



C.3 Stormwater Technical Guidance

3rd Revision
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Alameda County Flood
Control and Water
Conservation District
Zone 7 Water Agency

A handbook for
developers,
builders, and
project
applicants

Version 7.1

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Credits

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Glossary of Terms

<p>Alameda Countywide Clean Water Program</p>	<p>The Alameda Countywide Clean Water Program (Program) is established by a memorandum of understanding among the 14 Alameda County cities, Alameda County, the Alameda County Flood Control and Water Conservation District, and the Zone 7 Water Agency. All these agencies are listed as Co-permittees in the Municipal Regional Stormwater NPDES Permit (MRP) adopted by the Regional Water Quality Control Board. The Program implements common tasks and assists the member agencies to implement their local stormwater pollution prevention programs.</p>
<p>Bay Area Hydrology Model (BAHM)</p>	<p>A computer software application to assist project applicants in sizing specialized detention facilities that will allow a project to meet the Flow Duration Control standard where required by the hydromodification management provision (Provision C.3.g) of the Municipal Regional Stormwater NPDES Permit (MRP). The current version of the BAHM (BAHM 2013) is available for download at https://www.clearcreeksolutions.info/downloads.</p>
<p>Bay-Friendly Landscaping and Gardening</p>	<p>A holistic approach to gardening and landscaping that works in harmony with the natural conditions of the San Francisco Bay Watershed. Bay-Friendly practices foster soil health, conserve water and other valuable resources while reducing waste and preventing pollution.</p>
<p>Bay-Friendly Landscaping and Gardening Coalition/ ReScape California</p>	<p>The Bay-Friendly Landscaping & Gardening Coalition, also known as ReScape California, is a non-profit organization that partners with local organizations, customizing best management practices for each region to establish sustainable landscape practices in California. See more at: rescapeca.org/.</p>
<p>Best Management Practice (BMP)</p>	<p>Any program, technology, process, siting criteria, operational method or measure, or engineered system, which when implemented prevents, controls, removes, or reduces pollution. Includes schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce water pollution. BMPs also include treatment requirements, operating procedures, and practices to control site runoff, spillage or leaks, litter or waste disposal, or drainage from raw material storage.</p>

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<p>Bioinfiltration Area</p>	<p>A type of low development treatment measure designed to have a surface ponding area that allows for evapotranspiration, and to filter water through 18 inches of engineered biotreatment soil. After the water filters through the engineered soil, it encounters a 12-inch layer of rock in which an underdrain is typically installed. If the underlying soils have a saturated hydraulic conductivity rate of 1.6" per hour or greater, then the C.3.d amount of runoff is treated by evapotranspiration and infiltration. If the soils have a lower hydraulic conductivity rate, then the bioinfiltration area treats stormwater with evapotranspiration, some infiltration, and the remaining amount of the C.3.d amount of runoff is filtered and released into the underdrain. The difference between a bioinfiltration area and a bioretention area is that the bioinfiltration area is never lined with an impermeable layer; whereas, a bioretention area may be lined or unlined.</p>
<p>Bioretention Area</p>	<p>A type of low development treatment measure designed to have a surface ponding area that allows for evapotranspiration, and to filter water through 18 inches of engineered biotreatment soil. After the water filters through the engineered soil, it encounters a 12-inch layer of rock in which an underdrain is typically installed. If the underlying soils have a saturated hydraulic conductivity rate of 1.6" per hour or greater, then the C.3.d amount of runoff is treated by evapotranspiration and infiltration. If the soils have a lower hydraulic conductivity rate, or if infiltration is prohibited and the bioretention area is lined with an impermeable layer, then the bioretention area treats stormwater with evapotranspiration, some or no infiltration, and the remaining amount of the C.3.d amount of runoff is filtered and released into the underdrain. The difference between a bioinfiltration area and a bioretention area is that the bioinfiltration area is never lined with an impermeable layer; whereas, a bioretention area may be lined or unlined.</p>
<p>Biotreatment</p>	<p>A type of low impact development treatment allowed under Provision C.3.c of the MRP. As required by Provision C.3.c.i(2)(vi), biotreatment systems shall be designed to have a surface area no smaller than what is required to accommodate a 5 inches/hour stormwater runoff surface loading rate and shall use biotreatment soil as specified in the biotreatment soil specifications approved by the Regional Water Board, or equivalent.</p>
<p>Buffer Strip or Zone</p>	<p>Strip of erosion-resistant vegetation over which stormwater runoff is directed.</p>
<p>C.3</p>	<p>Provision of the Municipal Regional Stormwater NPDES Permit (MRP) that requires each Discharger to control the flow of stormwater and stormwater pollutants from new development and redevelopment sites over which it has jurisdiction.</p>
<p>C.3 Regulated Projects</p>	<p>Development projects as defined by Provision C.3.b.ii of the MRP. This includes public and private projects that create and/or replace 10,000 square feet or more of impervious surface, and restaurants, retail gasoline outlets, auto service facilities, and uncovered parking lots (stand-alone or part of another use) that create and/or replace 5,000 square feet or more of impervious surface. Single family homes that are not part of a larger plan of development are specifically excluded.</p>

