

Chapter 5 STORMWATER

Chapter 5

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5.010 General

The standards established by this chapter are intended to represent the minimum standards for the design and construction of stormwater facilities. Except as otherwise stated herein, these standards apply to all stormwater pipe and facilities, regardless of whether final ownership is private or public.

The latest adopted edition of the City of Olympia *Drainage Design and Erosion Control Manual (Drainage Manual, or DDECM)*, is considered a part of this chapter of the Engineering Design and Development Standards. This Drainage Manual sets forth the minimum drainage and erosion control requirements as supplemented herein.

5.020 Design Standards

The design of stormwater systems will depend on their type and local site conditions. The design elements of stormwater systems will conform to City standards as set in the DDECM and herein, and follow current design practice as set forth.

The General Notes for Stormwater Construction on Standard Drawing 3-1 shall be included on all plans dealing with stormwater systems. The Standard Notes for Erosion and Sediment Control Plans on Standard Drawing 3-1 shall be included on all Temporary Erosion and Sediment Control plans.

5.024 Testing

Prior to acceptance and approval of construction, the following tests shall apply to the stormwater pipe installed:

A. All stormwater pipes and catch basins will be high-velocity cleaned and pressure tested in accordance with Division 7 of the Washington State Department of Transportation Standard Specifications prior to paving. Hydrant flushing of lines is not an acceptable cleaning method. The contractor shall furnish all equipment and personnel for conducting the test under the observation of the City Inspector. The testing equipment will be subject to the approval of the City.

B. Testing of the stormwater pipe shall include a television (video) inspection. The video inspection will be conducted by the City at the applicant's expense. All video inspections shall be performed in accordance with NASSCO's Pipeline Assessment and Certification Program (PACP) standards, and be compatible with Cues GNET software. The video inspection will use the unique identification number (IDN) assigned to each stormwater pipe section, catch basin and manhole by the City. If not already provided to the contractor by the City, the contractor

shall request from the City assignment of these unique IDNs at least one week prior to completing the video inspections.

Video inspection shall be done after the air test has passed, all underground utilities are installed and before the roadway is paved. Immediately prior to a video inspection, enough water shall be run down the line so it comes out the lower manhole and the line is flushed clean.

Two copies of the video and two copies of the written report shall be submitted to the City for review and approval. Acceptance of the pipeline(s) will only be made after the video inspection documents have been reviewed and approved by Public Works. The allowable tolerance for sags or bellies in a newly installed pipe shall be 1/16 the nominal diameter of the pipe, per section 5.025.

The City will televise the new line during periods of high groundwater within the first two years after construction and acceptance of the line. Any defects in the pipe material, installation, or conditions resulting in inflow and infiltration (I & I) will be considered a system failure that shall be repaired by and at the expense of the contractor. If repairs to the system are required within this period, the contractor shall reimburse the City for the televising and re-televising of the pipe, before and after the repair work respectively.

5.025 Conveyance Pipes

Pipe: Stormwater pipes within a public right-of-way or easement will be sized to carry the maximum anticipated runoff for a 25-year, 24-hour storm event without street flooding from the possible contributing area. Additional design criteria for stormwater conveyance pipes is provided in the Drainage Manual. For culverts under driveway approaches, see Section 4B.140 for additional requirements.

Pipe outfalls shall be designed to pass the 25-year design storm event and suffer no structural or erosion damage in a 100-year design event.

Design flows may be calculated from any standard engineering methodology provided that the design flow is the peak discharge for the contributing area and land cover conditions and the stated return period. The City Engineer may require more detailed hydrologic and hydraulic analysis if special conditions apply.

The minimum main size will be 12 inches in diameter. Lateral lines may be 8 inches in diameter. Nothing will preclude the City from requiring the installation of a larger-sized main if the City determines a larger size is needed to serve adjacent areas or for future service.

The minimum cover for stormwater pipe shall be 2-feet. Where the minimum depth includes the roadway section, structural calculations for the appropriate H-loading shall be submitted along with the plans. All pipe specified where the cover is 2-feet or less shall be concrete or ductile iron of a class determined by the structural calculations.

