

**Clallam County
Small Project Drainage
Requirements
And Technical Guidance
Manual**

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Small Project Drainage Requirements and Technical Guidance Manual

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Section I: Introduction

A drainage plan is a proposed method for managing stormwater on your property. Clallam County requires drainage plans to control any increase in the amount and rate of stormwater that runs off each property as a result of the development of that property. The drainage plan illustrates how stormwater runoff will be retained on the property so it does not drain onto neighboring properties.

In Clallam County an approved drainage plan is required as a part of building permit submittals for either a new structure or for the enlargement of an existing structure. If you build in an area that has an existing community drainage system, a drainage plan showing the necessary connections and drainage to the community drainage system must be approved by the Road Department before a building permit will be issued. If you build in an area with no existing community drainage system (most of Clallam County), a drainage plan for your project is required. The plan must be approved by the **Road Department** before a building permit will be issued.

Why Drainage Requirements?

Almost every form of development increases the amount of surface runoff that occurs following a heavy rainstorm. For example:

- Removing trees and other vegetation reduces the amount of rain and snow intercepted by the tree canopy and leaves and the amount of water absorbed by roots.
- Regrading the land eliminates natural depressions in the soil that slow runoff and hold water until it is absorbed into the soil.
- Covering ground with roofs, pavements, and similar impervious surfaces prevents the underlying soil from absorbing rainwater.
- Covering porous soil with comparatively impervious topsoil and lawn decreases the rate the soil can absorb water.
- Driving over the ground (both during and after construction) compacts the surface, decreasing the small voids in the soil that let the water filter into the ground.
- Placing plastic films under landscaped areas prevents percolation of water through the soil.

These and other factors combine to decrease the landscape's ability to absorb rainfall. To minimize the detrimental impacts of stormwater runoff associated with development, Clallam County requires appropriate management of that runoff. When properly designed and constructed, a drainage plan protects the environment, property owners, and neighboring properties from adverse impacts related to residential development.

Do I qualify for a Small Project Drainage Plan Review?

The drainage techniques outlined in this manual are for small-scale residential projects within Clallam County that meet the requirements for a *Small Project Drainage Plan* review. For small scale projects, mitigation of runoff impacts can usually be achieved with a combination of the Best Management Practices (BMPs) outlined in this manual. These include practices such as preservation of native vegetation on site, protection of soil during construction, and creation of infiltration systems to absorb runoff from impervious areas. These small project drainage requirements can be met with plans prepared by contractors, architects, or homeowners without the involvement of a licensed civil engineer.

In general, a project will qualify for the *Small Project Drainage Plan* review if it meets all of the following criteria:

- The project is a single family residential project.
- Less than 10,000 square feet of impervious surface will result from the proposed project. However, on lots less than two acres, if the amount of impervious surfaces such as asphalt, concrete, gravel driveways, buildings, or other relatively impervious surfaces exceeds either 10% of the total lot area or 5,000 square feet, whichever is greater, the County may require an engineered drainage plan.
- Less than one acre of clearing and grading will result from the proposed project.
- A site on your property is available for the proposed stormwater management system which does not conflict with any septic drainfield or reserve drainfield, structure foundations, or wells. Sites with slopes greater than 15% may pose problems with the design of a small project drainage plan; engineering may be necessary.
- Your soils must be sufficiently permeable to implement the proposed techniques. Soils which allow the use of either a conventional on-site sewage disposal system or a pressurized sewage disposal system are considered to be sufficiently permeable for most drainage systems included in this manual.

For projects meeting the above criteria, the techniques spelled out in this manual may be used to create a *Small Projects Drainage Plan* for review.

For any project not meeting the above criteria, or for non-residential development, multi-family residential development, and development within 200 feet of critical areas such as floodplains, streams, wetlands, shorelines, or geologically hazardous areas, a drainage plan prepared by a civil engineer licensed in the state of Washington that complies with the current general drainage manual adopted by Clallam County and the Clallam County Critical Areas Ordinance will be required.

These criteria are intended to simplify the screening of drainage plans by the County and are not necessarily all-inclusive. The County reserves the option to require submittal of an engineered drainage plan prepared by a licensed engineer for any development. The County will inform land development applicants of any additional drainage requirements for their project(s).

Definitions of Key Terms

Proper application of the small project drainage requirements in this manual requires an understanding of the following key terms and their definitions.

Best Management Practice (BMP) A practice or combination of practices that are the most effective and practicable means of managing stormwater runoff based on the best available science.

Bioretention area A vegetated depression that is designed to collect, store and infiltrate runoff. Bioretention areas typically include a mix of amended soils and vegetation.

Civil engineer A person licensed by the State of Washington as a professional engineer in civil engineering.

Conveyance BMP A stormwater management technique that conveys stormwater to or from a runoff management BMP such as a rain garden or infiltration trench, and slows flows as stormwater travels across and from a developed site.

Critical Areas The Washington State Growth Management Act, Chapter 36.70A RCW, requires the protection of the following areas in Clallam County: (a) wetlands; (b) areas with a critical recharging effect on aquifers used for potable water; (c) aquatic and wildlife habitat conservation areas; (d) frequently flooded areas; and (e) geologically hazardous areas. Use and management within these areas is subject to regulation by Clallam County. Consult the Chapter 27.12 of the Clallam County Code for details on the Clallam County Critical Areas Code.

Discharge Any stormwater runoff that is not infiltrated or evaporated but instead flows from the conveyance or management BMPs onto adjacent land.

Dispersion Spreading stormwater runoff over vegetated pervious areas to slow runoff and aid in infiltration

Drainage easement A portion of the land set aside to assist in the management of stormwater runoff. Easements are permanent and are transferred with the title to the land.

End-of-Line Discharge BMP A stormwater management technique that disperses stormwater *on-site* from a runoff management or conveyance BMP in a slow and diffuse manner to prevent concentration and associated channeling.

Engineered drainage plan A plan designed by a civil engineer licensed in the State of Washington as a professional engineer in civil engineering.

Hydrologic soil group Soils are classified by the Natural Resource Conservation Service into four Hydrologic Soil Groups based on the soil's runoff potential. Soil properties that influence runoff potential include depth to a seasonally high water table, intake rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. The four Hydrologic Soils Groups are A, B, C and D. Type A soils generally have the smallest runoff potential and Type D soils have the greatest.

Impervious surface A hard or compacted surface like a roof, pavement, or gravel that does not allow water to soak into the ground.

Pervious surface A surface that allows water to enter the ground by virtue of its porous nature or by large spaces in the material. Due to compaction, gravel driveways and parking areas do not count as permeable surfaces unless specifically engineered to be pervious or porous.

Runoff management BMP A stormwater management technique designed to capture and absorb stormwater runoff from impervious surfaces such as roofs and driveways.

Single family residential project A dwelling unit detached from any other dwelling unit and intended for occupation by one family and including accessory improvements and uses. This definition includes manufactured homes such as mobile homes, modular homes and other homes manufactured in components or as one complete dwelling unit.

Stormwater region Clallam County has three different stormwater regions based on the soil types, and amount of rainfall found in these areas. These regions determine the types and sizes of stormwater BMPs appropriate for use in managing stormwater in the project area. Consult the map on page X or the website --- to determine the stormwater region your project is within.

Stormwater runoff Water which is not absorbed into the ground during and after a storm which then flows over the land.

Vegetated open space Native undisturbed areas, rehabilitation of previously disturbed areas, or fields that are not regularly mowed. Active recreation areas and lawn shall not count towards vegetated open space.

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Small Project Drainage Plan Requirements

Submittals

Carol- this sub-section gets into permitting procedures that we think are most appropriate for the DCD to determine what should be included and what the procedure for permitting should be. But we started to flesh out some suggestions based on other jurisdictions examples.

If you meet the criteria for a *Small Project Drainage Plan* Review and want to use it, the following must be submitted to the Department of Community Development:

- **Drainage Plan Submittal Form** which will guide you through the submittal requirements. See Appendix X for an example of this form. Copies of the form are available from the Department of Community Development.
- **Drainage Plan:** a scale drawing of the individual site showing how stormwater runoff will be managed on the property. Consult Section II: Developing a Drainage Plan for guidance in preparing this plan.
- **Written Drainage Assessment:** a written overview of the proposed project that includes a description of the property, existing site conditions, proposed site improvements, and proposed stormwater management techniques. Further instructions are available on the Drainage Plan Submittal Form.
- **Declaration of Drainage Easement** required to be recorded for application of the drainage plan on the property.
- **Operation and Maintenance Details??**
- **Erosion and Sedimentation Control Plan??-** (a scale drawing of the site or project site used to show the limits of disturbance by the project and how required erosion control measures will be applied to prevent sediment from leaving the site during construction activities.)

Implementation

After a proposed drainage plan is approved by the County it must then be installed, adhering to the approved plan. If you use a *Small Project Drainage Plan*, you must install the system according to the guidelines in this manual.

Inspection

The drainage system must be inspected by the Building Department prior to certifying the structure for occupancy. Do not backfill over any underground installation until it has been inspected. Drainage system inspections will be conducted only during regularly scheduled building inspections prior to the final inspection, and installation must be complete prior to the final inspection. The inspection requirements vary depending upon the type of system approved for your development. You can find out more about the inspection procedure when you obtain your permit.

Liability and Responsibility

You are responsible for damage caused by stormwater runoff due to your development. Clallam County's drainage requirements represent a good faith effort to address the potential problems associated with stormwater runoff due to development. However, the County has no control over the accuracy of information submitted and does not assume responsibility for damage which may occur due to stormwater runoff.

Operation and Maintenance Responsibility

The size, placement, and design of the drainage facilities as depicted by the drainage plan and approved by the Clallam County Department of Community Development must be maintained and may not be changed without written approval from the Clallam County Department of Community Development. Maintenance of all required drainage facilities is the responsibility of the owner of the site/lot served by these facilities.

Erosion and Sediment Control

Appendix G: Small Project Erosion and Sediment Control includes the specifications for erosion and sediment control BMPs applicable to prevent transport of soils from a small project construction site. **The Erosion and Sediment Control BMPs listed in the Appendix may be used if less than one acre of soil will be disturbed by the project.** Additional measures may be required by Clallam County if these are insufficient for the project or fail to contain sediment on the project site.

The following pages contain planning guidelines to direct the reader through the small project drainage planning process. The first section (Developing a Drainage Plan, [pages x-x](#)) deals with designing your site to minimize impacts to the landscape and outlines the required elements in a small project drainage plan. The final section of the manual (Small Project Drainage Plan Design BMPs, [pages x-x](#)) describes the specific requirements, designs, and specifications of each BMP. The Appendices include examples of drainage plans and supporting documents needed for the development of an effective drainage plan.

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Section II: Developing a Drainage Plan

The steps described below outline the process for development of a *Small Project Drainage Plan*. For effective stormwater management, the project should minimize land disturbance and impervious surfaces such as roofs and driveways, and maximize protection of soil and vegetation.

1. Conduct a site inventory to determine existing patterns of water movement and vegetated areas on your site. Consider ways your proposed development can avoid impacts to them.
2. Obtain an accurate topographic map for the site to use as a basis for the drainage plan. This can be as simple as a map that denotes flat areas, sloped areas, and drainage paths. Topographic information for your site can be found at the website: -----
3. Consult the map on page X to determine the stormwater region your project is within. This is critical for sizing various stormwater management techniques.
4. Find out the soil type on your project site in order to determine which stormwater management techniques in this manual will be applicable for your site. For a County soils map showing this information, consult the *Soil Survey of Clallam County*, go to <http://www.clallam.net/Maps/>, or visit the Clallam Conservation District. Appendix C lists the BMPs appropriate for your soil type.
5. Use the drainage project planning chart on page x to select options for managing roof water runoff, driveway runoff, conveyance areas, and end-of-line discharge areas.
6. Consult Section III of this manual for details on the design and applicability of each of the BMP options.
7. Use the sizing charts located in Section III to determine the required dimensions for each BMP based on the stormwater region in which the project is located.
8. Sketch your drainage plan. Page x includes a list of the required information to include in the plan.
9. Visit the Department of Community Development to discuss your plan prior to submittal.

Site Planning Tips

The following are tips for creating a development that minimizes the impact your construction project will have on the patterns of water flow and vegetated areas of the site and help facilitate stormwater infiltration on the property:

- Place structures as close to the public access point as possible to minimize road/driveway length. Minimize paved parking areas, and utilize porous paving options wherever possible.
- Slope paved areas to facilitate drainage to stormwater management areas.
- Reduce building footprints whenever possible. Utilize basements or taller structures with lofts or second stories to achieve square footage goals.
- Orient buildings on slopes with long-axis along topographic contours to reduce grading requirements.
- Set clearing limits that give maximum protection to soils and vegetation while allowing reasonable areas for equipment to maneuver on the site. Delineate the areas both on the construction plans and on the ground with temporary fencing or taping.

Elements of a Drainage Plan

The drainage plan must show the square footage of the impervious areas such as a roof and driveway, the technique for managing the runoff generated by the impervious surfaces and the drainage path of the runoff from source to treatment area.

