CITY OF ESCONDIDO SUSMP

Standard Urban Stormwater Mitigation Plan Requirements for Development Projects

Adapted from the Countywide Model SUSMP

January 2011

ESCONDIDO
City of Choice

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City of Escondido Standard Urban Stormwater Mitigation Plan (SUSMP)

SUMMARY

In January 2007, the San Diego Regional Water Quality Control Board (San Diego RWQCB) reissued a municipal stormwater permit (Order R9-2007-0001, referred to in this document as the "Stormwater Permit") that updates and expands stormwater requirements for new development and redevelopment projects. Stormwater treatment requirements have been made more widely applicable and more stringent; minimum standards for Low Impact Development (LID) have been added. LID is an integrated site design methodology that uses small-scale detention and retention to minimize pollutants conveyed by runoff and to mimic preproject site hydrological conditions. The City of Escondido (City) is required to develop and implement criteria for controlling the peaks and duration of runoff from development sites.

As required by the Stormwater Permit, the City has updated this standard urban stormwater mitigation plan (SUSMP) to assist the land development community in streamlining project reviews and maximizing cost-effective environmental benefits. Moreover, this updated SUSMP incorporates a unified LID design procedure that integrates site planning and design measures with engineered, small-scale integrated management practices (IMPs) such as bioretention. This procedure is included within this manual. By following the procedure, applicants can develop a single integrated design that complies with the Stormwater Permit's requirements for LID, stormwater treatment, and runoff peak-and-duration control (hydromodification management).

Along with the detailed design procedure, this document includes guidance and criteria for dispersing runoff to landscaped areas and for using permeable pavements, bioretention facilities, flow-through planters, dry wells, infiltration basins, and cisterns. Where feasible and allowed, water in cisterns may be directed to nonpotable uses, augmenting water supplies. Bioretention facilities and planter boxes can be designed with an impermeable barrier so that runoff does not saturate native soils; instead, runoff is filtered through an engineered soil mix before being captured in an underdrain and conveyed to off-site storm drains. This configuration may be needed where groundwater is high (many areas of Escondido have high [i.e., shallow] groundwater table elevations) or contaminated, or where increasing soil moisture may present a hazard to foundations or slope stability.

Applicants for development project approvals may choose not to use the unified LID design procedure; however, they must still comply with the applicable LID, stormwater treatment, and hydromodification management criteria. In accordance with the Stormwater Permit, the City requires that runoff be infiltrated or treated by bioretention facilities, planter boxes, filters,

settling ponds, or constructed wetlands. In some special circumstances (retrofitting of existing drainage systems, some pedestrian-oriented developments, and roadway widening projects) where it can also be demonstrated that it is not feasible to construct any of these facilities, higher-rate surface biofilters or higher-rate vault-based filtration units may be used.

Applicants for approval of priority development projects must comply with the hydromodification management criteria in the Stormwater Permit. This SUSMP includes guidance for demonstrating compliance. Submittals for projects smaller than 50 acres may demonstrate compliance by using the integrated LID design procedure. For larger projects, the applicant may use a continuous-simulation hydrologic computer model to simulate the effects of LID facilities, detention basins, or other stormwater management facilities on preproject and postproject runoff, or may identify an exemption applicable to the site.

Applicants must also incorporate into their project designs features to control pollutants from specified on-site sources, such as refuse areas, outdoor storage areas, and vehicle washing and repair facilities. A table listing the types of sources to be controlled and the corresponding source control measures required is presented within this SUSMP.

This SUSMP provides the applicant with step-by-step instructions for preparing a SUSMP project submittal for review by City staff. The following steps should be followed:

1. Assemble needed information.
2. Identify site opportunities and constraints.
3. Follow the LID design guidance to analyze the project for LID and to develop and document the drainage design.
4. Specify source controls using the sources/source control checklist in the appendix.
5. Plan for ongoing maintenance of treatment and flow control facilities.
6. Complete the SUSMP project submittal.

The step-by-step instructions are augmented by a checklist that City staff will use as a guide when reviewing the SUSMP project submittal. This manual also includes a sample outline and contents for a SUSMP project submittal.

As required by the reissued Stormwater Permit, the City implements a program to verify that approved stormwater treatment facilities are operating effectively. To facilitate implementation of these programs, applicants must prepare detailed maintenance plans for each proposed stormwater treatment facility.

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Glossary

Best Management Practice (BMP)	Any procedure or device designed to minimize the quantity of pollutants that enter the storm drain system.
California Association of Stormwater Quality Agencies (CASQA)	Publisher of the California Stormwater Best Management Practices Handbooks, available at www.cabmphandbooks.com. Successor to the Storm Water Quality Task Force (SWQTF).
California BMP Method	A method for determining the required volume of stormwater treatment facilities. Described in Section 5.5.1 of the California Stormwater Best Management Practice Manual (New Development) (CASQA, 2003).
Conditions of Approval (COAs)	Requirements a municipality 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.
Continuous Simulation Modeling	A method of hydrological analysis in which a set of rainfall data (typically hourly for 30 years or more) is used as input, and runoff rates are calculated on the same time step. The output is then analyzed statistically for the purposes of comparing runoff patterns under different conditions (for example, pre- and post-development-project).
Copermittees	See Dischargers.
Detention	The practice of holding stormwater runoff in ponds, vaults, within berms, or in depressed areas and letting it discharge slowly to the storm drain system. See definitions of infiltration and retention.
Direct Discharge	Connection of project site runoff to an exempt receiving water body, which could include an exempt river reach, reservoir or lagoon. To qualify as a direct discharge, the discharge elevation from the project site outfall must be below the elevations detailed in the HMP Applicability section of this Model SUSMP.
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.
Directly Connected Impervious Area	Any impervious surface which drains into a catch basin, area drain, or other conveyance structure without first allowing flow across pervious areas (e.g. lawns).
Dischargers	The agencies named in the stormwater NPDES permit (see definition): the County of San Diego; the Cities of Carlsbad, El Cajon, La Mesa, Poway, Solana Beach, Chula Vista, Encinitas, Lemon Grove, San Diego, Vista, Coronado, Escondido, National City, San Marcos, Del Mar, Imperial Beach, Oceanside, and Santee; the San Diego Unified Port District, and the San Diego County Regional Airport Authority.

Drainage Management Areas	Areas delineated on a map of the development site showing how drainage is detained, dispersed, or directed to Integrated Management Practices. There are four types of Drainage Management Areas, and specific criteria apply to each type of area. See Chapter 4.
Drawdown time	The time required for a stormwater detention or infiltration facility to drain and return to the dry-weather condition. For detention facilities, drawdown time is a function of basin volume and outlet orifice size. For infiltration facilities, drawdown time is a function of basin volume and infiltration rate.
Environmentally Sensitive Areas	Areas that include but are not limited to all Clean Water Act Section 303(d) impaired water bodies; areas designated as Areas of Special Biological Significance by the State Water Resources Control Board (Water Quality Control Plan for the San Diego Basin [1994] and amendments); water bodies designated with the RARE beneficial use by the State Water Resources Control Board (Water Quality Control Plan for the San Diego Basin [1994] and amendments); areas designated as preserves or their equivalent under the Multi Species Conservation Program within the Cities and County of San Diego; and any other equivalent environmentally sensitive areas which have been identified by the Copermittees.
Flow Control	Control of runoff rates and durations as required by the Hydromodification Management Plan.
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.
Higher-Rate Biofilter	A biofilter with a design surface loading rate higher than the 5 inches per hour rate specified in this document for bioretention facilities and planter boxes.
Hydrograph	Runoff flow rate plotted as a function of time.
Hydromodification Management Plan (HMP)	A Plan implemented by the dischargers so that postproject runoff shall not exceed estimated preproject rates and/or durations, where increased runoff would result in increased potential for erosion or other adverse impacts to beneficial uses. Also see definition for flow control.
Hydrologic Soil Group	Classification of soils by the Natural Resources Conservation Service (NRCS) into A, B, C, and D groups according to infiltration capacity.
Impervious surface	Any material that prevents or substantially reduces infiltration of water into the soil. See discussion of imperviousness in Chapter Two.
Infeasible	As applied to best management practices, impossible to implement because of technical constraints specific to the site.
Infiltration	Seepage of runoff into soils underlying the site. See definition of retention.
Infiltration Device	Any structure, such as a dry well, that is designed to infiltrate stormwater into the subsurface and, as designed, bypasses the natural groundwater protection afforded by surface or near-surface soil. See definition for direct infiltration.
Integrated Management Practice (IMP)	A facility (BMP) that provides small-scale treatment, retention, and/or detention and is integrated into site layout, landscaping and drainage design. See Low Impact Development.

Term	Definition
Integrated Pest Management (IPM)	An approach to pest management that relies on information about the life cycles of pests and their interaction with the environment. Pest control methods are applied with the most economical means and with the least possible hazard to people, property, and the environment.
Jurisdictional Urban Runoff Management Plan (JURMP)	A written description of the specific jurisdictional urban runoff management measures and programs that each Copermittee implements to comply with the stormwater NPDES permit and ensure pollutant discharges are reduced to the MEP and do not cause or contribute to a violation of water quality standards. See Stormwater Pollution Prevention Program.
Lead Agency	The public agency that has the principal responsibility for carrying out or approving a project. (CEQA Guidelines §15367).
Low Impact Development	An integrated site design methodology that uses small-scale detention and retention (Integrated Management Practices, or IMPs) to mimic pre-existing site hydrological conditions.
Maximum Extent Practicable (MEP)	Standard, established by the 1987 amendments to the Clean Water Act, for the implementation of municipal stormwater pollution prevention programs (see definition). According to the Act, municipal stormwater NPDES 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."
National Pollutant Discharge Elimination System (NPDES)	As part of the 1972 Clean Water Act, Congress established the NPDES permitting system to regulate the discharge of pollutants from municipal sanitary sewers and industries. The NPDES was expanded in 1987 to incorporate permits for stormwater discharges as well.
Numeric Criteria	Sizing requirements for stormwater treatment facilities established in Provision D.1.d.(6)(c) of the San Diego RWQCB's stormwater NPDES permit.
Operation and Maintenance (O&M)	Refers to requirements in the Stormwater NPDES Permit to inspect treatment BMPs and implement preventative and corrective maintenance in perpetuity. See Chapter Five.
Parking Lot	A land area or facility for the temporary parking or storage of motor vehicles used personally, for business, or for commerce.
Permeable Pavements	Pavements for roadways, sidewalks, or plazas that are designed to infiltrate a portion of rainfall, including pervious concrete, pervious asphalt, unit-pavers-on-sand, and crushed gravel.
Priority Development Project	A project subject to SUSMP requirements. Defined in Stormwater NPDES Permit Provision D.1.d.(1). See Chapter One.
Project Area	The entire project area comprises all areas to be altered or developed by the project, plus any additional areas that drain on to areas to be altered or developed.
Project Submittal	Documents submitted to a municipality in connection with an application for development approval and demonstrating compliance with Stormwater NPDES Permit requirements for the project. Specific requirements vary from municipality to municipality.

