Chapter 1.0
GENERAL REQUIREMENTS & POLICIES

Summary of Chapter 1.0

This chapter outlines the City of Portland's stormwater management requirements and identifies who is required to conform to them. It includes:

1.1 PURPOSE AND APPLICABILITY OF MANUAL

1.1.1 Purpose of Manual

Stormwater management is a key element in maintaining and enhancing the City's livability. As the City is developed, the impervious surfaces that are created increase the amount of runoff during rainfall events, disrupting the natural hydrologic cycle. Without control, these conditions erode stream channels, prevent groundwater recharge, and are the cause of combined sewer overflows (CSOs) and basement sewer backups. Parking lots, roadways, rooftops, and other impervious surfaces increase the pollution levels and temperature of stormwater runoff that is transported to streams, rivers, and groundwater resources. Protecting these waters is vital for a great number of reasons, including fish and wildlife habitat, human health, recreation, and drinking water.

The purpose of this *Stormwater Management Manual* is to provide stormwater management principles and techniques that help preserve or mimic the natural hydrologic cycle, minimize sewer system problems, and achieve water quality goals. The manual provides developers and design professionals with specific

requirements for reducing the impacts of increased stormwater runoff flow quantity and pollution resulting from new development and redevelopment.

1.1.2 Applicability of Manual

This manual's requirements apply to all projects within the City of Portland, whether public or private.

- Projects of any size are required to comply with stormwater destination/ disposal requirements as identified in **Section 1.4** of this manual. Specific facility designs that meet these requirements are presented in **Chapter 2.0**.

- All projects developing or redeveloping over 500 square feet of impervious surface, or existing properties proposing new stormwater discharges off-site, are required to comply with pollution reduction and flow control requirements, presented in **Sections 1.5** and **1.6**, respectively. Specific facility designs that meet these requirements are presented in **Chapter 2.0**.

- All projects constructing destination/disposal, pollution reduction, or flow control facilities are also required to comply with operations and maintenance requirements, as outlined in **Chapter 3.0**.

- Projects that are classified as high risk because of certain site characteristics or activities (listed in **Section 4.1.1**) must comply with the source control requirements identified in **Chapter 4.0**.

1.2 SUMMARY OF MANUAL CONTENTS

How to Use This Manual, provides a flow chart for the navigation of the manual for projects of all sizes and types. It also takes a number of example projects step-by-step through the manual.

Chapter 1.0: General Requirements & Policies, outlines the purpose and applicability of this manual and defines terms. It outlines pollution reduction, flow control, and destination/disposal requirements, explains the rules for connecting to existing systems, and differentiates public and private stormwater management systems. This chapter also discusses the City's policies regarding the protection of open drainageways. Finally, it identifies special circumstances that may make it impractical to implement on-site pollution reduction or flow control to the standards specified in this manual.

Chapter 2.0: Stormwater Management Facility Design, provides methods for selecting and designing stormwater management facilities that accomplish

pollution reduction, flow control, and/or destination/disposal standards. The "simplified," "presumptive," and "performance" approaches are presented.

Chapter 3.0: Operations & Maintenance, presents operations and maintenance (O&M) requirements and provides templates for stormwater management facility O&M plans.

Chapter 4.0: Source Controls, addresses site activities and characteristics with the potential to generate pollutants that may not be addressed solely through the pollution reduction facilities presented in Chapter 2.0. It identifies when and what kinds of source controls are required.

Appendix A: City Code Chapter 17.38, Policy Framework, Appeals & Update Process, contains the section of City Code that includes stormwater management policies and standards and that officially recognizes the City's *Stormwater Management Manual*. The appendix also includes the policy framework for the City's stormwater management requirements, the appeals process, and the process for updating this manual.

Appendix B: Vendor Submission Guidance for Evaluating Stormwater Treatment Technologies, describes the City's testing protocol for acceptance of stormwater pollution reduction facilities. It includes a detailed definition of the City's basic pollution reduction requirement of 70 percent total suspended solids (TSS) removal.

Appendix C: Santa Barbara Urban Hydrograph Method, describes the Santa Barbara Urban Hydrograph method of computing stormwater runoff hydrographs. It includes the City's 24-hour rainfall depths, formulas for computing time of concentration, and runoff curve numbers.

Appendix D: Simplified Approach Sizing Calculations, provides a sample of the method used to calculate the simplified approach sizing factors.

Appendix E: Pollution Reduction Storm Report, outlines the rationale behind the development of Portland's pollution reduction storm intensity and volume, and the associated goal of treating 90 percent of the average annual runoff.

Appendix F: Facility Planting & Soil Recommendations, presents recommended plant species, soil, and design information for landscaped stormwater management facilities.

Appendix G: Supplemental Drawings, includes color cross-section and plan view drawings of many stormwater management facilities, as well as example planting plans.

Appendix H: Stormwater Facility Photos, provides a number of stormwater management facility photos, with site addresses.

References & Resources

Index

1.3 DEFINITIONS

Note: All definitions are used in this manual and are intended to be consistent with City Code Chapters 17.34, 17.38, and 17.39. Some references to specific chapters or sections are included to assist the user in manual navigation.

Above-Ground Storage of Liquid Materials (**Section 4.3**): Places where exterior storage (either permanent or temporary) of liquid chemicals, food products, waste oils, solvents, or petroleum products in above-ground containers, in quantities of 50 gallons or more exist.

***Aboveground Storage Tank (AST)*:** A stationary container, vessel, or other permanent holding device designated for the storage and/or distribution of a liquid product.

Applicant: Any person, company, or agency that applies for a permit through the City of Portland.

Approved Receiving System (Destination): Any system approved by BES to receive stormwater runoff or other discharges. Receiving systems include, but are not limited to, groundwater; on-site, off-site, or public stormwater, sanitary, or combined sewers; and waters of the state.

***Batch Discharge*:** The controlled discharge of a discrete, contained volume of water or wastewater. Batch discharges into the public sewer system must conform to the requirements of City Code sections 17.34- Industrial Wastewater Discharges; and 17.39- Stormwater Discharge.

BDS: Bureau of Development Services, City of Portland.

BES: Bureau of Environmental Services, City of Portland.

Bioretention Facility: A facility that utilizes soils and both woody and herbaceous plants to remove pollutants from stormwater runoff. Examples of bioretention facilities in this manual can include vegetated swales, flow-through and infiltration planters, vegetated filters, and vegetated infiltration basins.

***Bulk Fuel Terminal*:** Any area with its primary function dedicated to the storage and distribution of fuel to distributors (such as gas stations).

***Bulk Materials*:** Non-containerized materials.

***Bulk Material Transportation Route*:** Any path routinely used to transport materials regulated in **Section 4.5** onto, off of, or within a site.

Capacity: The capacity of a stormwater drainage system is the flow volume or rate that a facility (e.g., pipe, pond, vault, swale, ditch, drywell, etc.) is designed to safely contain, receive, convey, reduce pollutants from or infiltrate stormwater to meet a specific performance standard. There are different performance standards for pollution reduction, flow control, conveyance, and destination/ disposal, depending on location.

Catch Basin: A structural facility located just below the ground surface, used to collect stormwater runoff for conveyance purposes. Generally located in streets and parking lots, catch basins have grated lids, allowing stormwater from the surface to pass through for collection. Catch basins also include a sumped bottom and submerged outlet pipe (downturned 90 degree elbow, hood, or baffle board) to trap coarse sediment and oils.

Combined (or Combination) Sewers: Pipes that convey both sanitary sewage and stormwater.

Constructed Treatment Wetlands: A wetland-like facility designed and constructed for the specific purpose of providing stormwater management. Unlike natural wetlands (see definition), constructed treatment wetlands are not regulated by the Corps of Engineers or the Division of State Lands. See **Chapter 2.0** for information regarding the design of constructed treatment wetlands.

Contained Planter: A structural facility filled with topsoil and planted with vegetation. When placed over impervious surfaces such as sidewalks or flat rooftops, contained planters intercept rainfall that would otherwise contribute to stormwater runoff. See **Chapter 2.0** for information regarding the design of contained planters.

***Containerized*:** The storage of any product, by-product, or waste that is completely held or included on all sides, within a discrete volume or area.

***Containment*:** The temporary storage of potentially contaminated stormwater or process wastewater when a City sanitary sewer is not available for appropriate discharge.

Control Structure: A device used to hold back or direct a calculated amount of stormwater to or from a stormwater management facility. Typical control structures include vaults or manholes fitted with baffles, weirs, or orifices. See **Chapter 2.0** for information regarding the design of control structures.

Conveyance: The transport of stormwater or wastewater from one point to another.

Covered Vehicle Parking Areas (**Section 4.9**): Covered vehicle parking structures used to cover parked vehicles other than single-level covers, such as canopies, overhangs, and carports.

CSO (Combined Sewer Overflow): A discharge of a mixture of sanitary sewage and stormwater at a point in the combination sewer system designed to relieve surcharging flows.

DEQ: The Oregon Department of Environmental Quality.

Destination: The ultimate discharge point for the stormwater from a particular site, also known as the stormwater disposal point. Destinations can include on-site infiltration (surface infiltration facilities, drywells, sumps, and soakage trenches) and off-site flow to ditches, drainageways, rivers and streams, off-site storm pipes, and off-site combination sewers. See **Section 1.4** for information regarding destination requirements.

Detention Facility: A facility designed to receive and hold stormwater and release it at a slower rate, usually over a number of hours. The full volume of stormwater that enters the facility is eventually released.

Detention Tank, Vault, or Oversized Pipe: A structural subsurface facility used to provide flow control for a particular drainage basin. See **Chapter 2.0** for information regarding the design of detention tanks, vaults, and oversized pipes.

Development: Any human-induced change to improved or unimproved real estate, whether public or private, for which a permit is required, including but not limited to construction, installation, or expansion of a building or other structure, land division, street construction, drilling, and site alteration such as dredging, grading, paving, parking or storage facilities, excavation, filling, or clearing. Development encompasses both new development and redevelopment.

