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Stormwater Drainage Guidelines

Considerable resources have been spent addressing the important issue of controlling stormwater within Clyde Hill. Drainage and detention systems help prevent problems by controlling discharges into the public system; this protects the capacity of the existing City infrastructure and helps control sub-surface erosion and the springs that are common on Clyde Hill.

When Owners and Developers address a property’s drainage they are helping to control or eliminate potential stormwater problems on their own property as well as spill-over problems on adjoining and public properties. It is the duty of those who plan new or remodel projects to comply with City regulations for stormwater management in order to avoid these types of problems.

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1. Historical Information: Past Problems and the Need to Manage Drainage

Clyde Hill is responsible for maintaining a storm drainage system that benefits the entire community. There are currently 16 miles of storm drain lines within the City that collect and direct run-off from the streets and homes. All of the City's stormwater ends up in Lake Washington. Most of the stormwater in our community is directed out of Clyde Hill into two detention/retention ponds located on the Overlake Golf and Country Club. These ponds are utilized through an agreement with the Country Club to store run-off before the water enters Fairweather Creek and eventually Lake Washington.

During the early years of Clyde Hill's development, the City's drainage facilities were designed and constructed to handle only the water collected from the public streets. These systems, still in the ground today, were designed to handle only a 10-year storm event. Because there was still plenty of room in the community, flooding from a neighbor was not a major concern. However, as Clyde Hill developed, so did its corresponding stormwater related problems.

In the 1970's the City was about 90% developed and began to receive many complaints from residents describing how neighbors were discharging water onto their property. Some of the City's first drainage requirements were developed at this time. As the City continued to mature in the mid to late 1980's, Clyde Hill experienced flooding problems on the streets, in homes and as underground springs throughout the City. City Hall received numerous calls from residents very concerned about stormwater problems. In many cases property damage was occurring.

In 1989 the City tried to address problems in its biggest drainage basin so re-designed and enlarged the storm drains on 84th Avenue, including a connection to the detention ponds on the Overlake golf course. Those improvements helped alleviate the flooding problems experienced along most of the lower areas in Clyde Hill. Along with these improvements an accompanying analysis determined that the enlarged system would continue to manage flooding only if increases in the flow rates throughout the entire system could be controlled.

Unfortunately, the City's system cannot be significantly expanded to handle new development because of the presence of utility lines, such as sewer, gas and water that exist within the rights-of-way. Laws regulating storm drain systems in Washington make it clear that a system cannot negatively impact the property onto which it drains (in the majority of circumstances the golf course.) An uncontrolled increase in the flow of the City's system on downstream detention facilities would constitute a negative impact. With this understanding the City Council established the drainage and detention requirements that are now enforced today.

Code References for Drainage Requirements

Chapter 15.10 of the Clyde Hill Municipal Code is entirely devoted to drainage requirements. This document does not replace a thorough reading and understanding of the code.

Section 15.04.060(A) specifies the requirement for a storm drainage system: Section R105.1.1 IRC New (Storm Drainage Required). Section R105.1.1 of the International Residential Code is hereby added to read as follows: Except as specified within this code, no building or structure shall be erected, constructed, enlarged, altered, repaired, moved, improved, removed, converted or demolished unless a separate permit for each building or structure has first been obtained from the building official. All storm drainage systems (both on-site and off-site) shall be encompassed within the building permit and designed according to the requirements of the Clyde Hill Municipal Code.

Background on Updated Stormwater Regulations Effective 12/31/16

In 2012 the Department of Ecology issued new stormwater regulations as part of the Western Washington Municipal Stormwater Permit, required to take effect by December 31, 2016. As a permittee, Clyde Hill is required to implement these new regulations by December 31, 2016.

Previously, projects within Clyde Hill that disturbed an area of 1 acre or less were not subject to many of the Department of Ecology stormwater requirements, although in Clyde Hill these smaller projects continued to be subject to drainage and detention system requirements contained in previous versions of these Stormwater Drainage Guidelines.

The new Ecology stormwater regulations removed the 1-acre threshold and expanded requirements for construction projects to require On-Site Stormwater Management (also known as Low Impact Development) to be incorporated into site designs to the maximum extent feasible. In addition, with the 1-acre exemption no longer in effect, Ecology's flow control requirements will need to be applied. The Ecology flow control requirements typically only apply to projects with 10,000 square feet or more of total effective impervious surfaces, but require significantly more volume than Clyde Hill's previous requirements.

2. Stormwater Requirements for All Projects

The stormwater management requirements for projects in Clyde Hill are found in Section 15.10 of the Clyde Hill Municipal Code. The Code references two documents, Appendix 1 of the *Western Washington Phase II Municipal Stormwater Permit*, and the *2014 Stormwater Management Manual for Western Washington (SWMMWW)*. Although the Municipal Code and its referenced documents are the primary stormwater requirements, this document provides additional guidelines for their application, particularly for single-family residential redevelopment projects that are typical in Clyde Hill.

The attached decision charts from the Department of Ecology (see Appendix A) can be used to identify what Minimum Requirements may apply to specific projects. To use these charts, the following information must be known:

- Percentage of site with existing impervious surface
- Area of new hard surface, in square feet
- Area of replaced hard surface, in square feet
- Value of proposed improvement (interior and exterior)
- Assessed value of property

With this information, it can be determined which of the nine Minimum Requirements must be applied to the project, and whether they apply to only the new impervious hard surface, or both the new and replaced hard surfaces.

All but the smallest projects (< 2,000 sf of new/replaced hard surface) are required to submit a Stormwater Site Plan (Minimum Requirement #1), which documents how the project will incorporate the applicable Minimum Requirements. The required content of the Stormwater Site Plan is outlined in Volume 1, Chapter 3 the 2014 SWMMWW, and in most cases will include the following components:

- A Soils Report that includes soils logs and an assessment of infiltration capability and the feasibility of bioretention and permeable pavement.

- A Stormwater Site Plan Report that documents compliance with the applicable Minimum Requirements, existing and proposed site conditions, off-site analysis, and includes all relevant engineering analysis and calculations.
- Permanent Stormwater Control Plan drawings.
- A Construction Stormwater Pollution Prevention Plan (SWPPP) consisting of a narrative and drawings.

Section 5 of this document contains other requirements specific to the submittal of stormwater plans.

3. Stormwater Requirements for Small Projects with Less Than 5,000 Square Feet of New or Replaced Hard Surface

Since the majority of development in Clyde Hill consists of redevelopment of existing single-family residential properties, the following guidelines have been prepared as an aid to applicants in understanding the requirements and in preparing a complete submittal. These guidelines apply only to single-family redevelopment projects that will result in that addition or replacement of less than 5,000 square feet of hard surfaces, and that are subject to MR #1 - #5 for new and replaced hard surfaces only (per flowcharts in Appendix A). All other applications must address the requirements of the 2014 SWMMWW directly.

All projects with less than 2,000 square feet of new or replaced hard surfaces must prepare and submit the following:

A. Construction Stormwater Pollution Prevention Plan (SWPPP)

A SWPPP detailing the pollution prevention measures to be implemented during construction must be submitted, which includes drawings and a narrative. Additional guidance for preparing a SWPPP can be found in the following sections of the 2014 SWMMWW:

- Volume I, Section 2.5.2 (Minimum Requirement #2 – Construction Stormwater Pollution Prevention)
- Volume II, Section 3.2 (Construction SWPPP Requirements)

B. Drainage Control Plan

- See Chapter 4 of this document for additional City of Clyde Hill requirements for a Drainage Control Plan, and in some cases a small detention system.

Projects with between 2,000 and 5,000 square feet of new or replaced hard surfaces must prepare Items A and B above and the following:

C. Soils Report

A soils report must be prepared by a professional engineer, geologist, hydrogeologist, or engineering geologist registered in the State of Washington:

The report shall meet the requirements outlined in Volume 1, Section 3.1.1(2) of the 2014 SWMMWW and specifically address the following:

1. Feasibility of infiltration trench(s) for roof downspout infiltration
 - If site has outwash or loam soils, provide one soil log at the roof downspout infiltration system location, minimum 4 feet deep from the proposed grade and 1 foot below the bottom of the proposed infiltration trench or drywell facility.
2. Feasibility of infiltration using bioretention for roof downspout or impervious areas
 - If bioretention appears feasible (e.g. minimum one foot separation to groundwater or other impervious layer, and other criteria met per Volume V, Page 5-17 and Volume III, Section 3.4 of the 2014 SWMMWW), perform a Small-Scale Pilot Infiltration Tests (PITs) in areas proposed for bioretention to verify the 0.3 in/hr minimum is met.
3. Feasibility of using permeable pavement for driveways or patios.
 - If permeable pavement appears feasible (e.g. minimum one foot separation to groundwater or other impervious layer, and other criteria met per Volume V, Page 7-8 and Volume III, Section 3.4 of the 2014 SWMMWW), perform a Small-Scale Pilot Infiltration Test (PIT) in the areas proposed for permeable pavement to verify the 0.3 in/hr minimum is met.
4. Assess risk of erosion, slope failure, or down gradient flooding resulting from use of infiltration BMPs, including perforated stub-out connections. Groundwater seepage and other problems associated with stormwater infiltration has been a problem in many areas of Clyde Hill. Therefore, facilities that infiltrate stormwater will only be approved if it can be shown that such facilities will not adversely impact downstream properties. See Section 4 for additional requirements for approval of LID facilities.

D. On-Site Stormwater Management (MR #5) Assessment

To comply with the On-Site Stormwater Management requirements, Low Impact Development (LID) Best Management Practices (BMPs) must be used for each new or replaced hard surface to the maximum extent feasible. To do this, specific LID BMP options must be considered for each hard surface (roofs, driveways, patios, etc.) in a prescribed order of preference, and the first BMP that is determined to be feasible must be used. There are specific criteria for determining feasibility, many of which will be related to the findings of the soil report described in the previous section. Following is an outline of the On-Site Stormwater Management assessment process for use on small single-family residential projects in Clyde Hill. (This “streamlined” approach is based on the application of “List 1” of Minimum Requirement #5, but with the elimination of Full Dispersion, which is not feasible in Clyde Hill due to lack of the required vegetated flowpaths.)

Assessment of LID BMPs for Roofs:

Priority #1 for Roofs: Downspout Infiltration

Infeasibility Criteria:

- Requires outwash or loam soils
- Less than 3 feet or more of permeable soils from the proposed final grade
- Less than 1 foot from the expected bottom elevation of the infiltration trench or dry well and the seasonal high water table or impervious layer.

- If the infiltration trench or drywell cannot be designed to meet the minimum design criteria in Volume III, Section 3.3.1 of the 2014 SWMMWW.

Design Guidelines:

- Downspout Infiltration Trench & Drywell Details, Appendix B of this document
- BMP T5.10A in Volume III, Section 3.1.1 of the 2014 SWMMWW

Priority #2 for Roofs: Rain Garden/Bioretention

Infeasibility Criteria:

- Within a designated erosion hazard or landslide hazard area
- Locations on slopes of 8% or steeper
- Less than 0.3 in/hour measured infiltration rate
- Less than 1 foot vertical separation between the bottom of the proposed facility and the seasonal high water table or impervious layer
- Reasonable concerns about erosion, slope failure, or down gradient flooding in professional geotechnical evaluation.
- Any of the other infeasibility criteria listed in Volume V, Page 7-9 of the 2014 SWMMWW.

Design Guidelines:

- Typical Bioretention Details, Appendix B of this document
- BMPs T5.14A, T5.14B & T7.30 in Volume V of the 2014 SWMMWW

Priority #3 for Roofs: Downspout Dispersion System

Infeasibility Criteria:

- A vegetated flowpath of less than 25 feet between the downspout and the property line is not available.
- Where implementation of downspout dispersion might cause erosion or flooding problems.

Design Guidelines:

- Downspout Dispersion Trench Detail, Appendix B of this document
- BMP T5.10B in Volume III, Section 3.1.2 of the 2014 SWMMWW

Priority #4 for Roofs: Perforated Stub-Out Connection

Infeasibility Criteria:

- Seasonal water table is less than one foot below trench bottom
- Evaluation by licensed professional geologist, hydrogeologist, or engineering geologist recommends against use of perforated stub-out connection.

Design Guidelines:

- Perforated Stub-Out Connection Detail, Appendix B of this document

- BMP T5.10C in Volume III, Section 3.1.3 of the 2014 SWMMWW

Assessment of LID BMPs for Driveways and Patios:

Priority #1 for Driveways/Patios: Rain Garden/Bioretenention or Permeable Pavement

Infeasibility Criteria for Rain Gardens/Bioretenention:

- Within a designated erosion hazard or landslide hazard area.
- Within 50 feet from the top of slopes that are greater than 20% and over 10 feet of vertical relief.
- Locations on slopes of 8% or steeper
- Less than 0.3 in/hour measured infiltration rate.
- Less than 1 foot vertical separation between the bottom of the proposed facility and the seasonal high water table or impervious layer.
- Reasonable concerns about erosion, slope failure, or down gradient flooding in professional geotechnical evaluation.
- Any of the other infeasibility criteria listed in Volume V, Page 7-9 of the 2014 SWMMWW.