Proprietary	A proprietary device is one marketed under legal right of the manufacturer.
Redevelopment	The creation, addition, and or replacement of impervious surface on an already developed site. Examples include the expansion of a building footprint, road widening, the addition to or replacement of a structure, and creation or addition of impervious surfaces. Replacement of impervious surfaces includes any activity that is not part of a routine maintenance activity where impervious material(s) are removed, exposing underlying soil during construction. Redevelopment does not include trenching and resurfacing associated with utility work; resurfacing and reconfiguring surface parking lots and existing roadways; new sidewalk construction, pedestrian ramps, or bikelane on existing roads; and routine replacement of damaged pavement, such as pothole repair.
Rational Method	A method of calculating runoff flows based on rainfall intensity, tributary area, and a factor representing the proportion of rainfall that runs off.
Regional (or Watershed) Stormwater Treatment Facility	A facility that treats runoff from more than one project or parcel.
Regional Water Quality Control Board (Regional Water Board or RWQCB)	California RWQCBs are responsible for implementing pollution control provisions of the Clean Water Act and California Water Code within their jurisdiction. There are nine California RWQCBs.
Retention	The practice of holding stormwater in ponds or basins, or within berms or depressed areas, and allowing it to slowly infiltrate into underlying soils. Some portion will evaporate. See definitions for infiltration and detention.
Self-retaining area	An area designed to retain runoff. Self-retaining areas may include graded depressions with landscaping or pervious pavements and may also include tributary impervious areas up to a 2:1 impervious-to-pervious ratio.
Self-treating area	A natural, landscaped, or turf area drains directly off site or to the public storm drain system.
Source Control	Land use or site planning practices, or structural or nonstructural measures that aim to prevent urban runoff pollution by reducing the potential for contamination at the source of pollution. Source control BMPs minimize the contact between pollutants and urban runoff.
Standard Industrial Classification (SIC)	A Federal government system for classifying industries by 4-digit code. It is being supplanted by the North American Industrial Classification System but SIC codes are still referenced by the Regional Water Board in identifying development sites subject to regulation under the NPDES permit. Information and an SIC search function are available at http://www.bls.gov/bls/NAICS.htm.
Stormwater NPDES Permit	A permit issued by a Regional Water Quality Control Board (see definition) to local government agencies (Dischargers) placing provisions on allowable discharges of municipal stormwater to waters of the state.
Storm Water Pollution Prevention Plan (SWPPP)	A plan providing for temporary measures to control sediment and other pollutants during construction as required by the statewide stormwater NPDES permit for construction activities.

Stormwater Pollution Prevention Program	A comprehensive program of activities designed to minimize the quantity of pollutants entering storm drains. See Jurisdictional Urban Runoff Management Plan.
Standard Urban Stormwater Mitigation Plan (SUSMP)	Refers to various documents prepared in connection with implementation of the stormwater NPDES permit mandate to control pollutants from new development and redevelopment. Each discharger will adapt this model countywide SUSMP to create a local SUSMP for their respective jurisdiction. Applicants for development project approvals will use the local SUSMP to prepare a submittal for each Priority Development Project they propose.
Treatment	Removal of pollutants from runoff, typically by filtration or settling.
Water Board	See Regional Water Quality Control Board.
Water Quality Volume (WQV)	For stormwater treatment facilities 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.

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Start

How to Use the Standard Urban Stormwater Mitigation Plan

Review Chapters 1 and 2 to get a general understanding of the requirements. Then follow step-by-step instructions in Chapter 3 to prepare the SUSMP project submittal.

THIS *Standard Urban Stormwater Mitigation Plan* (SUSMP) will help ensure that your project complies with requirements established by the San Diego Regional Water Quality Control Board (San Diego RWQCB). Most applicants will require the assistance of a qualified civil engineer, architect, and/or landscape architect. Because every project is different, begin by checking specific requirements with City of Escondido (City) staff. **It is important to note that projects that disturb 1 acre or more must also comply with the Construction General Permit (Order 2009-0009-DWQ), which sets forth requirements for construction activities and includes preparation of a** storm water pollution prevention plan (SWPPP) **to provide for temporary measures to control sediment and other pollutants during construction. The SUSMP project submittal, as described herein, is a separate document from the project's SWPPP. The Construction General Permit can be found at the State Water Resources Control Board web site at http://www.swrcb.ca.gov/water_issues/programs/stormwater/construction.shtml. For more information on SWPPPs, refer to the Construction Handbook (subscription only) at http://www.cabmphandbooks.org.**

To use this SUSMP, first review **Chapter 1**, "Policies and Procedures," to find out whether and how stormwater quality requirements apply to your project. Chapter 1 also provides an overview of the process of planning, design, construction, operation, and maintenance leading to compliance.

For explanations of any puzzling terms and issues, review **Chapter 2**, "Concepts and Criteria." Chapter 2 provides background on key stormwater concepts and water quality regulations, including design criteria. Terms in bold are defined in the glossary.

Then proceed to **Chapter 3**, "Preparing the Standard Urban Stormwater Management Plan Project Submittal," and follow the step-by-step guidance to prepare a SUSMP project submittal for your site.

Chapter 4, "Low Impact Development Design Guide," includes design procedures, calculation procedures, and instructions for presenting designs and calculations in a SUSMP project submittal.

Chapter 5, "Operation and Maintenance of Stormwater Facilities," describes in detail the process for ensuring operation and maintenance of stormwater facilities over the life of the project. The chapter includes step-by-step instructions for preparing a stormwater facilities operation and maintenance plan.

Throughout each chapter, references and resources are listed to help you understand the regulations, complete a SUSMP project submittal, and design stormwater control measures for your project.

► PLAN AHEAD TO AVOID THE THREE MOST COMMON MISTAKES

The following are the most common (and costly) errors made by applicants for development approvals with respect to stormwater quality compliance:

1. Not planning for compliance early enough. Think about a strategy for stormwater quality compliance before completing a conceptual site design or sketching a layout of subdivision lots (Chapter 3).

2. Assuming that proprietary stormwater treatment facilities are adequate for compliance; most are not (Chapter 2).

3. Not planning for periodic inspections and maintenance of treatment and flow control facilities. Consider who will own and who will maintain the facilities in perpetuity and how they will obtain access, and identify which arrangements are acceptable to the City (Chapter 5).

Chapter

1

Policies and Procedures

Determining whether a development project must comply with stormwater quality requirements, and the steps to compliance.

A Low Impact Development Design Procedure

The San Diego RWQCB reissued a municipal stormwater permit to the City of Escondido in January 2007 (i.e., Order R9-2007-0001, hereafter called the "Stormwater Permit"). The permit updates and expands stormwater requirements for new development and redevelopment projects. Stormwater treatment requirements have been made more stringent, minimum standards for Low Impact Development (LID) have been added, and the City is required to develop and implement criteria controlling the peaks and duration of runoff from development sites.

To assist the land development community, streamline project reviews, and maximize cost-effective environmental benefits, a unified LID design procedure has been developed, as detailed in Chapter 4. This design procedure integrates site planning and design measures with engineered, small-scale integrated management practices (IMPs) such as bioretention. By following the procedure, applicants can develop a single integrated design that complies with the Stormwater Permit's requirements for LID, stormwater treatment, and flow control (hydromodification management).

Applicants may choose not to use this design procedure. In this case they must demonstrate in their submittal the project's compliance with applicable criteria for LID, stormwater treatment, and flow control. These criteria are described in Chapter 2 and in the Stormwater Permit.

Requirements for All Development Projects

All development projects must include control measures to reduce the discharge of stormwater pollutants to the maximum extent practicable. In general, all development projects must include:

- implementation of source-control best management practices (BMPs) as listed in Appendix A;
- inclusion of some LID features that conserve natural features, set back development from natural water bodies, minimize imperviousness, maximize infiltration, and retain and slow runoff; and
- compliance with requirements for construction-phase controls on sediment and other pollutants for all phases of construction. In addition, an emergency cash clean-up deposit will be collected for all projects.

The City may also require additional controls appropriate to the project, which may include stormwater treatment controls. LID treatment controls such as infiltration or bioretention are preferred. See "Selection of Stormwater Treatment Facilities" on page 18. If treatment facilities are included, provisions must be made to ensure their long-term maintenance.

Priority Development Projects

The National Pollutant Discharge Elimination System (NPDES) permit requires that more specific runoff treatment controls be incorporated into priority development projects (i.e., Table 1-1).

► NEW DEVELOPMENT

Projects on previously undeveloped land are priority development projects if they are in one or more of the categories listed in Table 1-1. If a project feature such as a parking lot falls into a priority development project category, then the entire project footprint is subject to the requirements for priority development projects. To use the table, review definitions A–I. If any of the definitions match, the project is a priority development project. Note that some thresholds are defined by square footage of impervious surface created, others by the total area of the development.

► PREVIOUSLY DEVELOPED SITES

Projects on previously developed sites ("redevelopment projects") are priority development projects if they would create, add, or replace 5,000 square feet or more of impervious surface and are in one of the categories listed in Table 1-1.

► POLLUTANT-GENERATING PROJECTS THAT DISTURB 1 ACRE OR MORE OF LAND

Projects that generate pollutants at levels greater than background levels and disturb 1 acre or more of land are considered priority development projects. In most cases linear pathway projects that are for infrequent vehicle use (such as emergency or maintenance access) or for pedestrian or bicycle use are not considered pollutant generating above background levels if they are built with pervious surfaces or if they allow runoff to sheet flow to surrounding pervious surfaces.

Table 1-1. Priority Development/SUSMP Projects

Is the project in any of these categories?