Runoff Management BMPs (Section III-A)

The **Runoff Management** section of this manual presents general guidelines for design of BMPs for managing runoff from impervious surfaces such as roofs and driveways. In a *Small Project Drainage Plan* there are seven options to manage stormwater from roofs and paved areas:

- Rain Gardens
- Rainwater Planters
- Rainwater Dispersion
- Infiltration Systems
- Runoff Filter Strips
- Porous Pavement
- Rainwater Collection

The runoff management section of this manual provides general design requirements for the BMPs listed above, as well as specific sizing requirements for each stormwater region in the county.

Stormwater Conveyance BMPs (Section III-B)

The stormwater conveyance section of this manual presents general guidelines for conveying stormwater on your site. The stormwater conveyance BMPs serve to both convey stormwater from, and if necessary to, a runoff management area such as a rain garden or infiltration trench, and to slow flows as they travel across and from a developed site. There are four options for the conveyance of stormwater on the site:

- Swales
- Conveyance Furrows
- Conveyance Gardens
- Gravel Trenches

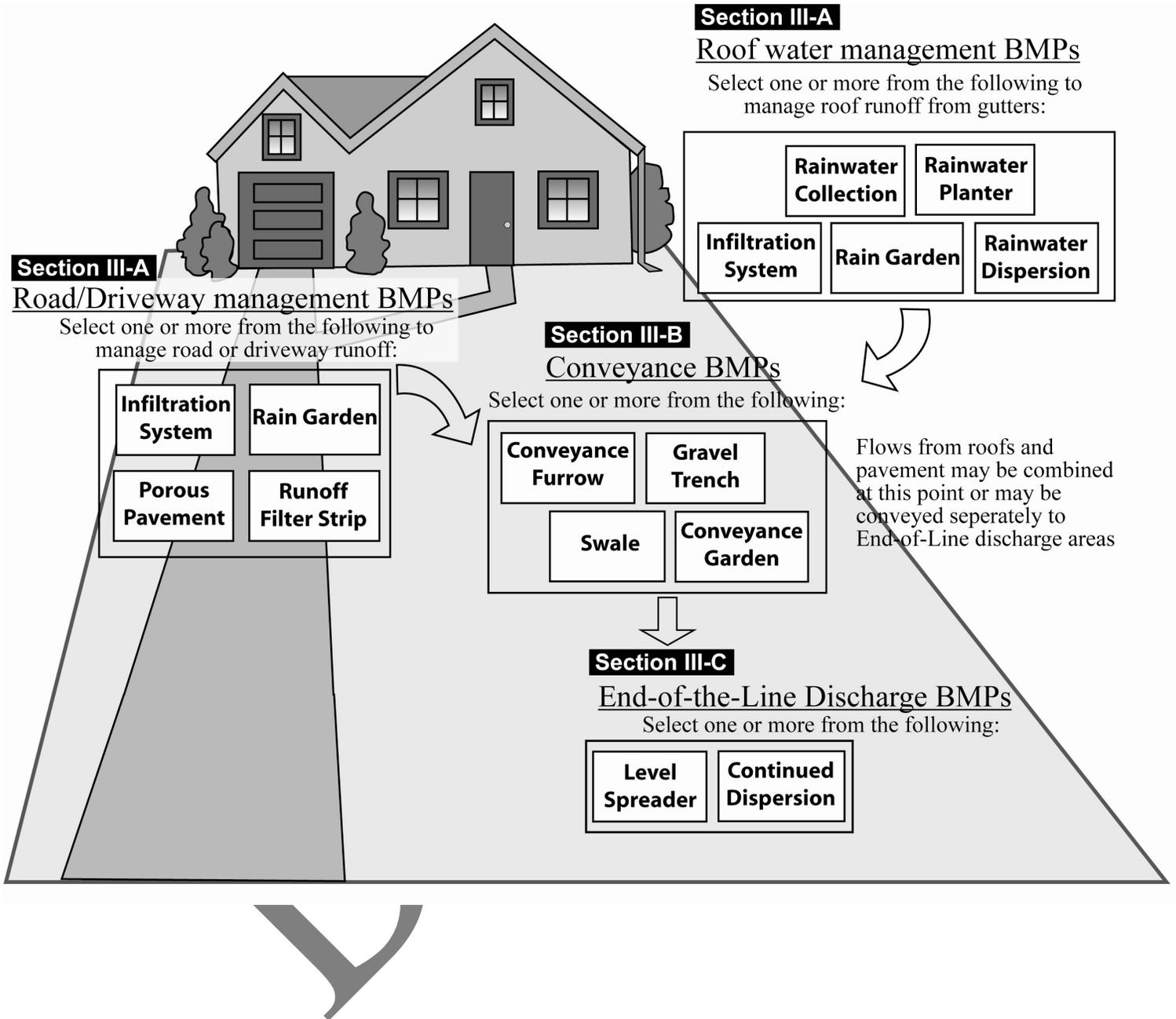
End-of-Line Discharge BMPs (Section III-C)

The discharge BMPs provide a means for stormwater from a developed lot to disperse in a slow and diffuse manner to prevent concentration and associated channeling. End-of-Line Discharge BMPs are designed to be used to disperse stormwater *on-site* and shall not be used to disperse stormwater outside the project property's boundaries. These options are outlined in the End-of-Line Discharge section of the manual. They include:

- Level Spreaders
- Continued Dispersion

Figure 1. Drainage Planning Flowchart

The following chart outlines the typical elements of a small project drainage system.



Drainage plan requirements

The following information must be included in the *Drainage Plan Submittal Form* (see Appendix A, or visit the Clallam County Department of Community Development or the website: [-----](#) for a copy of the form):

Identification

- Name, address, and phone number of applicant
- Parcel number
- Dimension of all property lines
- Street names and existing or proposed property address
- North arrow
- Legend if needed
- Scale—use a scale that clearly illustrates drainage features and BMPs/measures.
- Show at least 5-foot contours for all slopes steeper than 15%

Building and Site Development Features

- Footprint of all structures (existing and proposed)
- Future structures and planned improvements
 - If you wish to have drainage review fees waived for future structures/improvements on this parcel, you must show them (with dimensions) on the site plan.
- Parking, roads, and driveways (existing and proposed)
- Sport courts, patios, pools and any other paved or impervious surfaces (existing and proposed)
- Total impervious surface land cover (existing and proposed)
- Location of any retaining walls and rockeries (existing and proposed)
- Existing or proposed septic system, including all system components and both primary and reserve drainfields
- Utility structures (poles, fire hydrants, etc.)
- Existing easements
- Existing wells or wells to be abandoned
- Newly created vegetated areas
- Remaining **vegetated open space** that will remain undisturbed

Natural Features and Critical Areas

For a map detailing the critical areas on your site, go to <http://www.clallam.net/Maps/> or visit the permit counter at the Department of Community Development. *Development within 200 feet of a critical area requires an engineered drainage plan designed by a Civil Engineer licensed in the State of Washington.*

- Existing natural features of the property (woods, pasture, brush)
- Existing hydrology - location of all existing and proposed ditches, swales, pipes, etc.
- Delineation of all streams, wetlands, lakes, closed depressions, or other water features (including any required buffer widths)
- Delineation of all critical areas on the property including flood hazard areas, erosion hazard areas, steep slope hazard areas, landslide hazard areas, and their buffers and building setback lines

Stormwater Management Information

In addition to the general information listed above, the following additional information is required on drainage plans that include installation of stormwater BMPs:

- Identify the Stormwater Region your project is within. (The region the project is in is critical to the sizing of the drainage BMPs due to differing rainfall amounts)

- Consult the map on page X to determine the stormwater region your project is within. This is critical for sizing various stormwater management techniques.
- Identify the soil type(s) on your project site in order to determine which stormwater management techniques in this manual will be applicable for your site
 - For a County soils map showing this information, consult the *Soil Survey of Clallam County*, go to <http://www.clallam.net/Maps/>, or visit the Clallam Conservation District.
- Show delineation and dimensions of impervious surfaces and pervious surfaces, both existing and new
- Show location and dimensions of runoff management BMP methods such as but not limited to infiltration trenches, drywells, rain gardens, permeable pavements, rain water storage tanks for managing stormwater from all impervious surfaces
 - Use the drainage project planning chart on page x to select options for managing roof water runoff, driveway runoff, conveyance areas, and end-of-line discharge areas.
 - Appendix C summarizes the BMPs appropriate for your soil type and slope.
 - Consult Section III of this manual for details on the design and applicability of each of the BMP options. Use the sizing charts located in Section III to determine the required dimensions for each BMP based on the stormwater region in which the project is located.
- Show delineation and dimensions of the flowpath of stormwater through the site - from the runoff management BMPs, to conveyance BMPs, to end-of-line discharge BMPs
- Show setback lengths between stormwater management BMPs and any property line, structure, well, steep slope, stream, wetland, or septic system including drainfields.

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Putting it all together

This manual along with some basic measuring and drawing tools should be sufficient for most people to complete an acceptable drainage plan; however, if your project is somewhat large or complex, it may be a good idea at this point to have a professional engineer design the plan and create the plan drawings for submittal. Below is an example of a drainage plan that can be developed from a site plan. Consult Appendix D for other examples of simple drainage plans that can be developed.

Figure 2. Example Drainage Plan

JOHN DOE
444 GRASSHOPPER ROAD
PORT ANGELES, WA 98362
(360) 555-4444

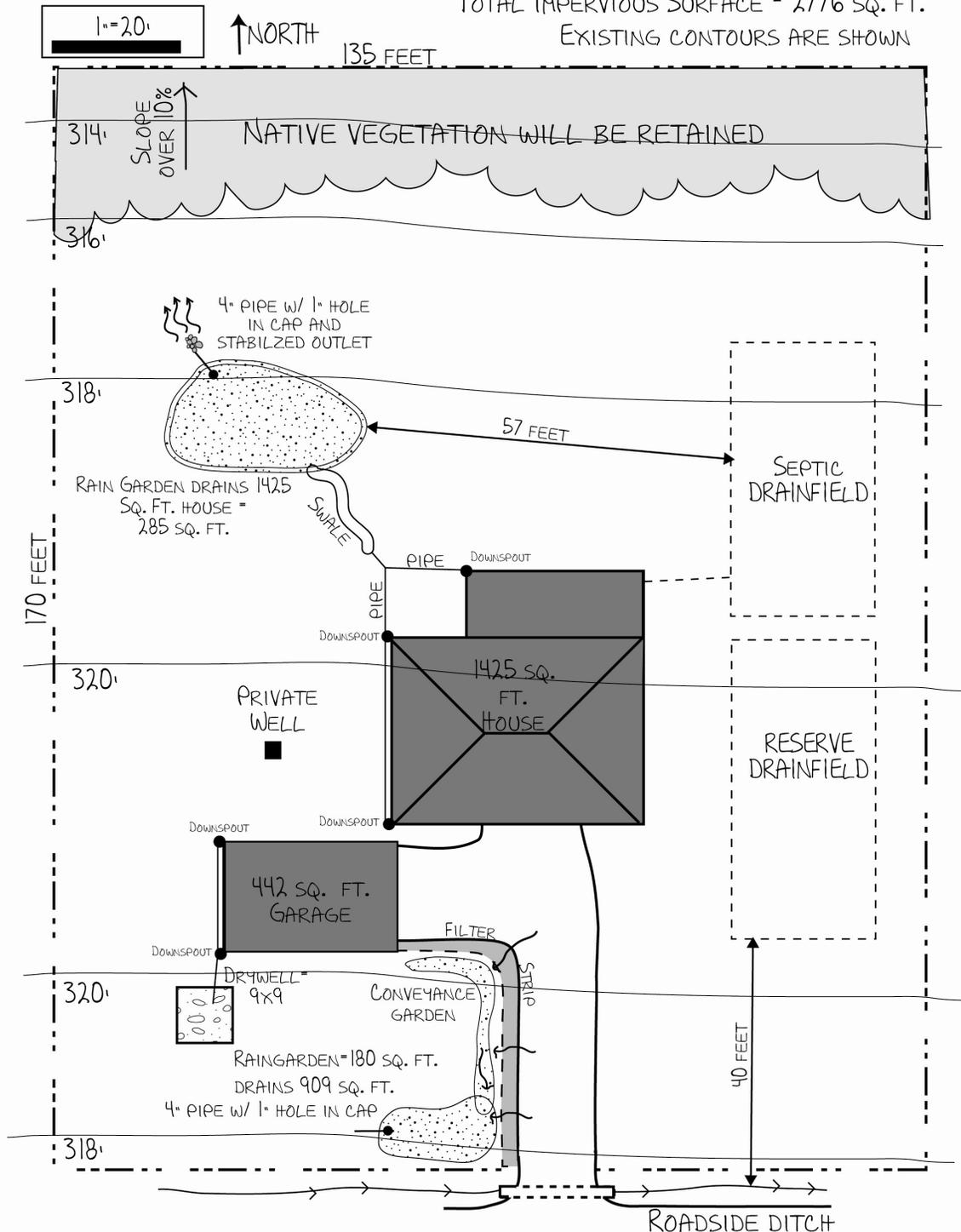
.52 ACRE LOT
RTS: 053009
PARCEL #: 053009479150

HOYFUS SOIL
-HYDROLOGIC GROUP A

REGION II

TOTAL IMPERVIOUS SURFACE = 2776 SQ. FT.