C.3.d Amount of Runoff	The amount of stormwater runoff from C.3 Regulated Projects that must receive stormwater treatment, as described by hydraulic sizing criteria in Provision C.3.d of the MRP.
California Association of Stormwater Quality Agencies (CASQA)	Publisher of the California Stormwater Best Management Practices Handbooks, available at www.casqa.org . Successor to the Storm Water Quality Task Force (SWQTF).
Clean Water Act (CWA)	The Federal Water Pollution Prevention and Control Act, or Clean Water Act (33 U.S. Code 1251 <i>et seq.</i>) is intended to control or eliminate surface water pollution and establishes the National Pollutant Discharge Elimination System, which regulates surface water discharges from municipal storm drains, publicly-owned treatment works and industrial discharges.
Complete Application	Applications that have been accepted by the Planning Department and have not received a letter within 30 calendar days stating that the application is incomplete (consistent with the Permit Streamlining Act). Where an application has not been accepted by the Planning Department and the applicant has received a letter within 30 days stating that the application is incomplete, the application will be deemed complete if the additional requested information is submitted to the satisfaction of the Planning Department.
Conditions of Approval (COAs)	Requirements the City may adopt for a project in connection with a discretionary action (e.g., adoption of an EIR or negative declaration or issuance of a use permit). COAs may include features to be incorporated into the final plans for the project and may also specify uses, activities, and operational measures that must be observed over the life of the project.
Conduit/ Conveyance System/ Culvert	Channels or pipes for collecting and directing the flow of water. Conduits and conveyance systems may be open channels, covered channels or pipes. Culverts are covered channels or large diameter pipes.
Constructed Wetland	Constructed detention basins that have a permanent pool of water throughout the year and capacity for temporary additional storage of runoff that is released via an outlet structure. They differ from wet ponds in that they are typically shallower and have greater vegetation coverage.
Construction General Permit	A NPDES permit issued by the State Water Resources Control Board (SWRCB) for the discharge of stormwater associated with construction activity from soil disturbance of one (1) acre or more. The current Construction General Permit was adopted by the SWRCB on September 2, 2009, and went into effect July 1, 2010.
Design Storm	A hypothetical rainstorm defined by rainfall intensities and durations.
Detention	The temporary storage of stormwater runoff in ponds, vaults, within berms, or in depressed areas to allow treatment by sedimentation and metered discharge of runoff at reduced peak flow rates. See Infiltration and retention.