Yes ❑	No ❑	A	**Housing subdivisions of 10 or more dwelling units.** Examples: Single-family homes, multifamily homes, condominiums, and apartments.
Yes ❑	No ❑	B	**Pollutant-generating projects that disturb 1 acre or more of land.** Projects that generate pollutants at levels greater than background levels and disturb 1 acre or more of land are considered priority development projects. In most cases linear pathway projects that are for infrequent vehicle use (such as emergency or maintenance access) or for pedestrian or bicycle use are not considered pollutant generating above background levels if they are built with pervious surfaces, or if they allow runoff to sheet flow to surrounding pervious surfaces.
Yes ❑	No ❑	C	**Automotive repair shop.** A facility categorized in any one of Standard Industrial Classification (SIC) codes 5013, 5014, 5541, 7532–7534, or 7536–7539.
Yes ❑	No ❑	D	**Restaurant.** Any facility that sells prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption (SIC code 5812), where the land area for development is greater than 5,000 square feet. Restaurants where land development is less than 5,000 square feet shall meet all SUSMP requirements except the requirements for structural treatment best management practices and numeric sizing criteria and hydromodification.
Yes ❑	No ❑	E	**Hillside development greater than 5,000 square feet.** Any development that would create 5,000 square feet of impervious surface and is located in an area with known erosive soil conditions, where the development would grade on any natural slope that is 25% or greater.
Yes ❑	No ❑	F	**Environmentally sensitive areas.** All development located within or directly adjacent to, or discharging directly to, an environmentally sensitive area (ESA) (where discharges from the development or redevelopment would enter receiving waters within the ESA) that would either create 2,500 square feet of impervious surface on a proposed project site or increase the area of imperviousness of a proposed project site to 10% or more of its naturally occurring condition. "Directly adjacent" means situated within 200 feet of the ESA. "Discharging directly to" means outflow from a drainage conveyance system that is composed entirely of flows from the subject development or redevelopment site, and not commingled with flows from adjacent lands.
Yes ❑	No ❑	G	**Parking lots 5,000 square feet or more** or with 15 or more parking spaces and potentially exposed to urban runoff.
Yes ❑	No ❑	I	**Retail gasoline outlets** that (a) are 5,000 square feet or larger or (b) support projected average daily traffic of 100 or more vehicles per day.
Yes ❑	No ❑	H	**Streets, roads, highways, and freeways.** Any paved surface that is 5,000 square feet or greater used to transport automobiles, trucks, motorcycles, and other vehicles.

► THE "50% RULE" FOR PREVIOUSLY DEVELOPED PROJECTS

Projects on previously developed sites may also need to retrofit drainage of all impervious areas of the entire site. The following requirements apply to sites creating or replacing more than 5,000 square feet of impervious area:

- If the new project would result in an increase of, or the replacement of, 50% or more of the previously existing impervious surface, and the existing development was not subject to SUSMP requirements, then the entire project must be included in the treatment measure design.
- If less than 50% of the previously impervious surface would be affected, only that portion must be included in the treatment measure design.

If a new development project feature such as a parking lot falls into a priority development project category, then the entire project footprint is subject to SUSMP requirements.

Projects are not subject to treatment requirements if they are limited to interior remodels; routine maintenance or repair; replacement of roofs or exterior surfaces; resurfacing and reconfiguring of surface parking lots and existing roadways; construction of new sidewalks, pedestrian ramps, or bike lanes on existing roads; and routine replacement of damaged pavement, such as pothole repair. However, other requirements, including incorporation of appropriate source controls, still apply.

Compliance Process at a Glance

Applicants for development project approval must follow these general steps for stormwater compliance:

1. Discuss requirements during a preapplication meeting with City staff.
2. Review the instructions in this SUSMP before preparing the project's tentative map, preliminary site plan, drainage plan, and landscaping plan.
3. Prepare the SUSMP project submittal with the application for development approvals (entitlements). The SUSMP project submittal consists of the project's Water Quality Technical Report (WQTR) and project drawings.
4. Create the detailed project design, incorporating the features described in the SUSMP project submittal.
5. In a table on the project construction plans, list each stormwater compliance feature and facility and the plan sheet where it appears.
6. Prepare a draft stormwater facility operation and maintenance plan and submit it as part of the project WQTR.

7. Maintain stormwater facilities during and after construction in accordance with required warranties.

8. After construction, formally transfer responsibility for maintenance to the owner.

9. Periodically verify that stormwater facilities are properly maintained and must provide the City with maintenance records annually.

Preparation of a complete and detailed SUSMP project submittal is the key to cost-effective stormwater compliance and expeditious review of a project. Instructions for preparing the SUSMP project submittal are in Chapter 3.

Phased Projects

When determining whether SUSMP requirements apply, a project should be defined consistent with California Environmental Quality Act (CEQA) definitions of "project." That is, the project is the whole of an action that has the potential to add or replace or to result in the addition or replacement of roofs, pavement, or other impervious surfaces, thereby resulting in increased flows and stormwater pollutants. "Whole of an action" means that the project may not be segmented or piecemealed into small parts if the effect is to reduce the quantity of impervious area for any part to below the SUSMP thresholds.

City staff may request, as part of an application for approval of a phased development project, a conceptual or master SUSMP project submittal that describes and illustrates, in broad outline, how the project's drainage will comply with the SUSMP requirements. The level of detail in the conceptual or master SUSMP project submittal should be consistent with the scope and level of detail of the development approval being considered. The conceptual or master SUSMP project submittal should specify that a more detailed SUSMP project submittal for each later phase or portion of the project will be submitted with subsequent applications for discretionary actions.

New Subdivisions

If approval of a tentative map would potentially entitle future owners to construct new or replace impervious area that, in aggregate, could exceed one of the SUSMP thresholds (Table 1-1), then the applicant must take steps to ensure that SUSMP requirements can and will be implemented as the subdivision is built out.

If the tentative-map application does not include plans for site improvements, the applicant should nevertheless identify the type, size, location, and final ownership of stormwater treatment and flow control facilities adequate to serve common private roadways and any other common areas, and to manage runoff from an expected reasonable estimate of the square footage of future roofs, driveways, and other impervious surfaces on each individual lot. The City may condition approval of the map on implementation of stormwater treatment and other SUSMP measures when construction occurs on the individual lots. At the City's discretion, this condition may be enforced by a grant deed of development rights or by a development agreement.

The future impervious area of one or more lots may be limited by a deed restriction, if the City deems it necessary. This might be the case when a project is exempted from one or all SUSMP provisions because the total impervious area is below a threshold, or to ensure that runoff from impervious areas added after project approval does not overload a stormwater treatment and flow control facility.

The City may require subdivision maps to dedicate an open space easement, as defined by California Government Code Section 51075, to suitably restrict the future building of structures at each stormwater facility location if necessary.

In general, in new subdivisions stormwater treatment, infiltration, or flow control facilities should not be located on individual single-family residential lots, particularly when those facilities manage runoff from other lots, streets, or common areas. A better alternative is to locate stormwater facilities on one or more separate, jointly owned parcels.

After consulting with City staff, applicants for subdivision approvals must propose one of the following four options, depending on project characteristics and City policies:

1. Show that the number of parcels and the total impervious area to be created on all parcels could not, in the future, exceed any of the thresholds in Table 1-1.
2. Show that, for each and every lot, the intended use can be achieved with a design that disperses runoff from roofs, driveways, streets, and other impervious areas to self-retaining pervious areas, using the criteria in Chapter 4.
3. Prepare improvement plans showing drainage to treatment and/or flow control facilities designed in accordance with this SUSMP, and commit to constructing the facilities before transferring the lots.
4. Prepare improvement plans showing drainage to treatment and/or flow control facilities designed in accordance with this SUSMP, and provide appropriate legal instruments to ensure that the proposed facilities will be constructed and maintained by subsequent owners.

For the option selected, City staff will determine the appropriate conditions of approval, easements, deed restrictions, or other legal instruments necessary to assure future compliance.

Compliance with Flow Control Requirements

Priority development projects (Section 6.1 of Appendix B) must be designed so that runoff rates and durations are controlled to maintain or reduce preproject downstream erosion conditions and protect stream habitat.

► HMP APPLICABILITY REQUIREMENTS

To determine if a proposed project must implement hydromodification controls, refer to the HMP Decision Matrix in Figure 6-1 of the HMP (Appendix B).

The HMP Decision Matrix can be used for all projects. For redevelopment projects, flow controls would only be required if the redevelopment project increases impervious area or peak flow rates as compared to preproject conditions.

It should be noted that all Priority Development Projects will be subject to the Permit's LID and water quality treatment requirements even if hydromodification flow controls are not required.

As noted in Figure 6-1, projects may be exempt from HMP criteria under the following conditions.

- If the project is not a Priority Development Project.
- If the proposed project does not increase the impervious area or peak flows to any discharge location.
- If the proposed project discharges runoff directly to an exempt receiving water such as the Pacific Ocean, San Diego Bay, an exempt river reach, an exempt reservoir, or a tidally influenced area.
- If the proposed project discharges to a stabilized conveyance system that extends to the Pacific Ocean, San Diego Bay, a tidally influenced area, an exempt river reach or reservoir.
- If the contributing watershed area to which the project discharges has an impervious area percentage greater than 70%.
- If an urban infill project discharges to an existing hardened or rehabilitated conveyance system that extends beyond the "domain of analysis," the potential for cumulative impacts in the watershed are low, and the ultimate receiving channel has a low susceptibility to erosion as defined in the SCCWRP channel assessment tool.

If the proposed project decreases the preproject impervious area and peak flows to each discharge location, then a flow-duration analysis is implicitly not required. If continuous simulation flow-frequency and flow duration curves were developed for such a scenario, the unmitigated postproject flows and durations would be less as compared to preproject curves.

The Municipal Permit also contains language to support exemptions for projects located in highly urbanized areas defined as an existing, preproject impervious percentage greater than 70% (as calculated for the sub-watershed between the project outfall downstream to the exempt receiving water). For further detail on exemptions, please refer to the HMP, Section 6.1.

► FLOW CONTROL PERFORMANCE CRITERIA

Figures 6-2 and 6-3 of the HMP (Appendix B) are also part of the HMP Decision Matrix, and detail how lower flow thresholds would be determined for a project site. Figures 6-4 and 6-5 of the HMP, which detail the SCCWRP lateral and vertical channel susceptibility requirements, complete the HMP Decision Matrix.

For further detail on flow control performance criteria, channel screening tools and related project applicant requirements, please refer to Section 6.2 of the HMP.

The HMP recommends the use of LID facilities to satisfy both 85th percentile water quality treatment as well as HMP flow control criteria. Detailed LID standards are outlined in Chapter 4 of this SUSMP. Hydromodification flow control criteria are detailed in Section 6.2 of the HMP. The following methods may be used to meet mitigation requirements.

- Install BMPs that meet design requirements to control runoff from new impervious areas. BMPs including bioretention basins, vegetated swales, planter boxes, extended detention basins, etc. shall be designed pursuant to standard sizing and specification criteria detailed in the SUSMP and the HMP Sizing Calculator to ensure compliance with hydromodification criteria.

- Use of the automated HMP Sizing Calculator that will allow project applicants to select and size LID treatment devices or flow control basins. The tool, akin to the sizing calculator developed for compliance with the Contra Costa HMP, uses pre-calculated sizing factors to determine required footprint sizes for flow control BMPs. The HMP Sizing Calculator also includes an automated pond sizing tool to assist in the design of extended detention facilities for mitigation of hydromodification effects. Because of the HMP Sizing Calculator's ease of implementation, and since hydromodification BMPs can also serve as treatment BMPs, it is anticipated that most project applicants will choose this option instead of seeking compliance through site-specific continuous simulation model preparation.