All conveyance pipes shall be installed on a uniform slope between structures. The allowable tolerance for sags or bellies in a newly installed pipe shall be 1/16 the nominal diameter of the pipe. Deviations from this tolerance shall be evaluated on a case-by-case basis and shall be solely the decision of the City Engineer.

Structures: All changes in pipe direction, slope, size and junctions must be made inside of a structure. Only those structures approved by Washington State Department of Transportation shall be used within the public right-of-way.

Pipe Slope: The maximum slope of piped conveyances shall be 20% or a maximum full pipe velocity of 30 feet per second, whichever is most restrictive. If full pipe velocities exceed 15 feet per second, the installation shall provide anchors at bends and junctions.

Trash Rack: Where open channels of ponds discharge into a conveyance pipe, trash racks are required on all stormwater pipe inlets 18 inches in diameter and larger. Trash racks must be removable with ordinary hand tools.

All stormwater pipe shall comply with one of the following types:

- A. Plain concrete pipe conforming to the requirements of AASHTO M 86, Class 2.
- B. Reinforced concrete pipe conforming to the requirements of AASHTO M 170.

- C. PVC pipe conforming to ASTM D 3034 SDR 35, ASTM F 794, or ASTM F 679 Type 1 with joints and gaskets conforming to ASTM 3212 and ASTM F 477.
- D. Ductile iron pipe conforming to the requirements of AWWA C 151 thickness class as shown on the plans.
- E. High-density polyethylene smooth interior pipe conforming to AASHTO M252 Type S or AASHTO M294 Type S with gasketed bell and spigot joints.
- F. Aluminized steel helical or spiral rib pipe in diameter of 30 inches or greater with Manning's "N" value of 0.020 or less.
- G. Dual or triple wall, smooth interior polypropylene pipe conforming to ASTM F2736 (12 to 30-inch) or F2764 (30 to 60-inch), with a minimum pipe stiffness of 53 pounds/in./in. when measured in accordance with ASTM D2412.

All stormwater pipes, including those flowing from catch basins or under pressure, shall be installed with continuous tracer tape installed 12 inches to 18 inches under the proposed finished subgrade. The marker will be plastic, non-biodegradable metal core or backing, marked "sewer" that can be detected by a standard metal detector. Tape will be Terra Tape "D" or approved equal.

Toning wire is also required for all stormwater piping. Toning wire shall be green, UL listed for direct bury, Type UF, HDPE or HMWPE-coated, 12-gauge copper taped to the top of the pipe to prevent movement during backfilling. Nylon PVC coated THHN wire shall not be used for toning wire. The wire will be laid loosely enough to prevent stretching and damage. The wire will be wrapped to manhole, catch basin or cleanout rings on gravity stormwater lines, or the valve box on pressurized pipe. Sufficient wire to allow a minimum of 2 feet (slack) above final grade shall be coiled/looped in structures to ensure the wire will be accessible to hook up to a locator.

A 1-pound magnesium anode will be buried with the pipe every 1,000 linear feet maximum for cathodic protection of the wire. Toning wire splices and connections to anodes will join wires both mechanically and electrically and will employ epoxy resin or heat-shrink tape insulation. Toning wire will be tested prior to acceptance of the pipe system. A written notice from the contractor to the City at least two days prior to the test is required; such notice is to include information on the relevant experience of the company proposed to complete the testing. All costs incurred for the testing will be the responsibility of the contractor. Contact the City of Olympia Water Operations Section at (360) 753-8333 for a copy of the City of Olympia Toning Wire Test Form, which shall be filled out during testing and submitted to the City before the work will be accepted.

5.026 Catch Basins

Maximum catch basin spacing will be 300 feet on arterials and collectors and 500 feet on all other street classifications. No surface water will cross any roadway to private property.

Catch basins located in "low points" will have a "through curb" feature as shown in Standard Drawing 5-6A.

Catch basin spacing shall be designed to allow a maximum of a 5-foot-wide stormwater runoff gutter flow width in the design storm event.