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Directly-Connected Impervious Area (DCIA)	The area covered by a building, impermeable pavement, and/or other impervious surfaces, which drains directly into the storm drain without first flowing across permeable land area (e.g., turf buffers).
Directly Discharging	Outflow from a drainage conveyance system that is composed entirely or predominantly of flows from the subject property, development, subdivision, or industrial facility, and not commingled with flows from adjacent lands.
Direct Infiltration	Infiltration via methods or devices, such as dry wells or infiltration trenches, designed to bypass unsaturated surface soils and transmit runoff directly to groundwater.
Discharge	A release or flow of stormwater or other substance from a conveyance system or storage container.
Discharger	Any responsible party or site owner or operator within the Municipal Regional Stormwater NPDES Permit (MRP) Permittees' jurisdiction whose site discharges stormwater runoff, or a non-stormwater discharge.
Drawdown Time	The time required for a stormwater detention or infiltration BMP to drain and return to the dry-weather condition. For detention BMPs, drawdown time is a function of basin volume and outlet orifice size. For infiltration BMPs, drawdown time is a function of basin volume and infiltration rate.
Dry Weather Flow	Flows that occur during periods without rainfall. In a natural setting, dry weather flows result from precipitation that infiltrates into the soil and slowly moves through the soil to the stream channel. Dry weather flows in storm drains may result from human activities, such as over-irrigation.
Dry Well	Structure placed in an excavation or boring, or excavation filled with open-graded rock, that is designed to collect stormwater and infiltrate into the subsurface soil.
Erosion	The diminishing or wearing away of land due to wind or water. Often the eroded debris (silt or sediment) becomes a pollutant via stormwater runoff. Erosion occurs naturally, but can be intensified by land disturbing and grading activities such as farming, development, road building, or timber harvesting.
Evapotranspiration	Evaporating water into the air directly or through plant transpiration.
Extended Detention Basin	Constructed basins with drainage outlets that are designed to detain runoff from a water quality design storm for some minimum time (e.g., 48 hours) to allow settling of sediment and pollutants.
Filter Fabric	Geotextile of relatively small mesh or pore size that is used to: (a) allow water to pass through while keeping sediment out (permeable); or (b) prevent both runoff and sediment from passing through (impermeable).
Flow-based Treatment Measures	Stormwater treatment measures that treat pollutants from a moving stream of water through filtration, infiltration, and/or biological processes.

Flow Duration	Either a) the total hours that surface flow from a watershed or drainage area occurs at a specified magnitude in response to a long-term time history of rainfall inputs, or b) the cumulative percentage of total hours that flows exceed the specified magnitude (as used in the BAHM). The overall distribution of flow durations is then expressed by a histogram or cumulative distribution curve, showing flow durations for equal subdivisions of the full range of flow magnitudes occurring over time.
Flow Duration Control	An approach to mitigating development-caused hydromodification which involves developing continuous simulation models of runoff from both pre-project and post-project site conditions, comparing flow durations for a designated range of flows, and designing specialized detention and discharge structures to reduce excess post-project flow duration for flows in the designated range (See Chapter 7).
Flow-Through Planter Box	Structure designed to treat stormwater by intercepting rainfall and slowly draining it through filter media and out of planter.
Grading	The cutting and/or filling of the land surface to a desired shape or elevation.
Green Roof/ Roof Garden	Vegetated roof systems that retain and filter stormwater prior to drainage off building rooftops.
Green Stormwater Infrastructure	Infrastructure that uses vegetation, soils, and natural processes to manage water and create healthier urban environments. At the scale of a city or county, green stormwater infrastructure refers to the patchwork of natural areas that provides habitat, flood protection, cleaner air, and cleaner water. At the scale of a neighborhood or site, green stormwater infrastructure refers to stormwater management systems that mimic nature by soaking up and storing water – providing a sustainable system that slows runoff by dispersing it to vegetated areas, harvests and uses runoff, promotes infiltration and evapotranspiration, and uses bioretention and other low impact development practices to clean stormwater runoff.
Groundwater	Subsurface water that occurs in soils, and geologic formations that are fully saturated.
Hazardous Waste	By-products of human activities that can pose a substantial or potential hazard to human health or the environment when improperly managed. Possesses at least one of four characteristics (flammable, corrosivity, reactivity, or toxicity), or appears on special EPA lists.
Head	In hydraulics, energy represented as a difference in elevation. In slow-flowing open systems, the difference in water surface elevation, e.g., between an inlet and outlet.
Heritage Tree	An individual tree of any size or species given the ‘heritage tree’ designation as defined by the municipality’s tree ordinance or other section of the municipal code.
High-Flow Bypass	In stormwater treatment measures, a pipe, outlet, or other structure designed to convey flood flows directly to the storm drain systems without entering the treatment measure.