- Prepare continuous simulation hydrologic models and compare the preproject and mitigated postproject runoff peaks and durations (with hydromodification flow controls) until compliance to flow control standards can be demonstrated. The project applicant will be required to quantify the long-term pre- and postproject runoff response from the site and establish runoff routing and stage-storage-discharge relationships for the planned flow control devices. Public domain software such as HSPF, HEC-HMS and SWMM can be used for preparation of a continuous simulation hydrologic analysis.

Grandfathering. Projects with prior lawful approval (such as a development agreement, vested tentative map, or a building or grading permit) that started construction before January 14, 2011 may not have to meet the hydromodification management requirements. Verify with City staff whether this applies to your project.

Waivers from Numeric Sizing Criteria

The Stormwater Permit allows for a project to be waived from numeric sizing criteria for stormwater treatment only if all available treatment facilities have been considered and found infeasible. If a project is waived from these requirements, City staff will inform the San Diego RWQCB within 5 days of granting the waiver. Other SUSMP requirements—including site designs to minimize imperviousness and source control BMPs—will still apply.

Experience has shown that implementation of LID facilities, as described in Chapter 4, is feasible on nearly all development sites. However, using LID to retrofit existing drainage systems, to manage runoff from sites smaller than 1 acre in pedestrian-oriented developments, or to manage runoff from widened portions of roadways sometimes presents special challenges. In these special situations, see "Selection of Stormwater Treatment Facilities" on page 18 and evaluate the options described there in order (depending on the specific characteristics of the project and as determined by City staff). All the options listed meet the numeric sizing criteria in the Stormwater Permit.

If infeasibility of all these options can be established, City staff may determine the project's eligibility for a waiver.

References and Resources

- San Diego RWQCB Order R9-2007-0001 (Stormwater Permit) (San Diego RWQCB 2007)
- Project Clean Water web page (www.projectcleanwater.org)

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Chapter

2

Concepts and Criteria

Technical background and explanations of policies and design requirements.

The Stormwater Permit mandates a comprehensive program to prevent stormwater pollution. This program now includes street sweeping, maintenance of storm drains, business inspections, public outreach, construction site inspections, monitoring and studies of stream and ocean health, and control of runoff pollutants from new development and redevelopment projects.

Stormwater Permit Provision D.1.d requires the City to regulate projects in specific categories (Table 1-1) to reduce discharges of pollutants to the maximum extent practicable and prevent runoff discharges from causing or contributing to a violation of water quality standards. The LID design procedure (Chapter 4) serves to ensure a consistent and thorough implementation of the San Diego RWQCB's requirements. This chapter explains the technical background of the LID approach and how it was derived.

The previous permit, issued in 2001, included a requirement to control postdevelopment peak stormwater runoff rates and velocities, to maintain or reduce downstream erosion relative to predevelopment levels, and to protect stream habitat. The 2007 Stormwater Permit added a new requirement to develop an HMP identifying and defining a methodology and performance criteria, to ensure that flow rates and duration do not exceed preproject runoff where increased runoff could cause erosion or other significant adverse impacts on beneficial uses.

As required by the Stormwater Permit, the City adopted final hydromodification criteria. See Chapter 1.

Water Quality Regulations

Stormwater Permit Provision D.1 requires applicable new development and redevelopment projects to take the following steps:

- Design the site to conserve natural areas, existing trees, and vegetation and soils to maintain natural drainage patterns, minimize imperviousness, detain runoff, and infiltrate runoff where feasible.
- Cover or control sources of stormwater pollutants.
- Treat runoff before discharge. Stormwater Permit Provision E.10 states: "Urban runoff treatment and/or mitigation must occur prior to the discharge of urban runoff to receiving waters." Federal regulations (40 Code of Federal Regulations [CFR] 131.10[a]) state that "in no case shall a state adopt waste transport or waste assimilation as a designated use for any waters of the U.S."
- Ensure that runoff does not exceed preproject peaks and duration where increases could affect downstream habitat or other beneficial uses.
- Maintain treatment and flow control facilities.

► MAXIMUM EXTENT PRACTICABLE

Clean Water Act Section 402(p)(3)(iii) sets the standard for stormwater controls as "maximum extent practicable," but does not define that term. As implemented, "maximum extent practicable" is ever-changing and varies with conditions.

Many stormwater controls, including LID facilities, have proven to be practicable in most site development projects. To achieve fair and effective implementation, criteria, and guidance, requirements for controls must be detailed and specific, while also offering the right amount of flexibility or exceptions for special cases. The Stormwater Permit includes various standards, including hydrologic criteria, that have been found to constitute the "maximum extent practicable."

► BEST MANAGEMENT PRACTICES

Clean Water Act Section 402(p) and U.S. Environmental Protection Agency regulations (40 CFR 122.26) specify a municipal program of "management practices" to control stormwater pollutants. A BMP refers to any kind of procedure, activity, or device designed to minimize the quantity of pollutants that enter the storm drain system. BMPs are typically used in place of assigning numeric effluent limits. The criteria for source control BMPs and treatment and flow control facilities are crafted to fulfill the "maximum extent practicable."

Within the context of this SUSMP, facilities, features, or controls to be incorporated into development projects are considered BMPs.

Pollutants of Concern

Applicants must identify pollutants of concern and select BMPs and facilities as described below.

► GROUPING OF POTENTIAL POLLUTANTS OF CONCERN

Urban runoff from a developed site has the potential to contribute pollutants (oil and grease, suspended solids, metals, gasoline, pesticides, and pathogens) to the stormwater conveyance system and receiving waters. For the purposes of identifying pollutants of concern and associated stormwater BMPs, pollutants are grouped into nine general categories as follows:

- **Sediments** are soils or other surficial materials eroded and then transported or deposited by the action of wind, water, ice, or gravity. Sediments can increase turbidity, clog fish gills, reduce spawning habitat, lower the survival rates of young aquatic organisms, smother bottom-dwelling organisms, and suppress growth of aquatic vegetation.

- **Nutrients** are inorganic substances, such as nitrogen and phosphorus. They commonly exist in the form of mineral salts that are either dissolved or suspended in water. Primary sources of nutrients in urban runoff are fertilizers and eroded soils. Excessive discharge of nutrients to water bodies and streams can cause excessive growth of aquatic algae and plants. Such excessive production, referred to as cultural eutrophication, may lead to excessive decay of organic matter in the water body, loss of oxygen in the water, release of toxins in sediment, and the eventual death of aquatic organisms.

- **Metals** are raw material components in nonmetal products such as fuels, adhesives, paints, and other coatings. Primary sources of metal pollution in stormwater are typically commercially available metals and metal products. Metals of concern include cadmium, chromium, copper, lead, mercury, and zinc. Lead and chromium have been used as corrosion inhibitors in primer coatings and cooling-tower systems. At low concentrations naturally occurring in soil, metals are not toxic. However, at higher concentrations, certain metals can be toxic to aquatic life. Humans can be affected by contaminated groundwater resources and the bioaccumulation of metals in fish and shellfish. Environmental concerns regarding the potential for release of metals to the environment have already led to restricted usage of metals in certain applications.

- **Organic compounds** are carbon-based. Commercially available or naturally occurring organic compounds are found in pesticides, solvents, and hydrocarbons. At certain concentrations, organic compounds can indirectly or directly constitute a hazard to life or health. When objects are rinsed off, toxic levels of solvents and cleaning compounds can be discharged to storm drains. Dirt, grease, and grime retained in the cleaning fluid or rinse water may also adsorb levels of organic compounds that are harmful or hazardous to aquatic life.

- Trash (such as paper, plastic, polystyrene packing foam, and aluminum materials) and biodegradable organic matter (such as leaves, grass cuttings, and food waste) are general waste products on the landscape. The presence of trash and debris may have a substantial effect on the recreational value of a water body and aquatic habitat. Excess organic matter can create high biochemical oxygen demand in a stream, thereby lowering its water quality. Also, in areas where stagnant water exists, the presence of excess organic matter can promote septic conditions, resulting in the growth of undesirable organisms and the release of odorous and hazardous compounds such as hydrogen sulfide.
- Oxygen-demanding substances include biodegradable organic material as well as chemicals that react with dissolved oxygen in water to form other compounds. Proteins, carbohydrates, and fats are examples of biodegradable organic compounds. Compounds such as ammonia and hydrogen sulfide are examples of oxygen-demanding compounds. The oxygen demand of a substance can lead to depletion of dissolved oxygen in a water body and possibly the development of septic conditions.
- Primary sources of oil and grease are petroleum hydrocarbon products, motor products from leaking vehicles, esters, oils, fats, waxes, and high-molecular-weight fatty acids. These pollutants can easily be introduced to the water bodies because of the wide uses and applications of some of these products in municipal, residential, commercial, industrial, and construction areas. Elevated oil and grease content can decrease the aesthetic value of the water body, as well as the water quality.
- Bacteria and viruses are ubiquitous microorganisms that thrive under certain environmental conditions. Their proliferation is typically caused by the transport of animal or human fecal wastes from the watershed. Excessive bacteria and viruses in water can alter the aquatic habitat and create a harmful environment for humans and aquatic life. Also, the decomposition of excess organic waste causes increased growth of undesirable organisms in the water.
- Pesticides (including herbicides) are chemical compounds commonly used to control nuisance growth or prevalence of organisms. Excessive application of a pesticide may result in runoff containing toxic levels of its active component.

► IDENTIFYING POLLUTANTS OF CONCERN BASED ON LAND USES

Refer to Table 2-1 to identify which pollutant categories of priority development projects apply to your project. Pollutants associated with any hazardous materials sites that have been remediated or are not threatened by the proposed project are not considered pollutants of concern.

Table 2-1. Anticipated and Potential Pollutants Generated by Land Use Type

Priority Project Categories	General Pollutant Categories								
	Sediment	Nutrients	Heavy Metals	Organic Compounds	Trash and Debris	Oxygen Demanding Substances	Oil and Grease	Bacteria and Viruses	Pesticides
Detached Residential Development	X	X			X	X	X	X	X
Attached Residential Development	X	X			X	P[1]	P[2]	P	X
Commercial Development Greater than 1 Acre	P[1]	P[1]	X	P[2]	X	P[3]	X	P[4]	P[3]
Heavy Industry	X		X	X	X	X	X		
Automotive Repair Shops			X	X[3, 5]	X		X		
Restaurants					X	X	X	X	P[1]
Hillside Development Greater than 5,000 Square Feet	X	X			X	X	X		X
Parking Lots	P[1]	P[1]	X		X	P[1]	X		P[1]
Retail Gasoline Outlets			X	X	X	X	X		
Streets, Highways, and Freeways	X	P[1]	X	X[5]	X	P[3]	X	X	P[1]

Notes:
X = anticipated
P = potential
[1] A potential pollutant if landscaping exists on-site.
[2] A potential pollutant if the project includes uncovered parking areas.
[3] Including solvents.
[4] A potential pollutant if land use involves food or animal waste products.
[5] Including petroleum hydrocarbons.

