mow, prune, and trim as needed.
- Inspect the vegetated filter strip and terrace areas following rainfall events. Correct erosion issues immediately.
- Remove accumulated trash, sediment, and debris.

VEGETATED FILTER STRIP AREAS
TYPICAL COMPONENTS

RESIDENTIAL LEVEL SPREADER TYPICAL SECTION (NTS)



UNDERDRAIN TYPICAL SECTION WHEN REQUIRED (NTS)

CONSTRUCTION STEPS:

1. Review potential filter strip areas and layout. Filter strips should slope between 1% and 5% away from the structure and should not be located above a septic field. Filter strips may be located over utilities except when using the amended soil option. In that case, be sure to note utility locations and take care when preparing the amended soil. If there is a concentrated overflow, ensure it is at least ten feet from adjacent property.
2. Prior to submittal, perform an infiltration test according to Appendix A. If the rate is less than 0.25 in/hr the amended soil option must be used. If the infiltration rate is less than or equal to 0.05 in/hr, this method can only be used with an underdrain as described in Appendix D.
3. Measure the area draining to the filter strip and determine required surface area and minimum length from the table on the next page. Determine the desired filter strip and level spreader options.
4. Lay out and mark the filter strip area, flow spreader line, and inlets.
5. Construct level spreader by filling trench with appropriate gravel, taking note of overflow points.
6. Construct filter strip option, prepare soil. Construct terracing if necessary.
7. If underdrain required, excavate area, install geosynthetic, install bedding aggregate, and install perforated HDPE (if below frost line: HDPE or PVC) (or equivalent) pipe with polyester filter sock.
   INTIAL INSPECTION POINT
8. Construct erosion control at the flow entrance and exit points as needed.
9. Plant dense vegetation according to plan, or sod/seed. Ensure an irrigation plan is in place.
10. Ensure temporary erosion control is in place as needed until vegetation is well-established.
    FINAL INSPECTION POINT

CITY OF KIRKWOOD PROPERTY ADDRESS: DATE:	ATTACH THIS TWO-PAGE SPECIFICATION TO SITE PLAN SUBMITTAL	FILTER STRIP SPECIFICATIONS PAGE 1 OF 2

VEGETATED FILTER STRIP – LAYOUT SKETCH

PROVIDE PLAN AND ELEVATION VIEWS OF FILTER STRIP AND STRUCTURE/HOUSE SHOWING ROOF AREA DIRECTED TO FILTER STRIP WITH KEY DIMENSIONS, CONNECTIONS AND OVERFLOW RELATIVE TO PROPERTY LINE. DESIGNATE VEGETATION PLAN ON SITE PLAN.

SIZING CALCULATION:

SITE INFILTRATION RATE= _____ IN/HR

- IS AN UNDERDRAIN REQUIRED? □ YES □ NO
- WHICH OPTION SUITABLE FOR THE SITE?
  □ CONVENTIONAL □ AMENDED SOIL □ BERM

Contributing Drainage Area (square feet)	Filter Strip Type		
	Conventional	Amended Soil	Berm
	Filter Strip Area (sq ft)		
100	200	100	75
500	1000	500	350
1000	2000	1000	700
2000	4000	2000	1500
3000	6000	3000	2000
4000	8000	4000	3000
5000	10000	5000	3500

MEASURE CONTRIBUTING DRAINAGE AREA AND READ AREA FOR GIVEN FILTER STRIP TYPE.

FILTER STRIP TYPE: □ CONVENTIONAL □ AMENDED SOIL □ BERM

CONTRIBUTING DRAINAGE AREA= _____ SQ FT

FILTER STRIP AREA= _____ SQ FT

CONVENTIONAL LENGTH = _____ FT (25' MINIMUM LENGTH)

BERM OPTION = _____ FT (15' MINIMUM LENGTH)

COMPOST OPTION= _____ CUBIC YARDS, MINIMUM

MAINTENANCE:

1. INSPECT GUTTERS AND DOWNSPOUTS, REMOVE ACCUMULATED LEAVES AND DEBRIS, CLEAN LEAF REMOVAL SYSTEM(S).
2. IF APPLICABLE, INSPECT PRETREATMENT DEVICES FOR SEDIMENT ACCUMULATION. REMOVE ACCUMULATED TRASH AND DEBRIS.
3. IF PLANTING SELECTED, SUBMIT PLANTING PLAN AT THE TIME OF THE INITIAL INSPECTION.
4. WATER AS NEEDED TO PROMOTE PLANT GROWTH AND SURVIVAL ESPECIALLY IN THE FIRST TWO SEASONS.
5. PROVIDE NORMAL TURF OR GARDEN MAINTENANCE - MOW, PRUNE, AND TRIM AS NEEDED.
6. INSPECT THE VEGETATED FILTER STRIP AND TERRACES (IF INSTALLED) FOLLOWING RAINFALL EVENTS. CORRECT EROSION ISSUES IMMEDIATELY.

CITY OF KIRKWOOD PROPERTY ADDRESS: DATE:	ATTACH THIS TWO-PAGE SPECIFICATION TO SITE PLAN SUBMITTAL	FILTER STRIP SPECIFICATIONS PAGE 2 OF 2