[PVC catch basins, manufactured from PVC pipe stock conforming to the requirements of ASTM D1784, cell classification and listed on the current WSDOT Qualified Product List, may be used if approved prior to installation by the City Engineer. PVC catch basins must meet WSDOT Standard Plan B-10.70, as well as Section 7-05.3 of the WSDOT Standard Specifications.](#)

5.027 Catch Basins Anti-Dumping Message

Each catch basin shall be marked with an anti-dumping message curb marker. The marker shall be a 4-inch disc which is epoxy glued to the top of the curb adjacent to the catch basin grate. The curb marker shall be oriented so that it is readable from the sidewalk.

The curb marker shall be the City of Olympia standard decorative bubbles with fish. The curb markers can be purchased from the City of Olympia at City Hall, 601-4th Avenue East, or ordered in bulk from Das Manufacturing, Inc.

5.028 Solid Round Catch Basin Covers

All catch basins designed to have a solid round frame and cover shall install the City of Olympia decorative feet with fish cover (per Standard Drawing 5-9). The decorative cover is manufactured by the East Jordan Iron Works and is available through local suppliers. The decorative cover conforms to WSDOT standard plan circular cover dimensions.

5.029 Stormwater Treatment Vaults

Lids for stormwater treatment vaults shall be rated for H-20 or LRFD loading. Lids shall be accessible at all times to maintenance personnel, equipment and vehicles. Lids weighing in excess of 110 pounds shall have lift-assisted lids with pneumatic, hydraulic, or stainless steel spring apparatus.

5.030 Surveying and Staking

All surveying and staking shall be performed under the direct supervision of a Professional Land Surveyor, licensed in the State of Washington.

A preconstruction meeting will be held with the City prior to commencing staking. All construction staking will be inspected by the City prior to construction.

For minimum staking requirements, see section 3.056.

5.040 Trench Excavation

See Chapter 6.160 for requirements regarding trench excavation.

5.050 Backfilling

See Chapter 6.170 for requirements regarding backfilling.

5.060 Street Patching and Restoration

See Chapter 4B.170 and 4B.180 for requirements regarding street patching and trench restoration.

5.065 Pipe Repairs

Repair couplings shall be of the type with a stainless steel shear ring, meeting the ASTM C1173 shear resistance test and equal to Fernco 1000 RC or 5000 RC Series couplings. Unshielded repair couplings shall not be used.

5.070 Storm Pond Information Signs

Detention ponds, infiltration ponds, wet ponds and combined ponds shall have an informational sign. The sign (s) will be provided by the City, and shall be placed for maximum visibility from adjacent streets and sidewalks and paths.

Signs may be ~~purchased-obtained~~ from the City of Olympia at City Hall, 601-4th Avenue, East, the cost of which is included in the applicable permit fee(s) or the equivalent signs can be fabricated and installed. Signs shall be fabricated from 1/8 inch aluminum sheet with 3 inch radius corners. The graphic print shall be as supplied by the City of Olympia and shall be screen printed with City of Olympia colors and background specifications.

Signs shall be mounted by the permittee or its representative on 2 1/2-inch dia. metal posts at location(s) approved by the City. The bottom of the sign shall be 5 feet from the ground.

5.080 Design Criteria for Channels

Channels shall be designed to suffer no erosion or scour damage for the conveyance system design event. Channels must be stabilized against erosion at the completion of construction. This may require temporary erosion control practices until the design vegetation is established.

5.090 Bioretention Facilities

The term bioretention specifically refers to an integrated stormwater management practice that uses the chemical, biological and physical properties of plants, soil microbes, and the mineral aggregate and organic matter in soils to transform, retain or remove pollutants from stormwater runoff. In addition to water quality treatment, bioretention facilities provide a level of stormwater detention and flow control. Site-specific soil and other characteristics, as discussed in the DDECM, may allow the use of bioretention swales within the right-of-way for certain street

classifications. See Chapter 4 for more information on what street classifications allow the installation of bioretention swales.