EXISTING CONTOURS ARE SHOWN



Section III: Small Project Drainage Plan Design BMPs

A drainage system collects, cleanses, infiltrates, and conveys stormwater to a natural drainage system or existing storm sewer. The following are guidelines for the design and implementation of a *Small Project Drainage Plan*, including techniques for managing run-off from impervious surfaces, conveying stormwater on the property, and for properly discharging stormwater from your property.

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* Maintenance guidelines for the BMPs have been adapted from King County, Washington *Surface Water Design Manual Appendix C: Small Project Drainage Requirements, 2005* and **City of Portland Stormwater Management Manual, Revision 3, 2004**.

Runoff Management BMPs

Runoff management is the main component of a small project drainage plan. This manual includes seven options to manage stormwater from roofs and paved areas. The main features and preferred application for each option are summarized below. Details of each option are explained in the following sections.

Rain Gardens

- Rain gardens are excavated basins in which runoff accumulates and slowly infiltrates or flows out through a small outlet opening.
- One of the most versatile options, rain gardens can be placed in any soil type and on most sites and should be the primary runoff management technique for most sites.

Rainwater Planters

- Rainwater planters are basins with raised sides of wood or concrete in which runoff accumulates and slowly infiltrates or flows out through small weep holes to surrounding surfaces.
- Planters are a good option where they can be installed near roof downspouts.

Rainwater Dispersion

- Dispersion emphasizes use of vegetated areas to receive dispersed stormwater.
- Requires at least 50% vegetated open space on site with a drainage easement.
- Best on slopes less than 10% where runoff is easily routed to vegetated areas.

Infiltration Systems: Trenches and Drywells

- Infiltration utilizes gravel-filled basins or trenches to infiltrate runoff into porous soil.
- Requires soil with sandy or gravelly texture without high water table. A list of suitable soils for infiltration techniques can be found in Appendix C.
- Infiltration systems may clog with sediment over time and require replacement.

Runoff Filter Strips

- Runoff filter strips are large roadside areas of sandy or gravelly soil covered with turf which allow filtering, storage and infiltration of paved area runoff.
- The filter strip area must be equal to that of the impervious paved area it is adjacent to (such as the driveway), excavated and filled with sand or gravel.

Porous Pavement

- Porous pavement allows rainwater to seep through the hardened surface through pores and spaces in the pavement.
- Porous pavement should be placed on slopes less than 5%.

Rainwater Collection

- Rain barrels and cisterns are containers in which roof runoff is collected for later use or release. These options have limitations on size and application.
- Rain barrels and cisterns can only collect roof runoff, and the collected water is suitable for non-potable uses only.
- Rain barrels and cisterns require careful management to control and manage overflow.

Rain Gardens

Rain gardens are excavated depressions lined with amended soil and planted with vegetation capable of thriving in wet soil in the winter and dry conditions in the summer. Rain gardens provide bioretention, a process in which storm runoff is temporarily captured in small vegetated basins, where physical and biological processes improve water quality and lessen flows before they enter public or other drainage systems.

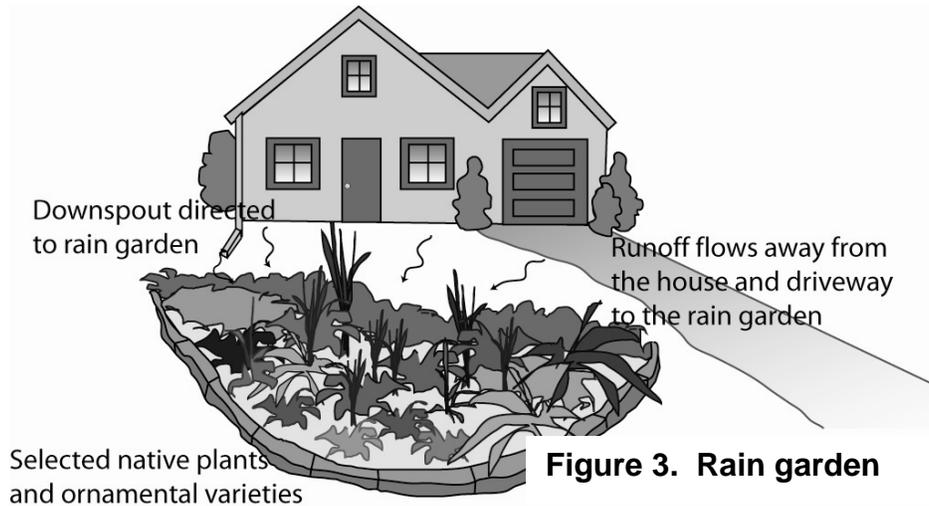


Figure 3. Rain garden

Rain gardens are the simplest, easiest to maintain, and most fool-proof option for runoff management and should be included as the primary runoff management option for most projects.

Rain gardens are sized according to the stormwater region that the project is located. Consult the map on page X, the Department of Community Development, or the website xxxxxx to determine what stormwater region applies for your project. The ratio of rain garden area to the impervious surface area draining to it is as follows: Region I is 15%; Region II is 20%; Region III is 25%. The table below serves as a guide to determine the surface area of the rain garden based on the stormwater region in which your project is located and the amount of impervious surface area draining to the garden.

		Square footage of impervious surface draining to rain garden							
		500	1000	1500	2000	2500	3000	4000	5000
Required Surface Area of Rain Garden by Region (Sq. ft.)	Region I	75	150	225	300	375	450	600	750
	Region II	100	200	300	400	500	600	800	1000
	Region III	125	250	375	500	625	750	1000	1250

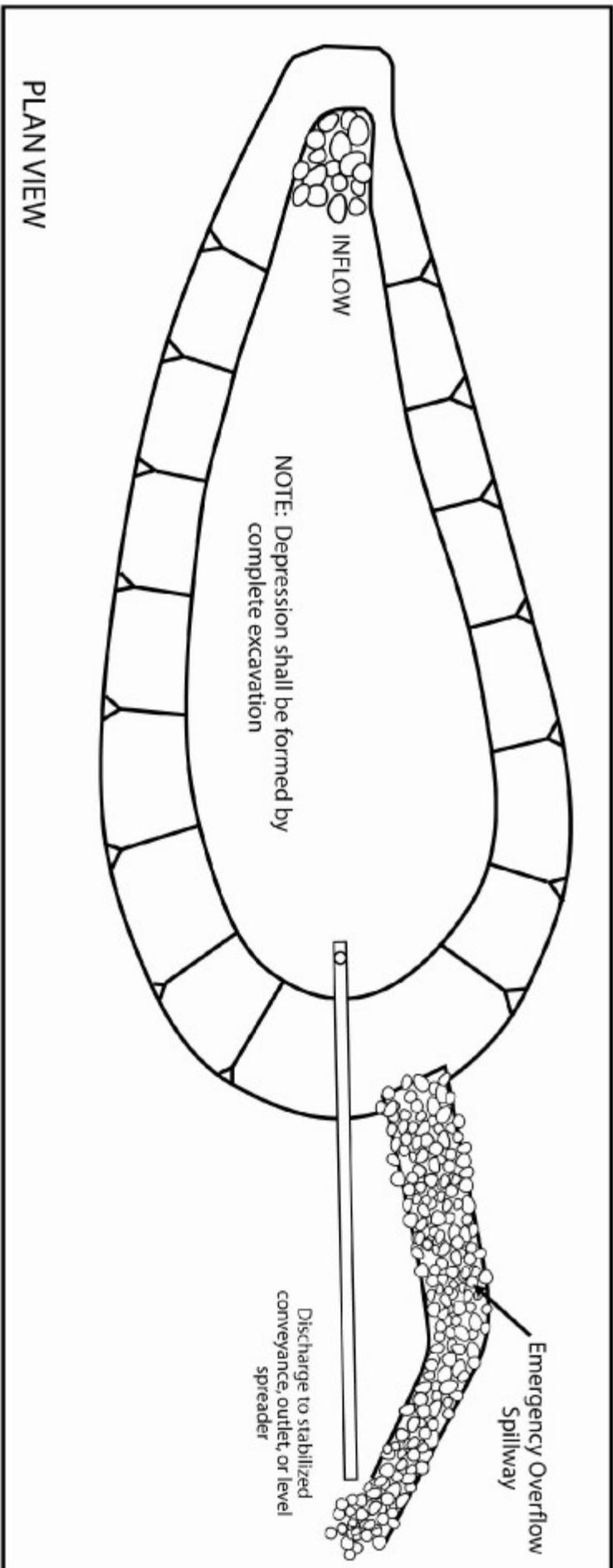
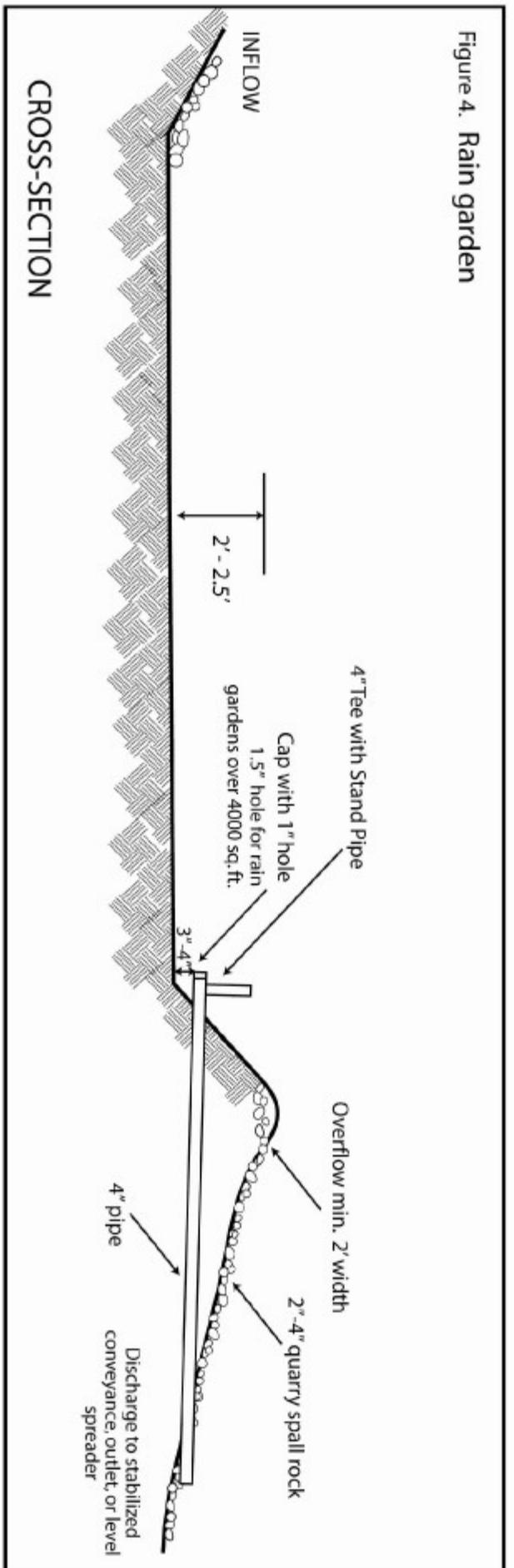
Rain gardens have a minimum depth of 2 feet.

Example: A 3,000 square foot house in Region II would require a rain garden with a surface area of 600 square feet.

If you utilize a rain garden to control stormwater runoff, you will need to follow the guidelines below:

- Rain gardens should be located on level to gently sloped ground. Use caution in locating rain gardens on slopes greater than 10%.
- Rain gardens shall be built to the required size as shown in the sizing table above.
- Rain gardens shall have a minimum depth of 2 feet.
- Side slopes shall be 3 horizontal to 1 vertical or less.
- Rain gardens shall include outlets consisting of a 4" pipe with a cap with a 1" hole to meter the outflow.
- The rain garden shall include an additional overflow either by surface sheet flow or stabilized rock spillway to a level spreader, ditch or other stormwater dispersal system.
- The rain garden should be planted with vegetation appropriate for moist and seasonally dry conditions. See Appendix E for a list of recommended plants.

Figure 4. Rain garden



Rain Garden Operation and Maintenance

Rain gardens are vegetated depressions that retain and filter stormwater from an area of impervious surface. The plant growth in the rain garden serves to filter the water and sustain infiltration. Depending on soil conditions, rain gardens may have water in them throughout the wet season and may overflow during major storm events.

- The size, placement, and design of the rain garden as depicted by the drainage plan must be maintained and shall not be changed without written approval from the Clallam County Department of Community Development.
- Plant materials may be changed to suit tastes, but chemical fertilizers and pesticides must not be used.
- Additional mulch and compost should be added to the rain garden periodically.
- Rain gardens must be inspected annually by the property owner for physical defects.
- After major storm events, the rain garden should be checked to see that the overflow system is working properly and is not clogged.
- If erosion channels or bare spots are evident, they should be stabilized with soil, plant material, and mulch.
- A supplemental watering program may be needed the first year to ensure the long-term survival of the rain garden's vegetation.
- Vegetation should be maintained as follows:
 - 1) replace all dead vegetation as soon as possible;
 - 2) remove debris as needed;
 - 3) remove all noxious vegetation when discovered;
 - 4) manually weed without herbicides or pesticides;
 - 5) mulch to conserve moisture and inhibit weed germination.