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Hydrodynamic Separator	A commonly used term for mechanical stormwater treatment systems that are designed as flow-through structures with a settling or separation unit to remove sediment and other pollutants that may settle to the bottom of the separation unit.
Hydrograph	Runoff flow rate plotted as a function of time.
Hydromodification	The modification of a stream's hydrograph, caused in general by increases in flows and durations that result when land is developed (e.g., made more impervious). The effects of hydromodification include, but are not limited to, increased bed and bank erosion, loss of habitat, increased sediment transport and deposition, and increased flooding.
Hydrologic Soil Group	Classification of soils by the Natural Resources Conservation Service (NCRS) into A, B, C, and D groups according to infiltration capacity.
Imperviousness	A term applied to surfaces – roads, sidewalks, rooftops, and parking lots – that prevent or inhibit rainfall from sinking into groundcover and groundwater.
Impervious surface	A surface covering or pavement of a developed parcel of land that prevents the land's natural ability to absorb and infiltrate rainfall/stormwater. Impervious surfaces include, but are not limited to, roof tops; walkways; patios; driveways; parking lots; storage areas; impervious concrete and asphalt; and any other continuous watertight pavement or covering. Landscaped soil and pervious pavement, including pavers with pervious openings and seams, underlain with pervious soil or pervious storage material, such as a gravel layer sufficient to hold at least the Provision C.3.d volume of rainfall runoff are not impervious surfaces. Open, uncovered retention/detention facilities are not considered impervious surfaces for purposes of determining whether a project is a Regulated Project under Provisions C.3.b and C.3.g. Open, uncovered retention/detention facilities shall be considered impervious surfaces for purposes of runoff modeling and meeting the Hydromodification standard.
Indirect Infiltration	Infiltration via facilities, such as swales and bioretention areas, that are expressly designed to hold runoff and allow it to percolate into surface soils. Runoff may reach groundwater indirectly or may be underdrained through subsurface pipes.
Infiltration	Seepage of runoff through the soil to mix with groundwater. See retention.
Infiltration Devices	Infiltration facilities that are deeper than they are wide and designed to infiltrate stormwater runoff into the subsurface and, as designed, bypass the natural groundwater protection afforded by surface soil. These devices include dry wells, injection wells and infiltration trenches (includes French drains).
Infiltration Facilities	A term that refers to both infiltration devices and measures.
Infiltration Measures	Infiltration facilities that are wider than they are deep (e.g., bioinfiltration, infiltration basins and shallow wide infiltration trenches and dry wells).

Infiltration Trench	Long narrow trench filled with permeable material (e.g., gravel), designed to store runoff and infiltrate through the bottom and sides into the subsurface soil.
Inlet	An entrance into a ditch, storm sewer, or other waterway.
Integrated Management Practice (IMP)	A stormwater treatment measure that meets both stormwater treatment and hydromodification management objectives.
Integrated Pest Management (IPM)	An approach to pest control that utilizes regular monitoring to determine if and when treatments are needed and employs physical, mechanical, cultural, biological, and educational tactics to keep pest numbers low enough to prevent unacceptable damage or annoyance. See Bay-Friendly Landscaping and Gardening.
Low Impact Development	A land planning and engineering design approach with a goal of reducing stormwater runoff and mimicking a site's predevelopment hydrology by minimizing disturbed areas and impervious cover and then infiltrating, storing, detaining, evapotranspiring, and/or biotreating stormwater runoff close to its source, or onsite.
Low Impact Development (LID) Treatment	Removal of pollutants from stormwater runoff using the following types of stormwater treatment measures: rainwater harvesting and use, infiltration, evapotranspiration, and biotreatment.
Maintenance Plan	A plan detailing operation and maintenance requirements for stormwater treatment measures and/or structural hydromodification measures incorporated into a project.
Maximum Extent Practicable (MEP)	A standard for implementation of stormwater management actions to reduce pollutants in stormwater. Clean Water Act (CWA) 402(p)(3)(B)(iii) requires that municipal stormwater permits "shall require controls to reduce the discharge of pollutants to the maximum extent practicable, including management practices, control techniques and system, design and engineering methods, and such other provisions as the Administrator or the State determines appropriate for the control of such pollutants." Also see State Board Order WQ 2000-11.
Media Filter	Two-chambered system that includes a pretreatment settling basin and a filter bed filled with sand or other absorptive filtering media.
Municipal Regional Stormwater NPDES Permit (MRP)	The Phase I municipal stormwater NPDES permit under which discharges are permitted from municipal separate storm sewer systems throughout Alameda County and other NPDES Phase I jurisdictions within the San Francisco Bay Region.
New Development	Land disturbing activities; structural development, including construction or installation of a building or structure, creation of impervious surfaces; and/or land subdivision.
Non-Stormwater Discharge	Any discharge to municipal separate storm drain that is not composed entirely of stormwater. Some types of non-stormwater discharges may be authorized by NPDES permits and others prohibited.

