Design Standards and Permitting Requirements

Native Landscaping

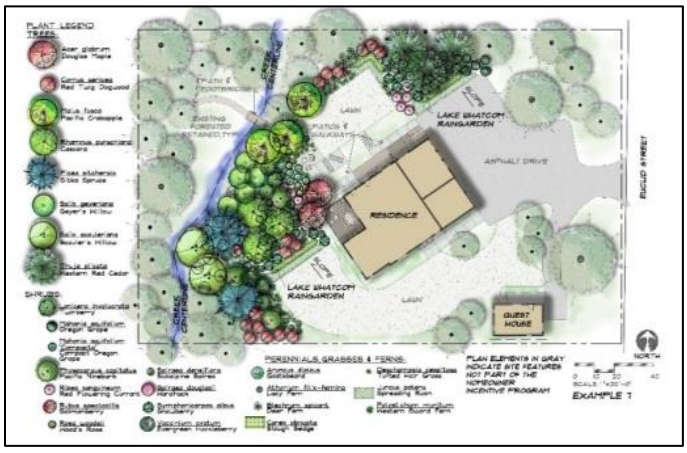
DESCRIPTION

Vegetated areas consisting of a thick mulch layer and a minimum density of plants common to forests of the Pacific Northwest. Native plants are generally defined as those found west of the Cascade Range prior to the arrival of European settlers, along with cultivars of those species and a few regionally-common species that are adapted to our climate.

Above: HIP Native Landscape Installed in 2016

METHOD OF PHOSPHORUS REDUCTION

Native landscaping re-creates the natural soil chemistry and biology found in forested areas. Plants and mulch in the vegetated area capture, neutralize, and recycle phosphorus, turning extra nutrients into healthy plants and soil. Up to 40% of rainfall is captured by plants prior to reaching the ground, resulting in less runoff.



Example of computer-generated native landscaping design

ADDITIONAL DESIGN FEATURES

Enhance your native landscape with one or more of the following site-specific options:

"Wet Garden" where moisture-loving native plants are installed in wet areas and thrive where other plants may struggle.

"Vegetated Berm" where strategically-placed soil piles are used to create visual complexity in the design.

"Riparian Buffer" a native plant garden that separates outdoor living spaces from streams, creeks, or shorelines.

Note: This design methodology is applicable for HIP projects only. These methods may not be suitable for, and have not been evaluated for, compliance with regulations which require professional engineering.

MINIMUM REQUIREMENTS AND DESIGN LIMITATIONS

All Native Landscaping projects must meet these minimum requirements in order to be approved for construction under these HIP Standards:

DESIGN

- At least 4" of low-P mulch throughout
- Minimum density of plants (use plant density calculator) divided between at least two layers (trees, shrubs, and groundcover)
- At least 90% of plants must be native to the Pacific Northwest, based on USDA PLANTS Database or equivalent*

LOCATION

- No trees or shrubs within 5' of a known utility on private property or within 10' of a known utility in the public rights-of-way.
- No trees on or adjacent to septic tanks, drainfields, and reserve areas
- Planting area is not on or next to a slope >35%

CONSTRUCTION METHOD/ CRITICAL PATH

1. Define planting area. If desired, install edging material or a hand-dug trench around the perimeter to keep new mulch in place. Digging trenches is limited to summer months only.
2. Recommended: Place a single layer of cardboard over all flat, lawn-covered areas, leaving existing lawn in place. Cardboard is not recommended on slopes or landscaped areas without an existing lawn.
3. Install mulch to a depth of 4" on flat areas or 6" on sloped areas
4. Prepare hole for planting. Push mulch away. Cut an "X" in the cardboard (if any) and fold it back, exposing the ground below. Dig a hole as deep as the root mass and twice as wide.
5. Install plants. Remove potting media from the roots. Spread roots out and backfill gently with native soil.
6. Replace mulch to within 6" of plant stems.
7. Optional: Install irrigation system and rain barrels.
8. Water plants well.
9. Optional: Install temporary deer fencing.
10. Sweep any impervious surfaces that may have been dirtied by mulch or soil

NOTES ON SEQUENCING

- Construction step order may be adjusted to meet individual project needs.
- To phase the work, mulch first in the spring or summer then plant during the fall.
- If planting and mulching at the same time, during the summer months, plant first then immediately mulch. In winter, mulch must be spread first before planting is allowed.

NATIVE LANDSCAPING ON THE SHORELINE

Installing native landscaping along the Lake Whatcom shoreline is an effective way to reduce direct phosphorus runoff into the lake and provides an opportunity to create pleasing landscapes combined with other HIP BMPs and existing landscape features. When working on a native landscaping project next to the shoreline, make sure to:

- Assess soil conditions prior to plant selection and select appropriate native plants for the conditions. Many shoreline areas are affected by a high water table.
- Identify the high water mark and install a barrier like a straw wattle above it prior to starting work.
- Take extra care to keep exposed soil and sediment from coming into contact with water.

Design Submittal

Native Landscaping

Section I: System and Sizing Summary

☐	I have defined the area that will be converted into native landscaping and have provided a site map showing the planting area.
	Native landscaping will replace _____ ft² of lawn/existing landscape and/or _____ ft² of impervious surface
☐	If any of my planting is in the public right-of-way, I have received written approval from the jurisdiction that manages the public area (City or County).
	The size of the area of the Right-of-Way I plan to landscape is _____ft²
☐	I have selected a vegetation layer combination for each unique planting area (e.g., right-of-way area, front yard, back yard, etc...) and used the HIP plant density calculator to calculate the number of plants and yards of mulch required for each planting area.
	The total combined quantities for <u>all</u> of my planting areas are: _____ cubic yards of approved mulch, _____ trees, _____ shrubs, and _____ groundcovers.

Section II: Site-Specific Planning

☐	I have determined that I will not be planting trees or shrubs within 5' of a known utility, including septic systems (on private property) or 10' from a utility (in public ROW).
☐	I have determined that I will not need additional approvals for planting trees in the public right-of-way (if proposed, tree planting in ROW is not required).
☐	I have determined that the planting area is not on or next to a slope steeper than 35%.
☐	I have developed a plan to prevent erosion or runoff during my planting activities, including work during the wet season that complies with winter work provisions.

Plant Density Calculator

Native Landscaping

Instructions: Select one of the options listed below for each unique planting area and calculate the minimum required planting density and mulch. Note that existing plants may be counted to meet required plant density numbers.

Option	Vegetation Layer Combination	Plant Layer	Project area (sq ft)	Density Divider	Number of Plants
A	Tree, Shrub, and Groundcover	Trees		225 (15' o.c.*)	
		Shrubs		64 (8' o.c.)	
		Groundcovers		25 (5' o.c.)	
B	Tree and Shrub Only (No Groundcovers)	Trees		144 (12' o.c.)	
		Shrubs		36 (6' o.c.)	
C	Tree and Groundcover Only (No Shrub)	Trees		144 (12' o.c.)	
		Groundcovers		16 (4' o.c.)	
D	Shrub and Groundcover Only (No Tree)	Shrubs		49 (7' o.c.)	
		Groundcovers		25 (5' o.c.)	
Cubic Yards of Mulch				80	

*The abbreviation "o.c." stands for "on center", a convention used to describe the average distance between plants. For example, a tree that is planted 15' o.c. would be, on average, 15' from its nearest neighbor.

Plant List

Instructions: submit a list of native plants proposed for the project categorized by tree, shrub, and groundcover. List plant name (scientific preferred) and quantity. Include number of existing plants used to meet plant density requirements. Identify non-natives and cultivars and limit to no more than 10% of total plants.

Design Standards and Permitting Requirements

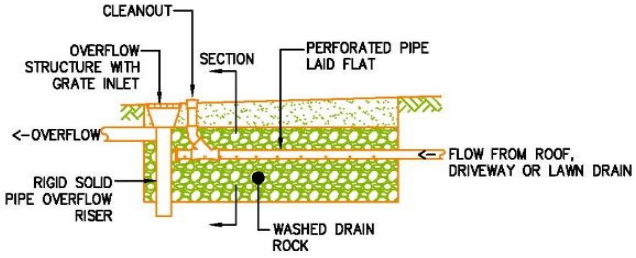
Infiltration Trench

DESCRIPTION

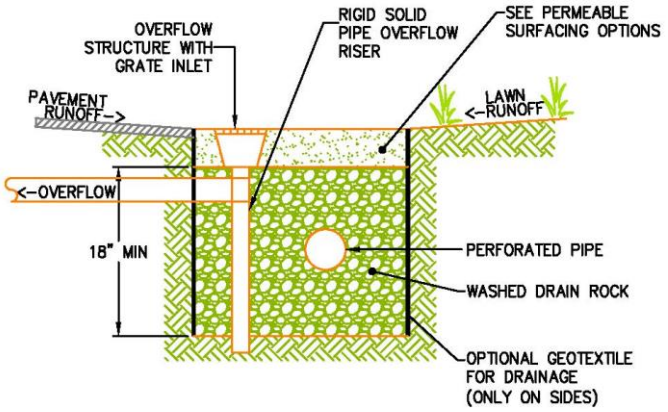
An underground drainage facility, consisting of washed rock and constructed with a flat bottom, intended to capture and infiltrate runoff from impervious and pervious surfaces. This facility does not have an underdrain or bypass structure, so it requires a dedicated and protected overflow structure.

METHOD OF PHOSPHORUS REDUCTION

Treatment via infiltration through native soils. Runoff entering the infiltration trench is detained and allowed to slowly pass through subsoils, where phosphorus is bound by, captured within, and recycled into the soil matrix.



PROFILE VIEW



SECTION VIEW

Above: HIP infiltration trench installed in 2016

ADDITIONAL DESIGN FEATURES

Enhance your infiltration trench with one or more of the following site-specific options:

"Dry Creek Bed" where river rock creates the look of a stream channel in the landscape.

"Patio Drywell" where spaced pavers* with gaps create a useable outdoor living space.

"Walkway Trench" where pea gravel or spaced pavers* create durable pathways.

"Garden Path" where low-P mulch provides a way to access and enjoy the landscape (only allowed through landscaped areas).

* See Design Standards for HIP Permeable Pavement Surfacing. Restrictions and limitations apply to certain properties.

Note: This design methodology is applicable for HIP projects only. These methods may not be suitable for, and have not been evaluated for, compliance with regulations which require professional engineering.

MINIMUM REQUIREMENTS AND DESIGN LIMITATIONS

All infiltration trench projects must meet these minimum requirements in order to be approved for construction under these HIP Standards:

DESIGN

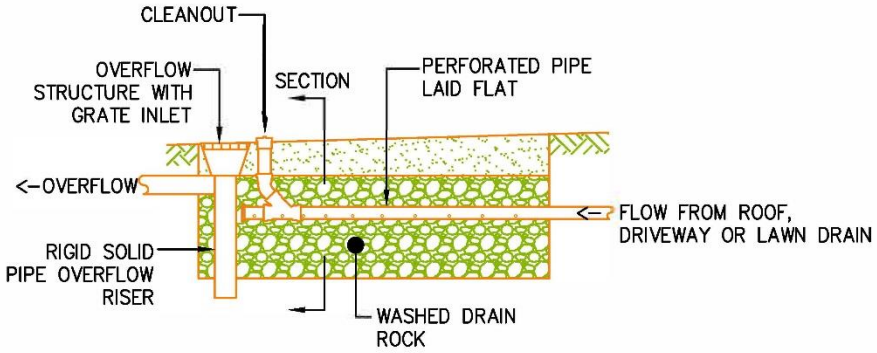
- At least 18" wide in all locations
- At least 18" deep, on average
- Total slope of trench less than 2%
- Bottom of trench more than 1' from groundwater or bedrock
- Only clean rock (no fines) is allowed in any layer

LOCATION

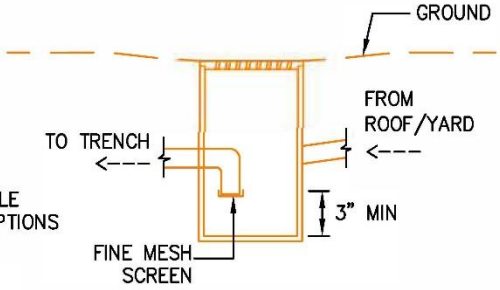
- **Critical Areas:** setback requirements near critical areas (wetlands, shorelines, or creeks) and their buffers will vary depending on site specifics. Consult with the HIP Coordinator for requirements pertaining to each unique site.
- **Slopes:** unless approved by a licensed geotechnical engineer, trenches cannot be placed on slopes >10% and must be at least 10' upgradient from slopes >15% and 50' upgradient from slopes steeper than 35%.
- **Separation:** at a minimum, all infiltration facilities must be at least: 25' from shorelines or creeks, 5' from known public and private utilities, 5' from structures with slab-on-grade foundations and 10' from structures with a basement or crawl space. Septic tanks must be protected by placing the trench at least 5' from tanks, and 10' upgradient and 30' downgradient from drain fields and drain field reserve areas.
- **Property Lines:** trenches cannot be located in public rights-of-way and should be placed at least 10' from neighboring property lines except in some specific cases. Consult with the HIP Coordinator to determine site-specific setback requirements.