Development Footprint: The new or redeveloped area covered by buildings or other roof structures and other impervious surface areas, such as roads, parking lots, and sidewalks.

Disposal: See definition of *Destination*.

Drainage Basin: A specific area that contributes stormwater runoff to a particular point of interest, such as a stormwater management facility, drainageway, wetland, river, or pipe.

Drainageway: An open linear depression, whether constructed or natural, which functions for the collection and drainage of surface water. It may be permanently or temporarily inundated.

Driveway**:** The area that provides vehicular access to a site. A driveway begins at the property line and extends into the site. In parking areas, the driveway does not include vehicular parking, maneuvering, or circulation areas.

Dry Detention Pond: A surface vegetated basin used to provide flow control for a particular drainage basin. Stormwater temporarily fills the dry detention pond during large storm events and is slowly released over a number of hours, reducing peak flow rates. See **Chapter 2.0** for information regarding the design of dry detention ponds.

Drywell: A structural subsurface cylinder or vault with perforated sides and/or bottom, used to infiltrate stormwater into the ground. See **Chapter 2.0** for information regarding the design and use of drywells.

Ecoroof: A lightweight low-maintenance vegetated roof system used in place of a conventional roof. Ecoroofs provide stormwater management by capturing, filtering, and evaporating rainfall. See **Chapter 2.0** for information regarding the design of ecoroofs.

Equipment and/or Vehicle Washing Facilities (**Section 4.7**): Designated equipment and/or vehicle washing or steam cleaning areas. This includes smaller activity areas such as wheel washing stations.

Extended Wet Detention Pond: A surface vegetated basin with a permanent pool of water and additional storage volume, used to provide pollution reduction and flow control for a particular drainage basin. The permanent pool of water provides a storage volume for pollutants to settle out. During large storm events, stormwater temporarily fills the additional storage volume and is slowly released over a number of hours, reducing peak flow rates. See **Chapter 2.0** for information regarding the design of extended wet detention ponds.

Exterior Materials Storage Area**:** Any outdoor materials storage location that is not completely enclosed by a roof and sidewalls.

Exterior Storage of Bulk Materials (**Section 4.5**): Outdoor areas used to stockpile erodible materials.

Flow Control: The practice of limiting the release of peak flow rates and volumes from a site. Flow control is intended to protect downstream properties, infrastructure, and natural resources from the increased stormwater runoff peak flow rates and volumes resulting from development.

Flow Control Facility: Any structure or drainage device that is designed, constructed, and maintained to collect, retain, infiltrate, or detain surface water runoff during and after a storm event for the purpose of controlling post-development quantity leaving the site.

Flow-Through Planter: A structural facility filled with topsoil and gravel and planted with vegetation. The planter is completely sealed, and a perforated collection pipe is placed under the soil and gravel, along with an overflow provision, and directed to an acceptable destination point. The stormwater planter receives runoff from impervious surfaces, which is filtered and retained for a period of time. See **Chapter 2.0** for information regarding the design of flow-through planters.

Fuel Dispensing Facilities (**Section 4.2**): Areas where fuel is transferred from bulk storage tanks to vehicles, equipment, and/or mobile containers (including fuel islands, above ground fuel tanks, fuel pumps, and the surrounding pad). This definition applies to large-sized gas stations as well as single-pump fueling operations.

Grassy Swale (or Bioswale): A long and narrow, trapezoidal or semicircular-shaped channel, planted with a dense grass mix. Stormwater runoff from impervious surfaces is directed through the swale, where it is slowed and in some cases infiltrated, allowing pollutants to settle and filter out. See **Chapter 2.0** for information regarding the design of grassy swales.

Hazardous Material**:** Any material or combination of materials that, because of its quantity, concentration, or physical, chemical, or infectious characteristics, may cause or significantly contribute to an increase in mortality or an increase in serious, irreversible, or incapacitating reversible illness; or that may pose a present or potential hazard to human health, safety, or welfare, or to animal or aquatic life or the environment when improperly used, stored, transported or disposed of, or otherwise managed. For purposes of chemical regulation by this manual, moderate to high toxicity and confirmed human carcinogenicity are the criteria used to identify hazardous substances.
(Note: This manual does not use the Resource Conservation and Recovery Act (RCRA) definition of hazardous. For the purpose of this manual, hazardous material is intended to include hazardous, toxic, and other harmful substances.)

***Hazardous Material Containment Zone (HMC Zone)*:** An area where a specific individual activity involving use of a hazardous material takes place, and where chemical quantities at that location are expected to exceed defined thresholds. HMCs may include (but are not limited to) storage and/or process areas, transportation routes, work areas, and loading/unloading facilities.

High-Risk Site: A site with characteristics and/or activities that have the potential to generate pollutants that may not be addressed solely through the pollution reduction facilities presented in Chapter 2.0. High-risk site characteristics and activities are listed in **Section 4.1.1**.

Impervious Surface/Area: Any surface that has a runoff coefficient greater than 0.8 (as defined in BES's *Sewer Design Manual*, Chart 10: Runoff Coefficients). Types of impervious surface include rooftops, traditional asphalt and concrete parking lots, driveways, roads, sidewalks, and pedestrian plazas. *Note:* Slatted decks are considered pervious. Gravel surfaces are considered pervious unless they cover impervious surfaces or are compacted to a degree that causes their runoff coefficient to exceed 0.8.

Infiltration: The percolation of water into the ground.

Infiltration Planter: A structural facility filled with topsoil and gravel and planted with vegetation. The planter has on open bottom, allowing water to infiltrate into the ground. Stormwater runoff from impervious surfaces is directed into the planter, where it is filtered and infiltrated into the surrounding soil. See **Chapter 2.0** for information regarding the design of infiltration planters.

Inlet: A structure located just below the ground surface, used to collect stormwater runoff. Generally located in streets and parking lots, inlets have grated lids, allowing stormwater from the surface to pass through for collection. The term "inlet" is also used in reference to the point at which stormwater from impervious surfaces or conveyance piping enters a stormwater management facility.

Landscaping: See definition of *Stormwater Facility Landscaping*.

***LD-50*:** The lethal dose of a substance that is expected to kill approximately 50 percent of experimental animals through oral ingestion. (Refer to product Material Safety Data Sheet.)

***Local Dispensing Location*:** An area within 15 feet of an aboveground storage tank (AST) and used to dispense fuel directly from the AST, typically through a flexible hose.

Manufactured Stormwater Treatment Technology: A proprietary structural facility or device used to remove pollutants from stormwater. Refer to **Chapter 2.0** and **Appendix B** for approval criteria related to manufactured stormwater treatment technologies.

Material Transfer Areas/Loading Docks (**Section 4.6**): Areas designed to accommodate a truck/trailer being backed up to or into them, and used specifically to receive or distribute materials to and/or from trucks/trailers. Includes loading/unloading facilities with docks, and large bay doors without docks.

Maximum Extent Practicable (MEP): See definition of *Practicable*. A term used in the Clean Water Act.

***Multi-Level Parking Structure*:** Any parking facility with greater than one continuous level of parking.

Off-site stormwater facility: Any stormwater management facility located outside the property boundaries of a specific development, but designed to provide stormwater management benefits for that development.

On-site stormwater facility: Any stormwater management facility located within the property boundaries of a specific development, and designed to provide stormwater management benefits for that development.

Open Channel: A fluid passageway which allows part of the fluid to be exposed to the atmosphere.

Operations and Maintenance (O&M): The continuing activities required to keep stormwater management facilities and their components functioning in accordance with design objectives. See **Chapter 3.0** regarding operations and maintenance requirements for stormwater management facilities.

Outfall: A location where collected and concentrated water is discharged. Outfalls can include discharge from stormwater management facilities, drainage pipe systems, and constructed open channels. See **Chapter 2.0** for information regarding the design of outfalls.

***Parking Area*:** The area of a site devoted to the temporary or permanent storage, maneuvering, or circulation of motor vehicles. Parking areas do not include driveways or areas devoted exclusively to non-passenger loading.

PDOT: Portland Department of Transportation.

Permeable Pavement: See definition of *Pervious Pavement*.

Pervious Pavement: The numerous types of pavement systems that allow stormwater to percolate through them and into subsurface drainage systems or the ground. See **Chapter 2.0** for design requirements related to pervious pavement. Also referred to as porous or permeable pavement.

Pollutant: An elemental or physical material that can be mobilized or dissolved by water or air and creates a negative impact to human health and/ or the environment. Pollutants include suspended solids (sediment), heavy metals (such as lead, copper, zinc, and cadmium), nutrients (such as nitrogen and phosphorus), bacteria and viruses, organics (such as oil, grease, hydrocarbons, pesticides, and fertilizers), floatable debris, and increased temperature.

Pollutants of Concern: Watershed-specific parameters identified by the Oregon Department of Environmental Quality (DEQ) as having a negative impact on the receiving water body. Pollutants of concern can include suspended solids, heavy metals, nutrients, bacteria and viruses, organics, floatable debris, and increased temperature.

Pollution Reduction: The practice of filtering, retaining, or detaining surface water runoff during and after a storm event for the purpose of maintaining or improving surface and/or groundwater quality.

Pollution Reduction Facility: A structure, landscape, or drainage device that is designed, constructed, and maintained to collect and filter, retain, or detain surface water runoff during and after a storm event for the purpose of maintaining or improving surface and/or groundwater quality.

Porous Pavement: See definition of *Pervious Pavement*.

Post-Developed Condition: As related to new or redevelopment: A site's ground cover and grading after development.

Practicable: Available and capable of being done as determined by the BES Director, after taking into consideration cost, existing technology, and logistics in light of overall project purpose.

Pre-Developed Condition: As related to new development: A site's ground cover and grading prior to development. Pre-developed condition, as related to redevelopment, is a site's ground cover and grading prior to any development taking place, i.e. Lewis & Clark days.