Rainwater planters

Rainwater planters are much like raised, above ground rain gardens. Generally planters are used for runoff from roofs and are built so that downspouts empty directly into the planter. Planter sides may be constructed of treated wood, concrete, or brick. Planters may be constructed with open contact to the ground or with impervious bottoms with side weep holes of 1/2 to 1 inch in diameter. The bottom layer shall be clean gravel with a 1 foot minimum depth covered by a minimum of 1 foot of topsoil. The planter must include an overflow notch or pipe and be designed to drain to a conveyance BMP with a minimum 1 foot of water storage depth.

Sizing for rainwater planters is the same as for rain gardens (see sizing chart in the Rain Garden section). The rainwater planter should be planted with vegetation appropriate for moist and seasonally dry conditions. Trees and large shrubs are not recommended. See Appendix E for a list of recommended plants.

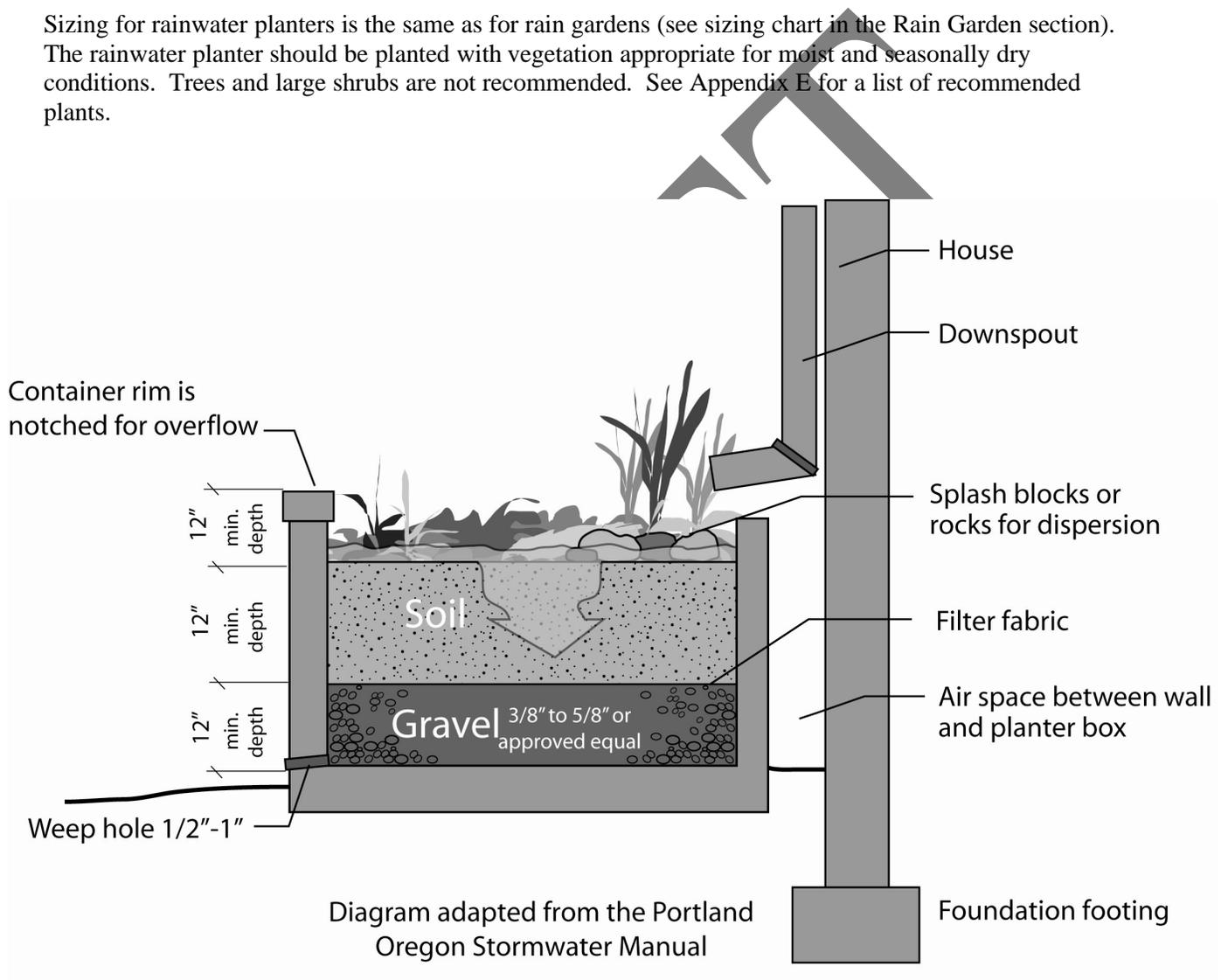


Figure 5. Rainwater Planter cross-section

Rainwater Planter Operation and Maintenance

Rainwater planters are containers designed to intercept rainfall that would normally fall on impervious surfaces and store and release the captured stormwater at a slower rate.

- The size, placement, and design of the rainwater planter as depicted by the drainage plan must be maintained and shall not be changed without written approval from the Clallam County Department of Community Development.
- Chemical fertilizers and pesticides must not be used.
- Additional mulch and compost should be added to the rainwater planter periodically.
- Rainwater planters must be inspected annually by the property owner for physical defects. Structural deficiencies in the planter including rot, cracks, and failure shall be repaired. Holes that are not consistent with the design and allow water to flow directly through the planter to the ground shall be plugged.
- After major storm events, the rainwater planter should be checked to see that the drainage system is working properly and is not clogged. If stormwater is not draining properly, the planter shall be excavated and cleaned, and gravel or soil shall be replaced to correct low infiltration rates.
- A supplemental watering program may be needed the first year to ensure the long-term survival of the rain garden's vegetation.
- Vegetation should be maintained as follows:
 - 1) replace all dead vegetation as soon as possible;
 - 2) remove debris as needed;
 - 3) remove all noxious vegetation when discovered;
 - 4) manually weed without herbicides or pesticides;
 - 5) mulch to conserve moisture and inhibit weed germination.

Rainwater Dispersion

Rainwater dispersion is a strategy that emphasizes minimization of impervious surfaces and evenly dispersing runoff into vegetated areas on your property. In order to utilize dispersion, a lot can not have more than 10% impervious surface and must maintain at least 50% of the lot area in vegetated open space. Vegetated open space includes native undisturbed areas, rehabilitation of previously disturbed areas, or fields that are not regularly mowed. Active recreation areas and lawn shall not count towards vegetated open space.

Dispersion is a good option for large rural lots. The following basic requirements apply to sites utilizing rainwater dispersion; additional measures may be required if site conditions warrant:

- The developed lot area must be predominately flat with slopes of no more than 10%.
- Areas of vegetated open space should be delineated clearly on the drainage plan.
- The maximum lot impervious surface area is 10%.
- At least 50% of the total lot area shall be protected with a drainage easement granted to Clallam County or other appropriate entity. (See Appendix F for sample easement form)
- A vegetated flowpath of at least 50 feet in length must be available along the path that runoff will follow upon discharge to the nearest property line.
- A minimum 200-foot vegetated buffer from the point of dispersion to a critical area such as a stream or wetland.
- Dispersion areas must be at least 30 feet away from primary and reserve septic drainfields.
- Careful attention must be paid to spreading the stormwater properly. Runoff from each distinct impervious area should be dispersed to *different areas* and combining the flows from different areas should be kept to a minimum. **No more than 3,000 square feet of impervious surface shall be routed to one area for dispersion.**

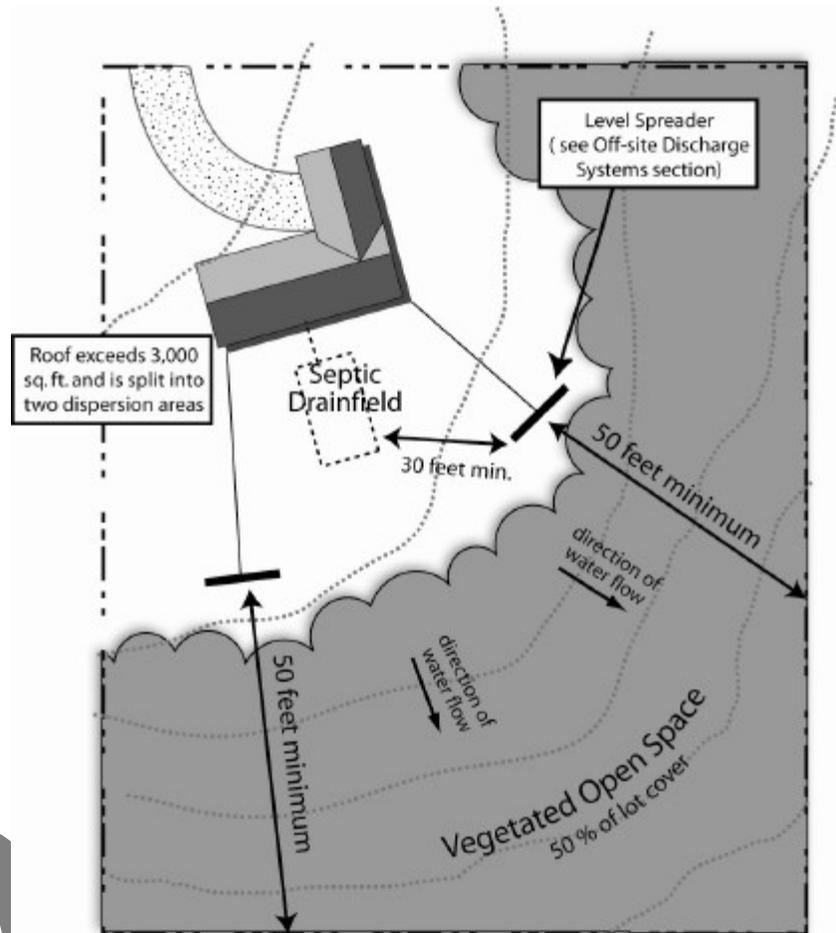


Figure 6. Rainwater Dispersion Example

Small Lot Dispersion

Some areas of Region I in eastern Clallam County have excessively drained soils that are classified as hydrologic groups A or B. In these areas, rainwater dispersion can be used as the sole stormwater management regardless of the amount of vegetated open space on the lot. This is called Small Lot Dispersion. **See Appendix C to determine if the soil type on your site is suitable for this option.**

In situations with excessively drained soils, splash blocks are the simplest way to disperse the runoff collected from the roof area and discharged via a downspout. Downspout splash blocks or downspout extensions with splash blocks may be the only hardware required for areas with these excessively drained soil types. In general, if the ground is sloped away from the foundation, and there is adequate vegetation for effective dispersion, splash blocks will adequately disperse storm runoff into these gravelly or sandy soils. If the ground is level, adding downspout extensions to move the discharge point further from the foundation may be a better choice.

- The developed lot area must be predominately flat with slopes of no more than 10%.
- When utilizing *Small Lot Dispersion*, no more than 700 square-feet of roof area may be drained to a single splash block.
- A vegetated flowpath of at least 50 feet in length must be available along the path that runoff will follow upon discharge from the splash block to the nearest property line.