CONSTRUCTION METHOD/ CRITICAL PATH

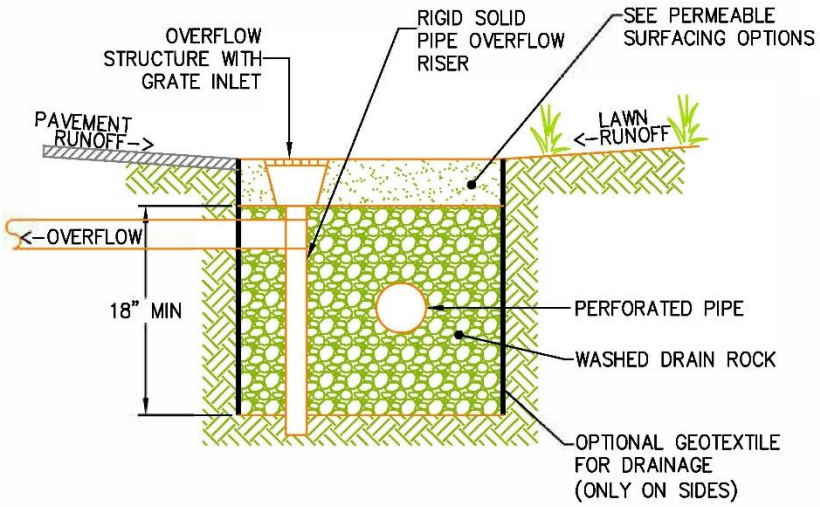
1. Install erosion controls
2. Excavate soil and reuse on site or dispose
3. Gently scarify subgrade
4. Install 75% base rock in first lift
5. Install elevated distribution pipe
6. Install overflow riser and pipe
7. Connect overflow pipe to downstream drainage system
8. Install drains and conveyance into trench from site surfaces
9. Connect conveyance to distribution pipe
10. Install second lift of rock (25%) to reach final grade
11. Install surfacing (optional)
12. Stabilize disturbed soils
13. Remove erosion controls



PROFILE VIEW



JUNCTION BOX



SECTION VIEW

ROCK-FILLED INFILTRATION TRENCH

HIP BMP "B" TYPICAL NTS

Construction Criteria for Infiltration Facilities

Initial basin excavation should be conducted to within 1-foot of the final elevation of the basin floor. Excavate infiltration trenches and basins to final grade only after all disturbed areas in the upgradient project drainage area have been permanently stabilized. The final phase of excavation should remove all accumulation of silt in the infiltration facility before putting it in service. After construction is completed, prevent sediment from entering the infiltration facility by first conveying the runoff water through an appropriate pretreatment system such as a pre-settling basin, wet pond, or sand filter.

Infiltration facilities should generally not be used as temporary sediment traps during construction. If an infiltration facility is to be used as a sediment trap, it must not be excavated to final grade until after the upgradient drainage area has been stabilized. Any accumulation of silt in the basin must be removed before putting it in service.

Traffic Control Relatively light-tracked equipment is recommended for this operation to avoid compaction of the basin floor. The use of draglines and trackhoes should be considered for constructing infiltration basins. The infiltration area should be flagged or marked to keep heavy equipment away.

Design Submittal
Infiltration Trench

Section I: System and Sizing Summary

☐	I have defined the area that will drain into the infiltration trench, by piping or sheet flow and have provided a site plan and facility cross-section.
	The drainage area is_____ft² of impervious surface and/or _____ft² of lawn/landscape
☐	I have sized the trench using approved methodology (HIP Sizing Calculator or stormwater hydrological modeling software) and attached that data.
	The trench will be at least _____ft² in size and at least 1.5' (18 inches) deep.
☐	I have calculated the amount of rock needed to fill the trench (cubic feet of trench volume ÷ 27).
	I will need to install at least _____ yd³ of drain rock.

Section II: Site-Specific Planning

☐	I have determined that the trench is at least 5' from known public and private utilities.
☐	I have determined that the trench is at least 5' from structures with slab-on-grade foundations and 10' from structures with a basement or crawl space.
☐	If any portion of my trench is within 10' of a neighboring property, I have received written approval to proceed from that neighboring property owner.
☐	I have determined that the trench is not on a slope steeper than 10% and not within 10' upgradient of a slope steeper than 15% and not within 50' upgradient of a slope steeper than 35%.
☐	I have developed an erosion control plan for the excavation of the trench and completed a site-specific SWPPP that is included with this application.

Soil Characterization Sheet

Step 1. Review available soil data and recommend on-site soil testing

To be completed by HIP Coordinator

Off-site test pit data. Review map provided by HIP. If one test pit is within 100' of any property line, list only that data. Otherwise, please list three representative test pits, preferably within ¼ mile of the site.

Test Pit Number	Soil Type/ Infiltration Rate	Depth to Groundwater	Depth to Bedrock

Based on this information, the recommended soil investigation procedure to follow in Step 2 is (determined by HIP Coordinator):

Step 2. On-site testing procedure to determine soil type

To be completed by HIP Coordinator or the project designer

Follow the soil testing methods and instructions for infiltration BMPs, found in the HIP Design Manual (Infiltration Trench and Lake Whatcom Rain Garden).

Note: If designing for infiltration facilities in multiple locations, it is suggested that each location be checked for factors that might affect design considerations. Consult with the HIP Coordinator to determine the number of additional investigations recommended for each unique site.

I completed an on-site soil investigation using (check boxes of all completed tests):

☐ Soil Drainage Test

I used the Rain Garden Manual

After one wet season (or three dry season) tests I have determined that my soil drainage rate is _____in/hr.

I've characterized my soil as:

- ☐ Good
- ☐ Moderate
- ☐ Marginal
- ☐ Poor

☐ Simple Investigation

I dug to a depth of 3' below ground surface and found:

- ☐ Groundwater
- ☐ Bedrock
- ☐ Other: _____
  _____
  _____
- ☐ None of the above

☐ Soil Texture Test

I used this test method to determine soil type (circle one):

Clay	Clayey Silt
Silt/Loam	Sandy Loam/Sand

I've characterized my soil as:

- ☐ Good
- ☐ Moderate
- ☐ Marginal
- ☐ Poor

"SOIL DRAINAGE TEST" INSTRUCTIONS

Modified for HIP from procedures found in the Rain Garden Handbook for Western Washington Homeowners

After identifying the location of a potential infiltration system (HIP Infiltration Trench BMP or HIP Lake Whatcom Rain Garden BMP), the next step is to test the soil in that location. You will be evaluating the "infiltration rate", defined as the amount of time it takes water to soak into the ground. Determining an infiltration rate will allow you to use the HIP Standard Calculator to size the system for maximum water quality benefit and free permits through HIP.

1 LOCATE UTILITIES

Call 8-1-1 and mark with white paint the location of your proposed test hole or other potential underground features. The Call-Before-You-Dig professionals will arrive, from the various utilities, over the next week or so to mark the location of public utilities on your property.

Make sure you identify any potential private utilities (such as septic system drain fields and/or private electrical conduit) that would not be part of the public utility marking. You may need to do shallow, careful, excavations (pot-holing) to confirm some utilities.

2 DIG TEST HOLE

Dig a small hole at least 2 feet deep and at least 18 inches in diameter.

3 DETERMINE DRAINAGE RATE

Fill the hole with 12 inches of water. Secure a yard stick or a self-made gauge in the hole for measuring the drainage rate. The self-made gauge can be a board or pipe with markings every half inch from the bottom.

Time how long it takes for the water to drain out completely. By the way, this can take a while, so start in the morning and check back regularly throughout the day. If there is still water in the hole after 12 hours, record how many inches have gone down since you started the test. Divide total inches by total hours to calculate the soil drainage rate.

4 REPEAT IN DRY SEASON

If it's the wet season (December through April), do this soil drainage test once. If you must test during the dry season, do the test three times (with each test performed immediately after completion of the last). Use the third test as your drainage rate (measured in inches per hour). Testing three times during the dry season provides a better estimate of wetter conditions present in the winter when the system is doing the most work.

5 CHARACTERIZE YOUR SOIL

- If your calculated drainage rate is greater than two inches per hour (2"/hr), **use the "good" designation** on the soil characterization sheet in the design packet. This soil is likely sand.
- If your calculated drainage rate is between a half-inch per hour (1/2"/hr) and two inches per hour (2"/hr), **use the "moderate" designation** on the soil characterization sheet in the design packet. This soil is likely silty sand.
- If your calculated drainage rate is between an eighth-inch per hour (1/8"/hr) and a half-inch per hour (1/2"/hr), **use the "marginal" designation** on the soil characterization sheet in the design packet. This soil is likely a silt or loamy material.
- If your calculated drainage rate is less than an eighth-inch per hour (1/8"/hr), **use the "poor" designation** on the soil characterization sheet in the design packet. This soil is likely clay.

"SIMPLE INVESTIGATION TEST" INSTRUCTIONS

Modified for HIP from procedures found in the Rain Garden Handbook for Western Washington Homeowners

Avoid locating your infiltration system in an area with high groundwater or shallow bedrock by performing a simple investigation test. It's best to figure out the groundwater level during the rainy winter months, December through April, and you can search for bedrock at the same time.

1 LOCATE UTILITIES

Call 8-1-1 and mark with white paint the location of your proposed test hole or other potential underground features. The Call-Before-You-Dig professionals will arrive, from the various utilities, over the next week or so to mark the location of public utilities on your property.

Make sure you identify any potential private utilities (such as septic system drain fields and/or private electrical conduit) that would not be part of the public utility marking. You may need to do shallow, careful, excavations (pot-holing) to confirm some utilities.

2 DIG INVESTIGATION HOLE

Dig down 36 inches below the ground surface, if possible. You can use a post-hole digger or hand operated auger to reach the desired depth.

If you are digging in groundwater (i.e. the hole is filling with water faster than you can remove it) or hitting rock that prohibits any additional digging, you can stop the test as this location is not conducive to infiltration.

3 LOOK INTO THE HOLE

If you see water seeping in from the bottom or sides, or hit an impenetrable layer of rock or clay, find another location for your infiltration facility or choose a treatment BMP (such as the HIP Media Filter Drain or Dispersion BMPs).

"SOIL TEXTURE TEST" INSTRUCTIONS

Modified for HIP from procedures found in the Rain Garden Handbook for Western Washington Homeowners

Avoid locating your infiltration system in an area with high groundwater or shallow bedrock by performing a simple investigation test. It's best to figure out the groundwater level during the rainy winter months, December through April, and you can search for bedrock at the same time.

1 LOCATE UTILITIES

Call 8-1-1 and mark with white paint the location of your proposed test hole or other potential underground features. The Call-Before-You-Dig professionals will arrive, from the various utilities, over the next week or so to mark the location of public utilities on your property.

Make sure you identify any potential private utilities (such as septic system drain fields and/or private electrical conduit) that would not be part of the public utility marking. You may need to do shallow, careful, excavations (pot-holing) to confirm some utilities.

2 DIG TEST HOLE

Dig a small hole at least 18 inches deep and at least 6 inches in diameter. A post-hole digger or small hand auger is the perfect tool for this job.

3 EVALUATE SOIL TEXTURE

When you reach a depth of at least 18", take a scoop of soil from the bottom of the hole and use the procedure below to characterize its soil type.

Prepare the soil: put some soil in the palm of your hand and try to squeeze it into a ball. If the soil is dry, add water a few drops at a time, break down the chunks to work the water into the soil, and then perform the soil texture test.

Characterize the soil texture:

- If the soil is light in color, feels gritty, and will not stick together at all when wet **use the "good" designation** on the soil characterization sheet in the design packet. This soil is likely sand.
- If the soil is dark in color, feels gritty, and falls apart easily when worked, **use the "moderate" designation** on the soil characterization sheet in the design packet. This soil is likely silty sand.
- If the soil feels smooth, and breaks apart into chunks when worked but stays together in a ball when held, **use the "marginal" designation** on the soil characterization sheet in the design packet. This soil is likely a silt or loamy material.

- If the soil is very sticky and forms a dense ball that can't be easily broken apart, **use the "poor" designation** on the soil characterization sheet in the design packet. This soil is likely clay.

Sizing Calculator
Infiltration Trench

Sizing Calculator: input soil characterization data into the table below to calculate the size of the facility.

Instructions: using the soil type identified on the Soil Characterization Sheet measure the amount of hard surface (roof, pavement, gravel) in square feet and amount of lawn and/or landscape area in square feet and insert values into table below. Use multipliers below to calculate required trench area.

Soil Type	Hard Surface (square feet)		Hard Surface Multiplier		Lawn/Landscape (square feet)		Lawn/LS Multiplier		Trench Minimum (square feet)
Good	[	×	0.06]	+	[	×	0.02]	=	
Moderate	[	×	0.09]	+	[	×	0.04]	=	
Marginal	[	×	0.12]	+	[	×	0.06]	=	
Poor	Infiltration Not Recommended. Use Media Filter Drain or Dispersion BMPs.								