Public Facility: A street, right-of-way, sewer, drainage, stormwater management, or other facility that is either currently owned by the City or will be conveyed to the City for maintenance responsibility after construction. A new stormwater management facility that receives direct stormwater runoff from a public right-of-way shall become a public (City-maintained) facility unless the right-of-way is not part of the City's road maintenance system.

Public Works Project: Any development (excluding public buildings) conducted or financed by a local, state, or federal governmental body, including local improvements and public improvements, as defined in Portland City Code Title 17, PUBLIC IMPROVEMENTS.

Rainwater Harvesting: The practice of collecting and using stormwater for purposes such as irrigation and toilet flushing. See **Chapter 2.0** for information regarding rainwater harvesting.

Recycled Land (**Section 4.8**): Land that currently has or previously has had pollutants detected in the soil or groundwater at concentrations that exceed risk-based cleanup levels or state/federal cleanup standards for the particular pollutant(s). Requirements of Section 4.8 may also apply to development projects that are bordered by these properties.

Redevelopment: Any development that requires demolition or complete removal of existing structures or impervious surfaces at a site and replacement with new impervious surfaces. Maintenance activities such as top-layer grinding, re-paving, and re-roofing are not considered to be redevelopment. Interior remodeling projects and tenant improvements are also not considered to be redevelopment. Utility trenches in streets are not considered redevelopment unless more than 50% of the street width is removed and re-paved.

Retention Facility: A facility designed to receive and hold stormwater runoff. Rather than storing and releasing the entire runoff volume, retention facilities permanently retain a portion of the water on-site, where it infiltrates, evaporates, or is absorbed by surrounding vegetation. In this way, the full volume of stormwater that enters the facility is not released off-site.

Roadway**:** Any paved surface used to carry vehicular traffic (cars/trucks, forklifts, farm machinery, or any other large machinery).

Roof Garden: A heavyweight roof system of waterproofing material with a thick soil and vegetation cover. Roof gardens provide stormwater management by capturing, filtering, and evaporating rainfall. See **Chapter 2.0** for information regarding the design of roof gardens.

Runoff: Stormwater flows across the ground surface during and after a rainfall event. Also simply referred to as stormwater.

Sand Filter: A structural facility with a layer of sand, used to filter pollutants from stormwater. See **Chapter 2.0** for information regarding the design of sand filters.

Santa Barbara Urban Hydrograph (SBUH): A hydrologic method used to calculate runoff hydrographs. See **Appendix C** for information regarding the use of the Santa Barbara Urban Hydrograph method.

Soakage Trench: A linear excavation backfilled with sand and gravel, used to filter pollutants and infiltrate stormwater. See **Chapter 2.0** for information regarding the design of soakage trenches.

Solid Waste Storage Areas, Containers, and Trash Compactors (**Section 4.4**): Outdoor areas with one or more facilities that store solid waste (both food and non-food waste). Single-family residential sites are exempt from the requirements of Section 4.4.

Stormwater: Water runoff that originates as precipitation on a particular site, basin, or watershed. Also referred to as runoff.

Stormwater Facility Landscaping: The vegetation (plantings), topsoil, rocks, and other surface elements associated with stormwater management facility design. See **Chapter 2.0** for stormwater facility landscaping requirements.

Stormwater Management: The overall culmination of techniques used to reduce pollutants from, detain and/or retain, and provide a destination for stormwater to best preserve or mimic the natural hydrologic cycle, to accomplish goals of reducing combined sewer overflows or basement sewer backups, or to fit within the capacity of existing infrastructure.

Stormwater Management Facility: A technique used to reduce pollutants from, detain and/or retain, or provide a destination for stormwater to best preserve or mimic the natural hydrologic cycle, to accomplish goals of reducing combined sewer overflows or basement sewer backups, or to fit within or improve the capacity of existing infrastructure.

Stormwater Re-use: See definition of *Rainwater Harvesting*.

Street Swale: A vegetated or grassy swale (or bioswale) located next to a public or private street for the purpose of managing stormwater. See **Chapter 2.0** for information regarding the design of street swales.

Sump: A large public drywell (see definition) used to infiltrate stormwater from public streets. Sumps are generally 48 inches in diameter and 30 feet deep. The term "sump" is also used to reference to any volume of a facility below the point of outlet, in which water can accumulate. See **Chapter 2.0** for information regarding the use and design of sumps.

Surface Conveyance: The transport of stormwater on the ground surface from one point to another.

Surface Infiltration Facility: A facility designed to receive and infiltrate stormwater runoff at the ground surface to meet stormwater destination/ disposal requirements. Pollution reduction and flow control requirements can also be met with surface infiltration facilities.

Surface Retention Facility: A facility designed to receive and hold stormwater runoff at the ground surface. Rather than storing and releasing the entire runoff volume, surface retention facilities permanently retain a portion of the water on-site, where it infiltrates, evaporates, or is absorbed by surrounding vegetation.

Tenant Improvements: Structural upgrades made to the interior or exterior of buildings. Tenant improvements may trigger **Chapter 4.0** Source Controls if they take place on sites with specified high-risk activities.

Time of Concentration (T of C): The amount of time it takes stormwater runoff to travel from the most distant point (measured by travel time) on a particular site or drainage basin to a particular point of interest. See **Appendix C** for calculations related to time of concentration.

Total Suspended Solids (TSS): Matter suspended in stormwater excluding litter, debris, and other gross solids exceeding 1 millimeter in diameter.

Underground Injection Control (UIC): A federal program under the Safe Drinking Water Act, delegated to the Oregon Department of Environmental Quality (DEQ), which regulates the injection of water below ground. The intent of the program is to protect groundwater aquifers, primarily those used as a source of drinking water, from contamination. See **Section 1.4.4** for information regarding the UIC program.

Vegetated Facilities: Stormwater management facilities that rely on plantings to enhance their performance. Plantings can provide wildlife habitat and enhance many facility functions, including infiltration, pollutant removal, water cooling, flow calming, and prevention of erosion.

Vegetated Filter: A gently sloping, densely vegetated area used to filter, slow, and infiltrate stormwater. See **Chapter 2.0** for information regarding the design of vegetated filters.

Vegetated Infiltration Basin: A vegetated facility that temporarily holds and infiltrates stormwater into the ground. See **Chapter 2.0** for information regarding the design of vegetated infiltration basins.

Vegetated Swale: A long and narrow, trapezoidal or semicircular channel, planted with a variety of trees, shrubs, and grasses. Stormwater runoff from impervious surfaces is directed through the swale, where it is slowed and in some cases infiltrated, allowing pollutants to settle out. Check dams are used to create small ponded areas to facilitate infiltration. See **Chapter 2.0** for information regarding the design of vegetated swales.

Water Body: Water bodies include coastal waters, rivers, sloughs, continuous and intermittent streams and seeps, ponds, lakes, aquifers, and wetlands.

Water Quality: See definition of *Pollution Reduction*.

Watercourse: A channel in which a flow of water occurs, either continuously or intermittently, with some degree of regularity. Watercourses may be either natural or artificial.

Wet Pond: A vegetated basin with a permanent pool of water, used to provide pollution reduction for a particular drainage basin. The permanent pool of water provides a storage volume for pollutants to settle out. See **Chapter 2.0** for information regarding the design of wet ponds.

Wetland: An area that is inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands include swamps, marshes, bogs, and similar areas except those constructed as pollution reduction or flow control facilities. Specific wetland designations shall be made by the Corps of Engineers and the Division of State Lands.

1.4 STORMWATER DESTINATION/DISPOSAL

1.4.1 The Purpose of Stormwater Destination/Disposal

Stormwater destination or disposal refers to the ultimate discharge point for stormwater generated by large, intense rainfall events from a particular development site. Destinations can be grouped into two general categories: on-site infiltration and off-site flow. On-site infiltration methods include surface infiltration techniques, soakage trenches, private drywells, and public infiltration sumps. Off-site flow methods include discharge to drainageways (including roadside ditches and natural drainages and streams), rivers, off-site storm sewers, and off-site combined sewers. The appropriate destination or disposal point is site-specific and depends on a number of factors, including soil type, slopes, and availability of public and private infrastructure.

While many of the stormwater management facilities in Chapter 2.0 are designed to provide pollution reduction, flow control, or both, not all of them infiltrate stormwater from large, intense rainfall events sufficiently enough to be considered the only stormwater disposal point for the site. Unless disposal credit is given, additional destination/ disposal measures are required and must be approved by BES (for off-site flow or infiltration within the public right-of-way) or BDS (for infiltration on private property). It should be noted that the disposal method might have an impact on the pollution reduction and flow control requirements for a site. Therefore, it is advantageous to determine the method of stormwater disposal first.

1.4.2 Destination/Disposal Requirements

Exhibit 1-1: Stormwater Destination/Disposal Hierarchy must be used to determine the ultimate discharge point for stormwater from a development site. The hierarchy is set up to protect watershed health and mimic predeveloped hydrologic conditions by requiring on-site infiltration wherever practicable. This also serves to protect the capacity of downstream infrastructure and minimize the occurrence of combined sewer overflows and basement sewer backups in the combined sewer system. The hierarchy is also intended to protect groundwater resources by limiting the use of infiltration in some cases. It requires infiltration at the ground surface where practicable, and pollution reduction where it isn't. Where on-site infiltration is not practicable, the hierarchy dictates the use of off-site storm-only systems for stormwater discharge if feasible, before discharge to combination sewer systems can be considered.

Section 1.4.3 identifies the standards that must be met for on-site infiltration and off-site flow conveyance.

EXHIBIT 1-1: STORMWATER DESTINATION/DISPOSAL HIERARCHY

Using Exhibit 1-1: For approval of a stormwater destination/disposal method in the City of Portland, the highest (1= high, 4=low) technically feasible category for the project must be used. All appropriate technical design criteria must be met to receive approval. Information provided in this chart does not guarantee that there will be an approvable destination for stormwater.

City of Portland Stormwater Destination/ Disposal Hierarchy

Category 1: On-site infiltration with a surface infiltration facility.