Infeasibility Criteria for Permeable Pavement:

- Within a designated erosion hazard or landslide hazard area.
- Within 50 feet from the top of slopes that are greater than 20% and over 10 feet of vertical relief.
- Less than 0.3 in/hour measured infiltration rate.
- Reasonable concerns about erosion, slope failure, or down gradient flooding, as documented in professional geotechnical evaluation.
- Where infiltrating water would compromise adjacent impervious pavements, threaten existing below grade basements, as documented in professional geotechnical evaluation.
- Any of the other infeasibility criteria listed in Volume V, Page 5-18 of the 2014 SWMMWW.

Design Guidelines for Rain Gardens/Bioretenention:

- Typical Bioretention Details, Appendix B of this document
- BMPs T5.14A, T5.14B & T7.30 in Volume V of the 2014 SWMMWW

Design Guidelines for Permeable Pavement:

- Example Permeable Pavement Details, Appendix B of this document
- BMP T5.15 in Volume V of the 2014 SWMMWW

Priority #2 for Driveways/Patios: Sheet Flow Dispersion

Infeasibility Criteria:

- Where use of sheet flow dispersion would result in flooding of downstream properties.

Design Guidelines:

- Sheet Flow Dispersion Details, Appendix B of this document
- BMP T5.12 in Volume V of the 2014 SWMMWW

Implementation of LID BMPs for Lawn and Landscaped Areas:

Priority #1 – Implement Post-Construction Soil Quality and Depth BMP

Infeasibility Criteria:

- Infeasible on till soils on slopes greater than 33 percent.

Design Guidelines:

- Planting Bed Cross Section figure in Appendix B of this document
- BMP T5.13 in Volume V of the 2014 SWMMWW

4. City of Clyde Hill Additional Drainage Control Requirements

The City of Clyde Hill has adopted additional drainage control requirements that supplement the Minimum Requirements of the SWMMWW. These additional requirements apply to projects as follows:

1. A **Drainage Control Plan** must be submitted for all new construction, additions, storage sheds, new or reconstructed patios, sidewalks, game courts, driveways, and any other impervious surface as defined in CHMC 17.04.255 (Impervious Coverage). This requirements applies to projects of all sizes, including those not requiring a Stormwater Site Plan per Minimum Requirement #1 of the SWMMWW. The required contents of Drainage Control Plans is described below.
2. **LID Facility Approval:** Use of LID and other facilities that infiltrate stormwater requires approval by the Public Works Director. Prior to approval, a soils report must be prepared by a professional engineer, geologist, hydrogeologist, or engineering geologist licensed in the State of Washington, and submitted to the Public Works Director for review. If infiltration is found to be feasible and the application includes the use of infiltration trenches, bioretention, permeable pavement, or perforated stub-out connections, the final signed/stamped soils report to be submitted must include the following statement:

Based on this analysis and my professional opinion, the use of a (roof downspout infiltration / bioretention / permeable pavement / perforated stub-out) facility will not result in surface flooding, seepage into downstream crawl spaces or basements, or slope instability. Furthermore, I have reviewed the engineering plans and certify that the design of such facilities is in compliance with my recommendations.

3. **Small Detention Requirement:** All projects that add 750 square feet or more of new hard surfaces, but that due to site conditions are unable to fully implement On-Site Stormwater Management BMP's per Minimum Requirement #5 for all new and replaced hard surfaces, and that are also not required to construct a flow control facility per Minimum Requirement #7, must install stormwater collection and small detention systems as described in these City of Clyde Hill Stormwater Drainage Guidelines. The

intent of the small detention system is to restrict peak stormwater flows to prevent overloading of the City's storm sewer system. The detention system must be sized for both new and replaced hard surfaces. In calculating the hard surface area, the surface of the water of swimming pools shall not be included, unless the public works director determines that such pool contributes to surface water runoff. For projects where the main structure on a redeveloped lot is deemed "substantially remodeled" as defined in CHMC 17.60.030, the small detention system sizing shall also include existing hard surfaces. Sizing requirements and details for small detention systems are attached in Appendix C.

Drainage Control Plan Content Requirements

The Drainage Control Plan shall include of the following:

1. A site plan showing the location of all structures, driveways, sidewalks, patios and any other impervious surface relating to the development. The plans shall also show the existing and proposed final grade contours.
2. Calculations of the impervious area from each of the above. (For drainage purposes, in calculating the impervious surface area, the water surface of swimming pools shall not be included, unless the public works director determines that such pool contributes to water run-off.)
3. The proposed elevation for the lower floor, including the garage floor slab, new or reconstructed driveways, patios, sidewalks or other new impervious surfaces.
4. The plans shall show the location, size and length of all drainage pipes within the collection system as well as their connections to the storage pipe or flow control manhole. Include the pipe invert elevation (the elevation at the bottom of the pipe) at catch basins and at any other point critical to the design and construction. All 4" drainage pipes shall have a minimum two-percent (2%) (1/4 inch per foot of pipe) slope. All 6" and larger drainage pipes shall have a minimum one-percent (1%) (1/8 inch per foot of pipe) slope. The storage pipe is to be installed at a 0.5 percent (0.5%) slope.
5. Location and details for any proposed On-Site Stormwater Management or LID facilities.
6. Locations and details for any proposed Runoff Treatment facilities.
7. Locations and details for any proposed Small Detention or Flow Control facilities.
8. Provide the sizing calculations for the detention/storage pipe on the plan set.

5. Permit Submittal Requirements

For permitting purposes, an applicant shall submit two copies of the following, based on project type and size:

For small single-family residential redevelopment projects following Section 3 of these Guidelines, with less than 2,000 square feet of new or replaced hard surface:

1. Construction Stormwater Pollution Plan & Narrative (see Section 3A)
2. Drainage Control Plan (see Chapter 4)

For small single-family residential redevelopment projects following Section 3 of these Guidelines, with between 2,000 and 5,000 square feet of new or replaced hard surface:

1. Soils Report (see Section 3B)
2. On-Site Stormwater Management Assessment (see Section 3D)
3. Small Detention Facility Sizing Calculations (if applicable, see Section 4 and Appendix C)

4. Drainage Control Plan (see Chapter 4)
5. Construction Stormwater Pollution Plan & Narrative (see Section 3A)
6. Declaration of Covenant, if applicable (see below)

For all other projects directly following the requirements of the Stormwater Management for Western Washington (SWMMWW):

1. Soils Report
2. Stormwater Site Plan
3. Construction Stormwater Pollution Plan & Narrative
4. Drainage Control Plan
5. Declaration of Covenant, if applicable (see below)

After the plans and reports have been approved, one set will be returned to the applicant while the other set stays on-file at City Hall. If the drainage plans were submitted in conjunction with a building permit, the building plans and the drainage plans will be released as a package.

Inspections

Applicants are required to call for inspections. If the work does not conform to the approved plans, or the inspection reveals other conditions that require modifications or additional information, that portion of the work will be stopped. No final occupancy shall be permitted until all On-Site Stormwater Management BMPs and other drainage control facilities are completed, inspected and approved.

Other Permit Requirements

Applicants may be required to obtain a Street Opening Permit if drainage work is to be done in the City's right-of-way. If the improvements include a concrete driveway that is to extend into the public right-of-way, a Public Place Use Permit is required for that portion of the driveway located within the public right-of-way.

Declaration of Covenant for On-Site Stormwater Management BMPs and Detention Systems

To ensure future maintenance and allow access for inspection by the City, any On-site Stormwater Management BMPs or Detention Systems for which the applicant identifies operation and maintenance to be the responsibility of a private party, must have a declaration of covenant and grant of easement. Design details, figures, and maintenance instructions for each On-site Stormwater Management BMP shall be attached.

A copy of the Declaration of Covenant form is attached in Appendix D. The form and attachments must be prepared and submitted by the applicant following approval of the Stormwater Site Plan

After approval by the local government, the declaration of covenant and grant of easement must be signed and recorded at the King County Recorder's Office.

6. Homeowner Maintenance Requirements

The owner of the property shall be responsible for maintaining all stormwater management facilities, including On-Site Stormwater Management BMPs and drainage/detention systems in good working condition. On-Site Stormwater Management and LID BMPs shall be maintained in accordance with the instruction recorded with the Declaration of Covenant (see Appendix D for examples). Maintenance of small detention systems includes the removal of any sand, silt or

other debris that may accumulate in the drainage system catch basins and flow control manhole. Depending upon the amount of soil that is permitted to wash into the drainage system, cleaning could be required every 3 to 5 years.

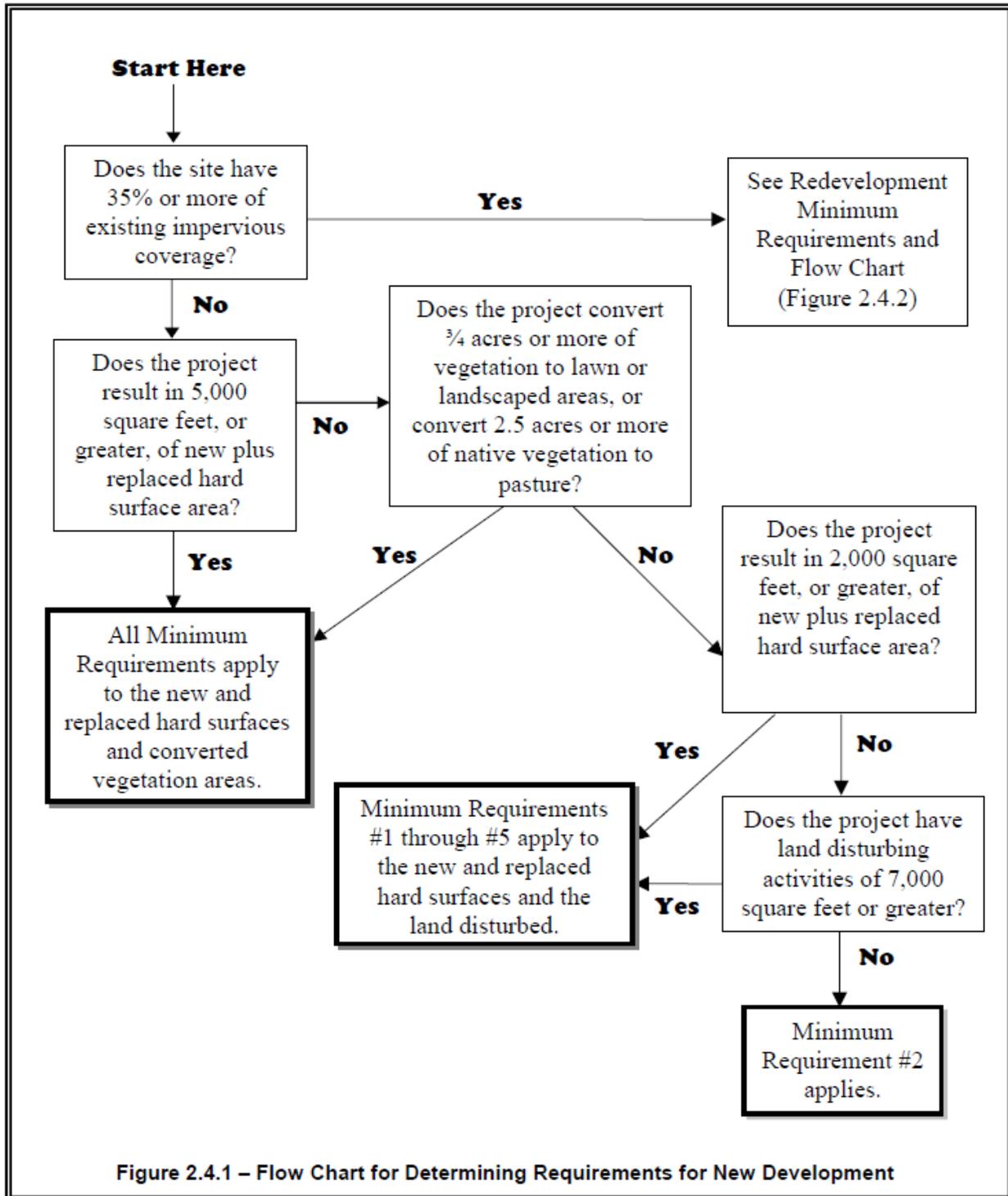
The City may make periodic maintenance inspections and can issue a deficiency notice if maintenance requirements have not been met or if the systems or BMPs are deemed to pose a danger. Such notice will specify the nature of the maintenance deficiency and a date of compliance. If corrections are not made by the date specified, the City may have the necessary work performed and bill the cost of correcting the deficiency to the property owner.