► WATERSHEDS WITH SPECIAL POLLUTANT CONCERNS

Local receiving water conditions may require specialized attention if they are 303(d)-listed waters and waters with established total maximum daily loads (TMDLs). The following receiving waters in Escondido currently require special pollutant protection because they are listed on the 303(d) list:

- Escondido Creek
- Reidy Canyon Creek
- San Marcos Creek
- Felicita Creek
- Lake Hodges
- Kit Carson Creek

The State Water Resources Control Board identifies receiving waters as impaired for constituents or water quality effects pursuant to Section 303(d) of the Clean Water Act. Placement of a surface water onto the list requires the San Diego RWQCB to analyze the impairment and develop TMDLs for addressing the impairment. The 303(d) listing in itself does not demand that a project applicant select BMPs on the basis of the impairment; however, the project applicant should be cognizant of the impairment and the future implications that a TMDL might have on the proposed land use.

Once a TMDL is established, it may impose conditions on development through either an implementation plan and schedule for the listed water, or special conditions required of the municipality affected by the TMDL's numeric sizing criteria. At this time, several 303(d) listings in San Diego County are at various stages of TMDL development, with only four TMDLs having been adopted by the San Diego RWQCB. However, the ongoing development of TMDLs will likely impose conditions on development occurring within Escondido and will be evaluated accordingly. The project applicant should meet with City staff to determine whether any project characteristics or watershed characteristics affect selection and design of BMPs. Except in rare circumstances, using the LID design guide (Chapter 4) and the Pollutant Sources and Source Control Checklist (Appendix A) will ensure that the proposed project would comply with all stormwater requirements.

Selection of Permanent Source Control BMPs

Based on identification of potential pollutants of concern associated with various types of facilities, the Pollutant Sources and Source Control Checklist (Appendix A) lists "maximum extent practicable" source controls associated with each facility type to ensure that appropriate BMPs are applied to potential sources of each pollutant of concern.

Selection of Stormwater Treatment Facilities

Table 2-2 generally compares the performances of various types of treatment facilities for each group of pollutants. This table should be used to select the appropriate BMP for the pollutant of concern at the project site, particularly for environmentally sensitive areas or sites adjacent to 303(d)-listed water bodies.

Table 2-2. Groups of Pollutants and Relative Effectiveness of Treatment Facilities

Pollutant of Concern	Bioretention Facilities (Low Impact Development)	Settling Basins (Dry Ponds)	Wet Ponds and Constructed Wetlands	Infiltration Facilities or Practices (Low Impact Development)	Media Filters	Higher-Rate Biofilters*	Higher-Rate Media Filters*	Trash Racks and Hydrodynamic Devices
Coarse Sediment and Trash	High	High	High	High	High	High	High	High
Pollutants that Tend To Associate w/ Fine Particles during Treatment	High	High	High	High	High	Medium	Medium	Low
Pollutants that Tend to Be Dissolved after Treatment	Medium	Low	Medium	High	Low	Low	Low	Low

*See page 19 for a discussion of selection of stormwater treatment facilities in special situations.

The following types of facilities are generally appropriate for treatment of runoff and hydromodification flow control from all land uses in Escondido watersheds, except where site-specific constraints make them infeasible:

- infiltration facilities or practices, including dry wells, infiltration trenches, infiltration basins, and other facilities that infiltrate runoff to native soils (sized to detain and infiltrate a volume equivalent to the 85th percentile 24-hour event water quality runoff event – greater capacity required to provide hydromodification flow control);
- bioretention facilities and media filters that detain stormwater and filter it slowly through soil or sand (sized with a surface area at least 0.04 times the effectively impervious tributary area for water quality treatment – a larger sizing factor is required to provide hydromodification flow control); and
- extended detention basins, wet ponds, and wetlands or other facilities using settling (sized to detain a volume equivalent to runoff from the tributary area generated by the 85th percentile 24-hour event water quality runoff even – greater capacity required to provide hydromodification flow control).

The recommended design procedure in Chapter 4 integrates LID practices (optimizing the site design, using pervious surfaces, and dispersing runoff to adjacent pervious areas) with the use of infiltration facilities, detention basins, and bioretention facilities to meet the Stormwater Permit's requirements for LID, treatment, and flow control in a cost-effective, unified design.

Oil/water separators ("water quality inlets"), storm drain inlet filters, and hydrodynamic separators, including vortex separators and continuous deflection separators ("CDS units"), are less effective means of stormwater treatment, although they may be used in series with more effective facilities.

Underground vaults typically lack the detention time required for settling of fine particles associated with stormwater pollutants. They also require frequent maintenance and may retain stagnant water, potentially providing harborage for mosquitoes. Because vaults may be "out of sight, out of mind," experience shows that the required maintenance may not occur.

Lack of space, in itself, is not a suitable justification for using a less-effective treatment on a development site, because the uses of the site and the site design can be altered as needed to accommodate bioretention facilities or planter boxes. In most cases, these effective facilities can be fit into required landscaping setbacks, easements, or other unbuildable areas.

Where possible, drainage to inlets, and drainage away from overflows and underdrains, should be by gravity. Where site topography makes it infeasible to accommodate gravity-fed facilities in the project design, the design flow may be captured in a vault or sump and pumped via force main to an effective facility.

The following situations sometimes present special challenges:

- portions of sites that are not being developed or redeveloped, but that must be retrofitted to meet treatment requirements in accordance with Stormwater Permit Provision D.1.d(1)(a), which states in part: "Where redevelopment results in an increase of, or replacement of, more than 50% of the impervious surface of a previously existing development, the numeric sizing criteria applies to the entire development"; and
- roadway widening projects.

In these special situations, the following types of facilities should each be evaluated in priority order (depending on the specific characteristics of the site and as determined by the City's stormwater coordinator) until a feasible design is found:

1. Bioretention areas or planter boxes fed by gravity.
2. Capture of the design flow in a vault or sump and pumping to bioretention areas or planter boxes.
3. A subsurface sand or media filter with a maximum design surface loading rate of 5 inches per hour and a minimum media depth of 18 inches. The sand surface must be made accessible for periodic inspection and maintenance (for example, via a removable grating).
4. A higher-rate biofilter, such as a tree-pit-style unit. The grading and drainage design should minimize the area draining to each unit and maximize the number of discrete drainage areas and units.
5. A higher-rate vault-based filtration unit (for example, vaults with replaceable cartridge filters filled with inorganic media).

Many proprietary stormwater treatment devices are currently marketed, and new brands will be introduced. Applicants and applicants' engineers and design professionals should review with City staff any proposals to use proprietary devices for stormwater treatment before commencing work on preliminary site layout, drainage plans, grading plans, or landscape plans.

Hydrology for National Pollutant Discharge Elimination System Compliance

► IMPERVIOUSNESS

Imperviousness has long been understood as the key variable in effectively controlling changes in urban hydrology. Peak runoff flow and total runoff volume from small urban catchments is usually calculated as a function of the ratio of impervious area to total area (the Rational Method). The ratio correlates to the runoff factor, usually designated "C." Increased flows resulting from urban development tend to increase the frequency of small-scale flooding downstream.

Imperviousness links urban land development to degradation of aquatic ecosystems in two ways:

1. The combination of paved surfaces and piped runoff collects urban pollutants and transports them (in suspended or dissolved form) to surface waters.

2. Increased peak flows and runoff duration from paved or hardscape surfaces can cause erosion of streambanks and beds, transport of fine sediments, and disruption of aquatic habitat.

Imperviousness has two major components: rooftops and transportation networks (including streets, highways, and parking areas). The transportation component is usually larger and is more likely to be directly connected to the storm drain system.

The effects of imperviousness can be mitigated by disconnecting impervious areas from the drainage system and by encouraging detention and retention of runoff near the point where it is generated. Detention and retention reduce peak flows and volumes and allow pollutants to settle out or adhere to soils before they can be transported downstream.

► LOW IMPACT DEVELOPMENT REQUIREMENTS

The Stormwater Permit requires that LID be used on all projects to minimize directly connected impervious area and promote infiltration. The following are the minimum standards for priority development projects:

- Drain a portion of impervious areas into pervious areas, if any.

- Design and construct pervious areas, if any, to effectively receive and infiltrate runoff from impervious areas, taking into account soil conditions, slope, and other pertinent factors.

- Construct a portion of paved areas with low traffic and appropriate soil conditions with permeable surfaces.

The LID design procedure in Chapter 4 incorporates these requirements into an integrated design that meets sizing requirements for stormwater treatment facilities and flow control (hydromodification management) requirements.

► SIZING REQUIREMENTS FOR STORMWATER TREATMENT FACILITIES

The guidance in Chapter 4 was crafted to ensure that LID facilities comply with the Stormwater Permit's hydraulic sizing requirements for stormwater treatment facilities and flow control facilities. The technical background follows.

Most runoff is produced by frequent storms of small or moderate intensity and duration. Treatment facilities are designed to treat smaller storms and the first flush of larger storms—approximately 80% of average annual runoff.

The Stormwater Permit identifies two types of treatment facilities—volume-based and flow-based.

Volume-based facilities must be designed to infiltrate, filter, or treat the volume of runoff produced from a 24-hour 85th percentile storm event as determined by review of the County of San Diego's (County's) 85th Percentile Precipitation Isopluvial Map, which can be found within the *County of San Diego Hydrology Manual* (County of San Diego 2003). As shown in the map, rainfall depths vary from about 0.55 inch to 1.55 inch.

For flow-based facilities, the Stormwater Permit specifies that the Rational Method is to be used to determine flow. The Rational Method uses the equation

$Q = CiA$, where

Q = flow

C = weighted runoff factor between 0 and 1

i = rainfall intensity

A = area

The permit identifies two alternatives for calculating rainfall intensity: the 85th percentile rainfall intensity times two, or 0.2 inch per hour. It is typically found that both methods yield similar results. The 0.2 inch per hour rainfall intensity should be used for sizing flow-based treatment facilities.

The 0.2 inch per hour criterion is the basis for a consistent countywide sizing factor for bioretention facilities when used for stormwater treatment only (i.e., not for flow control). The factor is based on maintaining a minimum percolation rate of 5 inches per hour through the engineered soil mix. The sizing factor is the ratio of the design intensity of rainfall on tributary impervious surfaces (0.2 inch per hour) to the design percolation rate in the facility (5 inches per hour), or 0.04 (dimensionless).

► FLOW CONTROL (HYDROMODIFICATION MANAGEMENT)

The Stormwater Permit (San Diego RWQCB 2007) specifies for applicable projects:

> … post-project runoff flow rates and durations shall not exceed pre-project runoff flow rates and durations where the increased discharge flow rates and durations will result in increased potential for erosion or other significant adverse impacts to beneficial uses, attributable to changes in flow rates and durations.