Under this category, a vegetated swale, grassy swale, street swale, vegetated infiltration basin, or infiltration planter shall be used, sized in accordance with the **Surface Infiltration Facility** design procedure in **Section 2.2.2**. This sizing procedure results in larger facilities than the simplified approach, which is used to meet pollution reduction and flow control goals only.

This category is not required if any of the following conditions exist:

1) Where subsurface soils infiltrate adequately, runoff from rooftops may be directed to underground injection control facilities, such as soakage trenches and drywells.
2) Soils do not infiltrate well enough for surface infiltration facility design. This exception includes projects on the west side of the Willamette River. Soils must achieve a minimum infiltration rate of 2 inches per hour.
3) Adequate space is not available for surface infiltration facility design (see **Surface Infiltration Facility** design methodology in **Section 2.2.2**). For facilities serving public street drainage and located within the street right-of-way, this is generally determined by comparing the amount of available pervious surface area (usually located between the curb and sidewalk) with the size of the required infiltration facility. Resident basements must have adequate setbacks. A minimum setback of 10 feet is required on private property, as approved by BDS. Additional right-of-way width may be dedicated by the applicant if needed, as approved by PDOT (for public streets) or BDS (for private streets). For surface infiltration facilities located outside of the street right-of-way, adequate space is determined by the applicant's ability to meet minimum density requirements, as determined by City of Portland zoning code, after the infiltration facility has been located on-site.
4) Contaminated soils are present on site such that DEQ will not permit stormwater infiltration. Documentation showing DEQ assessment must be submitted.
5) Slope instability conditions exist on site, as documented by a geotechnical investigation, which stormwater infiltration may exacerbate. Slopes must not exceed 10% in the facility area.
6) Site is located within the Columbia South Shore Wellhead Protection Area (see **Exhibit 2-33**), where on-site infiltration is not accepted for stormwater disposal.
7) For half-street improvements, existing utilities or street trees make it impractical to construct a surface infiltration facility within the street right-of-way.

City of Portland Stormwater Destination/ Disposal Hierarchy (Cont.)

Category 2: On-site infiltration with a public infiltration sump system, private drywell or soakage trench.

These facility types are classified as UICs (underground injection control structures) and must be rule-authorized or permitted by DEQ (see **Section 1.4.4**). The degree of pollution reduction required depends on the source of the stormwater runoff. Rooftop runoff does not require pollution reduction, runoff from residential low-use streets or parking lots (< 1,000 average daily trips) requires the use of sedimentation/ spill control manholes, and high-use streets and parking lots (> 1,000 average daily trips) require full pollution reduction. A surface retention facility is required to the maximum extent practicable (MEP) to meet applicable pollution reduction requirements (see **Section 1.6.2** for MEP criteria).

This category is not required if any of the following conditions exist:

1) Project does not meet DEQ UIC rule authorization or permitting criteria (see **Section 1.4.4** for list of criteria, or go to: **http://www.deq.state.or.us/wq/groundwa/RAStormwaterRequirements.pdf**).
2) Sub-surface soils do not infiltrate well enough for on-site infiltration, as approved by BES (for public streets) or BDS (for private streets).
3) Slope instability conditions exist on site, which stormwater infiltration may exacerbate. If this exception is claimed, a geotechnical investigation must be conducted and submitted, as approved by BES (for public facilities) or BDS (for private facilities).
4) Site is located within the Columbia South Shore Wellhead Protection Area (see **Exhibit 2-33**), where on-site infiltration with UICs is not allowed.

Category 3: Off-site flow to drainageway, river, or storm-only pipe system.

Pollution reduction is required. Flow control is required in most cases (see **Section 1.6.2**). A surface retention facility is required to the MEP to meet pollution reduction and flow control requirements (see **Section 1.6.2** for MEP criteria).

This category is not required if any of the following conditions exist:

1) System does not exist or does not have available capacity, as determined by BES.
2) Sensitivity of the water resource justifies connection to an alternative destination method, as determined by BES.

Category 4: Off-site flow to a combined sewer.

Pollution reduction and flow control are required. A surface retention facility is required to the MEP to meet pollution reduction and flow control requirements (see **Section 1.6.2** for MEP criteria).

This category is not accepted if the following condition exists:

1) System does not exist or does not have available capacity, as determined by BES.

1.4.3 Destination/Disposal Standards

ON-SITE INFILTRATION

Where complete on-site infiltration is used for the destination/disposal of stormwater, the following standards shall apply:

Surface Infiltration Facilities (public or private): Surface infiltration facilities must demonstrate the ability to store and infiltrate the 10-year, 24-hour storm. See **Section 2.2.2** for detailed surface infiltration facility sizing and design procedures, including safety factors.

Public Infiltration Sump Systems: The peak flow rate from a 10-year storm must be calculated using the Rational Method (Q=C*I*A), and a safety factor of 2 applied. The intensity shall correspond to the calculated time of concentration (5-minute minimum; see the City of Portland's *Sewer Design Manual* for rainfall intensity charts; for 5-minute time of concentration, intensity = 2.86 "/hr). The infiltration sump system must demonstrate the ability to steadily infiltrate stormwater at this rate.

Private Drywells and Soakage Trenches: Where the Bureau of Development Services (BDS) pre-approves on-site infiltration, drywell sizing charts or soakage trench sizing guidelines shall be used. See Chapter 2.0 for detailed drywell and soakage trench sizing and design procedures. Where on-site infiltration is not pre-approved, but the design professional wishes to prove the viability of on-site infiltration, the drywell testing procedure outlined in Chapter 2.0 shall be used.

OFF-SITE DISCHARGE TO SURFACE FLOW

Where stormwater is discharged to an off-site surface flow conveyance facility, such as a ditch, drainageway, stream, or river, the following standards shall apply:

Beginning at the point of discharge from the site, the surface conveyance facility must have the capacity to convey flows from the 25-year storm from all contributing upstream drainage areas. The 25-year storm flow rate shall be calculated using the Rational Method (Q=C*I*A), with intensity corresponding to the calculated time of concentration (5-minute minimum), or other approved hydrologic modeling method for conveyance. See the City of Portland's *Sewer Design Manual* for rainfall intensity charts and list of approved hydrologic modeling methods.

OFF-SITE DISCHARGE TO PIPED FLOW

Where stormwater is discharged to an off-site piped conveyance facility, such as a storm sewer or combined sewer, the following standards shall apply:

For new development or redevelopment with an increase in net impervious area: Beginning at the point of discharge from the site, the piped conveyance facility must have the capacity to convey flows from the 10-year storm from all contributing upstream drainage areas without surcharge. The piped conveyance facility may surcharge during the 25-year storm, but the hydraulic grade line must remain below ground surface level. Combined sewers, or sewers in the Cascade Station/Portland International Center and Columbia South Shore Plan Districts (**Exhibit 2-33**) must have the capacity to convey flows from the 25-year storm without surcharge. The 10- and 25-year storm flow rates shall be calculated using the Rational Method (Q=C*I*A), with intensity corresponding to the calculated time of concentration (5-minute minimum), or other approved hydrologic modeling method for conveyance. See the City of Portland's *Sewer Design Manual* for rainfall intensity charts and list of approved hydrologic modeling methods.

For redevelopment with no net increase in impervious area: Existing downstream pipe conveyance facilities may be allowed to surcharge under certain circumstances. See the City of Portland's *Sewer Design Manual* for allowable surcharge criteria.

100-YEAR ESCAPE ROUTE

All projects must demonstrate where stormwater from the 100-year storm event will go, and that public safety concerns and property damage will be avoided. This may include storage in parking lot, street, or landscaping areas.

Also see the City of Portland's *Sewer Design Manual* for more information regarding the conveyance and destination of stormwater.

1.4.4 Requirements for Underground Injection Control Structures (UICs)

This section provides general information only. The full regulations and requirements are available on the Oregon Department of Environmental Quality (DEQ) website: **http://www.deq.state.or.us/wq/groundwa/uichome.htm**

The federal Underground Injection Control (UIC) Program (under the Safe Drinking Water Act) regulates the injection of water below the ground. The intent of the program is to protect groundwater aquifers, primarily those used as a source of drinking water, from contamination. DEQ administers the UIC Program in Oregon.

DEQ defines a UIC as any system, structure, or activity that discharges fluid below the ground or subsurface. UICs can pollute groundwater and surface water if not properly designed, sited, and operated. Stormwater systems such as sumps, drywells, and soakage trenches are examples of UICs subject to DEQ regulation. Surface infiltration facilities such as pervious pavements, swales, planters, and vegetated infiltration basins are not classified as UICs.

Owners or operators of new and existing UICs are required to register and provide inventory data to DEQ. UICs that serve privately owned single-family residential roof and footing drains are exempt from these requirements. This information helps DEQ determine if the UIC is eligible for "rule authorization." Rule authorization allows the owner or operator to operate the UIC without a permit from DEQ. UICs that do not qualify for rule authorization must either be closed, modified to meet requirements for rule authorization, or the owner must submit a water pollution control facility permit application to DEQ and obtain a permit.

CRITERIA FOR RULE AUTHORIZATION

UICs must be registered and approved by DEQ before construction. DEQ has set minimum criteria for rule authorization, identified below:

- No other waste is mixed with stormwater.
- Site development, design, construction, and management practices have minimized stormwater runoff.
- No other stormwater destination is appropriate. Note: Discharge to the combined sewer system is not considered appropriate if on-site infiltration is possible.
- No domestic drinking water wells are present within 500 feet.
- No public drinking water supply wells are present within 500 feet or a two-year time of travel.
- No soil or groundwater contamination is present.
- The UIC is not deeper than 100 feet and does not discharge within 10 feet of the highest seasonal groundwater level.

- A confinement barrier or filtration medium is present, or best management practices (BMPs) are used to prevent or treat stormwater contamination. Stormwater management efforts should focus on maximizing source controls, use of vegetated pollution controls, and infiltration through surface infiltration or shallow subsurface facilities.
- Design and operation prevents accidental or illicit spills and allows for temporary blocking.