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NPDES Permit	An authorization, license, or equivalent control document issued by EPA or an approved State agency to implement the requirements of the National Pollutant Discharge Elimination System (NPDES) program. As part of the 1972 Clean Water Act, Congress established the NPDES permitting system to regulate the discharge of pollutants from municipal sewers and industries. The NPDES program was expanded in 1987 to incorporate permits for stormwater discharges as well. Regional Water Quality Control Boards issue stormwater NPDES Permits to local government agencies placing provisions on allowable discharges of municipal stormwater to waters of the state.
Numeric Criteria	Sizing requirements for stormwater treatment controls established in Provision C.3.d. of the MRP.
Operation and Maintenance (O&M)	Refers to requirements in the stormwater NPDES permit to inspect stormwater treatment systems and hydromodification controls and implement preventative and corrective maintenance in perpetuity. See Chapter 8.
Operational Source Control Measure	Low technology, low cost activities, procedures, or management practices designed to prevent pollutants associated with site functions and activities from being discharged with stormwater runoff. Examples include good housekeeping practices, employee training, standard operating practices, inventory control measures, etc.
Outfall/ Outlet	The point where stormwater discharges from a pipe, channel, ditch, or other conveyance to a waterway.
Percentile Rainfall Intensity	A method of designing flow-based treatment controls that ranks long-term hourly rainfall intensities and selects the 85 th percentile value, and then doubles this value.
Permeability	A property of soil that enables water or air to move through it. Usually expressed in inches/hour or inches/day.
Pervious Paving	For the purposes of this document, pervious paving is defined as (but not limited to) any of the following types of paving or pavement systems: permeable interlocking concrete pavement (PICP), pervious or permeable concrete pavers, pervious grid pavements, pervious concrete, porous asphalt, turf block, grasscrete, and bricks and stones set on a gravel base with gravel joints. Pervious paving or pavement systems are designed to store and infiltrate rainfall at a rate equal to immediately surrounding unpaved, landscaped areas, or store and infiltrate the rainfall runoff volume described in provision C.3.d of the MRP.
Pervious Surface	Permeable hardscape or paved surface that allows surface runoff to infiltrate into surface soil (e.g., turf block, brick, natural stone, cobbles, gravel).
Perviousness	The permeability of a surface that can be penetrated by stormwater to infiltrate the underlying soils.
Point of Compliance	For design to meet Flow Duration Control requirements for hydromodification management, the point at which pre-project runoff is compared to post-project runoff, usually near the point where runoff leaves the project area.

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Pollutant	A substance introduced into the environment that adversely affects or potentially affects the usefulness of a resource.
Post-Construction Stormwater Control	See Stormwater Control.
Precipitation	Any form of rain or snow.
Provision C.3	A reference to the requirements in the MRP requiring each MRP Discharger to control the flow of stormwater and stormwater pollutants from new and redevelopment sites over which it has jurisdiction.
Rational Method	A method of calculating runoff flows based on rainfall intensity and the amount of runoff from the tributary area.
Redevelopment	Land-disturbing activity that results in the creation, addition, or replacement of exterior impervious surface area on a site on which some past development has occurred. The MRP excludes interior remodels and routine maintenance or repair, including roof or exterior surface replacement, pavement resurfacing, repaving and road pavement structural section rehabilitation within the existing footprint.
Regional Water Quality Control Board, San Francisco Bay Area Water Board (RWQCB)	One of nine California Regional Water Boards, the Regional Water Board for the San Francisco Bay Region is responsible for implementing pollution control provisions of the Clean Water Act and California Water Code within the area that drains to San Francisco Bay. Also referred to as Water Board.
Retention	The storage of stormwater to prevent it from leaving the development site; may be temporary or permanent.
Runoff	Water originating from rainfall and other sources (e.g., sprinkler irrigation) that is found in drainage facilities, creeks, streams, springs, seeps, ponds, lakes, wetlands, and shallow groundwater.
Sedimentation	The process of depositing soil particles, clays, sands, or other sediments that were picked up by runoff.
Sediments	Soil, sand and minerals washed from land into water, usually after rain.
Self-Retaining Area	A portion of a development site designed to retain the first one inch of rainfall (by ponding and infiltration and/or evapotranspiration) without producing stormwater runoff. Self-retaining areas must have at least a 2:1 ratio of contributing area to a self-retaining area and a 3" ponding depth. Self-retaining areas may include graded depressions with landscaping or pervious pavement. Areas that Contribute Runoff to Self-Retaining Areas are impervious or partially pervious areas that drain to self-retaining areas.
Self-Treating Area	A portion of a development site in which infiltration, evapotranspiration and other natural processes remove pollutants from stormwater. Self-treating areas may include conserved natural open areas, areas of landscaping, green roofs and pervious pavement. Self-treating areas treat only the rain falling on them and do not receive stormwater runoff from other areas.