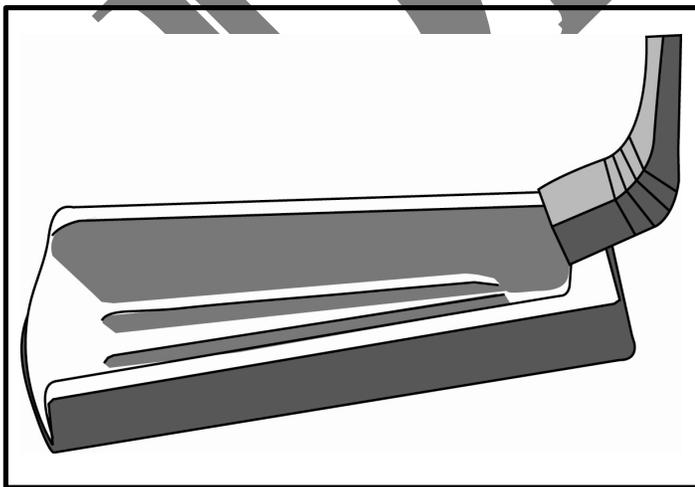


Figure 7. Splash Block close-up

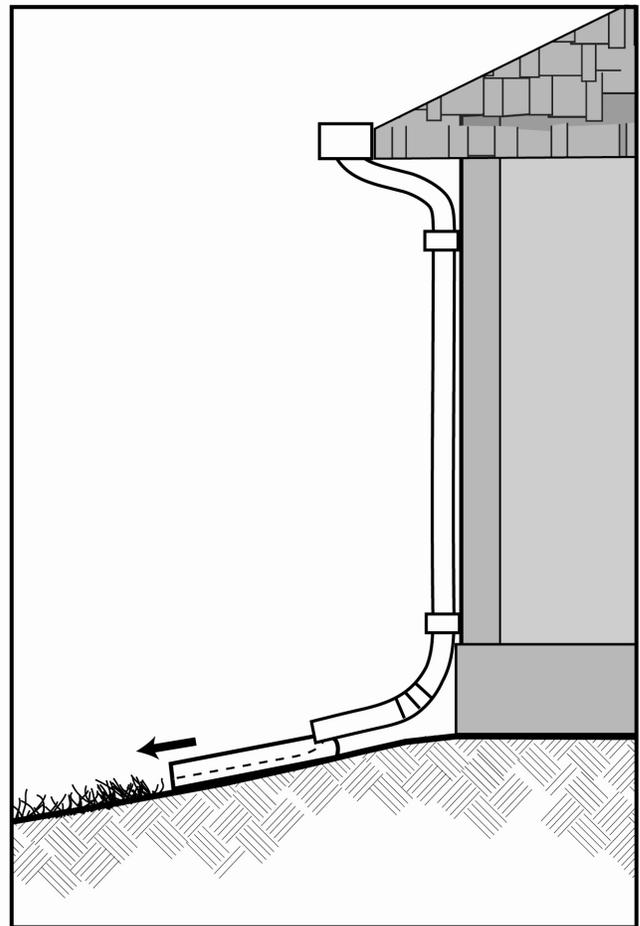


Figure 8. Downspout and Splash Block connection

Rainwater Dispersion Operation and Maintenance

Dispersion is a strategy for minimizing the area disturbed by development, retaining native vegetated areas and applying dispersion techniques that utilize the natural capacity of vegetation to mitigate the stormwater runoff quantity.

This flow control BMP has two primary components that must be maintained: (1) the dispersal flowpath and (2) the vegetated open space.

Dispersion Flowpath

- The size, placement, composition, and downstream flowpaths of these devices as depicted by the drainage plan must be maintained and shall not be changed without written approval from the Clallam County Department of Community Development.
- Dispersion devices such as splash blocks and level spreaders (See pg. xx for a description of level spreaders) must be inspected annually by the property owner and after major storm events to identify and repair any physical defects..
- When native soil is exposed or signs of erosion are present, the sources of the erosion or concentrated flow shall be identified and mitigated. Bare spots should be re-vegetated with native vegetation. Concentrated flow can be mitigated by leveling the edge of the pervious area and/or replenishing the rock in the dispersion device, such as in gravel-filled trenches.

Vegetated Open Space

- The vegetated surface required for dispersion should be delineated as "vegetation retention area" on the drainage plan.**
 - The trees, shrubs, ground cover, and soil conditions in this area shall not be disturbed, except as allowed by the following provisions:
 - Individual trees that have a structural defect due to disease or other defects, and which threaten to damage a structure, road, parking area, utility, or place of employment or public assembly, or block emergency access, may be topped, pruned, or removed as needed to eliminate the threat.
 - Dead or fallen trees, tree limbs within ten feet of the ground, and branches overhanging a residence may be removed to reduce the danger of wildfire.
 - Noxious weeds (i.e., plant species listed on the State noxious weed list in Chapter 16-750 WAC) and invasive vegetation (i.e., plant species listed as obnoxious weeds) shall be removed.
 - Passive recreation uses and related facilities, including pedestrian, equestrian and bicycle trails, nature viewing areas, fishing and camping areas, and other similar uses that do not require permanent structures, are allowed if clearing and soil compaction associated with these uses and facilities does not exceed 10 % percent of the vegetation retention area.

Infiltration Systems

Infiltration systems are BMPs that are designed to allow runoff to be absorbed into the ground. Soil conditions must be favorable enough to assure that the device used to soak water into the ground (e.g., infiltration trench, drywell, etc.) will perform as expected. Many locations in Clallam County have soils that are underlain by a compact layer of soil called glacial till or hardpan which severely limits infiltration capacity and causes water to accumulate at or near the soil surface during the wet season. This can make full infiltration of runoff impracticable, cost prohibitive, unreliable, or all three. **Consult Appendix C to determine if your soil is suitable for these techniques.**

If you plan to utilize infiltration trenches or drywells to control stormwater runoff, you will need to follow the guidelines listed below:

- In your drainage plan include locations of proposed drywells and trenches with their sizes. Indicate which roof areas will be routed into each.
- Runoff from paved areas including driveways and parking areas should flow through or across a vegetated strip or swale prior to infiltration.
- Infiltration systems must be appropriately sited with respect to the locations of septic drainfields, wells, and building foundations so as not to adversely affect them. Infiltration systems must be down gradient and at least 30 feet from the septic drainfield, at least 10 feet from foundations, and 100 ft. from wells. Infiltration systems shall be located on flat or gently sloped ground with grades of less than 15%.
- Infiltration systems must be filled with washed drain rock (1 ½" to 3" in diameter). The top and sides must be covered and wrapped with filter fabric so that the fine soils do not migrate into the voids of the drain rock. Landscaping cloth (generally available at hardware stores) works well for this purpose. A screen must be provided either at the outlet of the downspout or at the inlet to the drywell pipe to keep debris from entering the system.
- Connections between the infiltration system and the conveyance system such as swale, conveyance garden, or gravel trench should utilize one of the following:
 1. 3"-4" pipe buried not more than 6" below grade at least 2 feet in length.
 2. 8" wide x 8" deep gravel trench at least 2 feet in length
 3. Shallow earthen slot 4" deep and 4" wide

Consult the following pages for specifics on different infiltration techniques.

Infiltration Systems (cont.): Infiltration Trenches

Infiltration trenches are shallow gravel-filled trenches where runoff water is routed for storage and infiltration. Infiltration trenches work best in sandy or gravelly soil and are not appropriate in some clayey soil types (hydrologic groups C and D). **See Appendix C for a list of soils that are appropriate for this technique.**

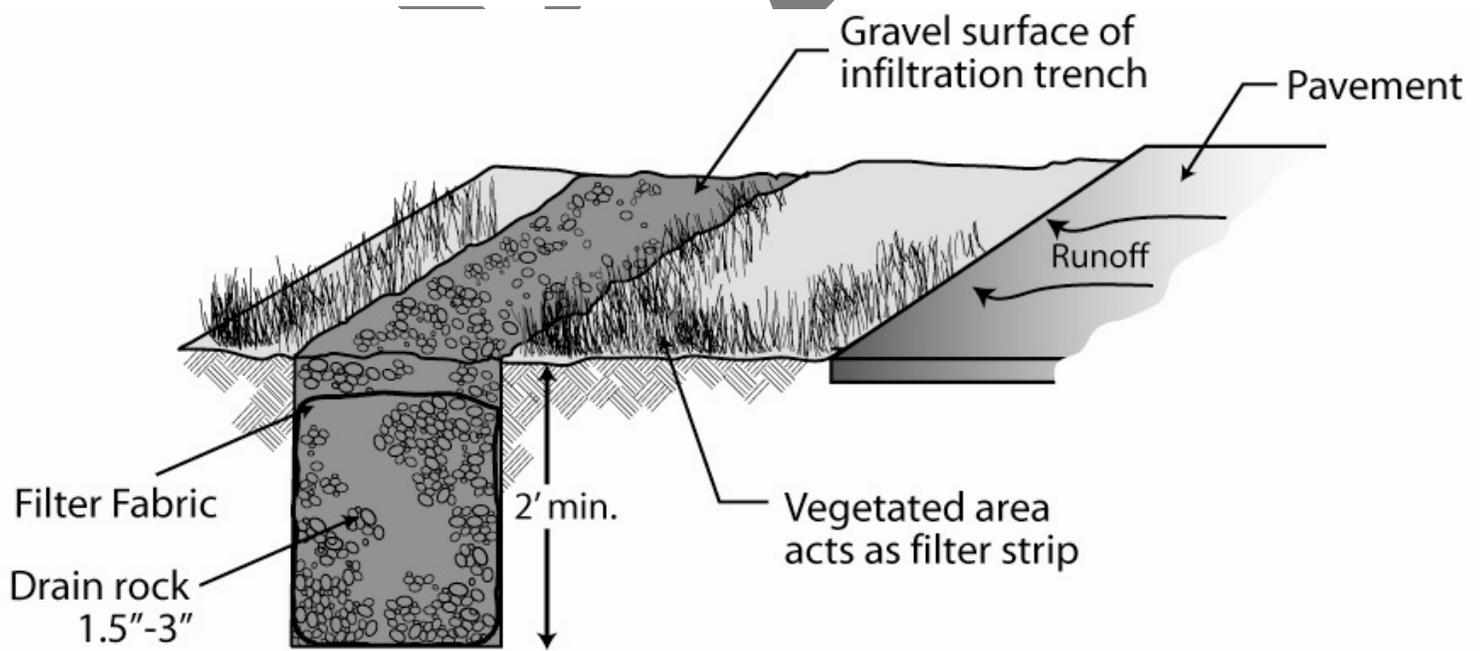
Runoff from paved areas including driveways and parking areas should flow through or across a vegetated strip or swale prior to infiltration.

Infiltration trenches are sized according to the stormwater region that the project is in. **Consult the map on page X, the Department of Community Development, or the website xxxxxx to determine what stormwater region your project is within.** The ratio of trench area to the impervious surface area draining to it is as follows: Region I is 30%; Region II is 40%; Region III is 50%. The table below can be used to determine the surface area needed for an infiltration trench based on the Region your project is in and the amount of stormwater draining to the trench.

Square Footage of Impervious Surface Draining to Infiltration Trench									
		500	1000	1500	2000	2500	3000	4000	5000
Required Surface Area of Trench by Region (Sq. ft.)	Region I	150	300	450	600	750	900	1200	1500
	Region II	200	400	600	800	1000	1200	1600	2000
	Region III	250	500	750	1000	1250	1500	2000	2500

The Infiltration Trench should be a minimum of 2' deep.

Figure 9. Infiltration Trench



Infiltration Systems (cont.): Drywells

A drywell is a simple, gravel-filled hole with a bottomless catch basin in the center into which runoff from the downspouts and gutters is routed. Drywells give a limited storage space for runoff to infiltrate slowly into the surrounding soil. Individual drywells can be used to manage runoff from up to 1,250 square feet of impervious surface area. Multiple drywells may be needed to manage the stormwater runoff on your property. Drywells are restricted to sandy or gravelly soil types (hydrologic group A and B). See Appendix C for a list of soils that are appropriate for this technique.

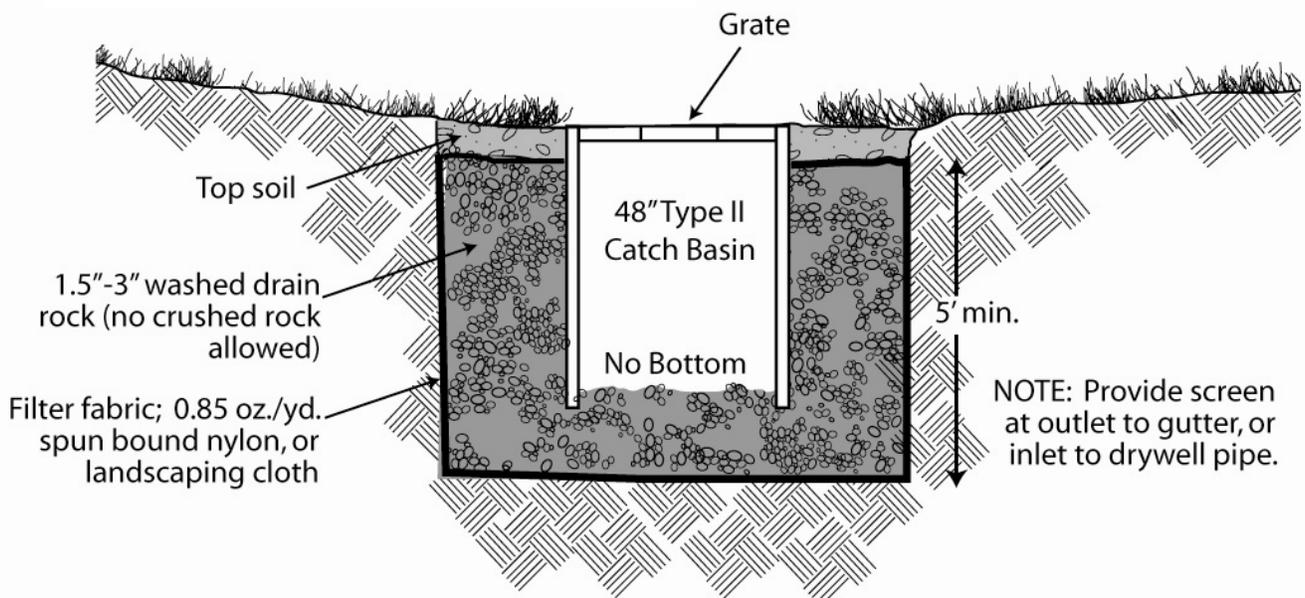
Drywells are sized according to the stormwater region in which the project is located. Consult the map on page X, the Department of Community Development, or the website xxxxxx to determine what stormwater region your project is within. The table below can be used to determine the surface area needed for a drywell depending on the Region your project is in and the amount of stormwater that drains to the drywell.