Compliance with these criteria must be demonstrated during the registration process. Compliance can generally be more readily accomplished if stormwater management efforts focus on maximizing source controls, using surface vegetated pollution control options such as swales and planters, and disposing of stormwater through surface infiltration or shallow subsurface facilities.

Exhibit 1-1 identifies stormwater destination/disposal options, prioritized to guide attainment of the rule authorization criteria.

RULE AUTHORIZATION PROCESS

The City of Portland is managing the rule authorization process for public facilities (UICs that drain public right-of-ways). To allow adequate time to complete the UIC process, registration and inventory information for proposed public UICs should be submitted to the City of Portland as soon as possible after it has been determined that new or existing public right-of-way will be constructed or improved. Contact BES Development Services at 503-823-7651 to get the public UIC process started.

Registration and inventory information for UICs proposed to serve private property should be submitted directly to Mr. Rodney Weick, Oregon DEQ, (503) 229-5886.

Registration and inventory data should be submitted at least 60 days in advance of potential start of work. In some cases, DEQ and the City will need additional information from the applicant to determine the potential use of a UIC. City approval for public or private facilities will not be given until DEQ determines that the proposed UIC can be rule authorized or permitted.

The registration, rule authorization, and permit process is explained in more detail on DEQ's permit webpage: **http://www.deq.state.or.us/pubs/permithandbook/wquic.htm** For technical questions, call the DEQ UIC Program at 503-229-5945. For copies of UIC registration applications or forms, call 503-229-5189.

1.5 POLLUTION REDUCTION

1.5.1 The Purpose of Pollution Reduction

Urbanization is recognized as having a serious impact on Portland's waters. As land is developed, impervious area and surface runoff increase. This runoff collects and transports pollutants to downstream receiving waters and the City sewer system.

General pollutants of concern include:

- Suspended solids (sediment)
- Heavy metals (dissolved and particulate, such as lead, copper, zinc, and cadmium)
- Nutrients (such as nitrogen and phosphorus)
- Bacteria and viruses
- Organics (such as oil, grease, hydrocarbons, pesticides, and fertilizers)
- Floatable debris
- Increased thermal load (temperature)

In response to the water quality impacts of urbanization, Congress passed the Clean Water Act amendments of 1987, mandating the U.S. Environmental Protection Agency (EPA) to issue regulations to control urban stormwater pollution. The regulations, published in 1990, require larger cities ("Phase I") such as Portland to obtain a National Pollutant Discharge Elimination System (NPDES) stormwater discharge permit for their municipal separate storm sewer discharges. Compliance with the NPDES permit requires the City to establish a comprehensive stormwater management program. Portland's citywide management program includes design standards for source control devices as well as best management practices designed to improve stormwater quality. This *Stormwater Management Manual* is part of Portland's NPDES stormwater management program to improve the quality of Portland's waters.

As noted in Section 1.4.4, the federal Underground Injection Control (UIC) Program (under the Safe Drinking Water Act) also requires pollution reduction in many cases prior to UIC infiltration.

1.5.2 Pollution Reduction Requirements

The City of Portland has a citywide pollution reduction requirement for all development projects with over 500 square feet of impervious development footprint area, and all existing sites that propose to create new off-site stormwater discharges. This requirement is summarized as follows:

- 70 percent removal of total suspended solids[1] is required from 90 percent of the average annual runoff.[2]
- Projects in watersheds that have established total maximum daily loads (TMDLs) must also select and use a pollution reduction facility that is capable of reducing the pollutants of concern, as approved by BES.

[1] See **Appendix B** for a more detailed definition of "70% removal of TSS," which is actually a function of influent TSS concentration.

[2] In Portland, flow rate-based pollution reduction facilities (such as swales and filters) designed to treat runoff generated by a rainfall intensity of 0.19 inches per hour (depending on time of concentration; see chart below), and flow volume-based facilities (such as wet ponds) designed to treat runoff generated by 0.83 inches of rainfall over 24 hours (with NRCS Type 1A rainfall distribution) with a Vb/Vr (volume of basin/ volume of runoff) ratio of 2, will treat roughly 90 percent of the average annual runoff. Facilities that must be sized by routing a hydrograph through the facility (rate-based facilities with a storage volume component) may utilize a continuous simulation program (with a minimum of 20 years of Portland rainfall data) or single-storm hydrograph-based analysis method, such as SBUH (with 0.83 inches of rainfall over 24 hours and NRCS Type 1A rainfall distribution) to demonstrate treatment of 90 percent of the average annual runoff volume. See **Appendix E** for more detailed information regarding the formulation of Portland's pollution reduction standards.

Rainfall intensity needed to treat 90% of the average annual runoff in Portland

Site's Time of Concentration (Minutes)	Rainfall Intensity (Inches per Hour)
5	0.19
10	0.16
20	0.13

One of the three design methodologies from **Chapter 2.0** must be used to design pollution reduction facilities to meet these requirements. The above rainfall intensities are to be used in the Rational Method (Q=CIA) equation to calculate pollution reduction runoff rates. These flow rates are used to size rate-based pollution reduction facilities unless the **Simplified Approach** from Chapter 2.0 is used.

TOTAL MAXIMUM DAILY LOAD (TMDL) REQUIREMENTS

In addition to the basic "70 percent TSS removal" requirement, projects discharging to water bodies that have established total maximum daily loads (TMDLs) must also select and use a pollution reduction facility that is capable of reducing the pollutants of concern, as approved by BES.

TMDL Parameters by Watershed (As of September 1, 2004)					
Columbia River	**Willamette River**	**Columbia Slough**	**Johnson Creek**	**Fanno Creek Ash Creek**	**Tryon Creek**
· Bacteria · Temperature · Nutrients · PCB · Dioxin · Trace Metals	· Bacteria · Temperature · PCB · Dioxin · PAH · Trace Metals	· Bacteria · Temperature · Nutrients · PCB · Dioxin · Trace Metals	· Bacteria · Temperature · PAH	· Bacteria · Temperature · Nutrients	· Temperature

- Development projects in watersheds with established TMDLs may use vegetated pollution reduction facilities from **Chapter 2.0** without submitting additional data on TMDL pollutant removal.

- If a project in a watershed with established TMDLs uses non-vegetated facilities from **Chapter 2.0** for pollution reduction, the applicant shall also demonstrate through the performance approach (**see Section 2.2.3**) that the development proposal is consistent with specific TMDL requirements. Unless a specific TMDL implementation plan has been adopted for a watershed with established TMDLs, the basic requirement is to select and use a stormwater management facility that is capable of reducing the pollutants of concern, as approved by BES.

Exhibit 1-2 provides guidance on the pollution reduction or prevention capabilities of the facilities in Chapter 2.0, pertaining to TMDL parameters.

Exhibit 1-2: Pollution Reduction Facility Removal Capabilities For TMDL Parameters

The facility can likely remove or prevent the parameter.
The facility can potentially remove or prevent the parameter, depending on design.
The facility cannot likely remove or prevent the parameter.

Pollution Reduction or Prevention Facility	Bacteria	Temperature	Nutrients	Pesticides (DDT, Dieldrin, Aldrin)	PCB	2,3,7,8 TCDD (Dioxin)	PAH	Trace Metals (Pb, As, Fe, Mn)
Ecoroof	■	■			▒	■	■	
Roof garden	▒	■			▒	■	■	
Pervious pavement	■	■	▒	▒	▒	▒	▒	▒
Tree credit		■						
Contained planter		■				■	■	
Rainwater Harvesting	■	■	■	▒	■	■	■	▒
Infiltration planter	■	■	■	▒	■	■	■	■
Flow-through planter	■	■	■	▒	■	■	■	■
Vegetated swale	▒	▒	▒	▒	▒	▒	▒	▒
Grassy swale	▒	▒	▒	▒	▒	▒	▒	▒
Street swale	▒	▒	▒	▒	▒	▒	▒	▒
Vegetated filter	▒	▒	▒	▒	▒	▒	▒	▒
Vegetated infiltration basin	■	■	■	▒	■	■	■	■
Wet pond	▒	▒	▒	▒	■	■	■	■
Extended wet detention pond	▒	▒	▒	▒	■	■	■	■
Constructed treatment wetland	▒	■	■	▒	■	■	■	■
Sand filter	■	■	■	▒	■	■	■	■
Manufactured filtration device	■	▒	■	▒	■	■	■	■

Note: This table is based on limited information and should be used for guidance only. Actual pollutant reduction and prevention capabilities are based on specific facility design and site conditions.

POLLUTION REDUCTION IN COMBINED SEWER AREAS

Because most combined sewers overflow to the Willamette River in wet conditions, it is essential to keep as much stormwater out of the combined sewer system as possible. For this reason, on-site infiltration is required to the maximum extent practicable. Pollution reduction is also required, unless all of the following conditions are met:

- The combined sewer system to which the development is connecting does not backup into basements or overflow during a 25-year storm event.
- The development has used on-site surface retention facilities within the project area to the maximum extent practicable, as approved by BES.
- The development pays the off-site stormwater management fee. See **Section 1-11** for information regarding current off-site stormwater management fee rates.

OIL CONTROL FOR VEHICLE AND EQUIPMENT TRAFFIC AREAS

Vehicle and equipment traffic areas are required to incorporate oil controls into the stormwater management design if they have the following characteristics:

- Commercial or industrial parking lots that store wrecked or impounded vehicles.
- Areas with a high likelihood of oil and grease loadings, such as fast-food restaurant drive-thru and parking, grocery and convenient store parking, vehicle repair, vehicle sales, and vehicle fueling services.

Oil controls can include spill control manholes (**Exhibit 2-26**) or the incorporation of Lynch-type catch basins within the parking lot or at the outlet to swales or other pollution reduction facilities. The discharge of stormwater with a visible sheen off-site or into on-site UICs is prohibited. Vehicle and equipment traffic areas that trigger these requirements must be paved with an impervious material. Because gasoline can react with asphalt pavement, it is preferable to pave the areas with concrete.