Refer to Appendix B to review the final HMP developed by the San Diego Copermittees and approved by the RWQCB in July 2010. A brief summary of the HMP document is provided in Chapter 1 of this SUSMP.

Criteria for Infiltration Devices

The Stormwater Permit restricts the design and location of the following "infiltration devices" that, as designed, may bypass filtration through surface soils before reaching groundwater:

- infiltration basins;
- infiltration trenches (includes French drains);
- unlined retention basins (i.e., basins with no outlets); and
- unlined or open-bottomed vaults or boxes installed below grade (dry wells).

Infiltration devices may not be used in the following areas:

- areas of industrial or light industrial activity;
- areas subject to high vehicular traffic (25,000 or greater average daily traffic on a main roadway or 15,000 or more average daily traffic on any intersecting roadway);
- automotive repair shops;
- car washes;
- fleet storage areas (e.g., bus, truck);
- nurseries; or
- areas within Escondido that are associated with high groundwater tables.

These areas will need special consideration for BMP selection and design and approval from City staff.

The vertical distance from the base of any infiltration device to the seasonal high-groundwater mark must be at least 10 feet. Infiltration devices must also be located a minimum of 100 feet horizontally from any known water supply wells.

In addition, infiltration devices are not recommended where:

- the infiltration device would receive drainage from areas where chemicals are used or stored, where vehicles or equipment are washed, or where refuse or wastes are handled;
- surface soils or groundwater are polluted;
- the facility could receive sediment-laden runoff from disturbed areas or unstable slopes;
- increased soil moisture could affect the stability of slopes or foundations (the design, sizing, and siting guidelines and criteria listed in Chapter 4 provide further details and restrictions for a variety of typical infiltration devices); or
- soils are insufficiently permeable to allow the device to drain within 72 hours.

Self-treating areas, self-retaining areas, permeable pavements, bioretention facilities, and planter boxes are not considered infiltration devices.

Bioretention facilities work by percolating runoff through 18 inches or more of engineered soil, which removes most pollutants before the runoff seeps into native soils below. Further pollutant removal typically occurs in the unsaturated (vadose) zone before moisture reaches groundwater.

Where there is concern about the effects of increased soil moisture on slopes or foundations, an impermeable barrier may be added so the facility is "flow through" and all treated runoff is underdrained away from the facility. See the design sheets for bioretention facilities and flow-through planters in Chapter 4.

Environmental and Economic Benefit Perspective

Escondido is located in northern San Diego County, approximately 13 miles east of the Pacific Ocean. Land within the city generally ranges in elevation between 800 and 1,000 feet above mean sea level; however, Burnt Mountain (Daley Ranch) is more than 2,100 feet above mean sea level. The city encompasses approximately 24,000 acres, most of which is residential. More than 60% of Escondido is either in residential land use or dedicated space for parks and recreation. Only 11% of the jurisdiction remains undeveloped.

The climate in Escondido is warm during the summer months, when temperatures tend to be in the 70s, and cool during the winter, when temperatures tend to be in the 50s. The warmest month of the year is August, with an average maximum temperature of 89 degrees, and the coldest month of the year is December, with an average minimum temperature of 42 degrees. The annual average precipitation in Escondido is 15.10 inches. The wettest month of the year is January, with an average rainfall of 3.37 inches.

Approximately 75% of Escondido is located within the Carlsbad watershed. Most of the northern part of the city drains to Escondido Creek within the Escondido Creek drainage area. Reidy Creek, located mostly within the city, is a main tributary to Escondido Creek. A very small portion of the city drains into the San Marcos Creek subwatershed. The Carlsbad watershed drains to several coastal lagoons, including the San Elijo Lagoon. Escondido Creek is tributary to the San Elijo Lagoon. The southern part of Escondido is located within the San Dieguito watershed. The major receiving water within the San Dieguito watershed is the San Dieguito River. For the most part, the San Dieguito River is an ephemeral stream that flows into Lake Hodges during extreme wet weather. Additionally, except during extreme wet-weather events, the water contained behind Lake Hodges Dam is only rarely released and allowed to proceed westerly to the San Dieguito Lagoon. Most of the city's area within this watershed drains to Felicita and Kit Carson Creeks and ultimately Lake Hodges.

In addition, most of these water bodies have been affected by development and/or channelization. Impervious surfaces now cover much of the land, and storm drains pipe runoff from urban areas directly into streams. As in many of California's urban areas, growth and development have caused changes in the timing and intensity of streamflows. These changes can then lead to more frequent flooding, destabilization of streambanks, armoring of streambanks with riprap and concrete, loss of streamside trees and vegetation, and the destruction of stream habitat.

The remaining habitat in the region is composed of sensitive coastal sage scrub, chaparral, woodlands, and grasslands. Human encroachment and habitat loss threaten close to 300 species of plants and animals in California. Many of those species, ranging from native grasslands to the fairy shrimp, are found in southern California.

Once altered, natural streams and their ecosystems cannot be fully restored. However, it is possible to stop, and partially reverse, the trend of declining habitat and preserve some ecosystem values for the benefit of future generations. This is an enormous, long-term effort. Managing runoff from a single development site may seem inconsequential, but by changing the way most sites are developed (and redeveloped), it may be possible to preserve and enhance existing stream ecosystems in urban and urbanizing areas.

References and Resources

- San Diego RWQCB Order R9-2007-0001 (Stormwater Permit) (San Diego RWQCB 2007)
- *County of San Diego Low Impact Development Handbook* (County of San Diego 2007)
- Clean Water Act Section 402(p)
- 40 CFR 122.26
- San Diego Regional Water Quality Control Board—TMDLs (San Diego RWQCB 2010)
- *Site Planning for Urban Stream Protection* (Scheuler 1995)
- *Application of Water-Quality Engineering Fundamentals to the Assessment of Stormwater Treatment Devices* (Salvia 2000)

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Chapter

3

Preparing the SUSMP Project Submittal

Step-by-step assistance to demonstrate compliance.

The SUSMP project submittal serves to demonstrate that the project complies with all applicable requirements in the Stormwater Permit (i.e., it minimizes imperviousness, retains or detains stormwater, slows runoff rates, incorporates required source controls, treats stormwater before discharge, controls runoff rates and durations, and provides for operation and maintenance of treatment and flow control facilities).

The SUSMP project submittal must be coordinated with the application for discretionary actions and must be sufficiently detailed to ensure that the stormwater design, site plan, and landscaping plan are congruent. A complete and thorough SUSMP project submittal will facilitate quicker review, with fewer review cycles.

A Water Quality Technical Report (WQTR) must be included with the SUSMP project submittal. City staff will use the following checklist to evaluate the SUSMP project submittal.

EXAMPLE PROJECT SUBMITTAL CHECKLIST

CONTENTS OF EXHIBIT

Show all of the following on drawings:

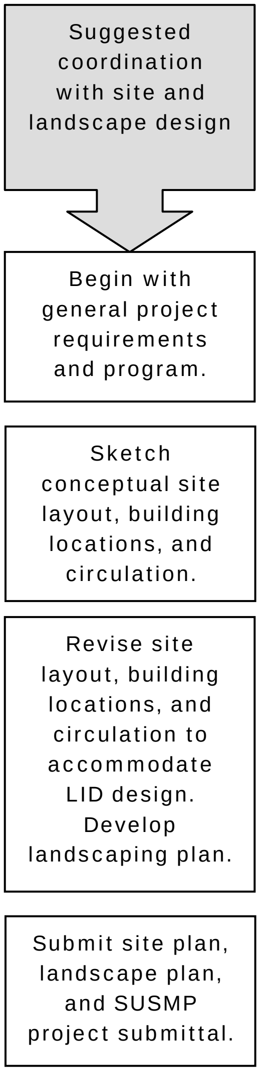
- ❒ Existing natural hydrologic features (depressions, watercourses, floodplains, relatively undisturbed areas) and significant natural resources. (Step 1 in the following step-by-step instructions)
- ❒ Soil types and depth to groundwater. (Step 1)
- ❒ Existing and proposed site drainage network and connections to drainage off-site. (Step 3)
- ❒ Proposed design features and surface treatments used to minimize imperviousness. (Step 3)
- ❒ Entire site divided into separate drainage areas, with each area identified as self-treating, self-retaining (zero-discharge), draining to a self-retaining area, or draining to an IMP. (Step 3)
- ❒ For each drainage area, types of impervious area proposed (roof, plaza/sidewalk, and streets/parking) and area of each. (Step 3)
- ❒ Proposed locations and sizes of treatment or flow-control facilities. (Step 3)
- ❒ Potential pollutant source areas, including refuse areas, outdoor work and storage areas, etc. listed in Appendix A and corresponding required source controls. (Step 4)

CONTENTS OF REPORT

Include all of the following in a report:

- ❒ Narrative analysis or description of site features and conditions that constrain, or provide opportunities for, stormwater control. (Step 2)
- ❒ If the project is exempt from HMP requirements, a discussion demonstrating which exemption is being claimed and why the project qualifies must be included. (Step 2)
- ❒ Demonstrate how hydromodification requirements are met, including calculations justifying determination of lower flow thresholds and the sizing of LID or extended detention facilities to provide for hydromodification flow control. Field investigation results and continuous simulation results should also be included where applicable. (Step 3)
- ❒ Narrative description of site design characteristics that protect natural resources. (Step 3)
- ❒ Narrative description and/or tabulation of site design characteristics, building features, and pavement selections that reduce imperviousness of the site. (Step 3)
- ❒ Tabulation of proposed pervious and impervious area, showing self-treating areas, self-retaining areas, and areas tributary to each treatment or flow-control facility. (Step 3)
- ❒ Preliminary designs, including calculations, for each infiltration, treatment, or flow-control facility. Elevations should show sufficient hydraulic head for each. (Step 3)
- ❒ A table of identified pollutant sources and for each source, the source control measure(s) used to reduce pollutants to the maximum extent practicable. See worksheet in Appendix A. (Step 4)
- ❒ General maintenance requirements for infiltration, treatment, and flow-control facilities. (Step 5)
- ❒ Means by which facility maintenance will be financed and implemented in perpetuity. (Step 5)
- ❒ Statement accepting responsibility for interim operation & maintenance of facilities. (Step 5)
- ❒ Identification of any conflicts with codes or requirements or other anticipated obstacles to implementing the proposed facilities in the submittal. (Step 6)
- ❒ Construction Plan SUSMP Checklist. (Step 6)
- ❒ Certification by a civil engineer, architect, and landscape architect. (Step 6)

Step by Step



Plan and design stormwater controls integrally with the project site planning and landscaping. It is best to start with general project requirements and preliminary site design concepts, then prepare the detailed site design, landscape design, and stormwater control design simultaneously. This will help ensure that the site plan, landscape plan, and SUSMP project submittal are congruent.