Design Standards and Permitting Requirements

Media Filter Drain (MFD)

DESCRIPTION

An underground drainage facility, consisting of specially-mixed media (MFD mix), intended to treat runoff from hard surfaces and lawn and landscaped areas. Configurations are slightly different depending on how runoff enters the facility (via pipe or sheet flow). This facility does have an underdrain and requires either a controlled bypass structure or an overflow to function properly.

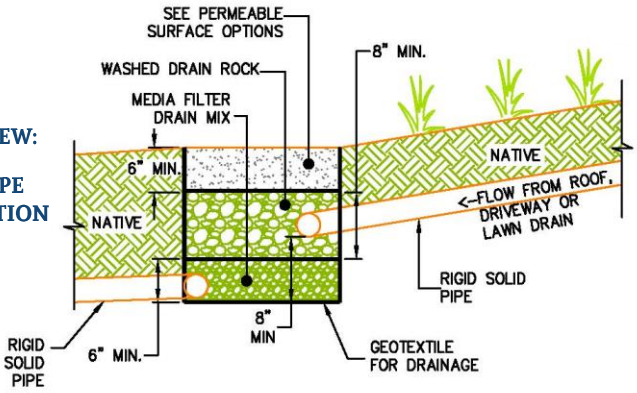
METHOD OF PHOSPHORUS REDUCTION

Treatment via media (MFD mix). Runoff entering the facility passes through the media, where perlite, dolomite, and gypsum provide physical, chemical, and biological treatment for total and dissolved phosphorus.

Above: useful yard space on top of a MFD

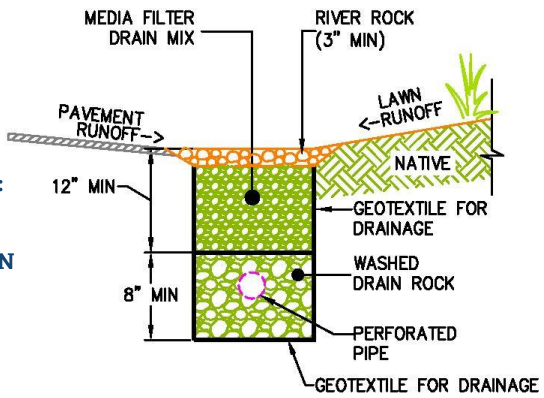
SECTION VIEW:

END-OF-PIPE CONFIGURATION



SECTION VIEW:

SHEET FLOW CONFIGURATION



ADDITIONAL DESIGN FEATURES

Enhance the look of your MFD with one or more of the following site-specific options:

"Patio MFD" where spaced pavers* with gaps create a useable outdoor living space.

"Sidewalk MFD" where pea gravel or spaced pavers* create durable pathways.

* See Design Standards for HIP Permeable Pavement Surfacing. Restrictions and limitations apply to certain properties

Note: This design methodology is applicable for HIP projects only. These methods may not be suitable for, and have not been evaluated for, compliance with regulations which require professional engineering.

MINIMUM REQUIREMENTS AND DESIGN LIMITATIONS

All Media Filter Drain projects must meet these minimum requirements in order to be approved for construction under these HIP Standards:

DESIGN

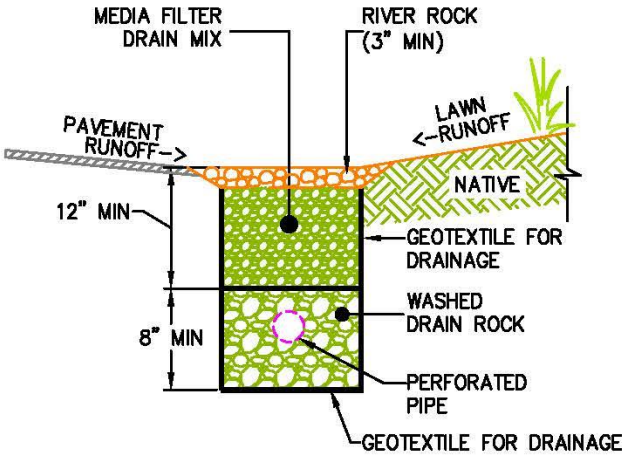
- For MFD trenches accepting sheet flow, trench must be at least 24" wide in all locations
- MFD mix at least 12" deep throughout (sheet flow design)
- For MFD trenches accepting piped flow, the trench must be at least 36" wide in all locations
- MFD mix at least 6" deep throughout (end-of-pipe design)
- Total slope of trench less than 2%
- No single trench longer than 50', use multiple trenches
- Bottom of MFD mix cannot contact groundwater

LOCATION

- **Critical Areas:** setback requirements near critical areas (wetlands, shorelines, or creeks) and their buffers will vary depending on site specifics. Consult with the HIP Coordinator for requirements pertaining to each unique site.
- **Slopes:** unless approved by a licensed geotechnical engineer, MFDs cannot be placed on slopes >10% and must be at least 10' upgradient from slopes >15% and 50' upgradient from slopes steeper than 35%
- **Separation:** at a minimum, all MFDs must be at least: 25' from shorelines or creeks (distance may be reduced if soil investigation demonstrates feasibility; check with HIP Coordinator), 5' from known public and private utilities, 5' from structures with slab-on-grade foundations and 10' from structures with a basement or crawl space. Septic tanks must be protected by placing the trench at least 5' from tanks and 10' upgradient and 30' downgradient from drain fields and drain field reserve areas
- **Property Lines:** MFDs cannot be located in public rights-of-way and should be placed at least 10' from neighboring property lines except in some specific cases. Consult with the HIP Coordinator to determine site-specific setback requirements.

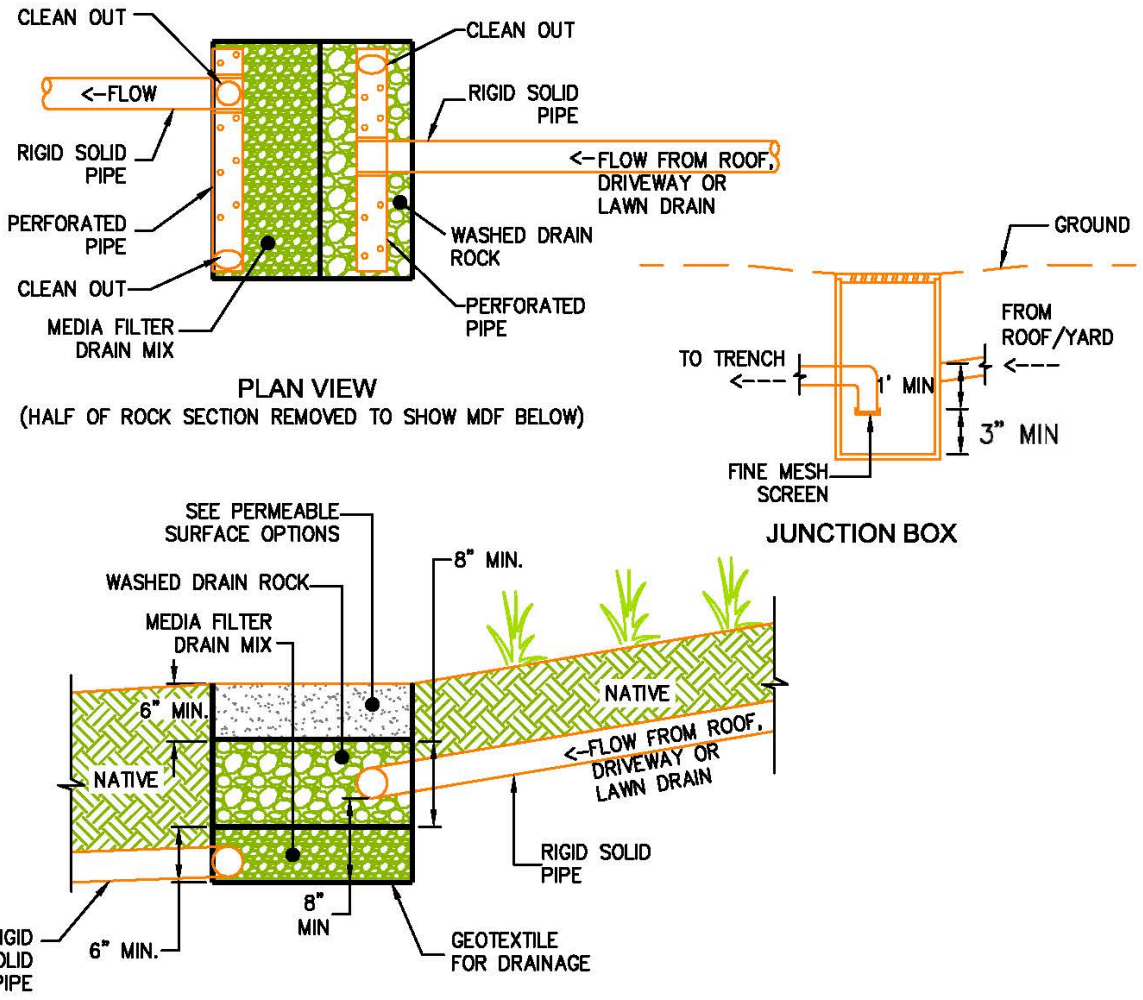
CONSTRUCTION METHOD/ CRITICAL PATH

1. Install erosion controls
2. Excavate soil and reuse on site or dispose
3. Lay fabric in trench and pin to edge
4. Install bottom layer* of material to bed underdrain pipe
5. Install underdrain pipe and stub out
6. Fold fabric over bottom layer
7. Place fabric over remaining trench
8. Install second layer* of material in 6" lifts over fabric
9. Install dispersion inlet (runnel with grade board or perforated pipe)
10. Fold fabric over second layer, cut to fit.
11. Connect underdrain pipe to downstream drainage system
12. Install conveyance to dispersion inlet
13. Connect roof/driveway/yard drains to conveyance
14. Install surfacing (optional)
15. Stabilize disturbed soils
16. Remove erosion controls



SECTION VIEW

MEDIA FILTER DRAIN ; SHEET FLOW CONFIGURATION
HIP BMP "C.1", TYPICAL NTS



MEDIA FILTER DRAIN END-OF-PIPE CONFIGURATION
HIP BMP "C.2", TYPICAL NTS

Design Standards and Permitting Requirements

Media Filter Drain (MFD) - Clean Beach

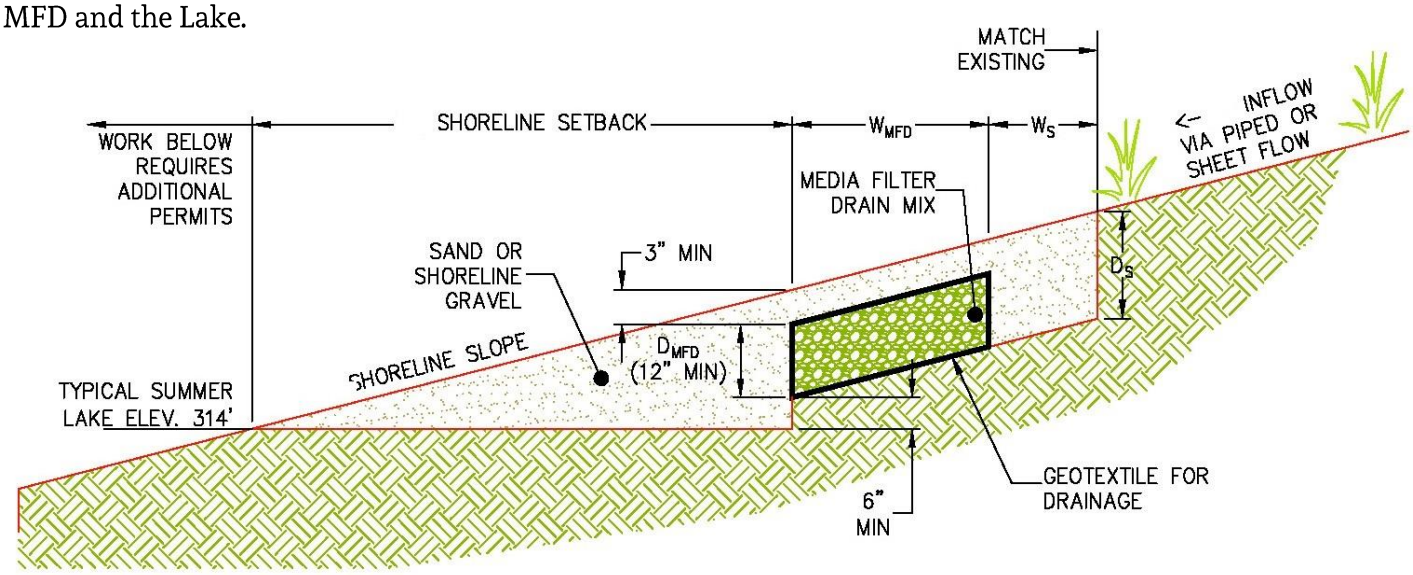
DESCRIPTION

An underground drainage facility, consisting of specially-mixed media (MFD mix), intended to treat runoff from hard surfaces and lawn and landscaped areas. Along the shoreline, MFDs can be coupled with a beach made of treatment sand and native landscaping to enhance the performance of the system. This facility does not require an underdrain or structural overflow because excess water will flow into the sand filter beach. Runoff enters the facility via pipe or sheet flow per to "HIP BMP C.1 and C.2". Projects within Whatcom County must be designed per 30% Clean Beach requirements (see below). Projects within the City of Bellingham can utilize up to 100% clean beach along the shoreline.