POLLUTION REDUCTION EXEMPTION FOR ROOFTOPS THAT INFILTRATE ON-SITE

Projects that infiltrate rooftop stormwater runoff with private soakage trenches, drywells, or surface infiltration facilities are not required to provide pollution reduction prior to infiltration. This exemption does not apply to projects that discharge stormwater off-site. Refer to **Section 1.4.4** for requirements specific to underground injection control structures (UICs).

1.6 FLOW CONTROL

1.6.1 The Purpose of Flow Control

Prior to development, runoff either appears as streamflow, evaporates into the atmosphere, or infiltrates into the ground where it recharges groundwater aquifers or surface water bodies. Urbanization results in the loss of forest, agricultural land, and open space and increases the amount of impervious area. As a result, development can have the following hydrologic impacts:

- Increased stormwater flow rates
- Increased stormwater runoff volumes
- Decreased groundwater recharge and base flows into streams
- Seasonal flow volume shifts

Flow control is intended to protect downstream properties, infrastructure, and natural resources from the increases in stormwater runoff peak flow rates and volumes resulting from development.

The City's policy is to ensure that runoff leaving the post-development site:

- Does not exceed the capacity of the receiving conveyance facility or water body.
- Does not increase the potential for stream bank and stream channel erosion.
- Does not add significant volume to an existing closed depression, such as Holgate Lake or other similar geologic features found throughout the City.
- Does not create or increase any upstream or downstream flooding problems.
- Does not create or increase the occurrence of CSOs or basement sewer backups.

The basic design concept for flow control (detention and retention) is simple: water from developed areas is managed with a variety of flow control techniques and released to downstream conveyance systems at a slower rate (detention) and lower volume (retention). Managing flows in this way attempts to mimic the site's natural rainfall runoff response prior to development (see **Exhibit 1-3**).

Detention facilities, such as ponds, tanks, vaults, or oversized pipes temporarily store stormwater runoff. The water is slowly released from the facility, typically over a number of hours.

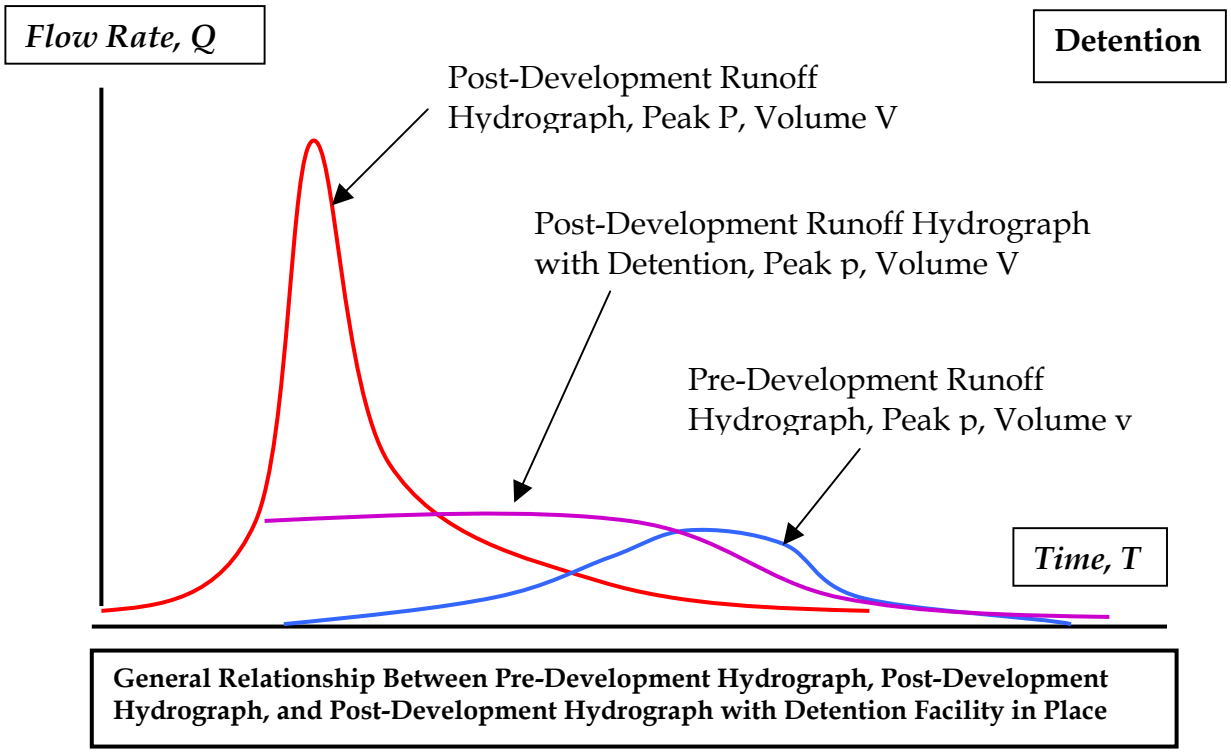
Retention facilities also store stormwater runoff. Rather than storing and releasing the entire runoff volume, however, the facility permanently retains a portion of the water on-site, where it infiltrates and recharges the groundwater aquifer, and in the case of surface retention facilities, evaporates or is absorbed and used by surrounding vegetation. In this way, retention facilities reduce the total volume of water released

downstream. Examples of retention facilities include surface treatments (such as eco-roofs or pervious pavements) that cover or replace traditional impervious surfaces and vegetated facilities such as swales, filters, ponds, and planter boxes.

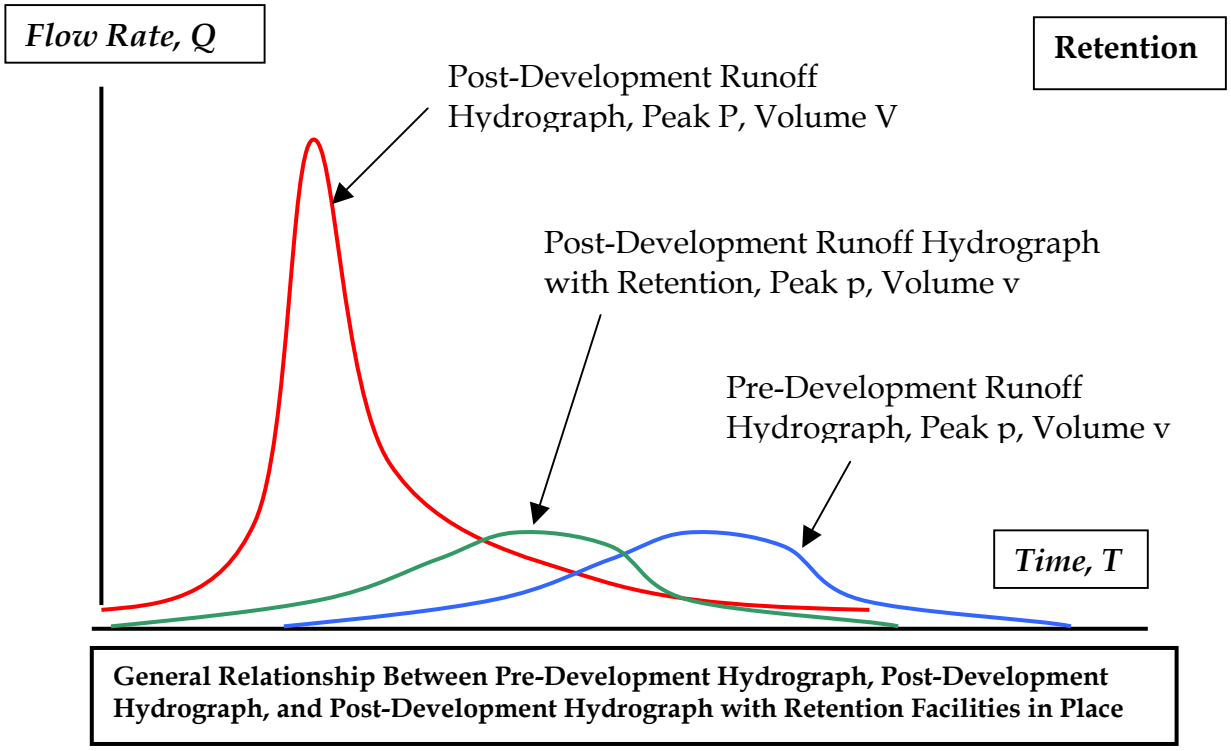
In the past, flow control plans often relied solely on detention facilities. Facilities that control only peak flow rates, however, allow the duration of high flows to increase, causing the potential for increased erosion downstream. For example, after development with detention, the magnitude of the 2-year peak flow rate may not increase, but the amount of time (duration) that the flow rate occurs will increase, and the frequency that the 2-year peak flow rate occurs will also increase. Retention systems, on the other hand, are particularly effective at lowering the overall runoff volume, reducing the amount of time (duration) that the peak flow rate occurs, as well as the frequency. In addition, by infiltrating stormwater, retention systems recharge groundwater that serves as the base flow for streams during the dry season. Therefore, stream systems that require erosion protection, including salmonid habitat streams, warrant the use of retention systems. Where retention systems cannot be used, detention systems that control the duration of the geomorphically significant flow (i.e., flow capable of moving sediment) shall be used. Such detention systems employ lower release rates and are therefore larger in volume.

Time of concentration (the time it takes rainfall to accumulate and run off a site) is another important factor in determining downstream hydrologic impacts created by development. Flow rates from individual sites may be controlled, but when they are combined quickly in fast-flowing conveyance pipes, the downstream effect will still be increased in-stream flow rates and volumes. Breaking flow patterns up into surface retention systems helps increase a site's time of concentration and lessens downstream impacts.