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Site Design Measures	Site planning techniques to conserve natural spaces and/or limit the amount of impervious surface at new development and significant redevelopment projects in order to minimize runoff and the transport of pollutants in runoff.
Source Control Measures	Land use or site planning practices, or structural or nonstructural measures, that aim to prevent runoff pollution by reducing the potential for contact with rainfall runoff at the source of pollution. Source control measures minimize the contact between pollutants and urban runoff.
Special Projects	Certain types of smart growth, high density and transit oriented development projects that are allowed, under Provision C.3.e.ii of the MRP, to receive LID treatment reductions.
Storm Drains	Above and belowground structures for transporting stormwater to creeks or outfalls for flood control purposes.
Storm Event	A rainfall event that produces more than 0.1 inch of precipitation and is separated from the previous storm event by at least 72 hours of dry weather.
Stormwater	Stormwater runoff, snow-melt runoff, surface runoff, and drainage, excluding infiltration and irrigation tailwater.
Stormwater Control	A design feature of a development or redevelopment project, or a routinely-conducted activity that is intended to prevent, minimize or treat pollutants in stormwater, or to reduce erosive flows during the life of the project. Stormwater control is a term that collectively refers to site designs to promote water quality, source control measures, stormwater treatment measures, and hydromodification management measures. Also referred to as “post-construction stormwater control” or “post-construction stormwater measure.”
Stormwater Pollution Prevention Plan (SWPPP)	A plan providing for temporary measure to control sediment and other pollutants during construction.
Stormwater Treatment Measure	Any engineered system designed to remove pollutants from stormwater runoff by settling, filtration, biological degradation, plant uptake, media absorption/adsorption or other physical, biological, or chemical process. This includes landscape-based systems such as vegetated swales and bioretention units as well as proprietary systems. Sometimes called a treatment control, treatment control measure treatment system, or treatment control BMP.
Total Project Cost	Total project cost includes the construction (labor) and materials cost of the physical improvements proposed; however, it does not include land, transactions, financing, permitting, demolition, or off-site mitigation costs.
Treatment	Any method, technique, or process designed to remove pollutants and/or solids from polluted stormwater runoff, wastewater, or effluent.

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Vector Control	Any method to limit or eradicate vectors of vector born diseases, for which the pathogen (e.g. virus or parasite) is transmitted by a vector which can be mammals, birds or arthropods, especially insects, and more specifically mosquitoes. For the purposes of this document, vector control refers to mosquito control.
Vegetated Buffer Strip	Linear strips of vegetated surfaces that are designed to treat sheet runoff flow from adjacent surfaces.
Volume-Based Stormwater Treatment Measures	Stormwater treatment measures that detain stormwater for a certain period and treat primarily through settling and infiltration.
Water Quality Inlet	Systems that contain one or more chambers that promote sedimentation of coarse materials and separation of undissolved oil and grease from stormwater. Also referred to as oil/water separators.
Water Quality Volume (WQV)	For stormwater treatment measures that depend on detention to work, the volume of water that must be detained to achieve maximum extent practicable pollutant removal. This volume of water must be detained for a specified drawdown time.
WEF Method	A method for determining the required volume of treatment BMPs, recommended by the Water Environment Federation and American Society of Civil Engineers. Described in Urban Runoff Quality Management (WEF/ASCE, 1998).

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