If bioretention facilities such as swales are to be used, they shall be designed and installed consistent with the Guidelines of Volume V of the DDECM, applicable Standard Drawings in this chapter, as well as the following:

A. Bioretention Soil Mix

Engineered soil installed as the water quality treatment layer of bioretention facilities shall meet the default Bioretention Soil Mix specifications of BMP T7.30, Volume V, of the DDECM. Specially designed Bioretention Soil Mixes not meeting that standard may request a deviation from the City Engineer.

Bioretention Soil Mix placement shall be a minimum of 18-inches thick, and compacted to no greater than 85% of modified proctor maximum density (ASTM D 1557).

Bioretention Soil Mixes shall be tested in accordance with the US Composting Council “Test Method for the Examination of Compost and Composting” (TMECC) as established in the Composting Council’s “Seal of Testing Assurance” (STA) program. The soil mix specifications published by the facility manufacturing the compost, and certified TMECC results for soil placed in bioretention facilities, shall be provided prior to facility acceptance by the City.

B. Bioretention Mulch Top Layer

Mulch shall be arborist chips similar in size to a medium grind bark mulch comprised of only fir, cedar, or hardwood and free of deleterious material. 75% of mulch must not float after 24 hours of soaking under laboratory testing. Phosphorus shall be < 0.3 ppm per EPA 365.2, standard method 4500-PE. Mulch shall be installed at a 3” depth to maximize moisture retention and weed suppression. Mulch shall not be pure bark, shredded wood debris, leaves, or grass clippings.

C. Bioretention Plant Selection

Table 1 includes both native and non-native plant species commonly available in the Puget Sound region and suitable for bioretention cell and swale applications located along City streets and located within City right-of-way. Bioretention facilities located on private property and maintained by the respective property owner may use the additional planting recommendations found in the Low Impact Development Technical Guidance Manual for Puget Sound (2012) prepared by Washington State University Extension and Puget Sound Partnership. Individual site characteristics and goals may exclude some species or require modifications or additions to plant suggestions provided.

Bioretention cells and swales generally feature three planting zones characterized by soil moisture and periodic inundation during the growing season. Right-of-way bioretention vegetation for the growing zones depicted in City of Olympia Standard Drawing 5-13 shall use only the plants listed in the respective zones in Table 1. The following is a brief summary of each zone

Zone 1: Area of periodic or frequent standing or flowing water. Many Zone 1 plants will also tolerate the seasonally dry periods of summer in the Northwest without extra watering and may be applicable in Zone 2 or 3.

Zone 2: Periodically moist or saturated during larger storms. Plants listed under Zone 2 will also be applicable in Zone 3.

Zone 3: Typically dry soils, though infrequently subject to inundation or saturation. This area should blend with the existing landscape.

Table 1: Bioretention Plant Selection By Zone

Zone 1				
Species/Common Name	Exposure	Mature Size	Time of Bloom	Comments

Zone 1				
Species/Common Name	Exposure	Mature Size	Time of Bloom	Comments
<i>Emergents</i>				
<i>Carex obnupta*</i> Slough sedge	Sun/Partial Shade	1-5 feet		Moist to seasonally saturated soils; shiny foliage; excellent soil binder; drought-tolerant
<i>Carex stipata*</i> Sawbeak sedge	Partial Shade	10 inches – 3 feet		Wet soils; excellent soil binder
<i>Carex morrowii</i> Japanese Variegated Sedge	Partial Shade to Full Shade	1 to 1.5 feet	April to July	Moist soils; 1.5 to 2 foot spread; low maintenance
<i>Juncus tenuis*</i> Slender rush	Sun	6 inches – 2.5 feet		Moist soils; tufted perennial
<i>Juncus effusus*</i> Common rush	Sun/Partial Shade	1-2 feet	Summer	Wet soils; evergreen perennial; hardy and adaptable; drought-tolerant; small, non-showy flowers
<i>Scirpus acutus*</i> Hardstem bulrush	Sun	4-8 feet		Wet soils; favors prolonged inundation; excellent soil binder
<i>Scirpus microcarpus*</i> Small-fruited bulrush	Sun/shade	2-4 feet		Wet soils; tolerates prolonged inundation; good soil binder; drought-tolerant
<i>Shrubs</i>				
<i>Cornus kelseyii</i> Kelsey Dogwood	Sun/Partial Shade	2-3 feet	Late spring	Tolerates wet soils, Compact low growing, red stems in winter
<i>Perennial</i>				
<i>Iris tenax</i> Oregon Iris	Sun/Partial Shade	1-2 feet	Spring	Tolerates seasonally wet soils; showy bloom
<i>Deschampsia cespitosa</i> Tufted Hairgrass	Sun	2-3 feet		Tolerates seasonally wet soils; drought tolerant; tufted perennial
<i>Grass Mix for Zone 1 Areas with Very Shallow and Temporary Inundation**</i>				
Mix 1		Mix 2		
75-80 percent	Tall or meadow fescue	60-70 percent	Tall fescue	
10-15 percent	Seaside/colonial bentgrass	10-15 percent	Seaside/colonial bentgrass	
5-10 percent	Redtop	10-15 percent	Meadow foxtail	
		6-10 percent	Alsike clover	
		1-5 percent	Marshfield big trefoil	
		1-6 percent	Redtop	
*Denotes native species		** Note all percentages are by weight		