Exhibit 1-3: The Effect of Detention and Retention Facilities on Post-Developed Hydrographs (Large Storm Events)



General Relationship Between Pre-Development Hydrograph, Post-Development Hydrograph, and Post-Development Hydrograph with Detention Facility in Place



General Relationship Between Pre-Development Hydrograph, Post-Development Hydrograph, and Post-Development Hydrograph with Retention Facilities in Place

1.6.2 Flow Control Requirements

On-site infiltration is required to the maximum extent practicable to control stormwater volumes and flow rates. (See **Exhibit 1-1**: Stormwater Destination/Disposal Hierarchy.) Where complete on-site infiltration is not practicable, other on-site retention techniques (such as pervious pavement, ecoroofs, planters, swales, and other surface vegetated facilities) are required to the maximum extent practicable to reduce runoff volumes, with the following exceptions:

- Space constraints prohibit the construction of on-site retention facilities. Required setbacks from buildings and property lines need to be considered for each facility type.
- The use of surface retention is not practicable or safe because of soil or slope conditions. The City may require an investigation and recommendation of a qualified geotechnical engineer or engineering geologist to demonstrate that this exception applies to a site. It should be noted that some surface retention facilities, such as flow-through planter boxes, are lined and therefore do not infiltrate stormwater into surrounding soils.
- Contaminated soils limit the use of retention approaches.
- Required source controls for high-risk sites (as identified in **Chapter 4.0**) conflict with the use of on-site retention facilities.
- The development is located in an area of Portland where flow control is not required (See **Exhibit 1-4**) **and** discharges to a storm-only system with adequate capacity**.**

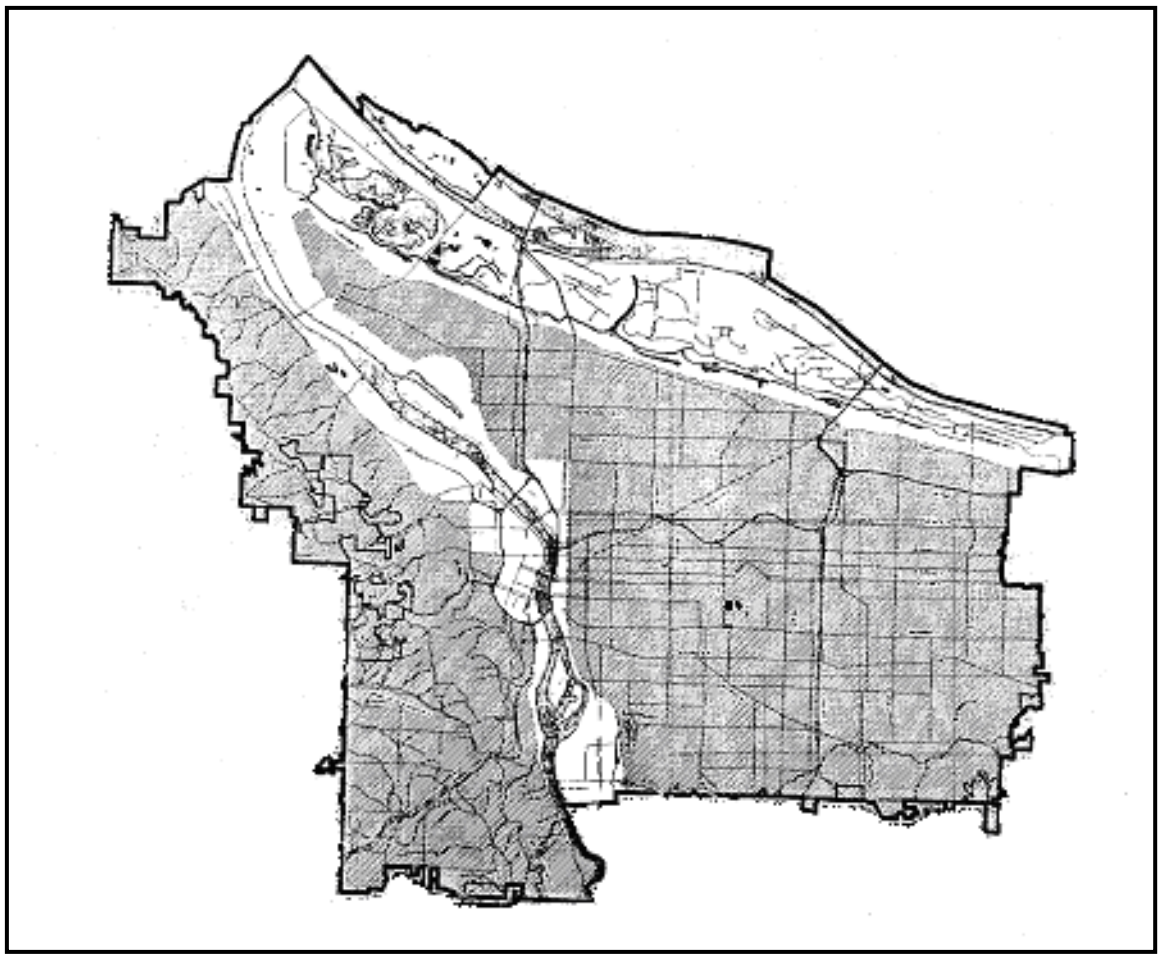
Where complete on-site infiltration or the use of retention facilities is not practicable, flow control (detention) shall be sufficient to maintain peak flow rates at their pre-development levels for the 2-year, 5-year, and 10-year, 24-hour runoff events. Note that for redevelopment projects, pre-development condition is defined as undeveloped land. (See definition of pre-developed condition in **Section 1.3**)

Because of minimum orifice size specifications (2 inches for public facilities, 1 inch for private facilities), detention facilities that rely on orifice structures to control flows for small projects (under 15,000 square feet of impervious development footprint area) may not be effective. In these cases, rather than constructing a detention facility on-site, the applicant may pay the flow control portion of the off-site stormwater management fee (see **Section 1.11**).

CIRCUMSTANCES WHEN FLOW CONTROL IS NOT REQUIRED

New development and redevelopment are exempt from flow control requirements if they discharge stormwater runoff directly into either the Willamette River, Columbia River, or Columbia Slough through a private storm sewer, separated public storm sewer, or Multnomah Country Drainage District system with available capacity. Although not always the case, these areas generally fall within the unshaded areas of Exhibit 1-4.

Exhibit 1-4: General Areas Where On-Site Flow Control May Not Be Required (Shown as unshaded areas of this map)



IMPORTANT NOTES:

- This exemption is for flow control only; pollution reduction requirements still apply.
- Development must still properly dispose of stormwater using approved methods in accordance with **Section 1.4** of this manual.

CIRCUMSTANCES WHEN MORE RESTRICTIVE FLOW CONTROL IS REQUIRED

Most tributary streams in Portland show evidence of excessive stream bank and channel erosion. Any development that discharges stormwater off-site that eventually flows to a tributary stream shall be designed to a more restrictive requirement to reduce the potential for further aggravation of instream erosion problems. This applies to all tributaries and storm sewers that drain to tributaries within the Portland area, except the Columbia Slough.

The added controls are based on the geomorphically significant flow, which is the flow that initiates sediment movement in the channels. The erosion-causing flow varies from channel to channel. Unless more specific data are available, the City assumes that the erosion-causing flow is one-half of the 2-year, 24-hour pre-developed (Lewis & Clark era) peak flow, and the requirements of this manual are based on that assumption. **Specifically, the more restrictive control requirement is to limit the 2-year, 24-hour post-development peak flow rate to the pre-development erosion-initiating rate (one-half of the 2-year, 24-hour flow rate). The facilities shall also control the post-development flows from the 5-, 10-, and 25-year, 24-hour peak flows to the pre-development 5-, 10-, and 25-year, 24 hour levels**.

Development projects proposing to discharge stormwater off-site must evaluate the capacity of the off-site receiving system (storm sewer, combination sewer, ditch, drainageway, etc.) against the standards presented in **Section 1.4.3**. Additional flow control may be required on-site if off-site receiving systems do not have sufficient capacity to accept the additional flows.

FLOW CONTROL REQUIREMENTS SPECIFIC TO DEVELOPMENTS DISCHARGING TO THE COMBINED SEWER SYSTEM

Substantial stormwater volumes in the combined sewer system result in combined sewer overflows (CSOs) and basement flooding in many areas served by combined sewers. Stormwater that enters the combined sewer system during low-flow periods is treated at the City's wastewater treatment plants, using costly energy and other resources. For these reasons, it is important to limit the quantity of stormwater entering the combined sewer system, and development projects in combined sewer areas are subject to the requirement to **infiltrate stormwater on-site to the maximum extent practicable**. For developments that are served by combined sewers but are unable to infiltrate on-site, the following requirements apply:

- Development projects that are allowed to discharge to a combined sewer system (cannot infiltrate on-site) are not required to provide detention for the 2- and 5-year

storm events. Detention facilities must be designed to control post-development flows from the 25-year peak flow to the pre-developed 10-year peak flow rate.

- Redevelopment projects that result in an equal or decreased coverage of impervious surface and that discharge into a combined sewer system with available capacity (no overflows during 25-year storm event, as determined by BES) are not required to provide flow control.

SUMMARY OF THE CITY'S FLOW CONTROL REQUIREMENTS:

1) On-site infiltration is required to the maximum extent practicable.
2) Where complete on-site infiltration is not practicable, on-site retention (flow volume control) facilities must be used to the maximum extent practicable.
3) Where complete on-site infiltration or retention is not practicable, flow control requirements below shall apply, after the **Stormwater Destination/ Disposal Hierarchy** from Section 1.4 has been applied to determine the point of stormwater discharge.
4) Piping systems that provide conveyance from a site to an ultimate discharge point must have adequate capacity per BES's standard, or additional flow control on-site may be required.