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APPENDIX A

Flow Charts for Determining Applicable Minimum Requirements

- Flowchart for New Development
- Flowchart for Redevelopment



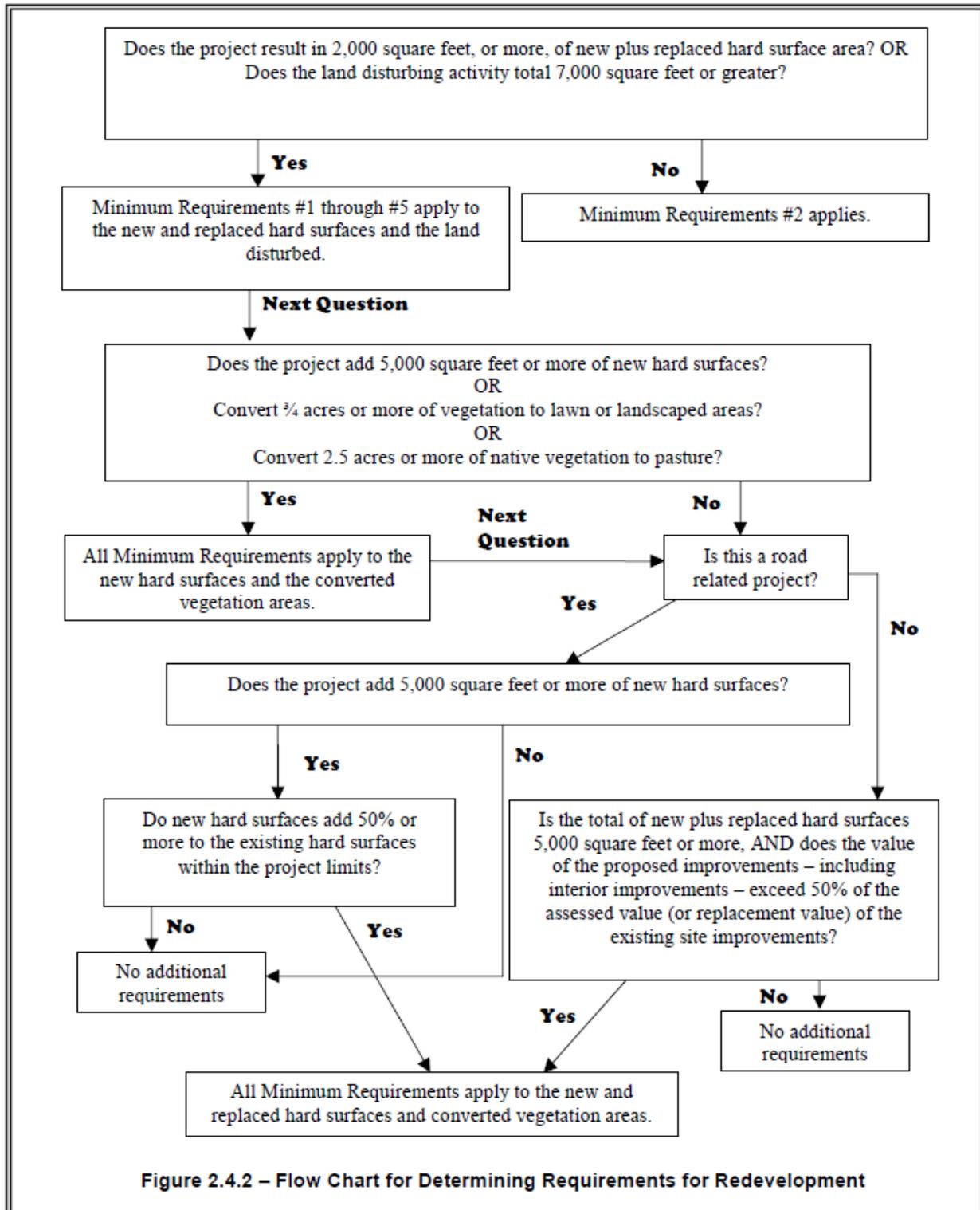


Figure 2.4.2 – Flow Chart for Determining Requirements for Redevelopment

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APPENDIX B

On-Site Stormwater Management Typical Details

- Typical Downspout Infiltration Trench
- Typical Downspout Infiltration Drywell
- Typical Bioretention
- Typical Bioretention with Underdrain
- Example Permeable Pavement Details
- Downspout Dispersion Trench
- Concentrated Flow Dispersion for Driveways
- Sheet Flow Dispersion for Driveways
- Perforated Stub-Out Connection
- Soil Quality & Depth BMP - Planting Bed Cross Section

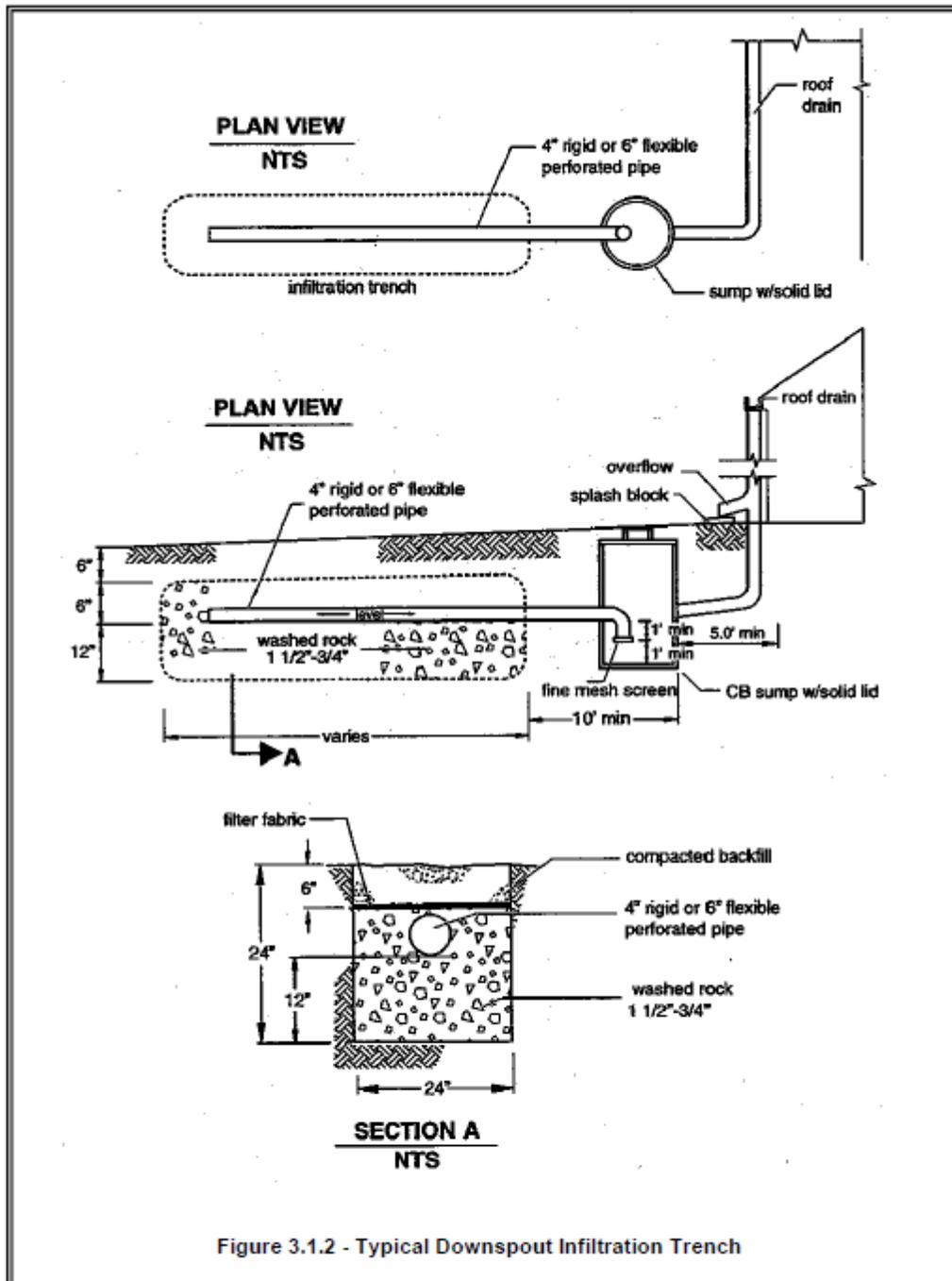
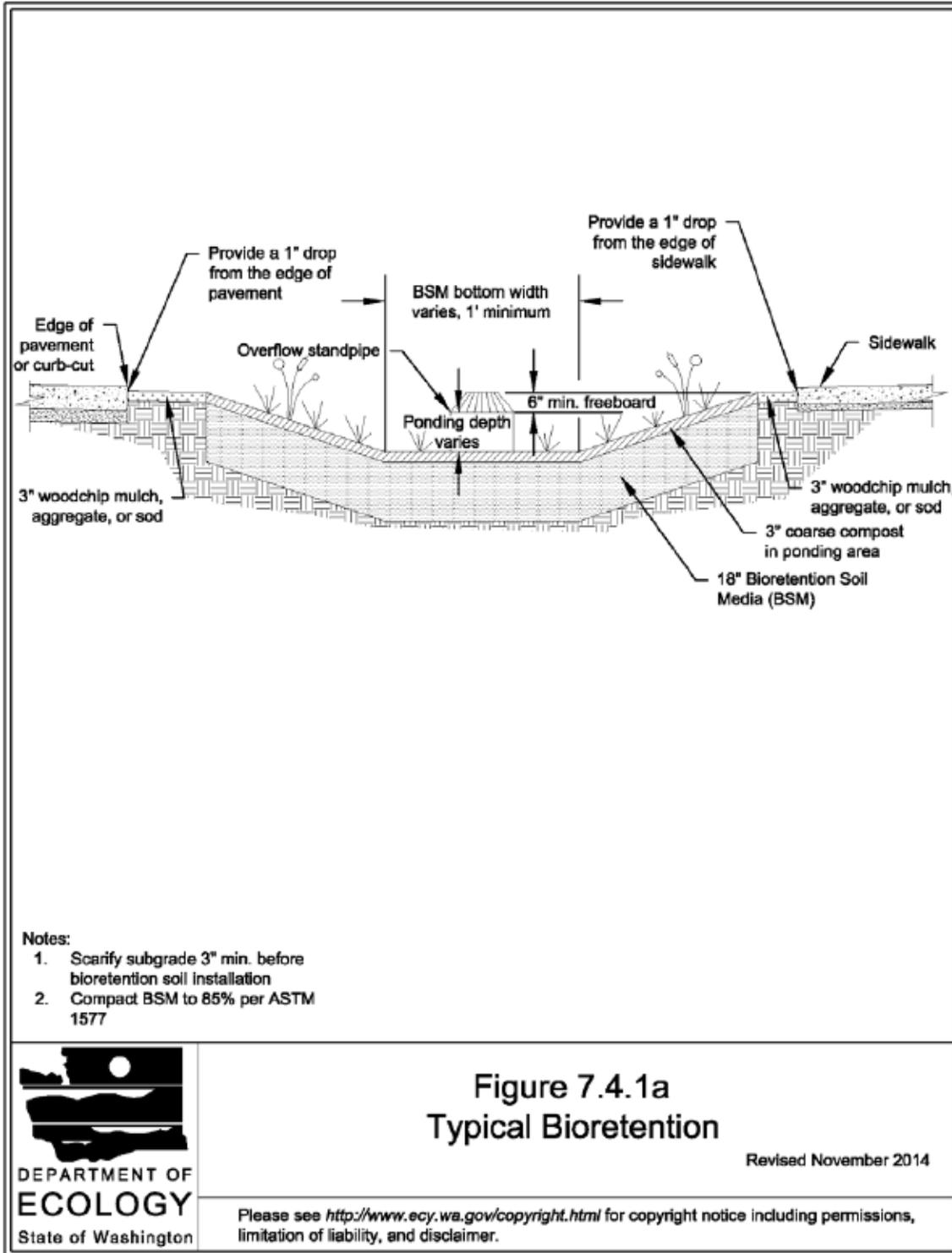