		Square footage of impervious surface draining to drywell				
		250	500	750	1000	1250 (max. area allowed)
Required size of dry well by region	Region I	6'x6'	9'x9'	11'x11'	13'x13'	15'x15'
	Region II	7'x7'	10'x10'	12'x12'	14'x14'	16'x16'
	Region III	8'x8'	11'x11'	13'x13'	15'x15'	17'x17'
Required catch basin size*	All regions	Type 1	Type 1L	2-Type1-L	1-48" Type II	1-54" Type II

*Catch basins may be purchased from local concrete distributors.

- The drywell should be a minimum of 5 feet deep.

Figure 10. Drywell cross-section



Infiltration Systems Operation and Maintenance

Infiltration systems are designed to absorb runoff from impervious area (such as paved areas and roofs) into the ground. To be successful, the soil condition around the infiltration device must be reliably able to soak water into the ground.

- The size, placement, and composition of these devices as depicted by the drainage plan must be maintained and shall not be changed without written approval from the Clallam County Department of Community Development.
- Infiltration systems must be inspected annually by the property owner and after major storm events to identify and repair any physical defects.
- Maintenance and operation of the system should focus on ensuring the system's viability by preventing sediment-laden flows from entering the device. Excessive sedimentation will result in a plugged or non-functioning facility. If the infiltration device has a catch basin, sediment accumulation must be removed on a yearly basis or more frequently if necessary. Annual inspection should be conducted to ensure system has not become clogged.
- Prolonged ponding around or atop a device may indicate a plugged facility. If the device becomes plugged, it must be replaced.
- Keep the areas that drain to infiltration devices well swept and clean to enhance the longevity of these devices. For roofs, frequent cleaning of gutters will reduce sediment loads to these devices.

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Runoff Filter Strips

Runoff filter strips are lawn areas underlain by 1 to 1.5 feet of sand or gravel that are adjacent to driveways or parking areas. The turf and sand filter pollutants from runoff and allow stormwater to slowly infiltrate into the underlying soil.

Runoff filter strips shall encompass an area equal to or larger than the impervious surface area that drains to them. For paved areas of 2,000 square feet or less, no other runoff management option is required. For paved areas larger than 2,000 square feet, additional runoff management is required. Recommended additional runoff management options for larger paved areas should be designed at one-third the standard sizing for regular impervious areas. For example, a runoff filter strip equal in area to the impervious surface area along with a rain garden 1/3 the size of the rain garden sizing chart recommendation would fulfill the runoff management needed for paved areas larger than 2,000 square feet.

Examples:

- A 1,500 square foot paved driveway in all regions would require a filter strip totaling an area of 1,500 square feet. No additional runoff management is needed for the paved area.
- A 2,500 square foot paved driveway in all regions would require a filter strip with a surface area of 2,500 square feet *in combination with*:
 - A rain garden with a surface area of 125 sq feet, which is 1/3 of 375 square feet needed according to the rain garden sizing chart on [page XX](#) for 2,500 square feet of impervious surface.
 - **OR** an infiltration trench with a surface area of 250 square feet, which is 1/3 of 750 square feet needed according to the infiltration trench sizing chart on [page XX](#) for 2,500 square feet of impervious surface.

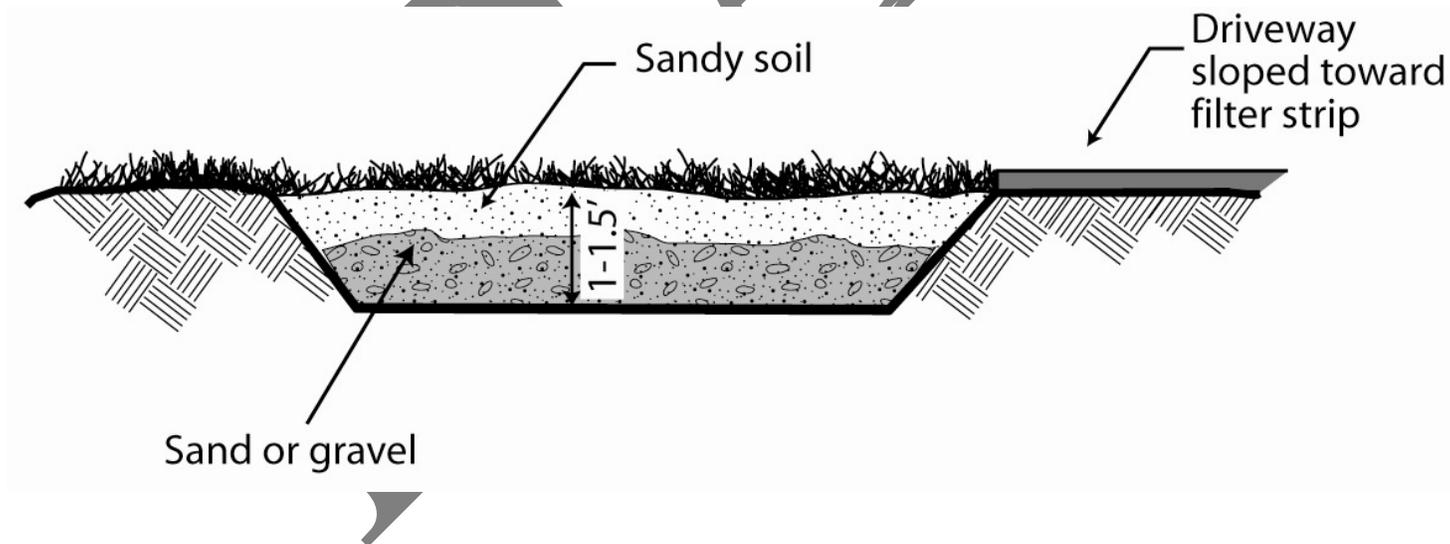


Figure 11. Runoff Filter Strip

Runoff Filter Strip Operation and Maintenance

Runoff filter strips are lawn areas that stormwater runoff is directed to flow and filter through. Pollutants are removed through infiltration and sedimentation.

- The size, placement, and composition of the filter strips as depicted by the drainage plan must be maintained and shall not be changed without written approval from the Clallam County Department of Community Development.
- Keep the areas that drain to the filter strip well swept and clean to enhance the longevity of the strip. For roofs, frequent cleaning of gutters will reduce sediment loads to these devices.
- Sources of erosion damage shall be identified and controlled when soil is exposed or erosion channels are forming.
- Sediment build-up in the filter strip that exceeds 2" in depth shall be removed.
- If the filter strip does not drain within 48 hours, it shall be regraded and reseeded.

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Porous Pavement

Porous pavements are designed to accommodate vehicle and pedestrian traffic, while allowing infiltration, stormwater treatment, and limited stormwater storage. Porous pavement can be used in many standard pavement applications. For paved areas of 2,000 square feet or less, no other run-off management option is required. For areas larger than 2,000 square feet, additional run-off management is required. Recommended additional run-off management options for porous paved areas exceeding 2,000 square feet should be designed at one-third the standard sizing for regular impervious areas. For example, a filter strip 1/3 the width of the driveway would fulfill the additional runoff management requirement.

Porous pavement is constructed above a gravel base of generally 1 to 1.5 inches of compacted, washed angular gravel with finer material or sand on top. A variety of types are available including porous asphalt and concrete, pavers, and concrete or plastic cellular paving systems. As most porous pavements have standard specifications, follow the manufacturers' recommendations.

- Use of porous pavement is restricted to sandy or gravelly soil types (hydrologic group A and B). **See Appendix C for a list of soils that are appropriate for use of porous pavement.**
- A minimum depth to seasonal ground water of 2 feet is required to utilize porous pavement.
- Porous pavement should be used on flat to gently sloped ground with a maximum slope of 5%.
- The type and location of porous pavement shall be marked on the drainage plan.
- Porous pavements should be used in low-speed applications only, i.e. walkways, driveways, fire lanes, overflow parking, etc. Plastic cellular paving systems with turf shall be restricted to low-use applications such as overflow parking, shoulders, etc.
- Porous pavement should be designed with adequate drainage to prevent water from remaining in pavement or base material for over 24 hours.
- Engineering consultation is recommended for all systems.

Hollywood Driveway

A Hollywood driveway, a driveway constructed with a center grass strip, is a simple and effective way to reduce impervious surface. When a Hollywood driveway is constructed with a permeable gravel base and sand under the sod and soil layers, it shall be considered a porous pavement option.

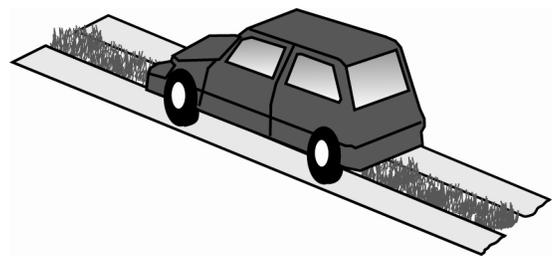


Figure 12. Hollywood Driveway

Porous Pavement Operation and Maintenance

Porous pavements reduce the amount of rainfall that becomes runoff by allowing water to seep through the pavement into a free-draining gravel or sand bed, where it can be infiltrated into the ground.

- The area covered by porous pavement as depicted by the drainage plan must be maintained as porous pavement and shall not be changed without written approval from the Clallam County Department of Community Development.
- Porous pavements must be inspected after major storms by the property owner to make sure it is working properly. Prolonged ponding or standing water on the pavement surface is a sign that the system is defective and may need to be replaced.
- To help extend the useful life of the system, the surface of the porous pavement should be kept clean and free of leaves, debris, and sediment through regular sweeping or vacuum sweeping.
- The owner is responsible for the repair of all ruts, deformation, and/or broken paving units.

A typical porous pavement system has a life expectancy of approximately 25 years.

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Rainwater Collection

Rainwater can be collected off of roofs and routed to containers such as rain barrels or cisterns for storage and later use. Up to 2,500 square feet of impervious surface may be mitigated by the use of rainwater catchment. Small systems of up to 2,200 gallons with water use restricted to non-potable outdoor uses can be incorporated into a drainage plan without engineered designs, although engineering consultation is strongly recommended for all systems. **Rainwater catchment systems are subject to Department of Ecology rules.**

The table shown below shows the minimum size of storage required for the roof area draining to the cistern.

Square footage of roof area draining to cistern							
		250	500	1000	1500	2000	2500
Required Cistern Volume by Region (Gallons)	Region I	400	800	1600	2400	3200	4000
	Region II	500	1100	2200	3300	4400	
	Region III	750	1600	3200	4800		

Shaded cells indicate rainwater catchment systems over 2,200 gallons that require an engineered design.

Rainwater catchment can be used as the sole runoff management option for roofs up to 1,250 square feet and for up to 50% credit for additional roof areas. To receive credit for roof areas routed to cisterns or rain barrels, the storage volume must equal or exceed the amounts required in the sizing table above.

In order for rainwater catchment to aid in reducing flows from developed areas, it is important to manage overflow during storms. Ideally, spigots should be shut off during stormy periods, and overflow routed to additional BMPs such as a rain garden or infiltration trench. Storage levels kept to less than ¾ full by slowly lowering levels during dryer weather by irrigating lawns or gardens or very slowly draining to conveyance areas. Larger clean-out valves should never be used to lower water levels especially during winter months. Water from the cistern should be drained prior to freezing weather.

If you plan to utilize a cistern or rain barrels to collect stormwater runoff, follow the guidelines below:

- Containers should be placed on a concrete or brick footing on firm ground.
- Container capacity shall meet or exceed the size specified in the sizing chart for the roof area draining to it.
- Containers storing less than 1,000 gallons shall use an outlet spigot of ½”, larger containers shall utilize spigots ¾” or larger.
- Containers must have an overflow pipe located below the top of the tank which is directly routed to a conveyance BMP.
- The container shall have a controllable spigot or valve located near the bottom. The spigot should drain to a hose or pipeline that can outlet to a conveyance BMP.
- The water collected from the gutter shall be filtered with a fine screen prior to discharging to the storage container.
- The container should have a valve of at least 2” in diameter to flush sediment out of the tank. This larger valve should not be used to drain the tank because of the rapid rate of draining.

- The effectiveness of rainwater collection systems is highly dependant on the ability to monitor the system closely for maintenance and needed adjustments.
- Engineering consultation is strongly recommended for all systems.

Rainwater Collection Systems Operation and Maintenance

Rainwater collection is a means of managing runoff through storage of roof runoff for irrigation use. Rainwater collection systems include a collection area, a filtering system, a storage device, and an outflow device.

- The size, components, and configuration of the rainwater system as depicted by the site plan and design details must be maintained and shall not be changed without written approval from the Clallam County Department of Community Development.
- The collection area (e.g., roof) should be routinely inspected by the property owner for debris and other material that could impede the entrance and/or exit of surface flows.
- The filtering system should be periodically inspected by the property owner for effectiveness and replaced or replenished as recommended by the manufacturer.
- Consulting with an engineer on the Operations and Maintenance of these systems is strongly recommended.