Discharge Point	Retention Requirement	Detention Requirement
Direct discharge to the Willamette River, Columbia River, or Columbia Slough, or discharge to a storm-only piping system or Multnomah Country Drainage District system with capacity that directly discharges to one of the above water bodies	Use on-site retention (flow volume control) facilities and infiltrate on-site to the maximum extent practicable.	None.
Discharge to any other overland storm drainage system, including ditches, drainageways, and streams, or any storm pipe system that eventually discharges to an overland drainage system	Use on-site retention (flow volume control) facilities and infiltrate on-site to the maximum extent practicable.	Limit 2-year post-development peak runoff rate to one-half of the 2-year pre-development peak rate; 5-year post to 5-year pre; 10-year post to 10-year pre; and 25-year post to 25-year pre-peak runoff rate.
Combined sewer	Use on-site retention (flow volume control) facilities and infiltrate on-site to the maximum extent practicable.	Limit 25-year post-development peak runoff rate to 10-year pre-development peak rate, unless sewer has available capacity.

1.7 OPEN DRAINAGEWAY POLICIES

A drainageway is an open linear depression, whether constructed or natural, that functions for the collection and drainage of surface water. It may be permanently or temporarily inundated. Drainageways provide many important functions to both the stormwater conveyance system and the environment. Drainageways provide both flow management (regulation of stream flow, retention and detention of water, flood control, contribution to seasonal base flows, and groundwater recharge) and water quality protection (filtration of pollutants and reduction of stormwater temperatures).

The City of Portland protects open drainageways by requiring them to be placed in drainage reserves. Drainage reserve requirements may be imposed during land use reviews, building permit reviews, or other development processes that require Bureau of Environmental Services review. The requirement to place the drainage reserve in a dedicated tract may be imposed during partition or subdivision land use reviews only.

Storm drainage reserves shall remain in natural topographic condition, or in the case of man-made drainages such as street ditches, the topographic condition at the time of the proposed development. No private structures, culverts, excavations, or fills shall be constructed within drainage reserves unless authorized by the BES Chief Engineer.

Sizing of Drainageway Reserves: Drainage reserves shall be sized to assure that the current flow rate and pattern of the drainageway continues to be adequately conveyed through the development site. Current flow volumes and/or drainageway capacities will be determined by reviewing existing data, which may include available hydrologic records, drainage basin hydrology, historical data, high-water marks, soil inundation records, photographs of past flooding, and other similar information. Reserves shall be placed on a proposed development site in one of the following manners:

1) 15 feet from the centerline of the channel; or
2) 15 feet from the delineated edge of a designated water feature (i.e. seep, spring, wetland); or
3) Within the boundary of a designated environmental zone; or
4) Over a designated seep, spring, or stream tract.

Exemptions: Drainage reserves shall not be required for drainageways located within a FEMA designated and mapped area.

Disturbances or Development within Drainage Reserves: Disturbances or development within the drainage reserve shall only be allowed when all of the following conditions exist:

1) The disturbance or development will not impede or reduce flows within the drainageway.
2) The disturbance or development will not cause detrimental impacts on habitat values or downstream water bodies for the migration, rearing, feeding, or spawning of fish.
3) Where the development involves a constructed crossing of the drainageway for vehicular or pedestrian access, there are no practicable alternatives with fewer impacts.
4) The development location, design, and construction method has the least significant detrimental impact to identified functional values of the drainageway of other practicable and different alternatives, including alternatives outside of the drainageway resource.

1.8 NON-CONFORMING USE PARKING LOTS

Non-Conforming Use Parking Lot Requirements

City Code Title 33.266: *Parking and Loading,* describes dimensions, landscaping, and other requirements for parking lots within the City of Portland. Title 33.248: *Landscaping and Screening* describes planting requirements for parking lots and other site uses. (See **Appendix F** for a list of approved parking lot trees.)

Existing parking lots required to meet the non-conforming use landscaping requirements under Title 33.258.070 must use surface retention facilities from **Chapter 2.0** where practicable in the newly required landscaped areas to manage stormwater from the parking lot. The appropriate sizing requirements shown on **Form SIM (Chapter 2.0)** shall be used to calculate the area needed for the applied measures. This requirement does not apply where it is not practical for runoff to flow into landscaped areas.

The following exceptions and/or conditions to these requirements may apply. If an exception is claimed, the applicant must still fulfill all other relevant requirements of this manual.

1. Contaminated soil conditions on the site preclude the use of landscape infiltration. Each site that has contaminated soils conditions must be evaluated by DEQ to determine if areas on the property are suitable for infiltration without the risk of mobilizing contaminants in the soil or groundwater. If it is determined that there are no suitable areas for infiltration, landscape facilities may be used for stormwater management, but must be lined to prevent infiltration.

2. The parking lot has been approved without landscaping, or has landscaping conditions that conflict with the use of the landscaping for stormwater management. (For example, if landscaping were required in a location that cannot receive stormwater as gravity flow, that portion of the landscaping would not have to be used for stormwater management)

1.9 DISCHARGING TO EXISTING STORMWATER MANAGEMENT FACILITIES

The City of Portland operates and maintains many stormwater management facilities. These facilities are designed to receive stormwater runoff from certain defined areas. A development may discharge to an existing **publicly** operated stormwater facility (see definition of public facility in **Section 1.3)** if all of the following criteria are met:

- The conveyance system and facility to which the development is discharging have capacity (see definition of capacity in **Section 1.3**). Stormwater runoff from development on private property shall not be discharged into new or existing public infiltration sump systems.

- The stormwater management facility is adequately designed in accordance with the most recent version of the *Stormwater Management Manual*, and was designed to include the development area in question.

- The applicant shows that private on-site infiltration facilities are being used to the maximum extent practicable, unless a previous land-use review case approved the development without such measures.

In addition to publicly owned and operated stormwater management facilities, many private facilities exist. A development may discharge to an existing **private** stormwater management facility if all of the following criteria are met:

- The conveyance system and facility to which the development is discharging has capacity (see definition of capacity in **Section 1.3**).

- The development's owner enters into a written agreement with the owner of the private stormwater management facility. BES and BDS must review and approve this agreement.

- There is no history of maintenance violations at the facility to which the development will be discharging, as determined by BES and BDS. BES may choose to conduct a site investigation to determine if the existing facility is being maintained adequately.

- The stormwater management facility is adequately designed in accordance with the most recent version of the *Stormwater Management Manual*, and was designed to include the development area in question.

1.10 PUBLIC VERSUS PRIVATE STORMWATER MANAGEMENT

Stormwater draining from private property shall be managed on private property, in privately maintained facilities. However, an applicant may construct and use a public facility for private and public stormwater management if **all** of the following conditions are met:

1) Public street improvements will require the construction of a public stormwater management facility.

2) The applicant has shown that private stormwater management facilities cannot be constructed on-site to manage the private runoff.

1.11 SPECIAL CIRCUMSTANCES

Special circumstances on a proposed site may make it impractical to implement on-site pollution reduction or flow control to the standards specified in this manual. Applicants who cite special circumstances shall submit **Form SC: Special Circumstances** (provided at the end of this section).

Properties are not eligible for special circumstances if they were divided or partitioned after this *Stormwater Management Manual* was adopted (July 1, 1999), and the division or partition resulted in the special circumstance (e.g., structural or other physical limitations at the site).

BES will determine if all or a portion of the stormwater management obligations may be fulfilled off-site. The applicant shall account for the management of all stormwater runoff from the site. If BES approves a special circumstances claim, the applicant must construct an appropriately sized off-site facility, or a fee must be paid to the City to construct off-site facilities. This fee is currently **$1.46** per square-foot of unmanaged impervious surface. The fee will be pro-rated to account for portions of the stormwater management obligation met on-site (as determined by the City's review of proposed on-site facilities). The unit cost will be further divided into pollution reduction and flow control components (**$0.73** per square-foot of impervious surface each) to account for differences in the development's ability to satisfy each component on-site.

No exceptions to meeting the stormwater management obligations are allowed. The developer shall either construct stormwater management facilities or pay the City to build off-site facilities. Except as listed above, on-site stormwater management shall be achieved to the maximum extent practicable, as approved by BES, in all cases before any off-site facilities or fees will be allowed.

In reviewing the applicant's plan submittal, the City will use the following criterion to determine if a special circumstance claim is allowed:

- Has the applicant made maximum use of on-site facilities identified in Chapter 2.0 for pollution reduction and/or flow control?

Applicants who are citing special circumstances are encouraged to obtain early assistance from BES by calling Development Assistance at 503-823-7761. BES will publish public notice of all requests for special circumstances.

Form SC	Special Circumstances

See Section 1.11 for requirements pertaining to Special Circumstances.

Part I: Identification of Special Circumstance(s)

Check all special circumstance(s) that apply:

☐ The site contains sensitive ecological or cultural features, or natural features that provide significant water quality or environmental benefits that should not be disturbed. There is no opportunity to avoid impact from facilities.

☐ On-site management would significantly increase the risk of landslides and slope instability.

☐ The project is declared emergency work, where there is a hazard posing imminent danger to life or property.

☐ Structural or other physical limitations at the site constrain the function, placement, or necessary maintenance of on-site pollution reduction or flow control measures.

☐ BES has determined that the use of an off-site regional facility is a better approach to achieve pollution reduction and flow control benefits.

☐ The project is a "linear" facility (e.g., sidewalk, bike lane) in an existing public right-of-way, and site conditions make it impractical to construct an on-site facility, as determined by BES.

Note: *Properties are <u>not</u> eligible for special circumstances if they were divided or partitioned after this Stormwater Management Manual was adopted (July 1, 1999), and the division or partition caused the special circumstance to occur (e.g., structural or other physical limitations at the site).*

Form SC **(Continued)**	**Special Circumstances**

Part II: Effects on Construction of On-site Stormwater Management

Describe the limiting effect(s) of the special circumstance(s) on the construction of on-site stormwater management facilities (pollution reduction, flow control, and destination):

Part III: Stormwater Management Percentages Achieved On and Off-Site

Indicate the portion of the site to be managed for pollution reduction:

On-site:	**Off-site:**

Indicate the portion of the site to be managed for flow control:

On-site:	**Off-site:**

Part IV: Proposed On and Off-site Stormwater Management Method(s)

Describe the destination/disposal method for the site. Also describe the on and off-site stormwater management methods to be used for pollution reduction and flow control. State "off-site management fee" if applicable.