Figure 3.1.2 - Typical Downspout Infiltration Trench

Source: King County



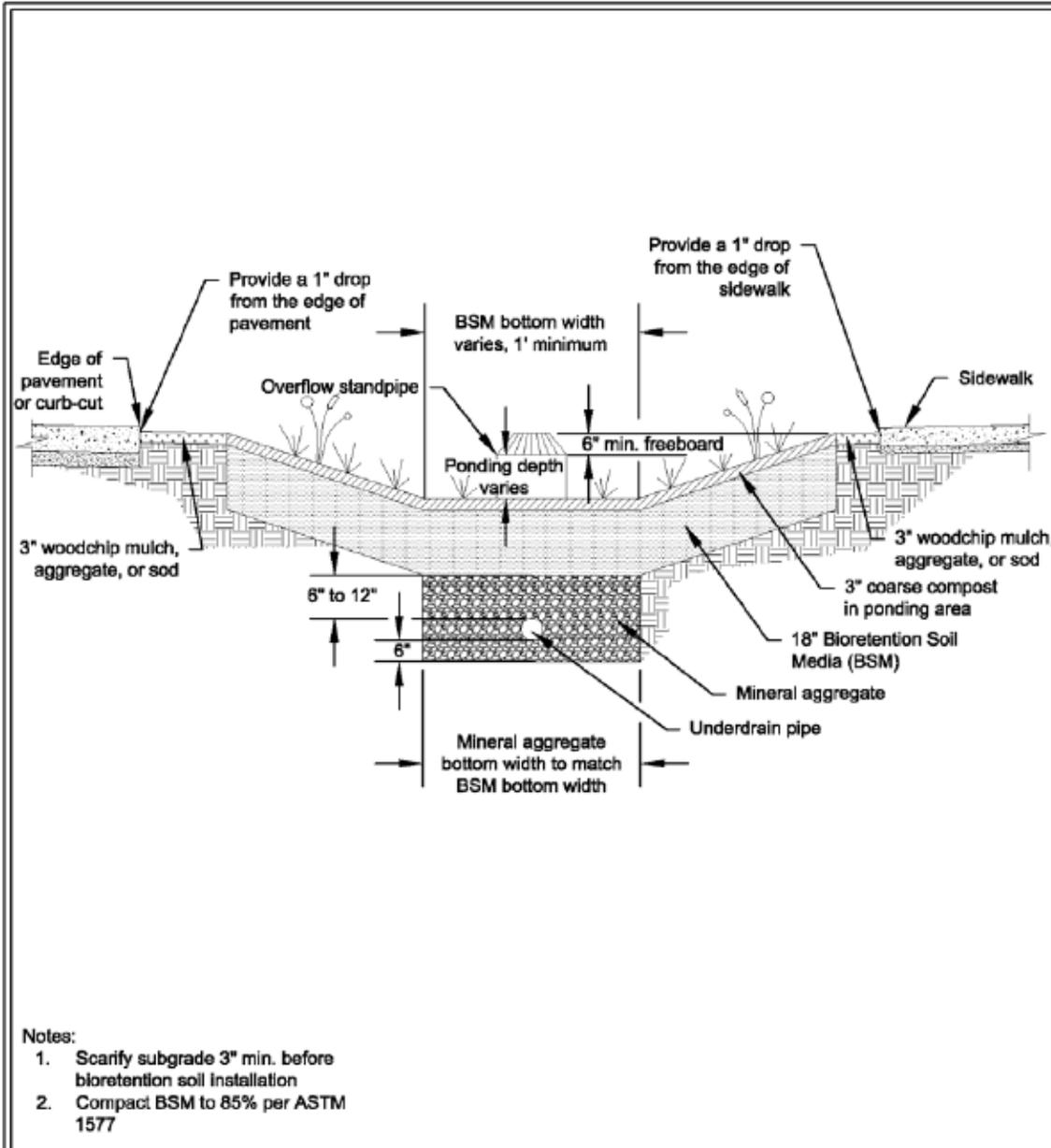
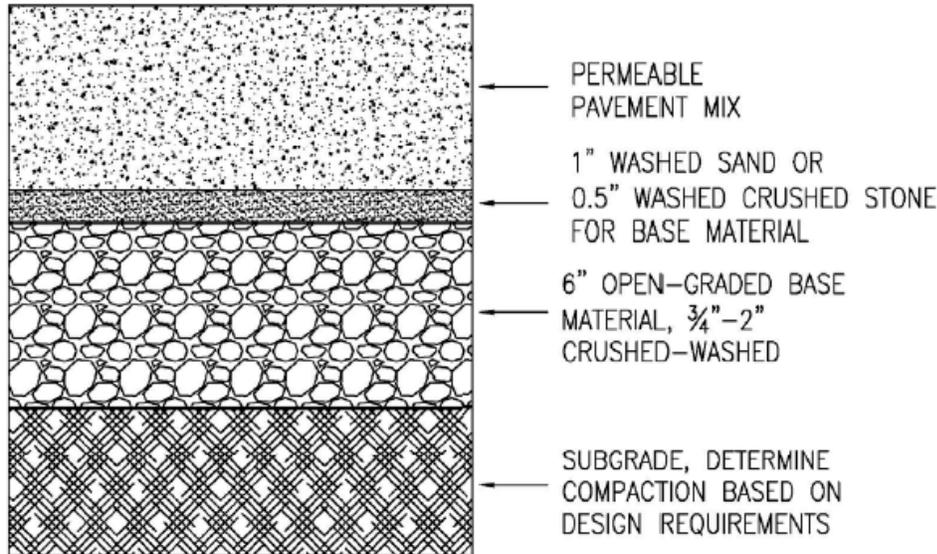


Figure 7.4.1b
 Typical Bioretention w/Underdrain

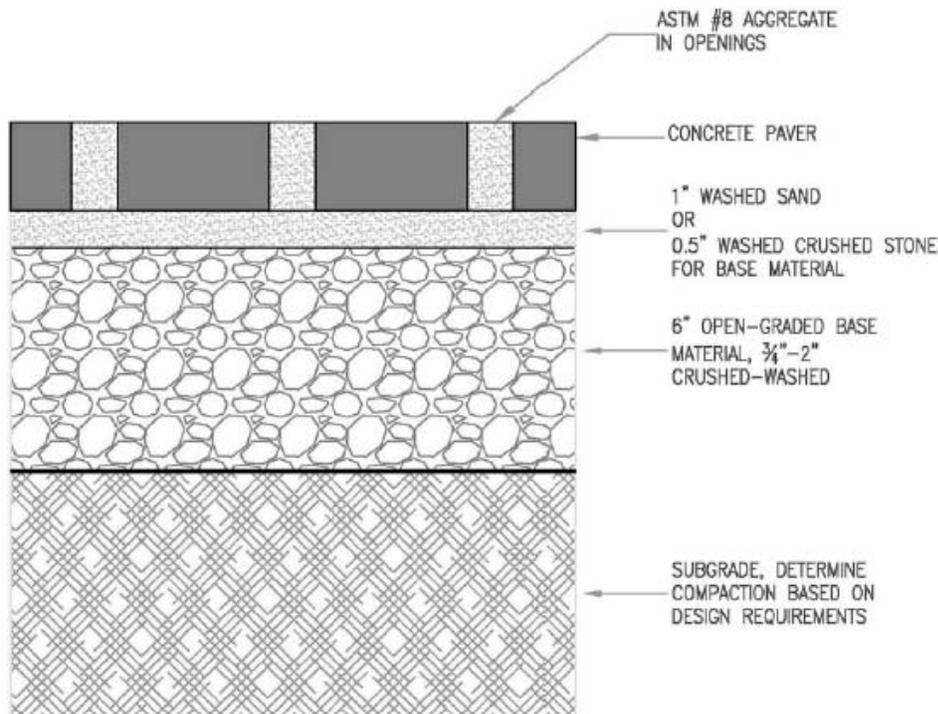
Revised November 2014

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Modified from
City of Portland
Detail SW-110