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Stormwater Conveyance BMPs

The stormwater conveyance BMPs collect and convey runoff on the site. When well implemented, conveyance BMPs can slow flows and allow some infiltration of stormwater as it travels across a developed site. To achieve these benefits, at least half of the flow paths from various impervious areas shall consist of open conveyance, thus limiting the use of pipes and narrow ditches. The four options for conveyance of stormwater consist of swales, furrows, gardens, and gravel-filled trenches. This section of the manual presents general guidelines for design of the following conveyance BMPs for small projects:

- Swales
- Conveyance Furrows
- Conveyance Gardens
- Gravel Trenches

Swales

Swales are broad, shallow ditches with gentle slopes. They are generally grassed and designed for easy mowing. Swales should be used on level or gentle sloped ground with grades less than 5%.

- The bottom width of a swale should be at least 2 feet. However, if the swale serves over 5,000 square feet of impervious surface, the bottom should be at least 3 feet wide.

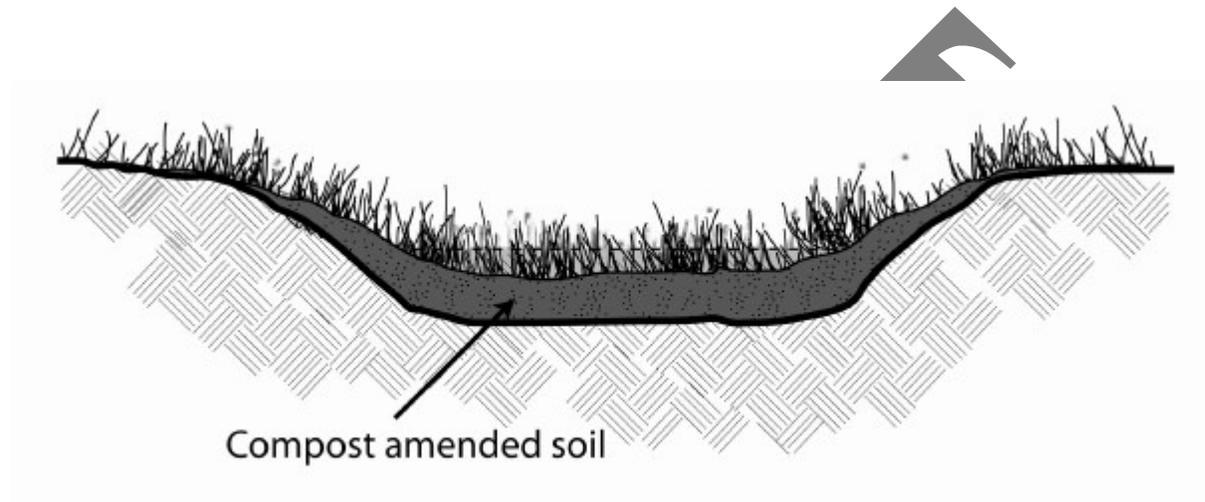


Figure 13. Grassy swale

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Swale Operation and Maintenance

Swales are planted or grassed open channels that trap pollutants by filtering and slowing flows, allowing particles to settle out.

- The size, placement, composition, and flowpaths of the swales as depicted by the drainage plan must be maintained and shall not be changed without written approval from the Clallam County Department of Community Development.
- Swales must be inspected annually by the property owner and after major storm events to identify and repair any physical defects.
- When soil is exposed or erosion channels are present, the sources of the erosion or concentrated flow shall be identified and mitigated. Bare spots should be re-vegetated.
- Sediment accumulation shall be hand-removed with minimum damage to vegetation. Sediment shall be removed if it is more than 4" thick or so thick as to damage or kill vegetation.
- Inlet shall be cleared when conveyance capacity is plugged. Sources of sediment and debris shall be identified and corrected.
- Annual or semi-annual tilling shall be implemented if compaction or clogging occurs.

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Conveyance Furrow

Conveyance furrows are a series of parallel troughs and berms perpendicular to the slope that runoff water flows across from one to another. Conveyance furrows can vary in form, from meandering, irregular, and vegetated to straight and grass-lined, and can be graded and planted to be an amenity to the residence. This option is best for slopes from 15% or more.

- At a minimum one furrow should be constructed for each foot of vertical drop, with a maximum spacing of 10 feet between furrows along the flow path.
- The total relief of the furrows should be 4 to 10 inches from bottom of trough to top of berm.
- To prevent concentration the furrows must be level and run along the contour of the land. Conveyance furrows and berms should be earth or drain rock.
- The furrows should be vegetated with grass or vegetation appropriate for moist and seasonally dry conditions. See Appendix E for a list of recommended plants.
- Conveyance furrows must be long enough to intercept all runoff generated from impervious sources.
- The bottom of the troughs should be a minimum of 1 foot wide.

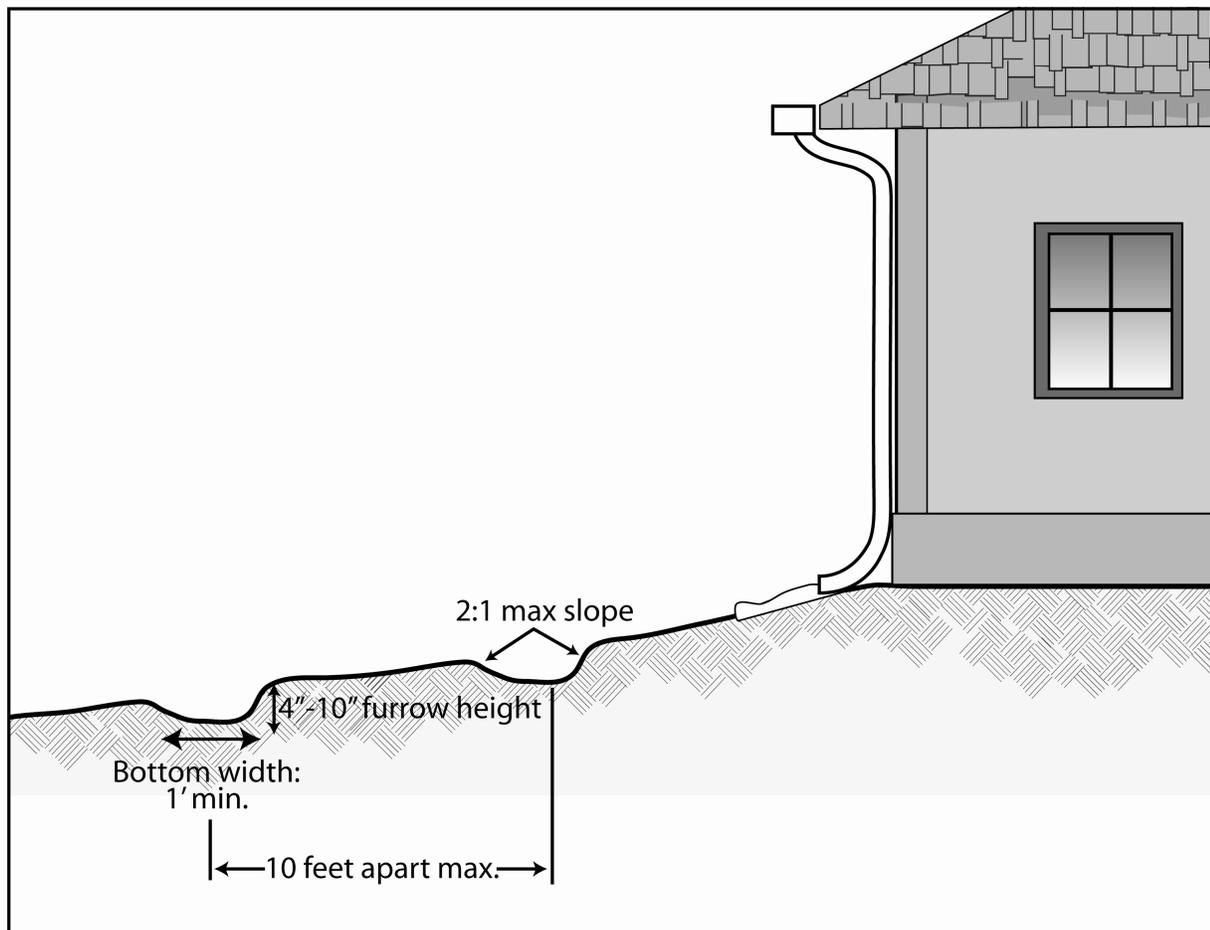


Figure 14. Conveyance Furrow

Conveyance Furrow Operation and Maintenance

Conveyance furrows are a series of parallel troughs and berms perpendicular to the slope that runoff water flows across from one to another that can be planted with vegetation grass, or filled with gravel.

- The size, placement, and design of the conveyance furrow as depicted by the drainage plan must be maintained and shall not be changed without written approval from the Clallam County Department of Community Development.
- Chemical fertilizers and pesticides must not be used.
- Conveyance furrows must be inspected annually by the property owner for physical defects.
- After major storm events, the conveyance furrows should be checked to see that the flow path has not been clogged with debris.
- If erosion channels or bare spots within the furrows are evident, they should be stabilized with soil, plant material, and mulch.
- If planted with grass or other vegetation, a supplemental watering program may be needed the first year to ensure the long-term survival of the conveyance furrows' vegetation.
- If planted, vegetation should be maintained as follows:
 - 1) replace all dead vegetation as soon as possible;
 - 2) remove fallen leaves and debris as needed;
 - 3) remove all noxious vegetation when discovered;
 - 4) manually weed without herbicides or pesticides;
 - 5) mulch to conserve moisture and inhibit weed germination.

Conveyance Garden

Conveyance gardens are similar to rain gardens but are smaller, narrower and part of a continuous ditch or ditch-pipe system.

- Existing and replacement soil shall be uncompacted to increase infiltration.
- If the site soil has low permeability, the soil in the bottom of the garden can be replaced or amended with a more permeable soil.
- Conveyance gardens should be located on level to gently sloped ground. Use caution in locating conveyance gardens on slopes greater than 10%.
- The bottom of a conveyance garden should be 6 to 12 inches below the grade of the outlet pipe or ditch.
- The bottom width of a conveyance garden should taper from the inlet ditch up to a minimum of 3 feet, then taper down to the width of the outlet pipe or ditch.
- Conveyance gardens serving over 5,000 square feet of impervious surface should have a minimum width of 4 feet at their widest point.
- The conveyance garden should be planted with vegetation appropriate for moist and seasonally dry conditions. See Appendix E for a list of recommended plants.
- Overflow shall connect to a designated management area or discharge point.

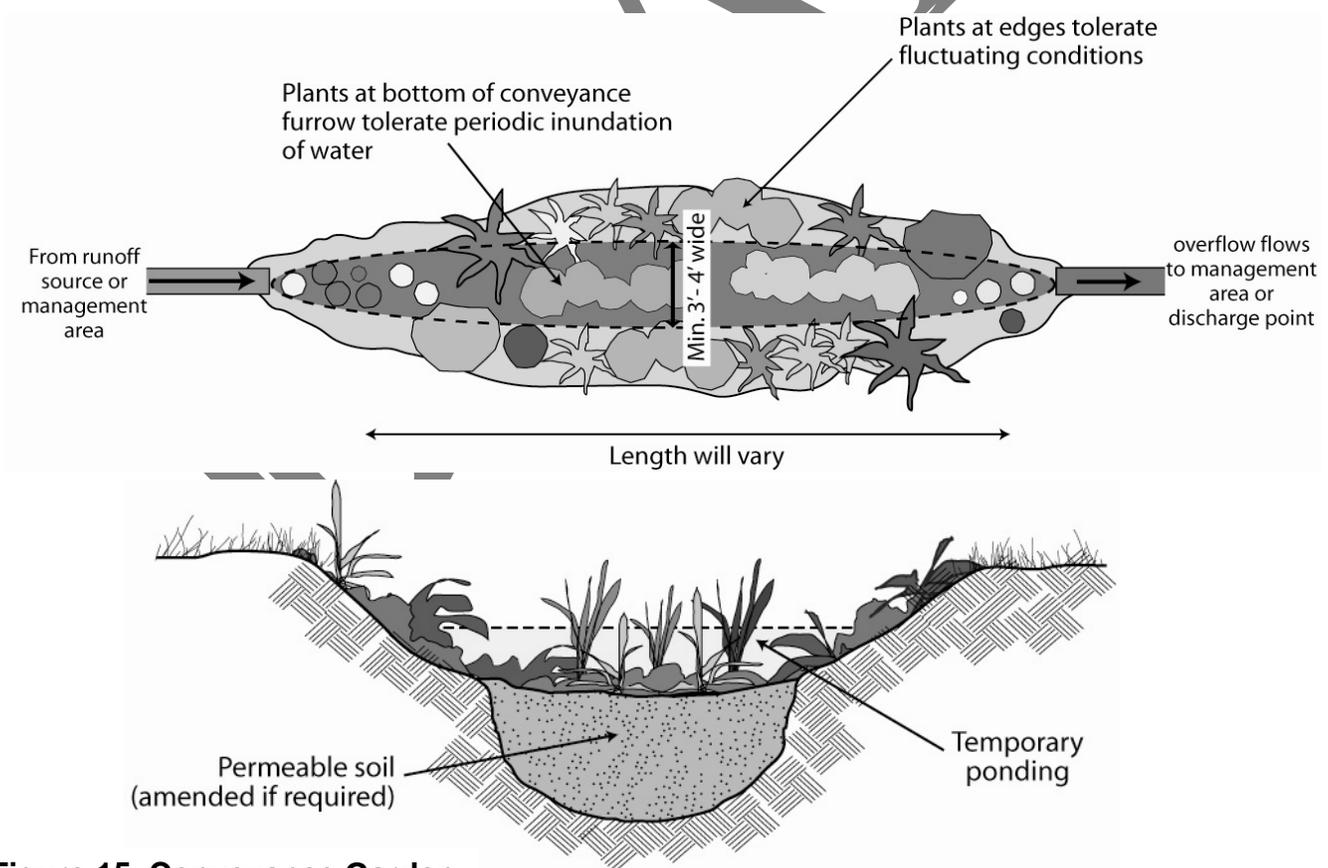


Figure 15. Conveyance Garden Plan View and Cross-section

Conveyance Garden Operation and Maintenance

Conveyance gardens are linear depressions that collect, infiltrate, and convey stormwater from an area of impervious surface to an end-of-line system such as a level spreader.