Above: Bloedel Donovan Beach MFD

METHOD OF PHOSPHORUS REDUCTION

Treatment via media (MFD mix). Runoff entering the facility passes through the media and sand layers, where perlite, dolomite, and gypsum provide physical, chemical, and biological treatment for total and dissolved phosphorus. Excess runoff is treated by sand between the MFD and the Lake.



Note: This design methodology is applicable for HIP projects only. These methods may not be suitable for, and have not been evaluated for, compliance with regulations which require professional engineering.

MINIMUM REQUIREMENTS AND DESIGN LIMITATIONS

All Clean Beach projects must meet the following minimum requirements in order to be approved for construction under these HIP Standards:

DESIGN

- For MFD trenches accepting sheet flow, the trench must be at least 24" wide in all locations
- For MFD trenches accepting piped flow, the trench must be at least 36" wide in all locations
- MFD mix at least 12" deep throughout
- Total slope of trench less than 2%
- No single trench longer than 50', use multiple trenches
- Bottom of MFD mix cannot contact groundwater
- Any non-lawn vegetation along the shoreline must be retained or replaced 3:1 elsewhere on site (see additional requirements if designing a 30% clean beach)
- Permeable surfacing is not permittable in a clean beach design

LOCATION

Conformance with MFD Standards: Clean beach MFD trenches must adhere to the minimum requirements for Critical Areas, Slopes, Separation, and Property Lines described in the HIP Standards for Media Filter Drains. Unless recommended by the HIP Coordinator, Clean Beach MFD trenches must be located at least 25' from the Lake Whatcom ordinary high water mark (OHWM). Placing MFD trenches closer to the shoreline (15' minimum setback) may be possible on some sites if soil investigations demonstrate feasibility.

CONSTRUCTION METHOD/ CRITICAL PATH

1. Install erosion controls
2. Excavate soil and reuse on site or dispose
3. Place non-woven geotextile (for drainage) onto subgrade
4. Install MFD mix in 6" lifts
5. Pull geotextile edges up and around MFD material, creating a MFD "burrito"
6. Backfill clean sand around and over MFD burrito and match to grade
7. Place drain rock layer and distribution piping*
8. Install conveyance to dispersion inlet*
9. Connect roof/driveway/yard drains to conveyance*
10. Stabilize disturbed soils
11. Remove erosion controls

*Additional steps for end-of-pipe configuration

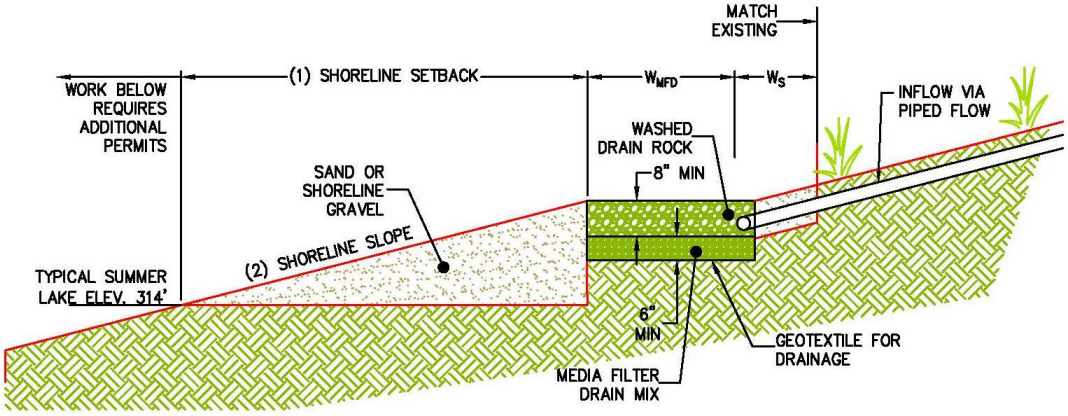
30% CLEAN BEACH OPTION WITH NATIVE LANDSCAPING BUFFER

Shoreline native vegetation provides benefits by reducing phosphorus and nutrients from entering the lake while providing habitat for fish and birds. Shoreline vegetation also provides visual interest and lower maintenance cost compared to lawns.

With the 30% clean beach option, 30% of the property's shoreline is converted to beach and 70% of the shoreline has native landscaping. Projects located within Whatcom County outside of city limits need to adhere to the 30% clean beach requirements listed below. HIP participants within the City of Bellingham may choose to incorporate any amount of native shoreline vegetation as part of their clean beach project design.

30% Clean Beach Requirements:

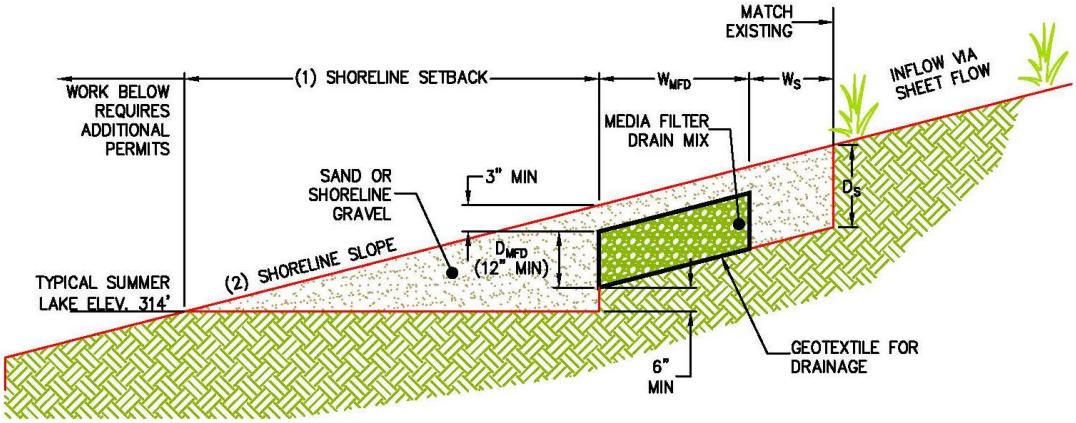
- Refer to the 30% clean beach plan view for conceptual configurations and notes
- See sectional view C.3 detail and notes
- Follow the HIP Native Landscaping BMP design standards included in this manual
- The minimum square footage of native shoreline planting installed must be equal to the total parcel shoreline length x 15'. Planting areas should be contiguous with the shoreline. Planting area shape can vary with a minimum buffer depth of 5' from the shoreline
- Maximum beach width at the shoreline is 30% of total shoreline length; above the shoreline beach width may vary up to the maximum width necessary to capture flow from the MFD



MEDIA FILTER DRAIN - CLEAN BEACH CONFIGURATION — SECTION VIEW
HIP BMP "C.3" TYPICAL END OF PIPE — NTS

(1) 25' RECOMMENDED SHORELINE SETBACK. MAYBE REDUCED TO 15' IF SOIL INVESTIGATION DEMONSTRATES BOTTOM OF MFD IS ABOVE HIGH GROUNDWATER ELEVATION.

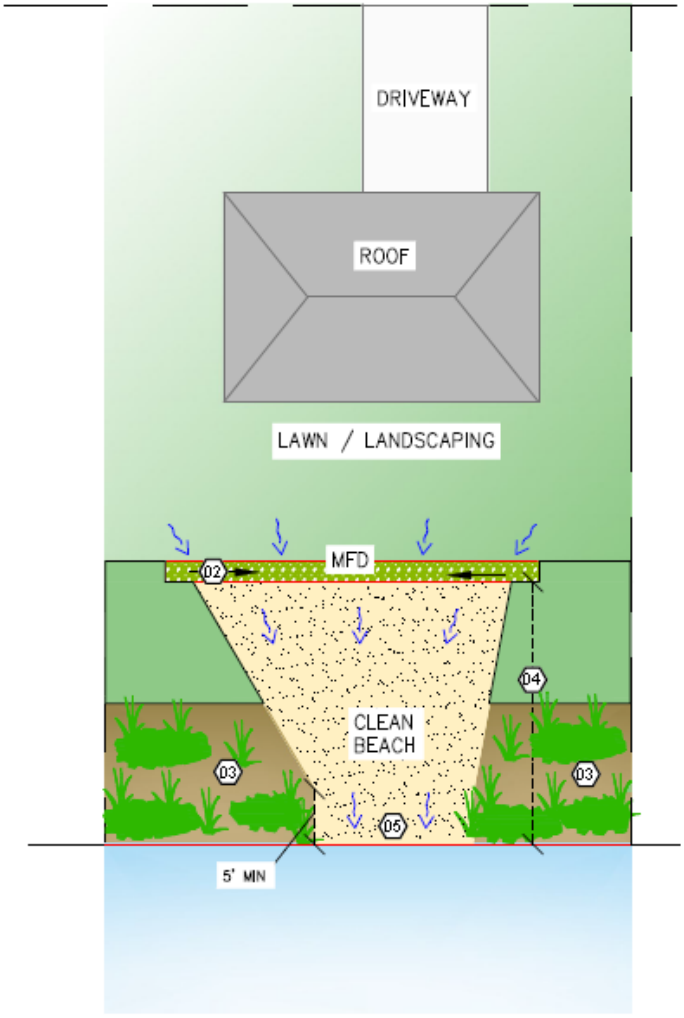
(2) MATCH EXISTING SLOPE TO GREATEST EXTENT FEASIBLE RECOMMENDED MAXIMUM SLOPE IS 7:1 (4:1 SLOPE MAY BE STABLE ON CERTAIN SITES).

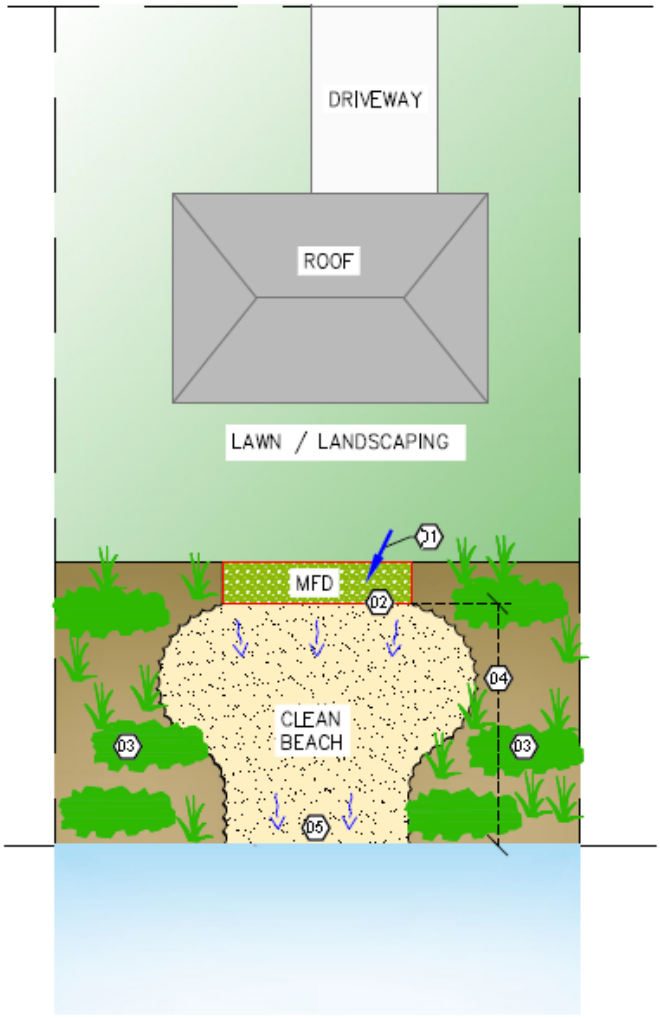


MEDIA FILTER DRAIN - CLEAN BEACH CONFIGURATION — SECTION VIEW
HIP BMP "C.3" TYPICAL — NTS

(1) 25' RECOMMENDED SHORELINE SETBACK. MAYBE REDUCED TO 15' IF SOIL INVESTIGATION DEMONSTRATES BOTTOM OF MFD IS ABOVE HIGH GROUNDWATER ELEVATION

(2) MATCH EXISTING SLOPE TO GREATEST EXTENT FEASIBLE. RECOMMENDED MAXIMUM SLOPE IS 7:1. 4:1 SLOPE MAYBE BE STABLE ON CERTAIN SITES





MEDIA FILTER DRAIN
30% CLEAN BEACH

PLAN VIEW
NTS

NOTES

01 INFLOW VIA SHEET OR PIPED FLOW.

02 DIRECT OUTFLOW FROM MFD TOWARDS CLEAN BEACH TO GREATEST EXTENT POSSIBLE. SURFACE GRADING AND SLOPING MDF TRENCH (2% MAX) ALLOWED.

03 SHORELINE NATIVE LANDSCAPING. PROVIDE MINIMUM PLANTED AREA EQUAL TO TOTAL PARCEL SHORELINE LENGTH X 15'. MINIMUM 5' PLANTING BUFFER WIDTH AT SHORELINE.