Figure 5.3.4 – Example of a Permeable Pavement (concrete or asphalt) Section



Modified from
City of Portland
Detail SW-110

Figure 5.3.5 – Example of a Permeable Paver Section

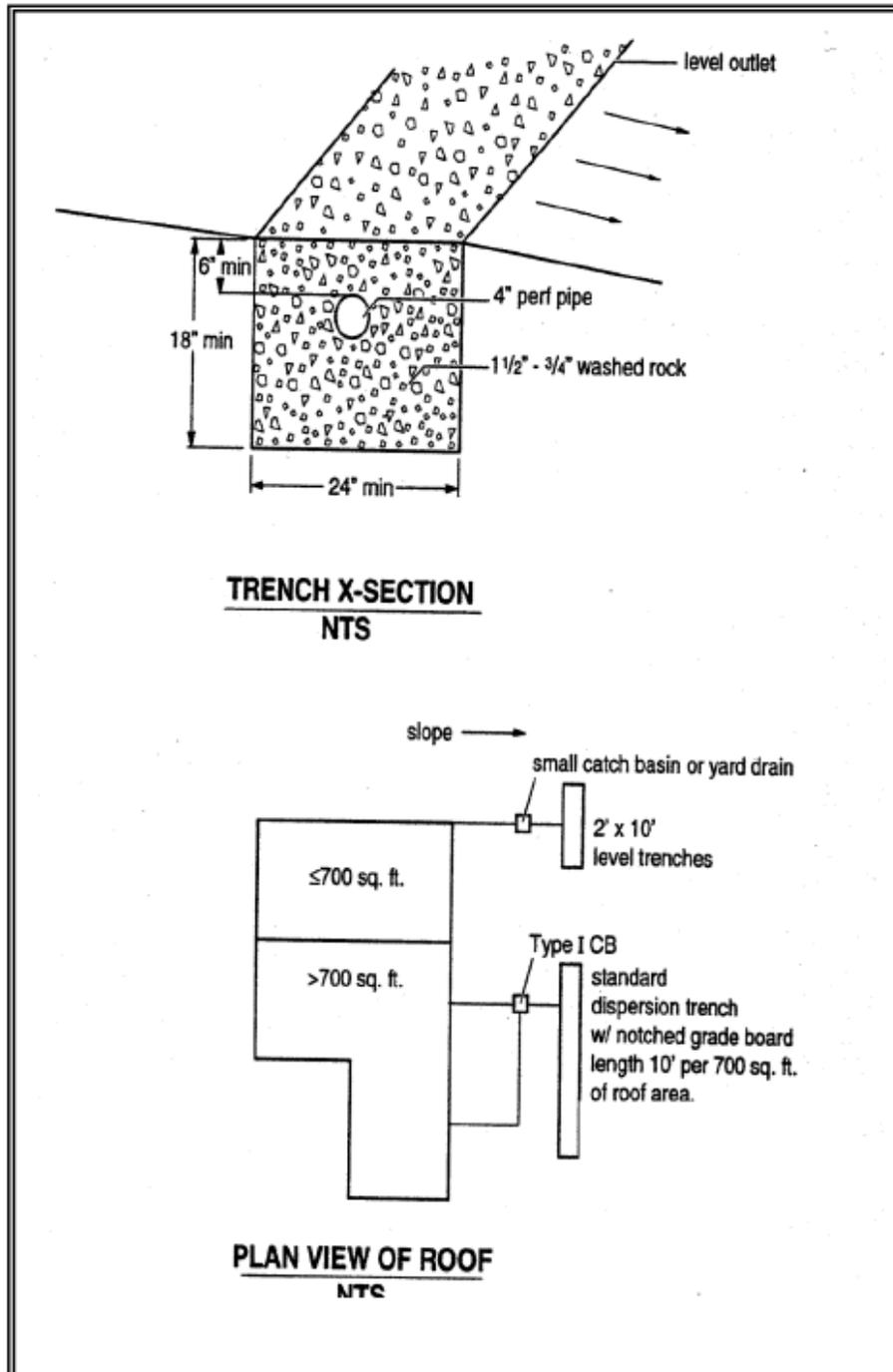


Figure 3.1.5 - Typical Downspout Dispersion Trench
 Source: King County

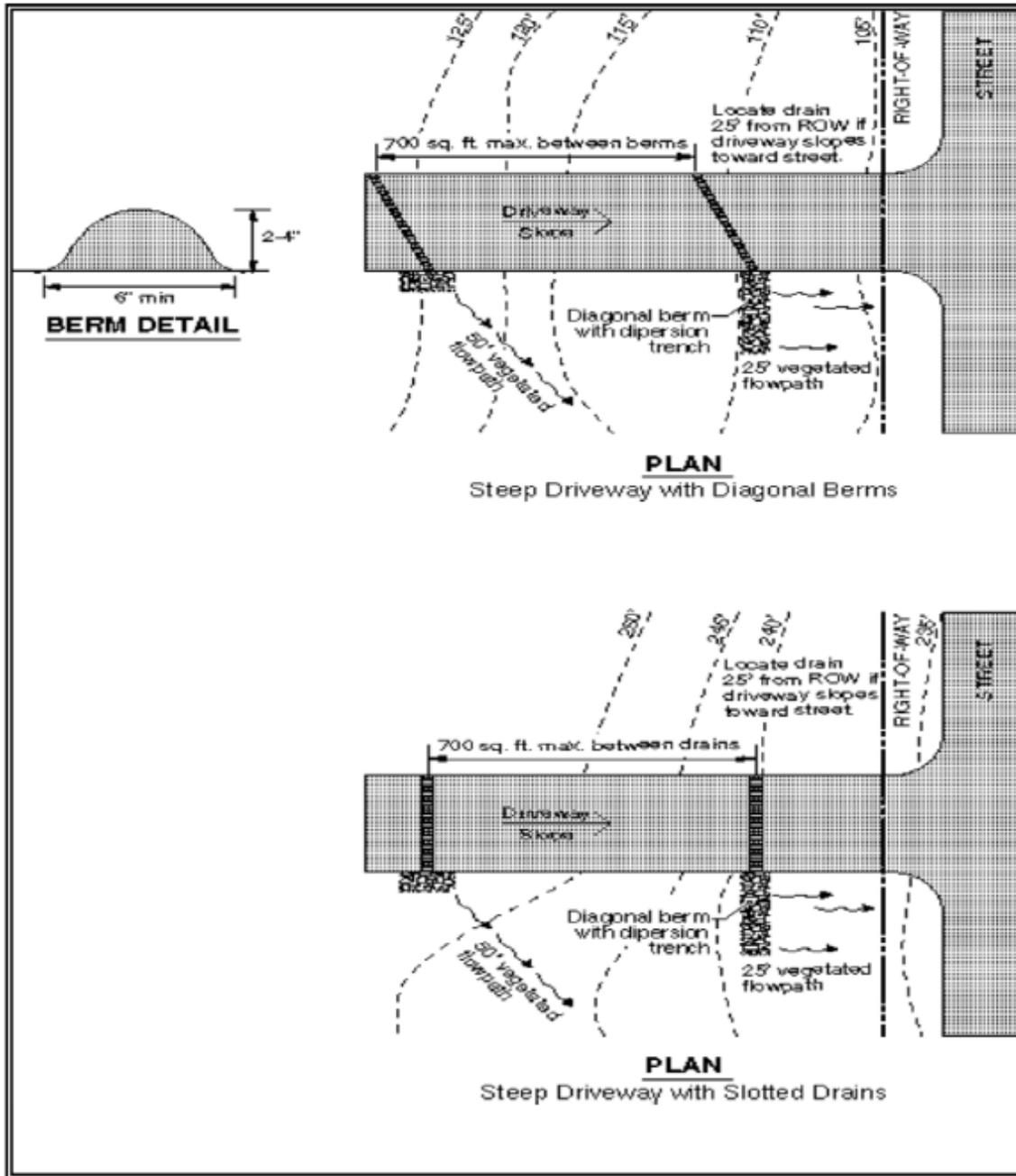


Figure 5.3.1 – Typical Concentrated Flow Dispersion for Steep Driveways

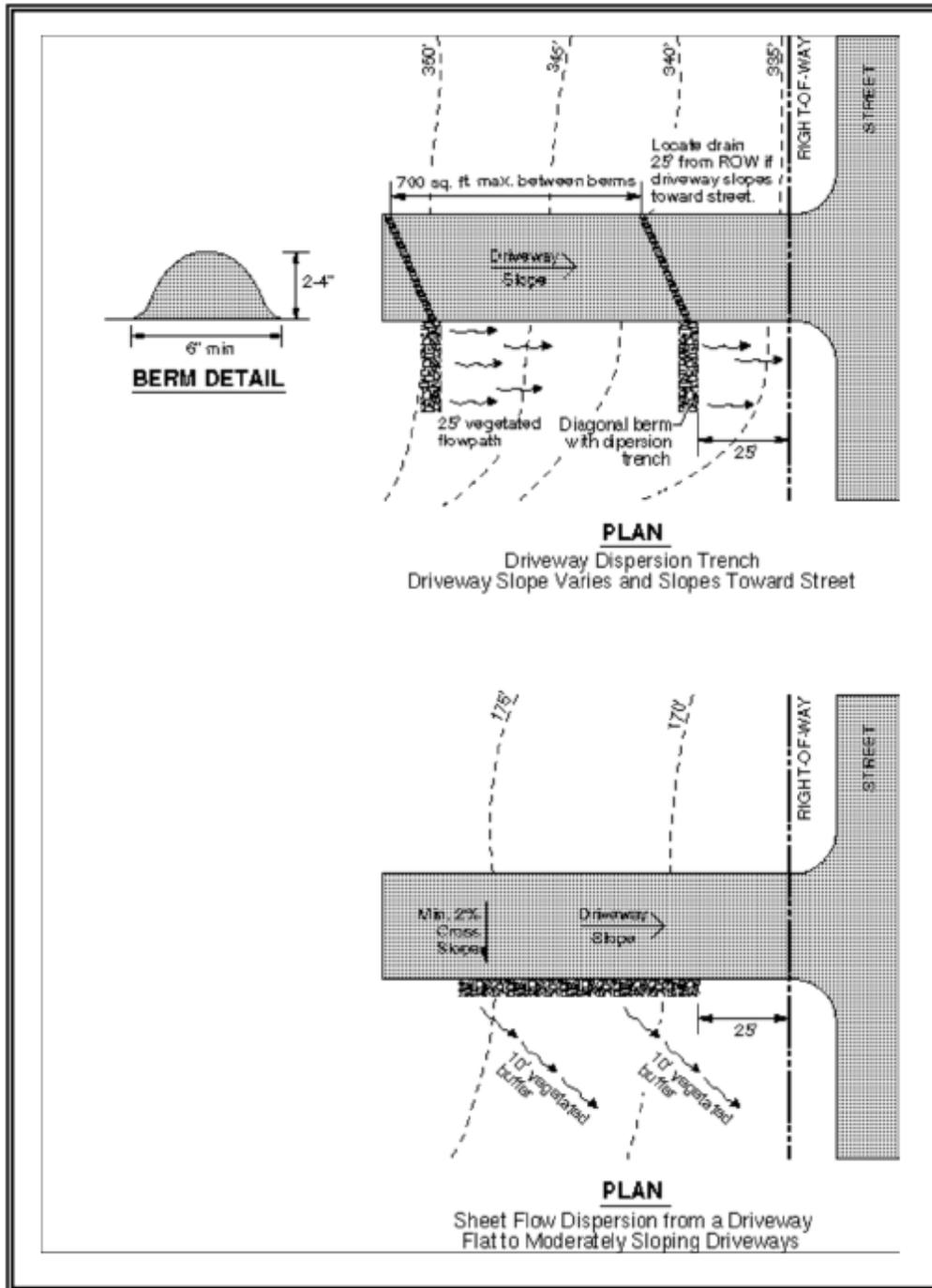
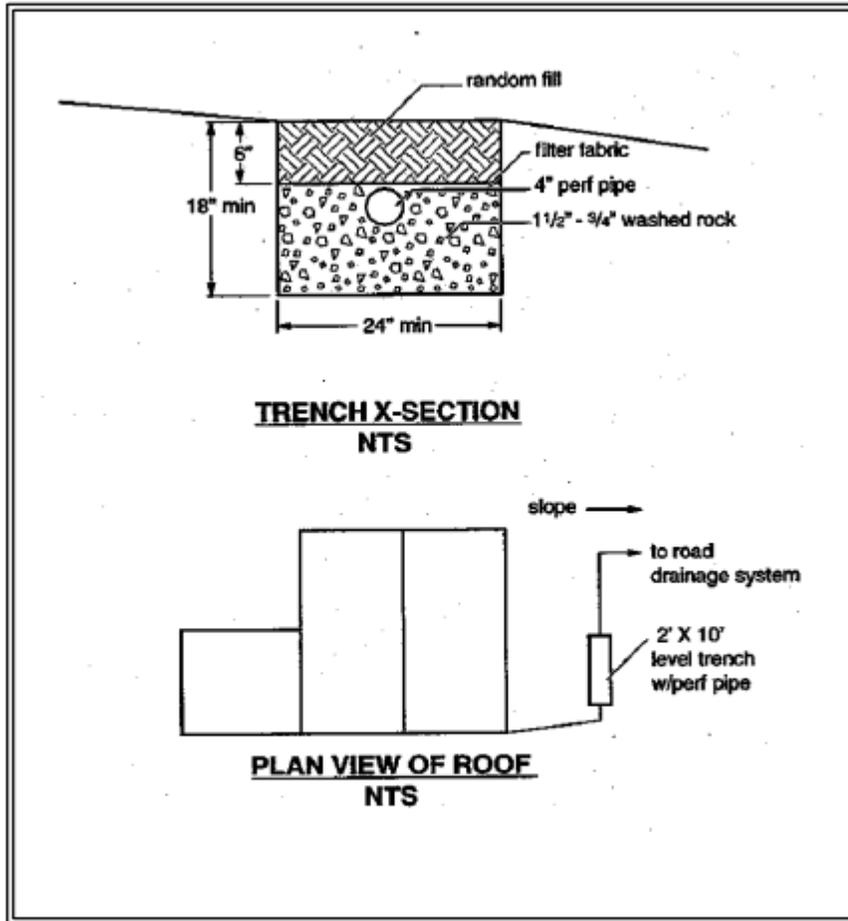


Figure 5.3.2 – Sheet Flow Dispersion for Driveways



Source: King County

Figure 3.1.8 - Perforated Stub-Out Connection

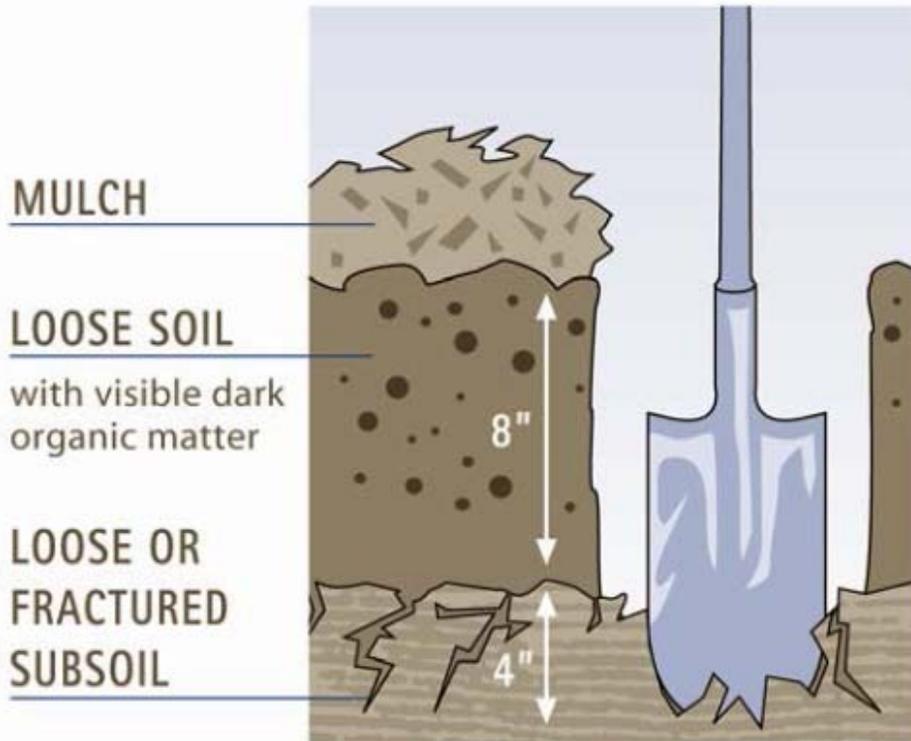


Figure 5.3.3 – Planting bed Cross-Section

(Reprinted from *Guidelines and Resources For Implementing Soil Quality and Depth BMP T5.13* in *WDOE Stormwater Management Manual for Western Washington*, 2010, Washington Organic Recycling Council)