- The size, placement, and design of the conveyance garden as depicted by the drainage plan must be maintained and shall not be changed without written approval from the Clallam County Department of Community Development.
- Chemical fertilizers and pesticides must not be used.
- Additional mulch and compost should be added to the soil of the conveyance garden periodically over time.
- Conveyance gardens must be inspected annually by the property owner for physical defects.
- After major storm events, the conveyance garden should be checked to see that the overflow system is working properly and is not clogged.
- If erosion channels or bare spots are evident, they should be stabilized with soil, plant material, and mulch.
- A supplemental watering program may be needed the first year to ensure the long-term survival of the conveyance garden's vegetation.
- Vegetation should be maintained as follows:
 - 1) replace all dead vegetation as soon as possible;
 - 2) remove fallen leaves and debris as needed;
 - 3) remove all noxious vegetation when discovered;
 - 4) manually weed without herbicides or pesticides;
 - 5) mulch to conserve moisture and inhibit weed germination.

Gravel Trenches

Gravel trenches are excavated trenches filled with loose gravel intended to convey runoff from the runoff management zone to an end-of-line discharge technique such as a level spreader (See Section III-C for a description of level spreaders). Gravel trenches should be used on gently sloped ground with grades less than 5%.

- The bottom width of a trench should be at least 2 feet. Gravel trenches serving over 5,000 square feet of impervious surface should be at least 3 feet wide at the bottom.
- The trench should be a minimum of 1 foot deep.

Gravel Trench Operation and Maintenance

- The size, placement, and composition of gravel trenches as depicted by the drainage plan must be maintained and shall not be changed without written approval from the Clallam County Department of Community Development.
- Gravel trenches must be inspected annually by the property owner and after major storm events to identify and repair any physical defects.
- Maintenance and operation of the trench should focus on ensuring the system's viability by preventing sediment-laden flows from entering the device. Excessive sedimentation will result in a plugged or non-functioning facility.
- Prolonged ponding around the gravel trench may indicate it has become blocked. The existing gravel in the trench should be excavated and replaced.

Section III-C

End-of-Line Discharge BMPs

After stormwater has traveled through a Runoff Management BMP such as a rain garden, rainwater planter, or infiltration system, it is conveyed through an open conveyance BMP to a discharge point. This point should be at or near the point where water naturally flowed from the site before the permitted development. In order to eliminate or minimize any impacts associated with the discharge of stormwater from a site, stormwater shall be dispersed utilizing either a level spreader, continued dispersion or conveyance furrows (see Section III-B for a description of conveyance furrows). This section of the manual presents general guidelines for design of the following discharge BMPs for small projects:

- Level Spreaders
- Continued Dispersion

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Level Spreaders

Level spreaders are structures that are designed to convert small concentrated stormwater flows to sheet flows over a large area. Level spreaders come in many forms but all designs follow the same principle:

1. Concentrated flow enters the spreader through a pipe, ditch or swale.
2. The flow is slowed and energy is dissipated.
3. The flow is distributed throughout a long linear shallow trench or behind a low berm.
4. Water then rises and is dispersed over the level spreader.

Two main types of level spreader may be used to disperse flows: level board spreaders and gravel spreader trenches. The key to either type is for the edge of the spreader to be even and level.

Level Board Spreaders

Boards are installed in a trench and serve as the downstream lip so that water can flow out of the level spreader more uniformly. The boards should be stabilized by rebar driven into the ground at regular intervals along the trench. Joints between boards can be constructed by wrapping cloth around both ends of the board.

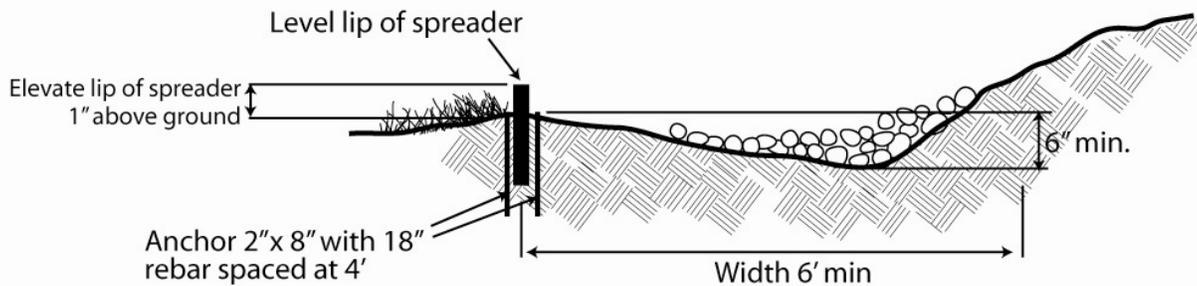
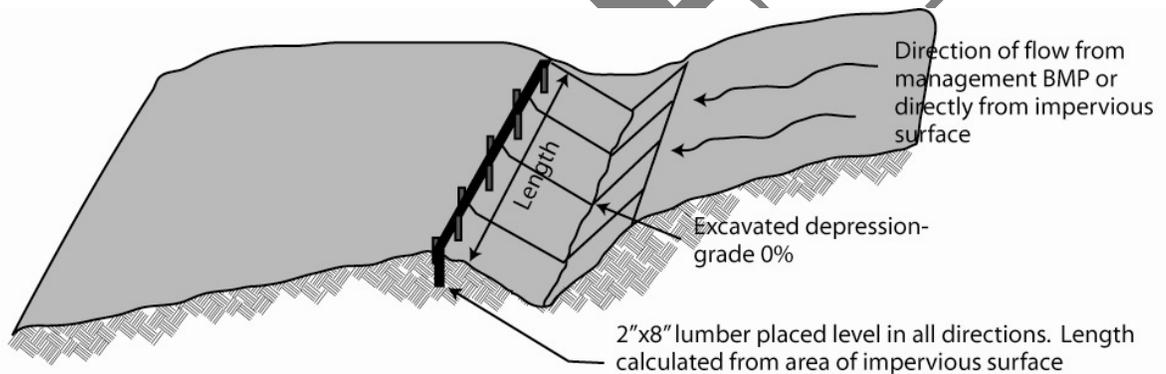


Figure 16. Level Board Spreader

Gravel Spreader Trenches

A gravel spreader trench is a gravel filled channel with a level downslope edge. Water pools in the channel, rises up and flows evenly over the edge of the channel as dispersed sheet flow. The channel should be dug along an elevation contour, which helps make the downstream lip “level.” Landscape fabric should be used to underlay the channel and protect the downslope lip. A disadvantage of this type of spreader is that it is very hard to get the lip truly level and keep it that way.

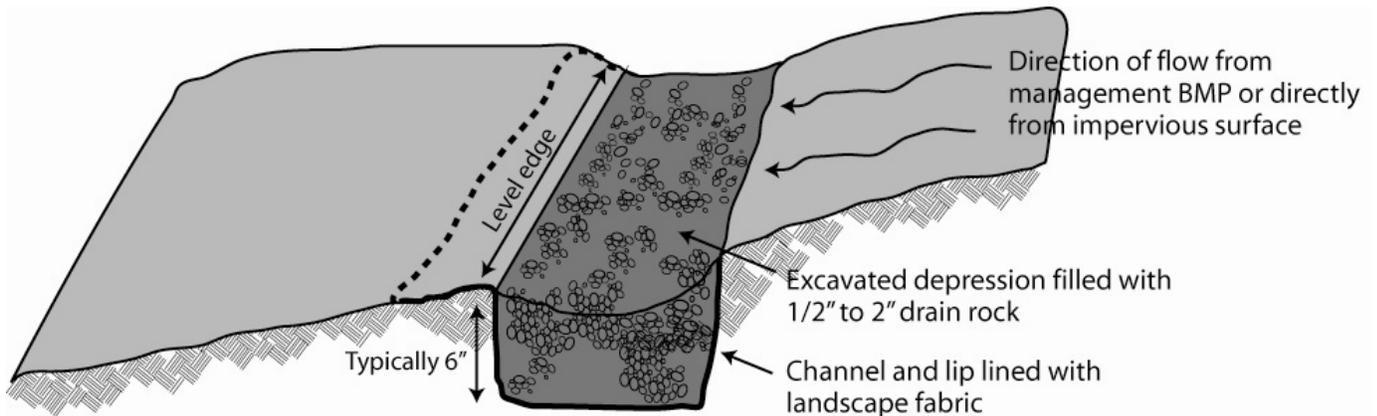


Figure 16. Gravel Spreader

A spreader shall have a minimum length of 10 feet for every 1,000 feet of directly tied impervious surface. For example, to adequately disperse flows from an impervious surface (such as a driveway) that measures 1,500 square feet, a level spreader 15 feet long would be needed.

For the outflow of a BMP such as a rain garden, or planter, 2,000 square feet of impervious surface may be routed for every 10 feet of width of the level spreader. For example, a rain garden receiving the runoff from a 4,000 square foot surface should have an overflow leading to a level spreader 20 feet in length.

The maximum length of one level spreader shall be 30 feet. For areas larger than 3,000 square feet of impervious surface that are drained directly by a level spreader, more than one level spreader should be used. When used in conjunction with runoff management and conveyance BMPs such as a rain garden or conveyance furrow, impervious surfaces larger than 6,000 should incorporate more than one level spreader.

A vegetated flowpath of at least 50 feet in length must be available along the path that runoff will follow upon discharge from the spreader to the nearest property line. The level spreader should be at least 200 feet from a critical area such as a stream, wetland or geologically hazardous area.

Level Spreader Operation and Maintenance

- The size, placement, and composition of level spreaders as depicted by the drainage plan must be maintained and shall not be changed without written approval from the Clallam County Department of Community Development.
- Level spreaders must be inspected annually by the property owner and after major storm events to identify and repair any physical defects.
- Maintenance and operation of the trench should focus on ensuring the system's viability by preventing sediment-laden flows from entering the device. Excessive sedimentation will result in a plugged or non-functioning facility.
- When soil is exposed or erosion channels are present, it may mean the level edge of the spreader is no longer level. The level spreader should be regraded to eliminate the problem.

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Continued Dispersion

Continued dispersion from level ground, a level spreader, conveyance furrows, filter strip or porous pavement is an appropriate discharge option where at least 100 feet of flow path through on-site native vegetation allows stormwater to naturally infiltrate and disperse. In some instances, this option may be limited or not allowed if County staff identify conditions that may concentrate stormwater flows and create downstream problems for public or private properties.

Continued Dispersion Operation and Maintenance

- The dispersion flowpath as depicted by the drainage plan must be maintained and shall not be changed without written approval from the Clallam County Department of Community Development.
- When soil is exposed or erosion channels are present, the sources of the erosion or concentrated flow shall be identified and mitigated. Bare spots should be re-vegetated with native vegetation.
- The vegetated surface required for dispersion should be delineated as "vegetation retention area" on the drainage plan.**
 - The trees, shrubs, ground cover, and soil conditions in this area shall not be disturbed, except as allowed by the following provisions:
 - Individual trees that have a structural defect due to disease or other causes, and which threaten to damage a structure, road, parking area, utility, or place of employment or public assembly, or block emergency access, may be topped, pruned, or removed as needed to eliminate the threat.
 - Dead or fallen trees, tree limbs within ten feet of the ground, and branches overhanging a residence may be removed to reduce the danger of wildfire
 - Noxious weeds (i.e., plant species listed on the State noxious weed list in Chapter 16-750 WAC) and invasive vegetation (i.e., plant species listed as obnoxious weeds) may be removed.
 - Passive recreation uses and related facilities, including pedestrian, equestrian community and bicycle trails, nature viewing areas, fishing and camping areas, and other similar uses that do not require permanent structures, are allowed if clearing and soil compaction associated with these uses and facilities does not exceed eight percent of the native growth retention area.