The following step-by-step procedure should optimize design by identifying the best opportunities for stormwater controls early in the design process.

The recommended steps are:

1. Assemble needed information.
2. Identify site opportunities and constraints.
3. Follow the LID design guidance in Chapter 4 to analyze the project for LID and to develop and document the drainage design.
4. Specify source controls using the sources/source control checklist in Appendix A.
5. Plan for ongoing maintenance of treatment and flow control facilities.
6. Complete the SUSMP project submittal.

City staff may recommend preparing and submitting a preliminary site design before formally applying for planning and zoning approvals. The preliminary site design should incorporate a conceptual plan for site drainage, including self-treating and self-retaining areas and the location and approximate sizes of any treatment facilities. This additional up-front design effort will save time and avoid potential delays later in the review process.

Step 1: Assemble Needed Information

To select the types and locations of treatment facilities, the designer needs to know the following site characteristics:

- Existing natural hydrologic features and natural resources, including any contiguous natural areas, wetlands, watercourses, seeps, or springs.
- Existing site topography, including the contours of any slopes of 4% or steeper, the general direction of surface drainage, local high or low points or depressions, and any outcrops or other significant geologic features.

- Zoning, including requirements for setbacks and open space.
- Public works standards or other local codes governing minimum street widths, sidewalk construction, allowable pavement types, and drainage. These codes may conflict with LID objectives to minimize imperviousness and to maintain or restore natural site hydrology. City staff will assist in reviewing these situations and resolving these conflicts.
- Soil types (including hydrologic soil groups) and depth to groundwater, which may determine whether infiltration is a feasible option for managing site runoff. Depending on site location and characteristics, and on the selection of treatment and flow control facilities, site-specific information (e.g., from boring logs or geotechnical studies) may be required.
- Existing site drainage. For undeveloped sites, this should be obtained by inspecting the site and examining topographic maps and survey data. For previously developed sites, site drainage and connection to the municipal storm drain system can be located from site inspection, municipal storm drain maps, and plans for previous development.
- Existing vegetative cover and impervious areas, if any.

References and Resources

- *Site Planning for Urban Stream Protection* (Schueler 1995)
- *Start at the Source* (BASMAA 1999), page 36

Step 2: Identify Constraints and Opportunities

Review the information collected in Step 1. Identify the principal constraints on site design and selection of treatment and flow control facilities as well as opportunities to reduce imperviousness and incorporate facilities into the site and landscape design. For example, constraints might include impermeable soils, high groundwater, groundwater pollution or contaminated soils, steep slopes, geotechnical instability, high-intensity land use, heavy pedestrian or vehicular traffic, restricted right-of-way, or safety concerns. Opportunities might include existing natural areas, low areas, oddly configured or otherwise unbuildable parcels, easements and landscape amenities such as open space and buffers (which can double as locations for bioretention facilities), and differences in elevation (which can provide hydraulic head). Note that stormwater treatment facilities should not be located within protected riparian areas.

Prepare a brief narrative in the WQTR describing site opportunities and constraints. This narrative will be helpful as LID design proceeds and design decisions are explained to others.

Step 3: Prepare and Document the Project's LID Design

Follow the detailed instructions in Chapter 4 to ensure that the project complies with the Stormwater Permit's requirements for LID (Provision D.1.d[4]) and stormwater treatment (Provision D.1.d[6]). Chapter 4 includes calculation procedures and formats for presenting the calculations.

As shown in the checklist (page 26), the SUSMP project submittal should include a drawing showing:

- the entire site divided into separate **drainage management areas** (DMAs), with each area identified as either self-treating, self-retaining, draining to a self-retaining area, or draining to an IMP, and clearly marked with a unique identifier;
- the types and area of impervious surface proposed for each drainage area; and
- proposed locations and sizes of treatment facilities, with each facility clearly marked with a unique identifier.

Compliance
The design criteria for DMAs in Chapter 4 ensure that the required volume of flow from all developed portions of the project, including landscaped areas, is infiltrated, filtered, or treated (Provision D.1.d[6][a]).

The SUSMP project submittal should include:

- tabulation of proposed self-treating areas, self-retaining areas, areas draining to self-retaining areas, and areas draining to IMPs, and the corresponding IMPs identified in the exhibit;
- calculations, in the format shown in Chapter 4, showing the minimum square footage required and proposed square footage for each IMP; and
- preliminary designs for each IMP. The design sheets and accompanying drawings in Chapter 4 may be used or adapted for this purpose.

The following is required to assist the reviewer in understanding the project design:

- an overview introducing the design and explaining how the design decisions optimize the site layout, use pervious surfaces, disperse runoff from impervious surfaces, and drain impervious surfaces to engineered IMPs (see Chapter 4);
- a brief description of each DMA and its drainage that specifies where drainage will be directed; and
- a brief description of each IMP. The description should include any special characteristics or features distinct from the design sheets in Chapter 4.

References and Resources

- Chapter 4
- *County of San Diego Low Impact Development Handbook* (County of San Diego 2007)
- The City's general plan
- The City Zoning Ordinance and Development Codes
- *Low-Impact Development Design Strategies* (County of Prince George's 1999)
- *Bioretention Manual* (County of Prince George's 2002)
- *Site Planning for Urban Stream Protection* (Schueler1995)
- *Low Impact Development Technical Guidance Manual for Puget Sound* (Puget Sound Action Team 2005)
- *LID for Big Box Retailers* (Low Impact Development Center 2006)

Step 4: Specify Source Control BMPs

Some everyday activities, such as trash recycling/disposal and washing vehicles and equipment, generate pollutants that tend to find their way into storm drains. These pollutants can be minimized by applying source control BMPs.

Source control BMPs include permanent, structural features that must be incorporated into project plans; operational BMPs, such as regular sweeping and "housekeeping," must be implemented by the site's occupant or user. The "maximum extent practicable" standard typically requires both types of BMPs. In general, operational BMPs cannot be substituted for a feasible and effective permanent BMP.

Use the procedure described below to specify source control BMPs for the project site.

► IDENTIFY POLLUTANT SOURCES

Review the first column in the Pollutant Sources and Source Control Checklist (Appendix A). Check off the potential sources of pollutants that apply to your site.

► NOTE LOCATIONS ON SUBMITTAL DRAWING

Note the corresponding requirements listed in Column 2 of the Pollutant Sources and Source Control Checklist (Appendix A). Show the location of each pollutant source and each permanent source control BMP in the submittal drawing(s).

► PREPARE A TABLE AND NARRATIVE

Check off the corresponding requirements listed in Column 3 in the Pollutant Sources and Source Control Checklist (Appendix A). Now create a table, using the format in Table 3-1. In the left column, list each potential source on the project site (from Appendix A, Column 1). In the middle column, list the corresponding permanent, structural BMPs (from Columns 2 and 3, Appendix A) used to prevent pollutants from entering runoff. Accompany this table with a narrative that explains any special features, materials, or methods of construction that will be used to implement these permanent, structural BMPs.

Table 3-1. Format for Table of Permanent and Operational Source Control Measures

Potential Source of Runoff Pollutants	Permanent Source Control BMPs	Operational Source Control BMPs

► IDENTIFY OPERATIONAL SOURCE CONTROL BMPS

To complete the table, refer again to the Pollutant Sources and Source Control Checklist (Appendix A, Column 4). List in the right column of the table the operational BMPs that should be implemented as long as the anticipated activities continue at the site. The same BMPs may also be required as a condition of a use permit or other revocable discretionary approval for use of the site.

References and Resources

- Appendix A: Stormwater Pollutant Sources and Source Control Checklist
- San Diego RWQCB Order R9-2007-0001 (Stormwater Permit) (San Diego RWQCB 2007), Provision D.1.d(5)
- *Start at the Source* (BASMAA 1999), Section 6.7, "Details, Outdoor Work Areas"
- *California Stormwater Industrial/Commercial Best Management Practice Handbook* (CASQA 2003)
- *Urban Runoff Quality Management* (WEF/ASCE 1998), Chapter 4, "Source Controls"

Step 5: Provide for Stormwater Facility Maintenance

Provision D.1.c(5) of the Stormwater Permit requires project applicants to submit proof of a mechanism under which ongoing long-term maintenance of stormwater treatment and flow-control facilities will be conducted. If applicable, one or more of the following items must be included in the SUSMP project submittal:

- a means to finance and implement facility maintenance in perpetuity;
- an acceptance of responsibility for maintenance from the time the facilities are constructed until responsibility for operation and maintenance is legally transferred (a warranty covering a period following construction may also be required); and/or
- an outline of general maintenance requirements for the treatment and flow control facilities selected.

In addition, a detailed plan must be prepared and submitted that sets forth a maintenance schedule for each of the treatment and flow control facilities built on the project site.

Details of these requirements, and instructions for preparing a detailed operation and maintenance plan, are provided in Chapter 5.

References and Resources

- Chapter 5
- *Operation, Maintenance, and Management of Stormwater Management Systems* (Watershed Management Institute 1997)

Step 6: Complete the SUSMP Project Submittal

The SUSMP project submittal should document the information gathered and decisions made in Steps 1–5. A clear, complete, well-organized SUSMP project submittal will make it possible to confirm that your project design meets the minimum requirements of the Stormwater Permit, the municipal stormwater pollution prevention ordinance, and this SUSMP.

► COORDINATION WITH SITE, ARCHITECTURAL, AND LANDSCAPING PLANS

Before completing the SUSMP project submittal, ensure that the project's stormwater control design is fully coordinated with the proposed site plan, grading plan, and landscaping plan.

Information submitted and presentations to design review committees, planning commissions, and other decision-making bodies must incorporate relevant aspects of the stormwater design. In particular, ensure that:

- curb elevations, elevations, grade breaks, and other features of the drainage design are consistent with the delineation of DMAs;
- the top edge (overflow) of each bioretention facility is level all around its perimeter (this is particularly important in parking lot medians);
- the resulting grading and drainage design is consistent with the design for parking and circulation;
- bioretention facilities and other IMPs do not create conflicts with pedestrian access between parking and building entrances;
- vaults and utility boxes can be accommodated outside bioretention facilities and will not be placed within bioretention facilities;
- the visual impact of stormwater facilities, including planter boxes at building foundations and any terracing or retaining walls required for the stormwater control design, is shown in renderings and other architectural drawings;
- landscaping plans, including planting plans, show locations of bioretention facilities, and the plant requirements are consistent with the engineered soils and conditions in the bioretention facilities; and
- renderings and representation of street views incorporate any stormwater facilities located in street-side buffers and setbacks.