APPENDIX C

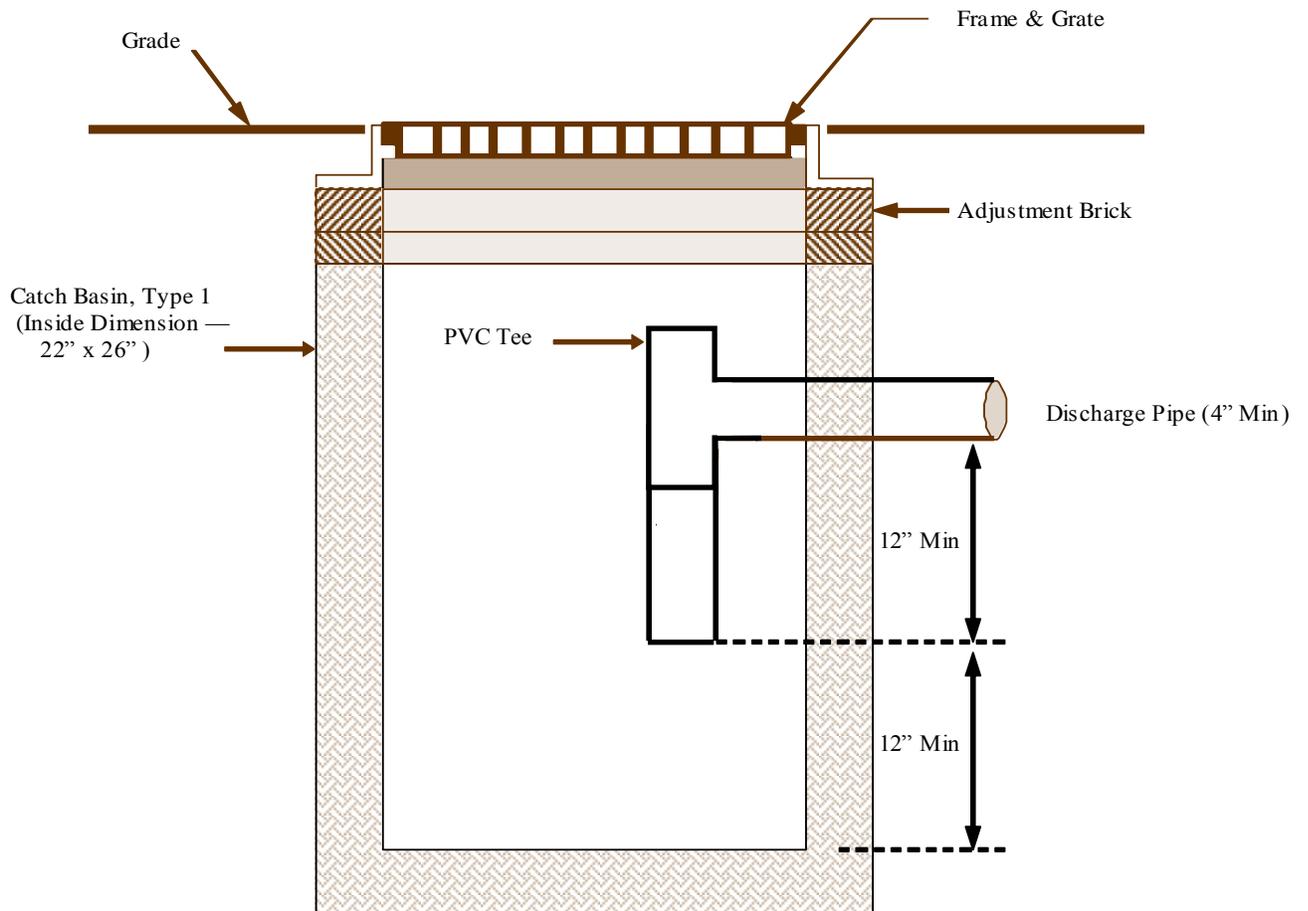
Clyde Hill Small Detention Sizing and Details

- Oil/Water Separator
- Detention Pipe Storage Table
- Storage Facility Plan and Profile
- Flow Control Manhole
- Emergency Overflow Trench

TYPE 1 — OIL/WATER SEPARATOR

(Figure 1)

(Mandatory for all new or re-built driveways when a storm water detention system is not required)



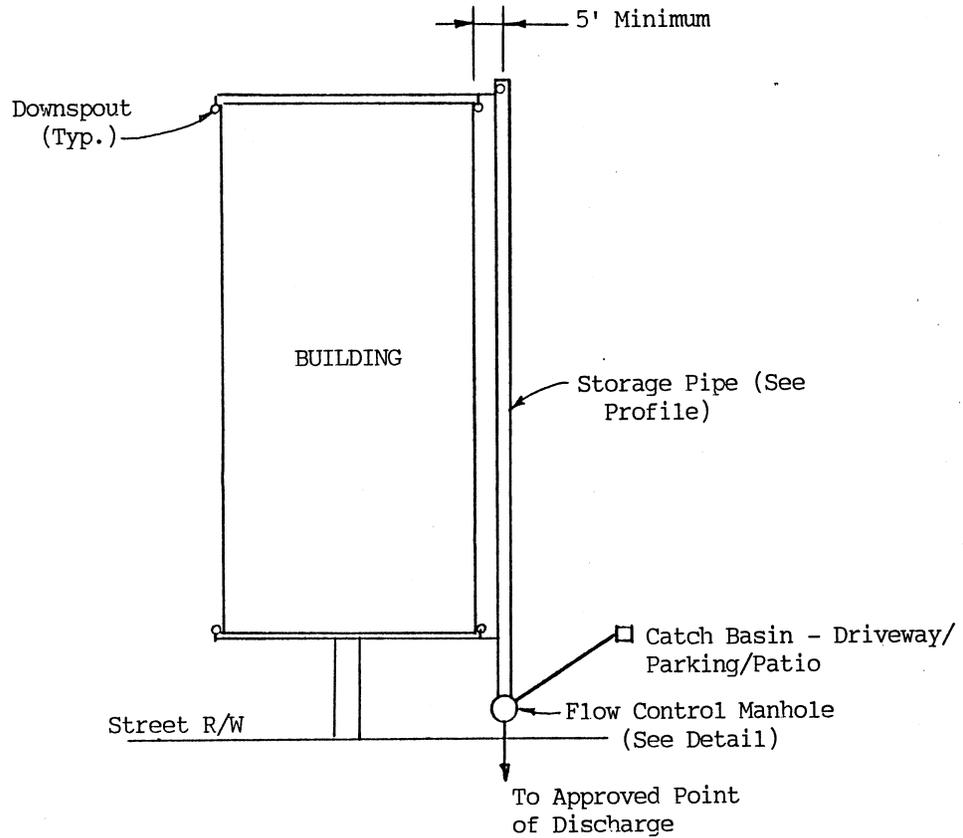
DETENTION STORAGE PIPE TABLE

(Table 1)

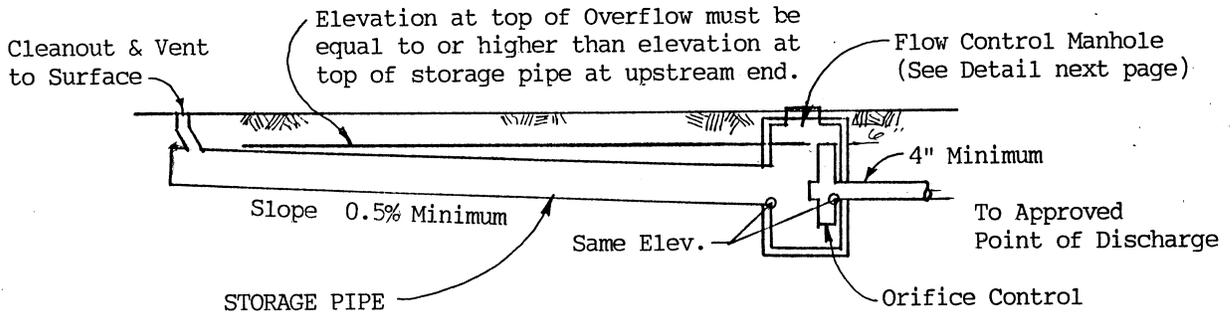
A	B	C	D			
Total Impervious Area (Square Feet)	Storage Volume Required (Cubic Feet)	Orifice Diameter (Inches)	Storage Pipe Size (Inches) Storage Pipe Length (Feet)			
			12" Dia.	15" Dia.	18" Dia.	24" Dia.
			Length	Length	Length	Length
750	19	½	36	23	16	9
1000	37	½	47	30	21	12
1500	55	½	71	45	31	18
2000	74	9/16	94	60	42	24
2500	92	5/8	118	75	52	29
3000	110	11/16	141	90	62	35
3500	129	¾	165	104	73	41
4000	147	¾	188	119	83	47
4500	165	13/16	212	134	93	53
5000	184	7/8	235	149	104	59
5500	202	7/8	259	164	114	64
6000	220	15/16	283	179	125	70

STORAGE FACILITY PLAN & PROFILE

(Figure 2)

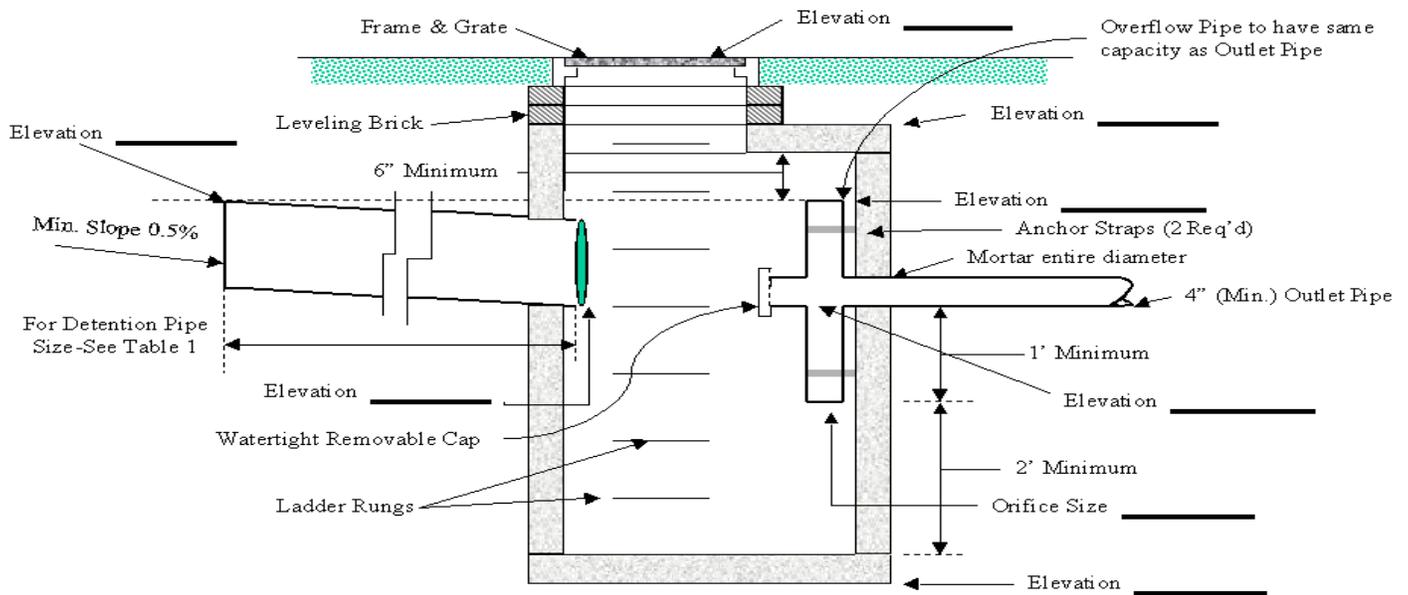


PLAN
No Scale



Flow Control Manhole

(Figure 3)



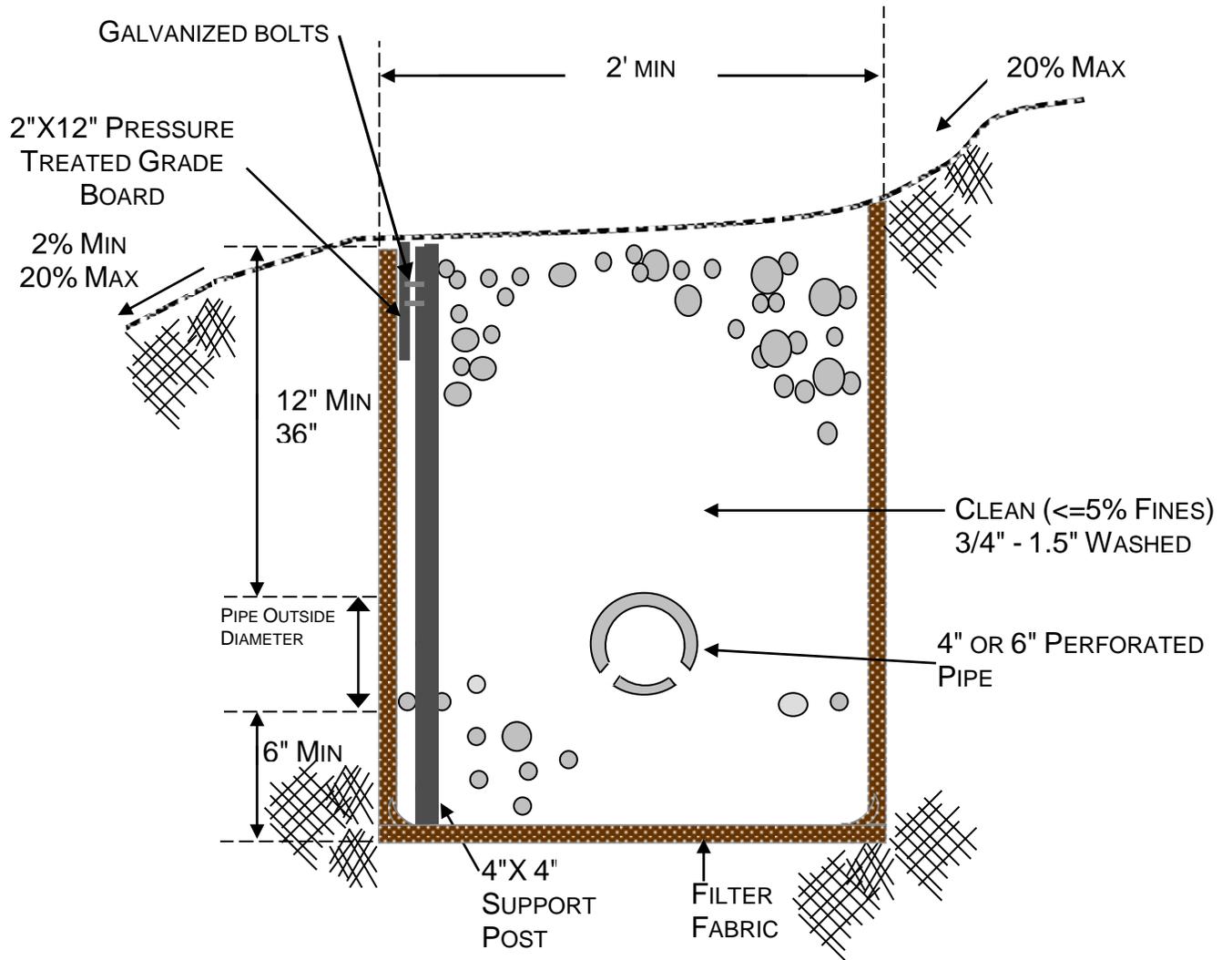
(No Scale)