Zone 2

Species/Common Name	Exposure	Mature Size	Time of Bloom	Comments
<i>Shrubs</i>				
<i>Cornus kelseyii</i> Kelsey Dogwood	Sun/Partial Shade	2-3 feet	Late spring	Tolerates wet soils, Compact low growing, red stems in winter
<i>Gaultheria shallon*</i> Salal	Partial shade/shade	3-7 feet	March -June	Dry and moist soils; white or pinkish flowers; reddish-blue to dark-purple fruit
<i>Symphoricarpos albus*</i> Snowberry	Sun/partial shade	2-6 feet		Wet to dry soils, clay to sand; excellent soil binder; drought and urban air tolerant; provides good erosion control; spreads well in sun; white berries; flowers attract hummingbirds
<i>Perennial</i>				
<i>Deschampsia cespitosa</i> Tufted Hairgrass	Sun	2-3 feet		Tolerates seasonally wet soils; drought tolerant; tufted perennial.
<i>Polystichum munitum</i> Sword Fern	Partial shade/ Deep shade	2-4 feet		Prefers moist, rich soil conditions, but drought-tolerant; large evergreen fern

Zone 3				
Species/Common Name	Exposure	Mature Size	Time of Bloom	Comments
<i>Shrub</i>				
<i>Cistus purpureus</i> Orchid rockrose	Sun	To 4 feet	June - July	Moist to dry well-drained soils; drought resistant; fast growing; reddish purple flowers
<i>Potentilla fruticosa</i> Shrubby cinquefoil	Sun	To 4 feet	May - September	Moist to dry soils; several cultivars available with varying foliage and flower hues; try 'Tangerine' or 'Moonlight'
<i>Gaultheria shallon*</i> Salal	Partial shade/shade	3-7 feet	March - June	Dry and moist soils; white or pinkish flowers; reddish-blue to dark-purple fruit
<i>Perennial</i>				
<i>Carex buchanaii</i> Leather leaf sedge	Sun/partial shade	1-3 feet		Prefers moist, well-drained soils; copper-colored foliage; perennial clumping grass; tolerant of a wide range of soils; inconspicuous flowers
<i>Dicentra formosa*</i> Pacific bleeding-heart	Sun/shade	6-20 inches	Early spring -early summer	Moist, rich soils; heart-shaped flowers

Zone 3				
Species/Common Name	Exposure	Mature Size	Time of Bloom	Comments
<i>Echinacea purpurea</i> Purple coneflower	Sun	4-5 feet		Prefers well drained soils; hardy perennial; may need watering in dry months
<i>Groundcover</i>				
<i>Fragaria chiloensis</i> * Wild/Coastal strawberry	Sun/partial shade	10 inches	Spring	Sandy well drained soils; flowers white; small hairy strawberries; evergreen; aggressive spreader

D. Bioretention Underdrains

Underdrain pipe shall be slotted subsurface drain PVC per ASTM D1785, SCH 40, with a minimum 6-inch diameter.