04 25' STANDARD MFD SETBACK. REDUCED TO 15' WITH SUBSURFACE SOIL INVESTIGATION AND ADEQUATE GROUNDWATER CLEARANCE.

05 PROVIDE MAXIMUM 30% CLEAN BEACH AT SHORELINE FOR WHATCOM COUNTY PROJECTS.

* PLAN VIEW SHOWN IS FOR CONCEPTUAL PURPOSES ONLY. MFD CONFIGURATIONS SHALL MEET ALL MINIMUM REQUIREMENTS IN HIP DESIGNER MANUAL AND MUST BE APPROVED BY PLANNING DEPARTMENT.

Design Submittal
Media Filter Drain System

Section I: System and Sizing Summary

☐	I have provided a site plan and facility cross-section.
☐	I have defined the area that will drain into the MFD by piping.
	That area is_____ft² of impervious surface and/or _____ft² of lawn/landscape
☐	I have defined the area that will drain into the MFD by sheet flow.
	That area is_____ft² of impervious surface and/or _____ft² of lawn/landscape
☐	I have sized the MFD using approved methodology (HIP Sizing Calculator or stormwater hydrological modeling software) and attached that data.
	My trench will need to be at least _____ feet wide and_____ ft² in filter area

Section II: Site-Specific Planning

☐	I have determined that the MFD is at least 5' from known public and private utilities.
☐	I have determined that the MFD is at least 5' from structures with slab-on-grade foundations and 10' from structures with a basement or crawl space.
☐	I have determined that the MFD is not on or next to a slope steeper than 15% and not within 50' upgradient of a slope steeper than 35%.
☐	I have developed an erosion control plan for the excavation of the trench and completed a site-specific SWPPP that is included with this application.

Sizing Calculator

Media Filter Drain System

Instructions: Measure hard surface area and lawn/landscaping surface area draining to trench. Characterize flow as sheet flow or piped flow. Insert values in the table below and use the following formula to calculate the size of MFD trench that is needed to adequately manage the runoff directed to the system. Sheet flow trenches must be at least 2' wide while piped flow trenches must be at least 3' wide in order for this calculation to be applicable. Runoff from a pipe that crosses at least 25' of lawn or landscape before reaching the trench can be considered sheet flow.

Drainage Type	Hard Surface (square feet)		Hard Surface Multiplier		Lawn/Landscape (square feet)		Lawn/LS Multiplier		Minimum Trench Area (square feet)
Sheet Flow	[	×	0.03]	+	[	×	0.01]	=	
Piped Flow	[	×	0.04]	+	[	×	0.01]	=	
Total area of trench needed (add trench areas above):									

Design Standards and Permitting Requirements

Dispersion

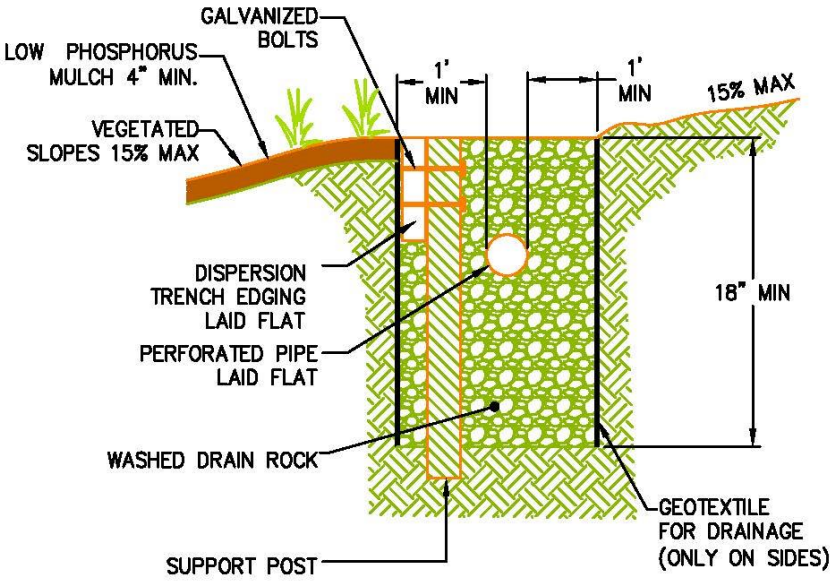
DESCRIPTION

A surface drainage facility, consisting of washed rock and constructed with a flat bottom, intended to convert concentrated flows into sheet flows for dispersion into existing or newly established vegetated areas. This facility does not have underdrain, bypass, or overflow structures.

Above: Dispersion system uses nearby forested area

METHOD OF PHOSPHORUS REDUCTION

Treatment via dispersion into native forested areas. Runoff entering the rock trench is spread evenly throughout the trench and then overflows evenly into the vegetated area. Plants and mulch in the vegetated area capture, neutralize, and recycle phosphorus into healthy plants and soil.



SECTION VIEW

ADDITIONAL DESIGN FEATURES

Enhance your dispersion system with one or more of the following site-specific options:

"Dry Creek Bed" where river rock creates the look of a stream channel in the landscape.

"Dispersion Walkway" where pea gravel creates durable pathways.

"Garden Path" where low-P mulch provides a way to access and enjoy the landscape (only allowed through landscaped areas).

Note: This design methodology is applicable for HIP projects only. These methods may not be suitable for, and have not been evaluated for, compliance with regulations which require professional engineering.

MINIMUM REQUIREMENTS AND DESIGN LIMITATIONS

All dispersion projects must meet these minimum requirements in order to be approved for construction under these HIP Standards:

DESIGN

- At least 24" wide in all locations
- Rock at least 18" deep
- Total slope of trench less than 2%
- Bottom of trench cannot contact groundwater
- No single trench longer than 50', use multiple trenches.
- Vegetated flow path is long enough to absorb all dispersed runoff[1]
- Plant density in flow path meets minimum requirements[2]

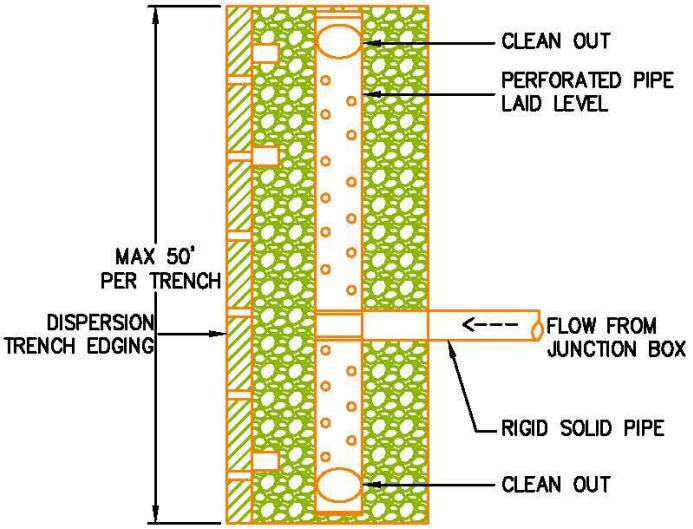
[1] use Dispersion Calculator to determine required flow path
[2] use the Native Landscaping BMP to create a new vegetated flow path

LOCATION

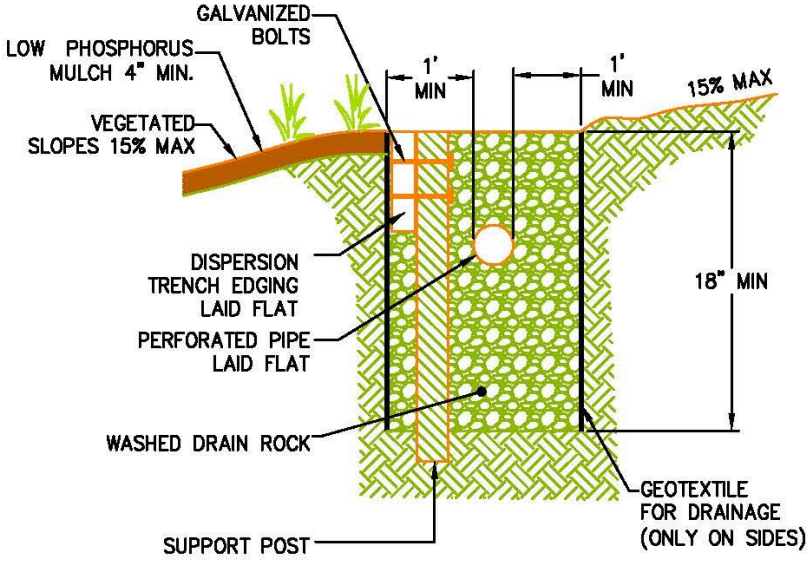
- **Critical Areas:** setback requirements near critical areas (wetlands, shorelines, or creeks) and their buffers will vary depending on site specifics. Consult with the HIP Coordinator for requirements pertaining to each unique site.
- **Slopes:** unless approved by a licensed geotechnical engineer, trenches cannot be placed on slopes >15% and must be at least 50' upgradient from slopes steeper than 35%
- **Separation:** at a minimum, all dispersion facilities must be at least: 25' from shorelines or creeks (distance is greater when critical areas are present), 5' from known public and private utilities, 5' from structures with slab-on-grade foundations and 10' from structures with a basement or crawl space. Septic tanks must be protected by placing the trench at least 5' from tanks, and 10' upgradient and 30' downgradient from drain fields and drain field reserve areas
- **Property Lines:** trenches cannot be located in public rights-of-way and dispersed water should not cross property lines. Consult with the HIP Coordinator to determine site-specific setback requirements.

CONSTRUCTION METHOD/ CRITICAL PATH

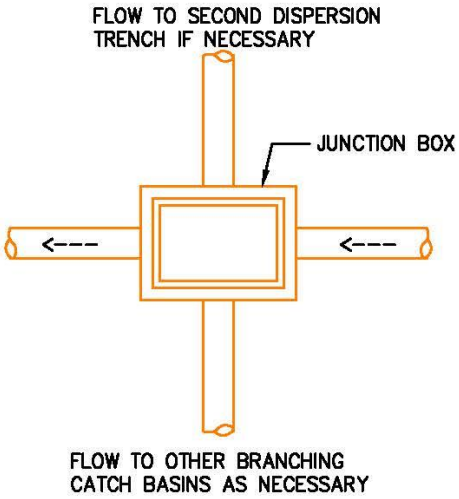
1. Install erosion controls
2. Excavate soil and reuse on site or dispose
3. Gently scarify subgrade
4. Install 75% base rock in first lift
5. Install elevated distribution pipe
6. Install drains and conveyance into trench from site surfaces
7. Connect conveyance to distribution pipe
8. Install second lift of rock (25%) to reach final grade
9. Install surfacing (optional)
10. Stabilize disturbed soils
11. Remove erosion controls

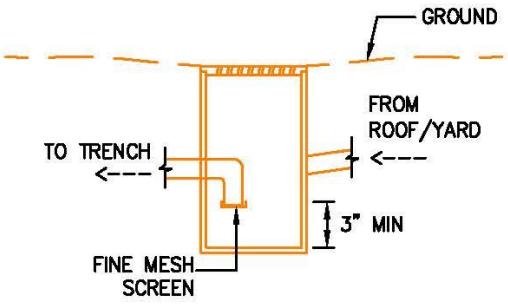


PLAN VIEW



SECTION VIEW





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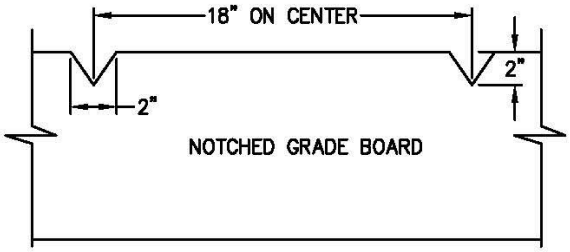


DISPERSION
TRENCH EDGING

DISPERSION TRENCH
HIP BMP "D" TYPICAL

NTS

Design Submittal
Dispersion

Section I: System and Sizing Summary

☐	I have provided a site plan and facility cross-section.
☐	I have defined the area that will drain into the trench by piping.
	The drainage area is_____ft² of impervious surface and/or _____ft² of lawn/landscape
☐	I have defined the area that will drain into the trench by sheet flow
	That area is_____ft² of impervious surface and/or _____ft² of lawn/landscape
☐	I have sized the trench using approved methodology (HIP Sizing Calculator or stormwater hydrological modeling software) and attached that data.
	The trench will be at least _____feet long and the downstream vegetated flow path must be at least _____feet in length.

Section II: Site-Specific Planning

☐	I have determined that the trench is at least 5' from known private or public utilities.
☐	I have determined that the trench is at least 5' from structures with slab-on-grade foundations and 10' from structures with a basement or crawl space.
☐	I have determined that the trench is not on or next to a slope steeper than 15% and not within 50' upgradient of a slope steeper than 35%.
☐	I have developed an erosion control plan for the excavation of the trench and completed a site-specific SWPPP that is included with this application.