Notes:

- Frame and grate shall be set directly over the ladder and offset so that the overflow pipe shall be visible at the edge of the access opening
- Elevations (_____) of component parts shall be provided by the Applicant
- The Flow Control Manhole shall be a standard Type II Catch Basin. Ladder runs shall be uniformly spaced 12" to 16 1/2 " vertically
- All steel pipe and parts shall be galvanized
- The storage pipe shall generally have a minimum of 2 feet of cover

Emergency Overflow Trench

Figure 4



NOTES:

- This trench shall be constructed so as to prevent point discharge and/or erosion.
- Trenches may be placed no closer than 50 feet to another.
- Trench and grade board must be level, aligned to follow contours of site.
- Grade board support post spacing as required by soil conditions.

APPENDIX D

Declaration of Covenant

- Declaration of Covenant Form
- Example Exhibit A site plan figure (not included at this time)
- Example Exhibit B maintenance instructions

RECORDING REQUESTED BY AND
WHEN RECORDED MAIL TO:

**DECLARATION OF COVENANT
FOR MAINTENANCE AND INSPECTION OF STORMWATER BMPS**

Grantor: _____

Grantee: City of Clyde Hill

Legal Description: _____

Additional Legal(s) on: _____

Assessor's Tax Parcel ID#: _____

IN CONSIDERATION of the approved City of Clyde Hill (check one of the following)

- residential building permit, commercial building permit, clearing and grading permit,
subdivision permit, or short subdivision permit for Application No. _____

relating to the real property ("Property") described above, the Grantor(s), the owner(s) in fee of that Property, hereby covenants(covenant) with the City of Clyde Hill, a State of Washington Municipal Corporation, ("City"), that he/she(they) will observe, consent to, and abide by the conditions and obligations set forth and described in Paragraphs 1 through 8 below with regard to the Property.

Grantor(s) hereby grants(grant), covenants(covenant), and agrees(agree) as follows:

1. Grantor(s) or his/her(their) successors in interest and assigns ("Owners") shall retain, uphold, and protect the stormwater management devices, features, pathways, limits, and restrictions, known as on-site stormwater best management practices ("BMPs"), shown on the approved Stormwater BMP Site Plan for the Property attached hereto and incorporated herein as Exhibit A.

2. The Owners shall at their own cost, operate, maintain, and keep in good repair, the Property's BMPs as described in the approved Design and Maintenance Details for each BMP attached hereto and incorporated herein as Exhibit B.

3. City of Clyde Hill shall provide at least 30 days written notice to the Owners that entry on the Property is planned for the inspection of the BMPs. After the 30 days, the Owners shall allow the City of Clyde Hill to enter for the sole purpose of inspecting the BMPs. In lieu of inspection by the City, the Owners may elect to engage a licensed civil engineer registered in the state of Washington who has expertise in drainage to inspect the BMPs and provide a written report describing their condition. If the engineer option is chosen, the Owners shall provide written notice to the City of Clyde Hill within fifteen days of receiving the City's notice of inspection. Within 30 days of giving this notice, the Owners, or the engineer on behalf of the Owners, shall provide the engineer's report to the City. If the report is not provided in a timely manner as specified above, the City may inspect the BMPs without further notice.

4. If the City of Clyde Hill determines from its inspection, or from an engineer's report provided in accordance with Paragraph 3, that maintenance, repair, restoration, and/or mitigation work is required for the BMPs, the City shall notify the Owners of the specific maintenance, repair, restoration, and/or mitigation work (Work) required under Chapter 15.10 of the Clyde Hill Municipal Code ("CHMC"). The City shall also set a reasonable deadline for completing the Work or providing an engineer's report that verifies completion of the Work.

After the deadline has passed, the Owners shall allow the City access to re-inspect the BMPs unless an engineer's report has been provided verifying completion of the Work. If the work is not completed properly within the time frame set by the City, the City may initiate an enforcement action. Failure to

properly maintain the BMPs is a violation of CHMC Chapter 15.10 and may subject the Owners to enforcement under the CHMC, including fines and penalties.

5. Apart from performing routine landscape maintenance, the Owners are hereby required to obtain written approval from the City before performing any alterations or modifications to the BMPs.

6. Any notice or approval required to be given by one party to the other under the provisions of this Declaration of Covenant shall be effective upon personal delivery to the other party, or after three (3) days from the date that the notice or approval is mailed with delivery confirmation to the current address on record with each Party. The parties shall notify each other of any change to their addresses.

7. This Declaration of Covenant is intended to promote the efficient and effective management of surface water drainage on the Property, and it shall inure to the benefit of all the citizens of Clyde Hill. This Declaration of Covenant shall run with the land and be binding upon Grantor(s), and Grantor's(s') successors in interest and assigns.

8. This Declaration of Covenant may be terminated by execution of a written agreement by the Owners and City of Clyde Hill that is recorded by King County in its real property records.

IN WITNESS WHEREOF, this Declaration of Covenant for the Maintenance and Inspection of Flow Control BMPs is executed this ____ day of _____, 20____.

GRANTOR, owner of the Property

GRANTOR, owner of the Property

STATE OF WASHINGTON)
COUNTY OF KING)ss.

On this day personally appeared before me:

_____, to me known to be the individual(s) described in and who executed the within and foregoing instrument and acknowledged that they signed the same as their free and voluntary act and deed, for the uses and purposes therein stated.

Given under my hand and official seal this ____ day of _____, 20____.

Printed name
Notary Public in and for the State of Washington,
residing at

My appointment expires _____

MAINTENANCE INSTRUCTIONS FOR DOWNSPOUT INFILTRATION

Your property contains a stormwater management flow control BMP (best management practice) called "*downspout infiltration*," which was installed to mitigate the stormwater quantity and quality impacts of some or all of the impervious surfaces on your property.

Downspout infiltration is a method of soaking runoff from impervious area (such as paved areas and roofs) into the ground. If properly installed and maintained, full infiltration can manage runoff so that a majority of precipitation events are absorbed. Infiltration devices, such as gravel filled trenches, drywells, and ground surface depressions, facilitate this process by putting runoff in direct contact with the soil and holding the runoff long enough to soak most of it into the ground. To be successful, the soil condition around the infiltration device must be reliably able to soak water into the ground for a reasonable number of years.

Infiltration Devices

The **infiltration devices** used on your property include the following as indicated on the flow control BMP site plan (CHECK THE BOX(ES) THAT APPLY):

- gravel filled trenches, drywells, ground surface depressions.

MAINTENANCE RESTRICTIONS

The size, placement, and composition of these devices as depicted by the flow control BMP site plan and design details must be maintained and may not be changed without written approval from the City of Clyde Hill.

INSPECTION FREQUENCY AND MAINTENANCE GUIDELINES

To be successful, the soil condition around the infiltration device must be reliably able to soak water into the ground for a reasonable number of years.

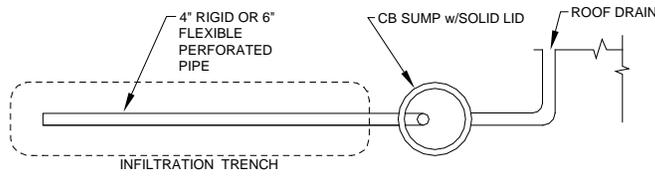
- Infiltration devices must be inspected annually and after major storm events to identify and repair any physical defects.
- Maintenance and operation of the system should focus on ensuring the system's viability by preventing sediment-laden flows from entering the device. Excessive sedimentation will 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.
- Prolonged ponding around or atop a device may indicate a plugged facility. If the device becomes plugged, it must be replaced.
- Keeping the areas that drain to infiltration devices well swept and clean will enhance the longevity of these devices.

For roofs, frequent cleaning of gutters will reduce sediment loads to these devices.

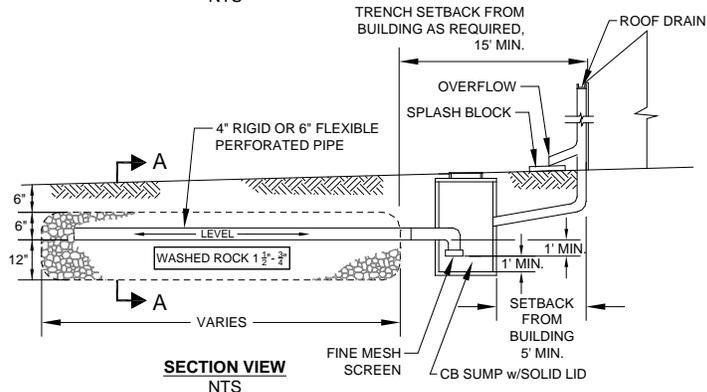
RECORDING REQUIREMENT

These full infiltration flow control BMP maintenance and operation instructions must be recorded as an attachment to the required **declaration of covenant**. The intent of these instructions is to explain to future property owners, the purpose of the BMP and how it must be maintained and operated. These instructions are intended to be a minimum; the City of Clyde Hill may require additional instructions based on site-specific conditions. See the Washington State Department of Ecology's website for additional information and updates.

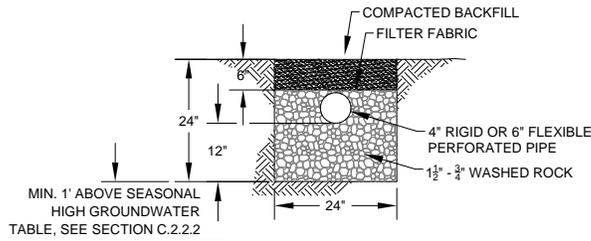
TYPICAL FULL INFILTRATION APPLICATIONS



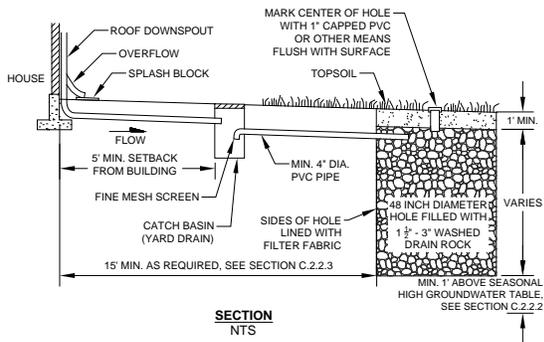
PLAN VIEW
NTS



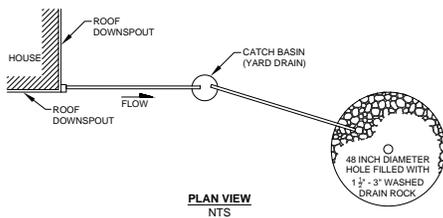
SECTION VIEW
NTS



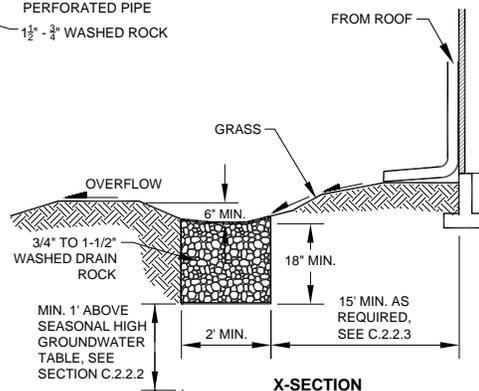
SECTION A
NTS



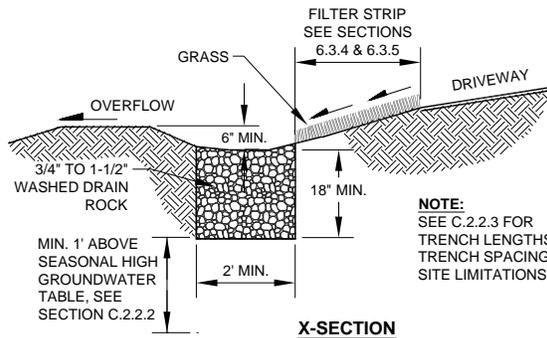
SECTION
NTS



PLAN VIEW
NTS



X-SECTION
NTS



X-SECTION
NTS

NOTE:
SEE C.2.2.3 FOR
TRENCH LENGTHS,
TRENCH SPACING AND
SITE LIMITATIONS

MAINTENANCE INSTRUCTIONS FOR RAIN GARDENS / BIORETENTION

Your property contains a stormwater management flow control BMP (best management practice) called a "*rain garden*" or "*bioretention*," which was installed to mitigate the stormwater quantity and quality impacts of some or all of the impervious or non-native pervious surfaces on your property.