Slots should be cut perpendicular to the long axis of the pipe and be 0.04 to 0.069 inches by 1 inch long and be spaced 0.25 inches apart (spaced longitudinally). Slots should be arranged in four rows spaced on 45-degree centers and cover 1/2 of the circumference of the pipe.

E. Maintenance Responsibility for Bioretention within the Right-of-Way

The applicant/owner shall be responsible for the first three years of plant establishment. If City staff determines that the applicant/owner fails to maintain bioretention facilities in the right-of-way during the first three years of plant establishment, the City may perform any maintenance operations on the facility and may exercise options under an applicable performance bond or bill the applicant/owner for costs incurred.

The applicant/owner will be required to post a surety in the form approved by the city attorney. The surety document shall have a face amount equal to 125 percent of the estimated amount necessary to guarantee the maintenance and replacement of plant materials in conformance with the maintenance requirements for a period of three years from the date the certificate of occupancy is issued by the city or from the date of final plat approval.

The City will supplement maintenance of bioretention facilities installed for stormwater code compliance within the right-of-way by entering bioretention facilities into the City’s maintenance program after the three (3) year plant establishment period. Facilities not passing City inspection at the end of the 3 year plant establishment period will not be accepted by the City and all maintenance activities will continue to be the sole responsibility of the adjacent property owner the maintenance until such deficiencies are corrected and approved by the City.

City maintenance focuses on function, not aesthetics, and includes removal of noxious weeds and rehabilitating the system should the ponded area hold water for more than 48 hours past the end of a rain event. Maintenance for aesthetic purposes after the three (3) year plant establishment period is the responsibility of the adjacent property owner.

5.100 Exterior Grease Storage

Containers such as barrels, cans and drums of new or used fats, oils and/or greases (FOG) that are stored outside of food establishments, or businesses preparing food that store such containers, shall be secured so they cannot be unintentionally tipped over or spilled. These grease storage containers and their lids shall be sealed and secured within a secondary containment area with a minimum storage capacity equal to the volume of the storage containers. The secondary containment area shall also be designed to prevent rainfall entering and thus reducing the capacity of the containment area.

Appendix 1: List of Standard Drawings

Title	Drawing No.	File Type (DWG includes all drawings in chapter)
	Chapter 5 – All	PDF DWG
Standard Grate and Frame	5-1	PDF DWG
Catch Basin Installation Traffic Curb	5-2	PDF DWG
Catch Basin Installation Concrete Wedge Curb and Gutter	5-3	PDF DWG
Catch Basin Installation Concrete Curb and Gutter	5-4	PDF DWG
Hooded Catch Basin Installation Detail	5-5	PDF DWG
Hooded Catch Basin Frame, Grate, and Hood	5-6A	PDF DWG
Hooded Catch Basin Installation Orientation (Type 1L)	5-6B	PDF DWG
Down Spout Infiltration Trench, Plan View	5-7A	PDF DWG
Down Spout Infiltration Trench, Notes	5-7B	PDF DWG
Post Construction Soil Quality and Depth	5-8	PDF DWG
Solid Round Decorative Catch Basin Cover	5-9	PDF DWG
Curb Inlet Grate and Catch Basin Installation	5-10	PDF DWG
Bioretention Swale With Underdrain	5-11	PDF DWG
Bioretention Swale Without Underdrain	5-12	PDF DWG
Bioretention Planting Schedule	5-13	PDF DWG
Bioretention Log Check Dam	5-14	PDF DWG
Bioretention Earth Check Dam	5-15	PDF DWG
Bioretention Overflow Structure	5-16	PDF DWG
Bioretention Underdrain Cleanout and Observation Port	5-17	PDF DWG
Tree Planting Within Bioretention Swale	5-18	PDF DWG
Curb Cut Inlet for Swale (1 of 2)	5-19A	PDF DWG
Curb Cut Inlet for Swale (2 of 2)	5-19B	PDF DWG
Tree Protection Fence	5-20	PDF DWG