Sizing Calculator
Dispersion

Step 1: Determine Trench Length. Measure the hard surface area draining to the trench. Measure the lawn/landscaping surface area draining to the trench. Use the following formula to calculate the length of dispersion trench that is needed to adequately mange the runoff directed to the system. All dispersion trenches are 2' wide at minimum. Runoff from a pipe that crosses at least 25' of lawn or landscape before reaching the trench can be considered sheet flow.

Drainage Type	Impervious Surface (square feet)	Hard Surface Multiplier	Lawn/Landscape (square feet)	Lawn/LS Multiplier	Minimum Trench Length (linear feet)
Sheet Flow	[	0.009] + [		0.005] =	
Piped Flow	[	0.014] + [		0.005] =	
Total length of trench needed (add trench lengths above):					

Step 2: Determine Vegetated Flow Path Length. Use the following formula to calculate how far the dispersed water must travel, through vegetation, before it leaves your property or enters a water body. Runoff from a pipe that crosses at least 25' of lawn or landscape before reaching the trench can be considered sheet flow.

Drainage Type	Hard Surface (square feet) "A"	Lawn/Landscape (square feet) "B"	Lawn Length "C"	Formula	Minimum Flow Path Length* (linear feet)
Sheet Flow	Not part of formula	Not part of formula		((C-25)/3)+25	
Piped Flow			Not part of formula	(((A+1)/(A+B) *100)+25	
Total length of vegetated flow path needed* (add flow path lengths above):					

* Note that the total vegetated flow path length will never be less than 25' or more than 100'. If your calculation comes out below or above those numbers, adjust up to 25 or down to 100.

Step 3: If there is no existing established vegetated flow path on-site to disperse to and a vegetated flow path needs to be created, please use the Native Landscaping BMP and accompanying calculator and submittal page in addition to this Dispersion BMP.

Design Guidance and Permitting Requirements

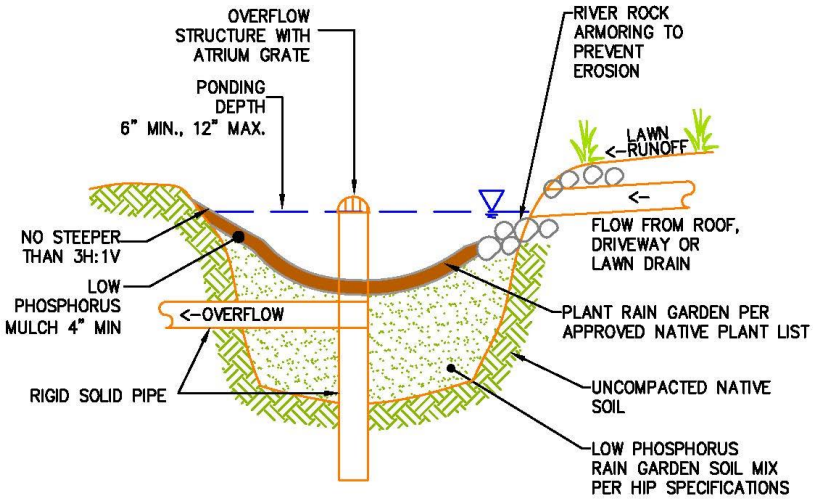
Lake Whatcom Rain Garden

DESCRIPTION

A hybrid underground/surface drainage facility, consisting of special soil mixes and vegetation and constructed with a flat bottom, intended to capture and infiltrate runoff from impervious and pervious surfaces.

METHOD OF PHOSPHORUS REDUCTION

Treatment via infiltration through native soils. Runoff entering the rain garden is detained and allowed to slowly pass through imported and native soil mixes, where phosphorus is bound by, captured within, and recycled into the soil matrix. Plants in the facility attenuate flows through evapotranspiration and reduce nutrient loading by uptake and binding in the vegetative biomass.



SECTION VIEW

Photo source: Stewardship Partners

Photo source: Stewardship Partners

Note: This design methodology is applicable for HIP projects only. These methods may not be suitable for, and have not been evaluated for, compliance with regulations which require professional engineering.

MINIMUM REQUIREMENTS AND DESIGN LIMITATIONS

All rain gardens must meet these minimum requirements in order to be approved for construction under these Design Standards:

DESIGN

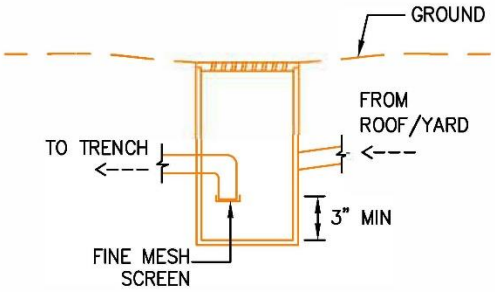
- At least 18" of rain garden soil throughout ponding area
- Total slope of bottom surface less than 2%
- Side slopes 3:1 Horizontal to Vertical or flatter, measured from top of soil mix
- Bottom of soil mix (media) must be more than 1' from groundwater or bedrock
- Low-P mulches from approved list cover all soils with at least 4" deep
- Includes a mix of approved rain garden plants at a minimum density
- Ponding depth cannot exceed 12" or occupy more than half of the side slope area

LOCATION

- **Critical Areas:** Setback requirements near critical areas (wetlands, shorelines, or creeks) and their buffers will vary depending on site specifics. Consult with the HIP Coordinator for requirements pertaining to each unique site.
- **Slopes:** unless approved by a licensed geotechnical engineer, rain gardens cannot be placed on slopes >10% and must be at least 10' upgradient from slopes >15% and 50' upgradient from slopes steeper than 35%
- **Separation:** at a minimum, all wetted areas must be at least: 25' from shorelines or creeks 5' from known public and private utilities, 5' from structures with slab-on-grade foundations and 10' from structures with a basement or crawl space. Septic tanks must be protected by placing the rain garden at least 5' from tanks, and 10' upgradient and 30' downgradient from drain fields and drain field reserve areas
- **Property Lines:** rain gardens cannot be located in public rights-of-way and placed at least 10' from neighboring property lines except in some specific cases. Consult with the HIP Coordinator to determine site-specific setback requirements.

CONSTRUCTION METHOD/ CRITICAL PATH

1. Install erosion controls
2. Excavate soil and reuse on site or dispose
3. Gently scarify subgrade
4. Install overflow riser and pipe
5. Install 75% of rain garden mix on first lift
6. Connect overflow pipe to downstream drainage system
7. Install drains and conveyance into rain garden from site surfaces
8. Install river rock for energy dissipation at inlet
9. Install second lift of rain garden mix (25%) to final surface grade
10. Place 75% of mulch over all soil surfaces
11. Install plants
12. Place remaining 25% of mulch
13. Stabilize disturbed soils
14. Remove erosion controls



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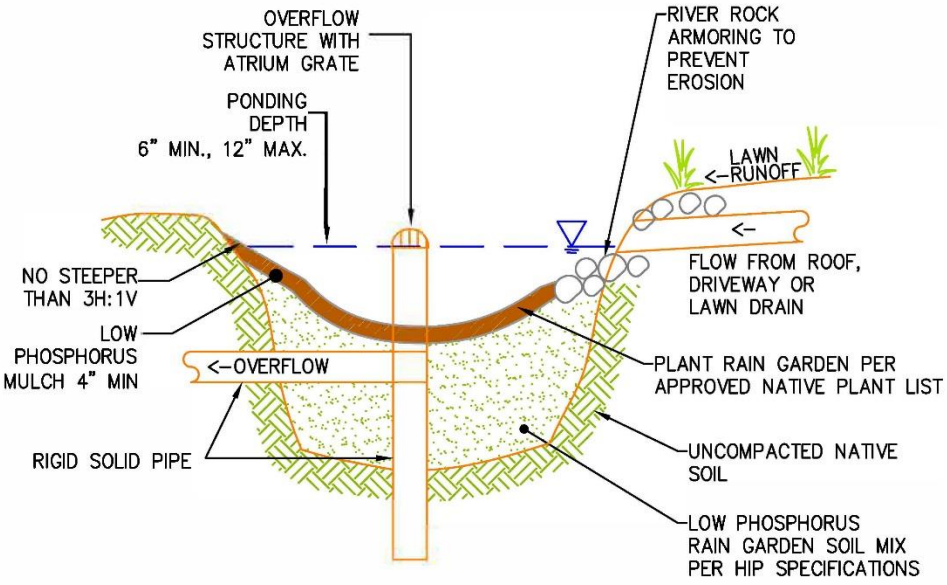


SECTION VIEW

LAKE WHATCOM RAIN GARDEN
HIP BMP "E" TYPICAL NTS

Construction Criteria for Infiltration Facilities

Initial basin excavation should be conducted to within 1-foot of the final elevation of the basin floor. Excavate infiltration trenches and basins to final grade only after all disturbed areas in the upgradient project drainage area have been permanently stabilized. The final phase of excavation should remove all accumulation of silt in the infiltration facility before putting it in service. After construction is completed, prevent sediment from entering the infiltration facility by first conveying the runoff water through an appropriate pretreatment system such as a pre-settling basin, wet pond, or sand filter.

Infiltration facilities should generally not be used as temporary sediment traps during construction. If an infiltration facility is to be used as a sediment trap, it must not be excavated to final grade until after the upgradient drainage area has been stabilized. Any accumulation of silt in the basin must be removed before putting it in service.

Traffic Control Relatively light-tracked equipment is recommended for this operation to avoid compaction of the basin floor. The use of draglines and trackhoes should be considered for constructing infiltration basins. The infiltration area should be flagged or marked to keep heavy equipment away.

Design Submittal

Lake Whatcom Rain Garden

Section I: System and Sizing Summary

☐	I have provided a site plan and facility cross-section. I have defined the area that will drain into the rain garden, by piping or sheet flow.
	The drainage area is_____ft² of impervious surface and/or _____ft² of lawn/landscape
☐	I have sized the system using approved methodology (HIP Sizing Calculator or stormwater hydrological modeling software) and attached that data.
	The ponding area of the rain garden will be at least _____ft² in size.
☐	I have calculated the number of plants needed for the total rain garden area (square feet of ponding area divided by 16) and completed a plant list.
	I will need to install at least _____ native plants in my rain garden.
☐	I have calculated the amount of lake-friendly mulch (area divided by 80) I will need. I have chosen mulch from the HIP-approved mulch list.
	My rain garden plan requires _____ cubic yards of approved mulch.

Section II: Site-Specific Planning

☐	I have determined that the ponding area is at least 5' from known utilities.
☐	I have determined that the ponding area is at least 10' from structures or property lines.
☐	I have determined that the rain garden is not on a slope >10% or within 10' upgradient of a slope >15% or within 50' upgradient of a slope >35%.
☐	I have developed an erosion control plan for the excavation of the rain garden and completed a site-specific SWPP that is included with this application.

Soil Characterization Sheet

Step 1. Review available soil data and recommend on-site soil testing

To be completed by HIP Coordinator

Off-site test pit data. Review map provided by HIP. If one test pit is within 100' of any property line, list only that data. Otherwise, please list three representative test pits, preferably within ¼ mile of the site.

Test Pit Number	Soil Type/ Infiltration Rate	Depth to Groundwater	Depth to Bedrock

Based on this information, the recommended soil investigation procedure to follow in Step 2 is (determined by HIP Coordinator):

_____

Step 2. On-site testing procedure to determine soil type

To be completed by HIP Coordinator or the project designer

Follow the soil testing methods and instructions for infiltration BMPs, found in the HIP Design Manual (Infiltration Trench and Lake Whatcom Rain Garden).

Note: If designing for infiltration facilities in multiple locations, it is suggested that each location be checked for factors that might affect design considerations. Consult with the HIP Coordinator to determine the number of additional investigations recommended for each unique site.

I completed an on-site soil investigation using (check boxes of all completed tests):

☐ Soil Drainage Test

I used the Rain Garden Manual

After one wet season (or three dry season) tests I have determined that my soil drainage rate is _____in/hr.

I've characterized my soil as:

- ☐ Good
- ☐ Moderate
- ☐ Marginal
- ☐ Poor

☐ Simple Investigation

I dug to a depth of 3' below ground surface and found:

- ☐ Groundwater
- ☐ Bedrock
- ☐ Other: _____
  _____
  _____
- ☐ None of the above

☐ Soil Texture Test

I used this test method to determine soil type (circle one):

Clay	Clayey Silt
Silt/Loam	Sandy Loam/Sand

I've characterized my soil as:

- ☐ Good
- ☐ Moderate
- ☐ Marginal
- ☐ Poor

"SOIL DRAINAGE TEST" INSTRUCTIONS

Modified for HIP from procedures found in the Rain Garden Handbook for Western Washington Homeowners

After identifying the location of a potential infiltration system (HIP Infiltration Trench BMP or HIP Lake Whatcom Rain Garden BMP), the next step is to test the soil in that location. You will be evaluating the "infiltration rate", defined as the amount of time it takes water to soak into the ground. Determining an infiltration rate will allow you to use the HIP Standard Calculator to size the system for maximum water quality benefit and free permits through HIP.

1 LOCATE UTILITIES

Call 8-1-1 and mark with white paint the location of your proposed test hole or other potential underground features. The Call-Before-You-Dig professionals will arrive, from the various utilities, over the next week or so to mark the location of public utilities on your property.