Rain gardens, often described as "bioretention," are vegetated closed depressions or ponds that retain and filter stormwater from an area of impervious surface or non-native pervious surface. The soil in the rain garden has been enhanced to encourage and support vigorous plant growth that serves to filter the water and sustain infiltration capacity. Depending on soil conditions, rain gardens may have water in them throughout the wet season and may overflow during major storm events.

MAINTENANCE RESTRICTIONS

The size, placement, and design of the rain garden as depicted by the flow control BMP site plan and design details must be maintained and may not be changed without written approval from the City of Clyde Hill. Plant materials may be changed to suit tastes, but chemical fertilizers and pesticides must not be used.

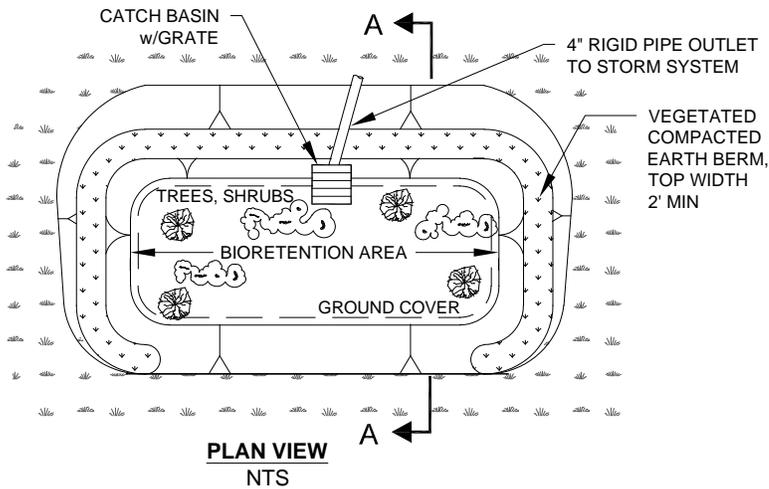
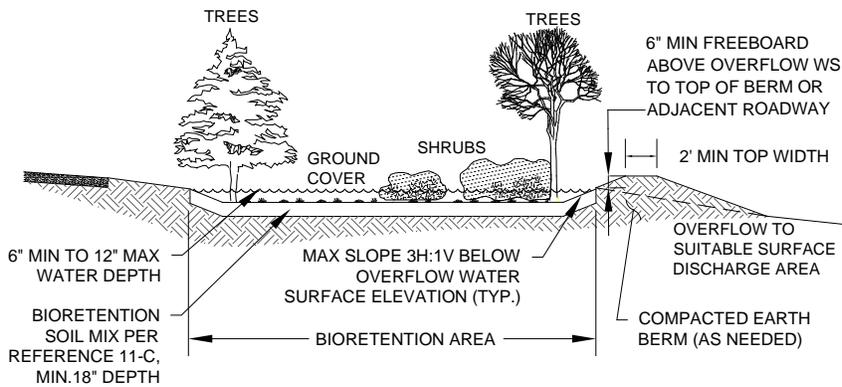
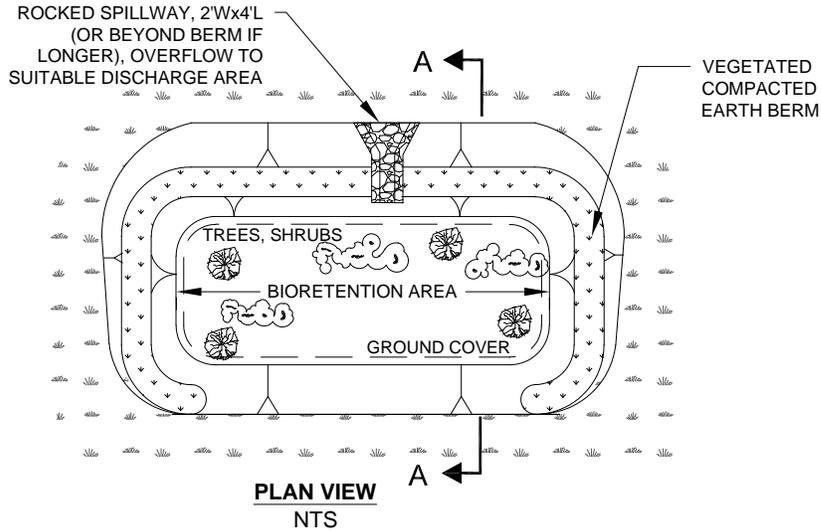
INSPECTION FREQUENCY AND MAINTENANCE GUIDELINES

- Rain gardens must be inspected annually for physical defects and sediment accumulation.
- After major storm events, the system should be checked to see that the overflow system is working properly and sedimentation is not occurring at the inlet. If erosion channels or bare spots are evident, they should be stabilized with soil, plant material, mulch, or landscape rock. Sediment deposits should be carefully removed and the sediment source eliminated.
- A supplemental watering program may be needed the first year to ensure the long-term survival of the rain garden's vegetation.
- Chemical fertilizers and pesticides must not be used.
- Mulch may be added and additional compost should be worked into the soil over time.
- Plant materials may be changed to suit tastes.
- 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) to protect infiltration performance, do not compact soils in the bioretention cell with heavy maintenance equipment and/or excessive foot traffic;
 - 6) during drought conditions, use mulch to prevent excess solar damage and water loss.

RECORDING REQUIREMENT

These rain garden flow control BMP maintenance and operation instructions must be recorded as an attachment to the required **declaration of covenant**. The intent of these instructions is to explain to future property owners, the purpose of the BMP and how it must be maintained and operated. These instructions are intended to be a minimum; the City of Clyde Hill may require additional instructions based on site-specific conditions. See the Washington State Department of Ecology's website for additional information and updates regarding BMP maintenance.

TYPICAL RAIN GARDEN (SPILLWAY OR CATCHBASIN OUTLET)



MAINTENANCE INSTRUCTIONS FOR PERMEABLE PAVEMENT

Your property contains a stormwater management flow control BMP (best management practice) called "*permeable pavement*," which was installed to minimize the stormwater quantity and quality impacts of some or all of the paved surfaces on your property.

Permeable 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.

Permeable Pavements

The type(s) of **permeable pavement** used on your property is (CHECK THE BOX(ES) THAT APPLY):

- porous concrete
- porous asphaltic concrete
- permeable pavers
- modular grid pavement.

MAINTENANCE RESTRICTIONS

The area covered by permeable pavement as depicted by the flow control BMP site plan and design details must be maintained as permeable pavement and may not be changed without written approval from the City of Clyde Hill.

INSPECTION FREQUENCY AND MAINTENANCE GUIDELINES

- Permeable pavements must be inspected after one major storm each year to make sure it is working properly. More frequent inspection is recommended.
- Prolonged ponding or standing water on the pavement surface is a sign that the system is defective and may need to be replaced. If this occurs, contact the pavement installer or the King County Water and Land Resources Division for further instructions.
- A typical permeable pavement system has a life expectancy of approximately 25-years. To help extend the useful life of the system, the surface of the permeable pavement should be kept clean, stable and free of leaves, debris, and sediment through regular sweeping or vacuum sweeping. Aggregate fill in modular grid pavement may need periodic surface replenishment.
- The owner is responsible for the repair of all ruts, deformation, and/or broken paving units.

RECORDING REQUIREMENT

These permeable pavement flow control BMP maintenance and operation instructions must be recorded as an attachment to the required **declaration of covenant**. The intent of these instructions is to explain to future property owners, the purpose of the BMP and how it must be maintained and operated. These instructions are intended to be a minimum; the City of Clyde Hill may require additional instructions based on site-specific conditions. See the Washington State Department of Ecology's website for additional information and updates regarding BMP maintenance.

MAINTENANCE INSTRUCTIONS FOR SHEET FLOW DISPERSION

Your property contains a stormwater management flow control BMP (best management practice) called "*sheet flow dispersion*," which was installed to mitigate the stormwater quantity and quality impacts of some or all of the impervious surfaces or non-native pervious surfaces on your property.

Basic dispersion is a strategy for utilizing any available capacity of onsite vegetated areas to retain, absorb, and filter the runoff from developed surfaces. This flow control BMP has two primary components that must be maintained:

- (1) the devices that disperse runoff from the developed surfaces and
- (2) the vegetated area over which runoff is dispersed.

Dispersion Devices

The **dispersion devices** used on your property include the following as indicated on the flow control BMP site plan (CHECK THE BOX(ES) THAT APPLY):

- splash blocks, rock pads, gravel filled trenches, sheet flow.

MAINTENANCE RESTRICTIONS

The size, placement, composition, and downstream flowpaths of these devices as depicted by the flow control BMP site plan and design details must be maintained and may not be changed without written approval from the City of Clyde Hill.

INSPECTION FREQUENCY AND MAINTENANCE GUIDELINES

This flow control BMP has two primary components that must be maintained:

- (1) the devices that disperse runoff from the developed surfaces and
- (2) the vegetated flowpath area over which runoff is dispersed.

Maintenance of Dispersion Devices

- Dispersion devices must be inspected annually and after major storm events to identify and repair any physical defects.
- When native soil is exposed or erosion channels are present, the sources of the erosion or concentrated flow need to be identified and mitigated.
- Concentrated flow can be mitigated by leveling the edge of the pervious area and/or realigning or replenishing the rocks in the dispersion device, such as in rock pads and gravel filled trenches.

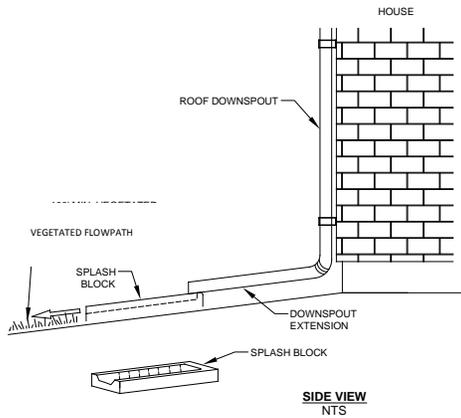
Maintenance of Vegetated Flowpaths

- The vegetated area over which runoff is dispersed must be maintained in good condition free of bare spots and obstructions that would concentrate flows.

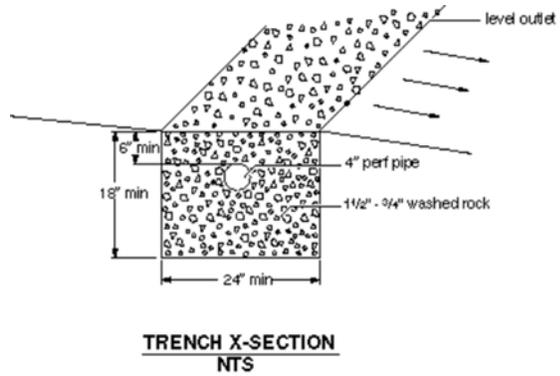
RECORDING REQUIREMENT

These basic dispersion flow control BMP maintenance and operation instructions must be recorded as an attachment to the required **declaration of covenant**. The intent of these instructions is to explain to future property owners, the purpose of the BMP and how it must be maintained and operated. These instructions are intended to be a minimum; the City of Clyde Hill may require additional instructions based on site-specific conditions. See the Washington State Department of Ecology's website for additional information and updates regarding BMP maintenance.

TYPICAL SPLASH BLOCK



TYPICAL 10-FOOT DISPERSION TRENCH CROSS-SECTION



TYPICAL DRIVEWAY APPLICATION OF DISPERSION TRENCH AND ROCK PAD