Make sure you identify any potential private utilities (such as septic system drain fields and/or private electrical conduit) that would not be part of the public utility marking. You may need to do shallow, careful, excavations (pot-holing) to confirm some utilities.

2 DIG TEST HOLE

Dig a small hole at least 2 feet deep and at least 18 inches in diameter.

3 DETERMINE DRAINAGE RATE

Fill the hole with 12 inches of water. Secure a yard stick or a self-made gauge in the hole for measuring the drainage rate. The self-made gauge can be a board or pipe with markings every half inch from the bottom.

Time how long it takes for the water to drain out completely. By the way, this can take a while, so start in the morning and check back regularly throughout the day. If there is still water in the hole after 12 hours, record how many inches have gone down since you started the test. Divide total inches by total hours to calculate the soil drainage rate.

4 REPEAT IN DRY SEASON

If it's the wet season (December through April), do this soil drainage test once. If you must test during the dry season, do the test three times (with each test performed immediately after completion of the last). Use the third test as your drainage rate (measured in inches per hour). Testing three times during the dry season provides a better estimate of wetter conditions present in the winter when the system is doing the most work.

5 CHARACTERIZE YOUR SOIL

- If your calculated drainage rate is greater than two inches per hour (2"/hr), **use the "good" designation** on the soil characterization sheet in the design packet. This soil is likely sand.
- If your calculated drainage rate is between a half-inch per hour (1/2"/hr) and two inches per hour (2"/hr), **use the "moderate" designation** on the soil characterization sheet in the design packet. This soil is likely silty sand.
- If your calculated drainage rate is between an eighth-inch per hour (1/8"/hr) and a half-inch per hour (1/2"/hr), **use the "marginal" designation** on the soil characterization sheet in the design packet. This soil is likely a silt or loamy material.
- If your calculated drainage rate is less than an eighth-inch per hour (1/8"/hr), **use the "poor" designation** on the soil characterization sheet in the design packet. This soil is likely clay.

"SIMPLE INVESTIGATION TEST" INSTRUCTIONS

Modified for HIP from procedures found in the Rain Garden Handbook for Western Washington Homeowners

Avoid locating your infiltration system in an area with high groundwater or shallow bedrock by performing a simple investigation test. It's best to figure out the groundwater level during the rainy winter months, December through April, and you can search for bedrock at the same time.

1 LOCATE UTILITIES

Call 8-1-1 and mark with white paint the location of your proposed test hole or other potential underground features. The Call-Before-You-Dig professionals will arrive, from the various utilities, over the next week or so to mark the location of public utilities on your property.

Make sure you identify any potential private utilities (such as septic system drain fields and/or private electrical conduit) that would not be part of the public utility marking. You may need to do shallow, careful, excavations (pot-holing) to confirm some utilities.

2 DIG INVESTIGATION HOLE

Dig down 36 inches below the ground surface, if possible. You can use a post-hole digger or hand operated auger to reach the desired depth.

If you are digging in groundwater (i.e. the hole is filling with water faster than you can remove it) or hitting rock that prohibits any additional digging, you can stop the test as this location is not conducive to infiltration.

3 LOOK INTO THE HOLE

If you see water seeping in from the bottom or sides, or hit an impenetrable layer of rock or clay, find another location for your infiltration facility or choose a treatment BMP (such as the HIP Media Filter Drain or Dispersion BMPs).

"SOIL TEXTURE TEST" INSTRUCTIONS

Modified for HIP from procedures found in the Rain Garden Handbook for Western Washington Homeowners

Avoid locating your infiltration system in an area with high groundwater or shallow bedrock by performing a simple investigation test. It's best to figure out the groundwater level during the rainy winter months, December through April, and you can search for bedrock at the same time.

1 LOCATE UTILITIES

Call 8-1-1 and mark with white paint the location of your proposed test hole or other potential underground features. The Call-Before-You-Dig professionals will arrive, from the various utilities, over the next week or so to mark the location of public utilities on your property.

Make sure you identify any potential private utilities (such as septic system drain fields and/or private electrical conduit) that would not be part of the public utility marking. You may need to do shallow, careful, excavations (pot-holing) to confirm some utilities.

2 DIG TEST HOLE

Dig a small hole at least 18 inches deep and at least 6 inches in diameter. A post-hole digger or small hand auger is the perfect tool for this job.

3 EVALUATE SOIL TEXTURE

When you reach a depth of at least 18", take a scoop of soil from the bottom of the hole and use the procedure below to characterize its soil type.

Prepare the soil: put some soil in the palm of your hand and try to squeeze it into a ball. If the soil is dry, add water a few drops at a time, break down the chunks to work the water into the soil, and then perform the soil texture test.

Characterize the soil texture:

- If the soil is light in color, feels gritty, and will not stick together at all when wet **use the "good" designation** on the soil characterization sheet in the design packet. This soil is likely sand.
- If the soil is dark in color, feels gritty, and falls apart easily when worked, **use the "moderate" designation** on the soil characterization sheet in the design packet. This soil is likely silty sand.
- If the soil feels smooth, and breaks apart into chunks when worked but stays together in a ball when held, **use the "marginal" designation** on the soil characterization sheet in the design packet. This soil is likely a silt or loamy material.

- If the soil is very sticky and forms a dense ball that can't be easily broken apart, **use the "poor" designation** on the soil characterization sheet in the design packet. This soil is likely clay.

Sizing Calculator

Lake Whatcom Rain Garden

How to Use Sizing Calculator:
Input project-specific data into the table below to calculate the size of the ponding area of the rain garden facility. Choose soil type based on test results in Step 1. Insert amount of hard surface (roof, pavement, gravel) in square feet and amount of lawn and/or landscape area in square feet. Determine multipliers by using the table below and calculate required ponding area.

Soil Type	Impervious Surface (square feet)		Hard Surface Multiplier (Varies)*		Lawn/Landscape (square feet)		Lawn/LS Multiplier (Varies)*		Ponding Area Minimum (square feet)**
Good	[	×	]	+	[	×	]	=	
Moderate	[	×	]	+	[	×	]	=	
Marginal	[	×	]	+	[	×	]	=	
Poor	Infiltration Not Recommended. Use Treatment, Dispersion, or Native Landscaping BMPs								

*Use multiplier reference table below.

** The ponding area is defined as the area that will be flooded before the system overflows. All rain gardens will have side slopes extending at least 18" from the top of this ponding area in all directions. See Design Guidance for more details and examples.

MULTIPLIER REFERENCE TABLE
RAIN GARDEN SIZING

	Multiplier by Soil Type		
	Good	Moderate	Marginal
Hard Surface Area			
Less than 5,000 sf	0.09	0.12	0.15
More than 5,000 sf	0.07	0.09	0.12
Lawn/Landscape Area			
Less than 2,000 sf	0.05	0.07	0.10
Between 2,000-10,000 sf	0.04	0.06	0.08
Between 10,000 - 40,000 sf	0.03	0.05	0.07
More than 40,000 sf	0.02	0.04	0.06

Design Guidance

Erosion and Sediment Control

GENERAL CONSTRUCTION STORMWATER POLLUTION PREVENTION PLAN

PURPOSE

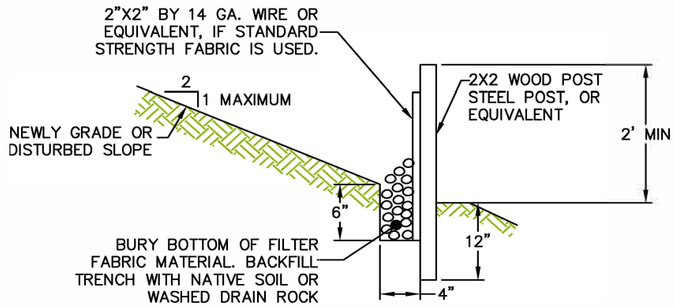
TO PREVENT THE DISCHARGE OF SEDIMENT AND OTHER POLLUTANTS TO THE MAXIMUM EXTENT PRACTICABLE FROM SMALL CONSTRUCTION PROJECTS.

DESIGN AND INSTALLATION

PLAN AND IMPLEMENT PROPER CLEARING AND GRADING OF THE SITE. IT IS MOST IMPORTANT ONLY TO CLEAR THE AREAS NEEDED KEEPING EXPOSED AREAS TO A MINIMUM. PHASE CLEARING SO THAT ONLY THOSE AREAS THAT ARE ACTIVELY BEING WORKED ARE UNCOVERED.

NOTE: CLEARING LIMITS SHALL BE FLAGGED ON THE LOT OR PROJECT AREA PRIOR TO INITIATING CLEARING.

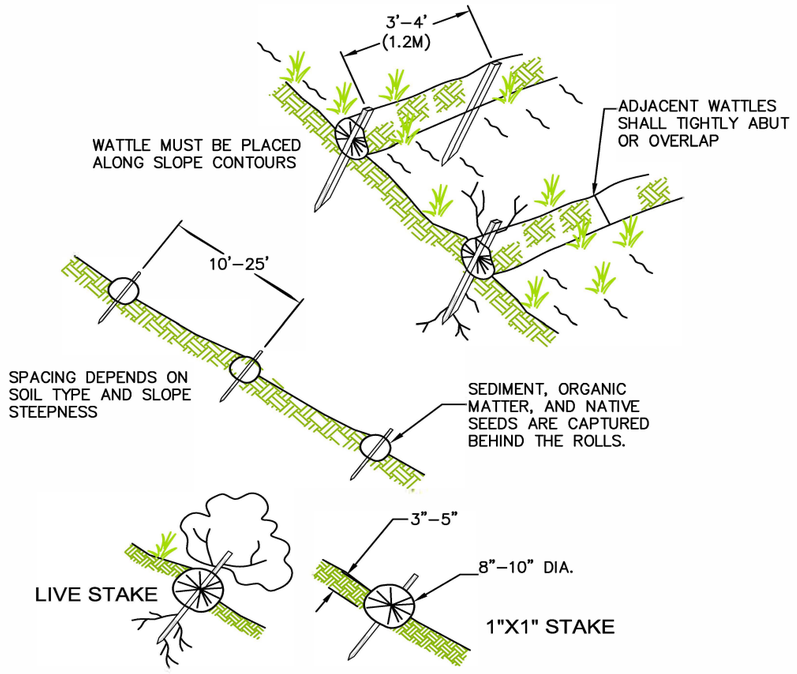
- FROM OCTOBER 1 THROUGH MAY 31, NO SOILS SHALL BE EXPOSED AND FROM JUNE 1 TO SEPTEMBER 30, NO SOILS SHALL REMAIN EXPOSED AND UNWORKED FOR MORE THAN SEVEN DAYS.
- SOIL SHALL BE MANAGED IN A MANNER THAT DOES NOT PERMANENTLY COMPACT OR DETERIORATE THE FINAL SOIL AND LANDSCAPE SYSTEM. IF DISTURBANCE AND/OR COMPACTION OCCUR THE IMPACT MUST BE CORRECTED AT THE END OF THE CONSTRUCTION ACTIVITY. THIS SHALL INCLUDE RESTORATION OF SOIL DEPTH, SOIL QUALITY, PERMEABILITY, AND PERCENT ORGANIC MATTER. CONSTRUCTION PRACTICES MUST NOT CAUSE DAMAGE TO OR COMPROMISE THE DEPTH OF PERMANENT LANDSCAPE OR INFILTRATION AREAS.
- LOCATE ANY SOIL PILES AWAY FROM DRAINAGE SYSTEMS. SOIL PILES SHOULD BE TARPED OR MULCHED UNTIL THE SOIL IS EITHER USED OR REMOVED. PILES SHOULD BE SITUATED SO THAT RUNOFF DOES NOT RUN INTO THE STREET OR ADJOINING YARDS.
- BACKFILL WALLS AS SOON AS POSSIBLE AFTER BACKFILLING. THIS WILL ELIMINATE ANY SEDIMENT LOSS FROM SURPLUS FILL.
- THE CONSTRUCTION ENTRANCE SHALL BE STABILIZED WHERE TRAFFIC WILL BE LEAVING THE CONSTRUCTION SITE AND TRAVELING ON PAVED ROADS OR OTHER PAVED SURFACES.
- PROVIDE FOR PERIODIC STREET CLEANING TO REMOVE ANY SEDIMENT THAT MAY HAVE BEEN TRACKED OUT. SEDIMENT SHOULD BE REMOVED BY SHOVELING OR SWEEPING AND CAREFULLY REMOVED TO A SUITABLE DISPOSAL AREA WHERE IT WILL NOT BE RE-ERODED, STREET WASHING IS PROHIBITED.



TYPICAL CROSS SECTION

SILT FENCE SEDIMENT BARRIER

NTS

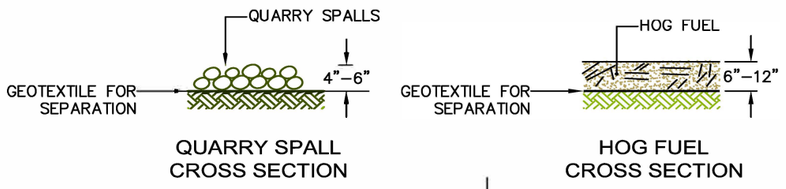


NOTE:

1. WATTLE INSTALLATION REQUIRES THE PLACEMENT AND SECURE STAKING OF THE WATTLE IN A TRENCH, 3"-5" DEEP, DUG ON CONTOUR. RUNOFF MUST NOT BE ALLOWED TO RUN UNDER OR AROUND WATTLE

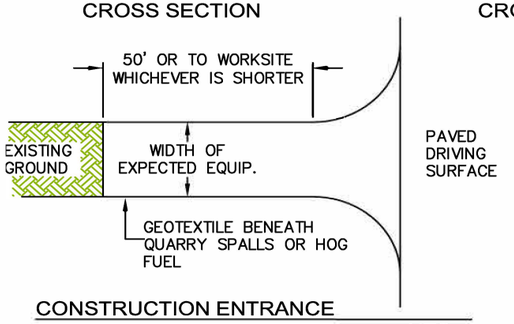
WATTLES (SEDIMENT BARRIER)

NTS



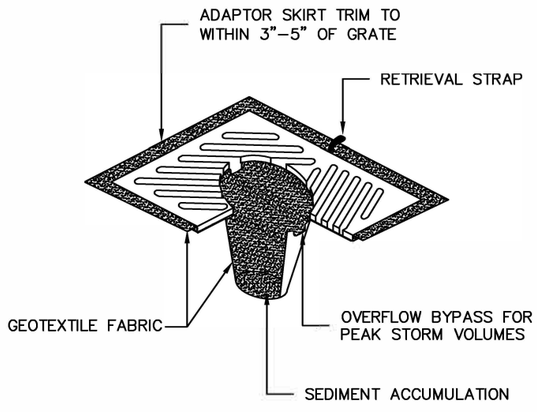
QUARRY SPALL CROSS SECTION

HOG FUEL CROSS SECTION



CONSTRUCTION ENTRANCE

NTS



NOTES:

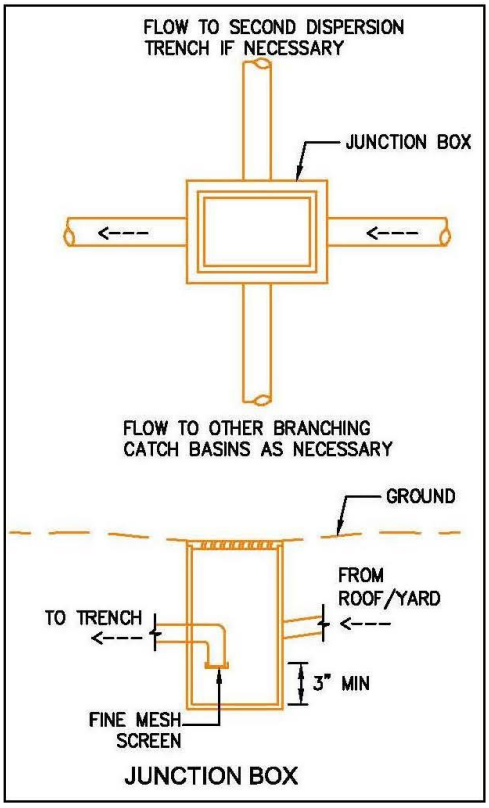
1. INSERT SHALL BE INSTALLED PRIOR TO CLEARING AND GRADING ACTIVITY, OR UPON PLACEMENT OF A NEW CATCH BASIN.
2. SEDIMENT SHALL BE REMOVED FROM THE UNIT WHEN IT BECOMES HALF FULL.
3. SEDIMENT REMOVAL SHALL BE ACCOMPLISHED BY REMOVING THE INSERT, EMPTYING, AND RE-INSERTING IT INTO THE CATCH BASIN.

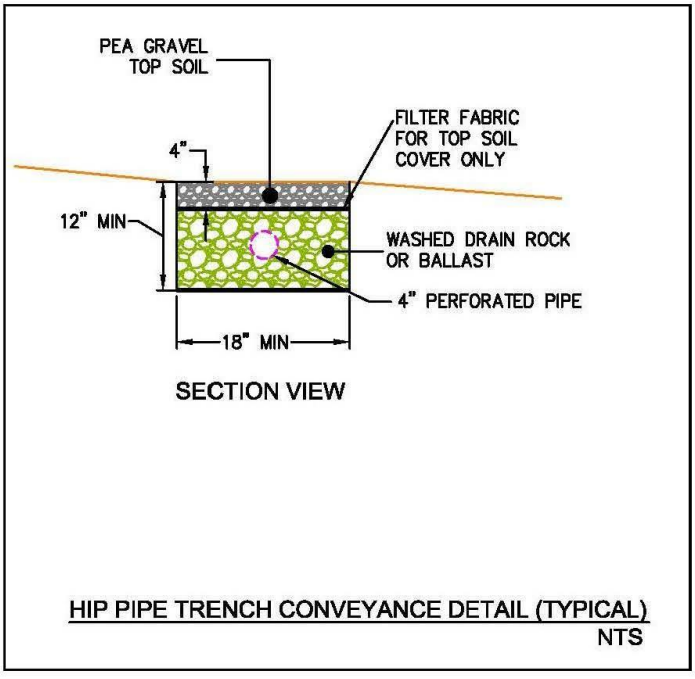
CATCH BASIN INSERT (INLET PROTECTION) DETAIL

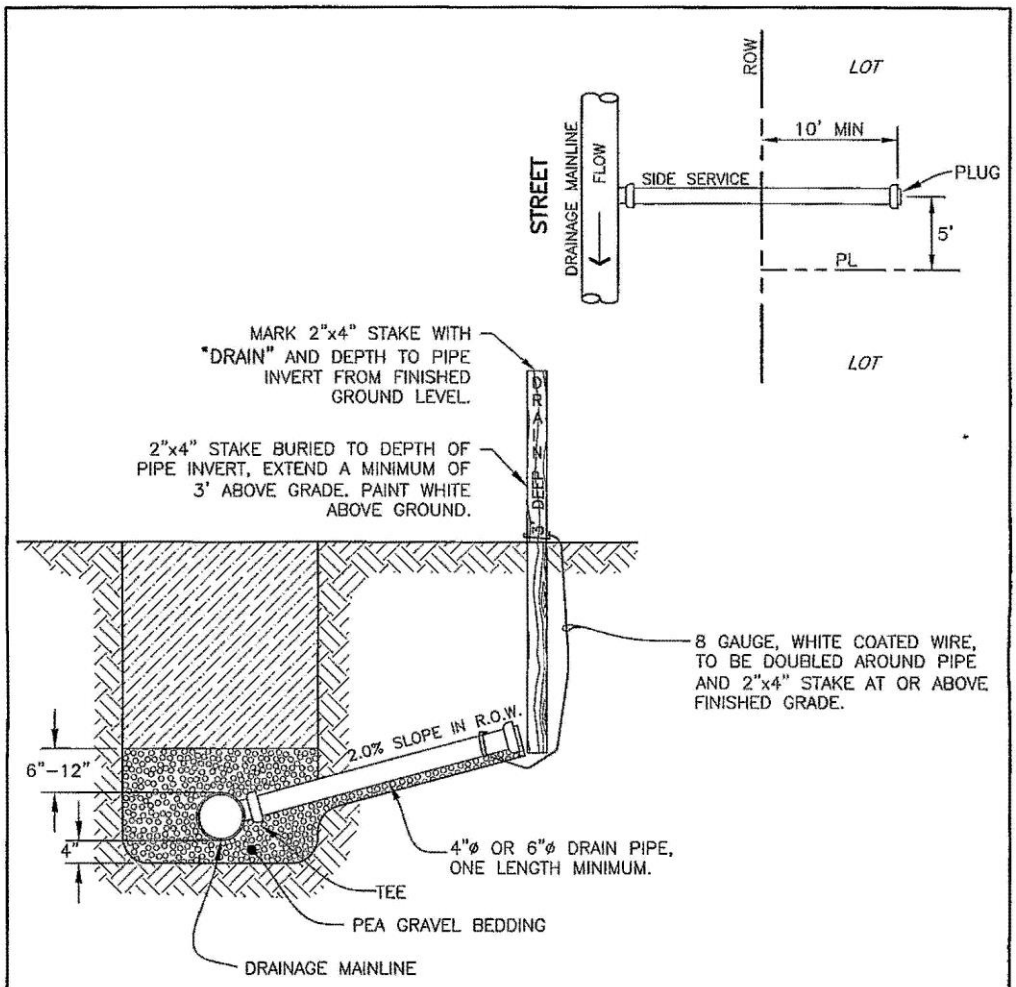
NTS

Design Guidance

Conveyance







NOTES:

1. UNLESS OTHERWISE INDICATED ON PLAN, SIDE SERVICE SHALL BE LOWER THAN THE LOWEST LOT ELEVATION.
2. WHEN REPLACING EXISTING SIDE SERVICE, CONTRACTOR SHALL VERIFY POSITIVE FALL, OTHER EXISTING CONNECTIONS, AND SAGS OR DEFLECTIONS IN PIPE, AS PER ASTM F 1743 8.6.

NOT TO SCALE

APPROVED		CITY OF BELLINGHAM	DRAWING
City Engineer	4-28-05 Date	STORM DRAIN SIDE SERVICE	DR–530

Design Guidance and Permitting Requirements

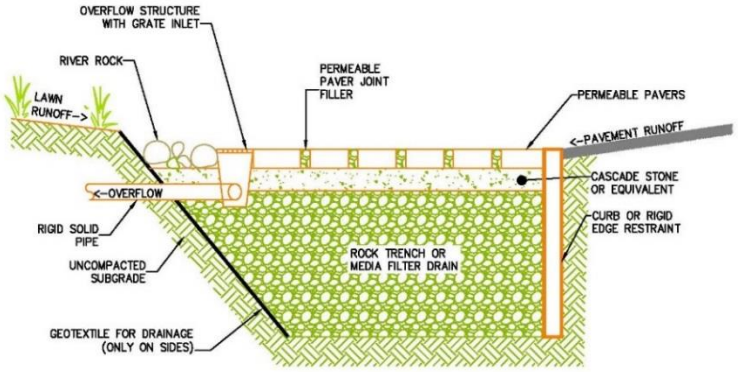
Permeable Pavement

DESCRIPTION

Permeable pavement provides surface stabilization and protection for infiltration trenches and drywells. In some cases, under the right conditions, this component may also be installed above Media Filter Drain (MFD) trenches.

METHOD OF PHOSPHORUS REDUCTION

Permeable pavement does not directly reduce the amount of phosphorus in runoff. This component protects the phosphorus-reducing capacity of the underlying infiltration or treatment facility.



SECTION VIEW

MATERIAL REQUIREMENTS

- All proprietary pavements must be installed and maintained per manufacturer's recommendations based on anticipated use.
- All non-propriety individual pavers must be less than 2 square feet with greater than ½ inch gaps between pavers.
- Special considerations apply near creeks or the Lake Whatcom shoreline. Consult with HIP Coordinator prior to selecting materials

CONSTRUCTION METHOD/ CRITICAL PATH

1. Install primary BMP
2. Install edge restraints (optional)
3. Place #2 stone over BMP surface
4. Place #8 stone ("Cascade Stone") to final depth
5. Install spaced pavers or proprietary permeable pavement material
6. Install clean pea gravel or manufacturer's recommended product in paver gaps. **DO NOT USE SAND.**

MATERIAL EXAMPLES

Note: This design methodology is applicable for HIP projects only. These methods may not be suitable for, and have not been evaluated for, compliance with regulations which require professional engineering.

Design Guidance
Rainwater Harvesting

DESCRIPTION

Rainwater harvesting is the process of collecting water from an impervious surface, such as a roof, and routing it to a location where it is beneficially used.

METHOD OF PHOSPHORUS REDUCTION

Rainwater harvesting does not directly reduce the amount of phosphorus in runoff. However, because rainwater is captured in barrels or cisterns, the amount of runoff that carries phosphorus to the Lake during precipitation events is decreased. In addition, harvested rainwater can be connected to other HIP projects, such as native landscaping, rain gardens, and underground pollution filters, where the water is slowed and cleaned prior to reaching Lake Whatcom.

CONSTRUCTION METHOD/ CRITICAL PATH

1. Install primary BMP
2. Choose a location for cistern
3. Choose a material that is compatible with water use
4. Design connectivity to other HIP water quality projects

DESIGN REQUIREMENTS

- All individual tanks hold less than 320 gallons
- Total system storage is less than 5,000 gallons when all tanks are full
- Height to width ratio of tanks are 2:1 or less
- Water from tanks are not used for indoor purposes such as drinking and cooking
- Tanks not meeting these requirements may be permitted through alternative pathways outside of the HIP permitting process
- Overflow/outflow water must be directed to a HIP BMP for tanks to be reimbursable under HIP

Note: This design methodology is applicable for HIP projects only. These methods may not be suitable for, and have not been evaluated for, compliance with regulations which require professional engineering.

For more guidance on rainwater harvesting for residential beneficial uses visit cob.org/rainwater.