► CONSTRUCTION PLAN SUSMP CHECKLIST

The City's reviewer will compare construction plans submitted for your project with the SUSMP project submittal. Creating a construction plan SUSMP checklist for the project can facilitate the reviewer's comparison and speed review of the project. The steps to take are as follows:

- Create a table similar to Table 3-2. In Columns 1 and 2 of the table, number and list each measure or BMP specified in the SUSMP project submittal. Leave Column 3 blank. Incorporate the table into the SUSMP project submittal.
- Duplicate the table (by photocopy or electronically). Now fill in Column 3, identifying the plan sheets where the BMPs are shown. List all plan sheets on which the BMP appears.
- Submit the updated table with the construction plans.

Table 3-2. Format for Construction Plan SUSMP Checklist

SUSMP Page #	BMP Description	See Plan Sheet #s

Note that the updated table—or construction plan SUSMP checklist—is only a reference tool to facilitate comparison of the construction plans to the SUSMP project submittal. City staff can advise you regarding the process required to propose changes to the approved SUSMP project submittal.

► CERTIFICATION

The SUSMP project submittal must be certified by a civil engineer. The certification should state: "The selection, sizing, and preliminary design of stormwater treatment and other control measures in this plan meet the requirements of San Diego Regional Water Quality Control Board Order R9-2007-0001 and subsequent amendments."

► EXAMPLE SUSMP PROJECT SUBMITTAL OUTLINE AND CONTENTS

Check with City staff for requirements specific to your project.

I. Project Setting

- A. Project Name, Location, Description
- B. Existing Site Features and Conditions
- C. Opportunities and Constraints for Stormwater Control

II. Low Impact Development Design Strategies

- A. Optimization of Site Layout
  - (1) Limitation of Development Envelope
  - (2) Preservation of Natural Drainage Features
  - (3) Setbacks from Creeks, Wetlands, and Riparian Habitats
  - (4) Minimization of Imperviousness
  - (5) Using Drainage as a Design Element
- B. Use of Permeable Pavements (not allowed in high-groundwater areas)
- C. Dispersal of Runoff to Pervious Areas
- D. Use of Integrated Management Practices

III. Hydromodification Analysis

- A. Hydromodification Applicability
- B. Flow Control Performance Criteria

IV. Documentation of Drainage Design

- A. Drainage Management Areas
  - (1) Tabulation
  - (2) Descriptions
- B. Integrated Management Practices
  - (1) Tabulation and Sizing Calculations
  - (2) Descriptions

V. Source Control Measures

A. Description of Site Activities and Potential Sources of Pollutants

B. Table Showing Sources, Permanent Source Controls, and Operational Source Controls

VI. Facility Maintenance Requirements

A. Ownership and Responsibility for Maintenance in Perpetuity

(1) Commitment to Execute Any Necessary Agreements

(2) Statement Accepting Responsibility for Operation and Maintenance of Facilities Until That Responsibility Is Formally Transferred

B. Summary of Maintenance Requirements for Each Stormwater Facility

VII. Construction Plan SUSMP Checklist

VIII. Certifications

Attachment: SUSMP Exhibit

► EXAMPLE SUSMP PROJECT SUBMITTALS

Your submittal should reflect the unique characteristics of your project and meet the requirements of this SUSMP. City staff can help determine how specific requirements apply to your project.

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Chapter

4

Low Impact Development Design Guide

Guidance for designing and documenting LID site drainage, stormwater treatment facilities, and flow-control facilities.

Follow the LID design guidance below to assure compliance with the stormwater treatment requirements of the Stormwater Permit. Compliance will require careful documentation of:

- pervious and impervious areas in the planned project;
- drainage from each of these areas; and
- locations, sizes, and types of proposed treatment facilities.

The SUSMP project submittal must include calculations showing that the site drainage and proposed LID treatment facilities meet the criteria in this SUSMP.

This chapter will help you:

- **analyze your project** and identify and select options for implementing LID techniques to meet runoff treatment requirements—and flow control requirements, if they apply;
- **design and document drainage** for the whole site and document how that design meets this SUSMP's stormwater treatment criteria; and
- **specify preliminary design details** and integrate the project's LID drainage design with its paving and landscaping design.

Alternatives to LID design are discussed in the final section of this chapter.

Analyze Your Project for LID

Conceptually, there are four LID strategies for managing runoff from buildings and paving:

1. Optimize the site layout by preserving natural drainage features and designing buildings and circulation to minimize the amount of roof area and paving.

2. Use pervious surfaces such as turf, gravel, or permeable pavement, or use surfaces that retain rainfall, such as vegetated roofs. All drainage from these surfaces is considered to be "self-retained" (a detailed definition corresponding to this concept is on page 46). No further management of runoff is necessary. An emergency overflow should be provided for extreme events.

3. Disperse runoff from impervious surfaces onto adjacent pervious surfaces (e.g., direct a roof downspout to disperse runoff onto a lawn).

4. Drain impervious surfaces to engineered IMPs, such as bioretention facilities, planter boxes, cisterns, or dry wells. IMPs infiltrate runoff to groundwater and/or percolate runoff through engineered soil and allow it to drain away slowly. The use of infiltration IMPs may be restricted in certain areas throughout Escondido because of high groundwater conditions. Depending on site conditions, it may be possible to harvest and reuse rainwater in conjunction with IMPs.

A combination of two or more strategies may work best. With forethought in design, the four strategies can provide multiple, complementary benefits to your development. Pervious surfaces reduce heat-island effects and temperature extremes. Landscaping improves air quality, creates a better place to live or work, and upgrades value for rental or sale. Retaining natural hydrology helps preserve and enhance the area's natural character. LID drainage design can also conserve water and reduce the need for drainage infrastructure.

Table 4-1 includes ideas for applying LID strategies to site conditions and types of development.

TABLE 4-1. Ideas for Runoff Management

Site Features and Design Objectives	Vegetated Roof	Self-Retaining Areas	Permeable pavement	Bioretention Facility	Flow-Through Planter	Dry Well	Cistern with Bioretention
Clayey native soils	✓			✓	✓		✓
Permeable native soils	✓		✓	✓	✓	✓	
Very steep slopes	✓				✓		
Shallow groundwater	✓				✓		
Avoiding saturation of subsurface soils	✓		✓		✓		
Connection to roof downspouts		✓		✓	✓	✓	✓
Parking lots/islands and medians			✓	✓		✓	
Sites with extensive landscaping		✓	✓	✓			
Densely developed sites with limited space/landscape	✓		✓		✓	✓	✓
Fitting IMPs into landscape and setback areas				✓			✓
Making drainage a design feature		✓		✓			✓
Conveying as well as treating stormwater				✓			

► OPTIMIZE THE SITE LAYOUT

To minimize stormwater-related effects, apply the following design principles to the layout of newly developed and redeveloped sites.

Conserve natural areas, soils, and vegetation. Define the development envelope and protected areas, identifying areas that are most suitable for development and areas that should be left undisturbed. Use the following categories to determine the least sensitive areas of the site, in order of increasing sensitivity:

1. Areas devoid of vegetation, including previously graded areas and agricultural fields
2. Areas of nonnative vegetation, disturbed habitats, and eucalyptus woodlands where receiving waters are not present
3. Areas of chamise or mixed chaparral, and nonnative grasslands
4. Areas containing coastal scrub communities
5. All other upland communities
6. Occupied habitat of sensitive species and all wetlands (as defined by the City)

Within each of these categories, hillside areas should be considered more sensitive than flatter areas.

Coordination
Chapter 1 describes how review of project site design and landscape design is coordinated with review for compliance with stormwater NPDES requirements.

Where possible, conform the site layout along natural landforms, avoid excessive grading and disturbance of vegetation and soils, and replicate the site's natural drainage patterns. Set development back from creeks, wetlands, and riparian habitats. Preserve significant trees, especially native trees and shrubs, and identify locations for planting additional native or drought-tolerant trees and large shrubs. Concentrate development on portions of the site with less permeable soils, and preserve areas that can promote infiltration.

Limit overall coverage of paving and roofs for all development. Where allowed by City zoning and design standards—and provided that public safety and a walkable environment are not compromised—this can be accomplished by designing compact, taller structures, narrower and shorter streets and sidewalks, smaller parking lots (fewer stalls, smaller stalls, and more efficient lanes), and indoor or underground parking. Examine site layout and circulation patterns and identify areas where landscaping can be substituted for pavement.

Detain and retain runoff throughout the site. On flatter sites, it typically works best to intersperse landscaped areas and IMPs among the buildings and paving. On hillside sites, drainage from upper areas may be collected in conventional catch basins and piped to landscaped areas and IMPs in lower areas.

Use drainage as a design element. Use depressed landscape areas, vegetated buffers, and bioretention areas as amenities and focal points within the site and landscape design. Bioretention areas can be almost any shape and should be located at low points. Bioretention areas shaped as swales can detain and treat low runoff flows and also convey higher flows.

► USE PERVIOUS SURFACES

Consider a vegetated roof. Although not yet widely used in California, vegetated or "green" roofs are growing in popularity. Potential benefits include longer roof life, lower heating and cooling costs, and better sound insulation, in addition to air quality and water quality benefits. For SUSMP compliance purposes, vegetated roofs are considered not to produce increased runoff or runoff pollutants (i.e., any runoff from a vegetated roof requires no further treatment or detention). For more information on vegetated roofs, see http://www.greenroofs.org.

Consider permeable pavements and surface treatments. Inventory all paved areas on the preliminary site plan. Identify where permeable pavements such as crushed aggregate, turf block, unit pavers, pervious concrete, or pervious asphalt could be substituted for impervious concrete or asphalt paving.

► DISPERSE RUNOFF TO ADJACENT PERVIOUS AREAS

Look for opportunities to direct runoff from impervious areas to adjacent landscaping. The design, including slopes and soils, must reflect a reasonable expectation that an inch of rainfall will soak into the soil and produce no runoff. For example, a lawn or garden depressed 3–4 inches below surrounding walkways or driveways provides a simple but functional landscape design element.

For sites subject to stormwater treatment requirements only, a 2:1 maximum ratio of impervious to pervious area is acceptable. Be sure that soils will drain adequately.

Under some circumstances, it may be allowable to direct runoff from impervious areas to permeable pavement (for example, from roof downspouts to a parking lot paved with crushed aggregate or turf block). The pore volume of pavement and base course must be sufficient to retain an inch of rainfall, including runoff from the tributary area. The slopes and soils must be able to infiltrate that volume without producing runoff.

► DIRECT RUNOFF TO INTEGRATED MANAGEMENT PRACTICES

Design criteria for the following IMPs can be found on the Project Clean Water Web site (http://www.projectcleanwater.com):

- bioretention facilities, which can be configured as swales, free-form areas, or planters for integration with the project's landscape design;
- flow-through planters, which can be used near building foundations and other locations where infiltration to native soils is not desired;
- dry wells and other infiltration facilities, which can be used only where soils are permeable; and
- cisterns or vaults, in combination with a bioretention facility.

See the design sheets at the end of this chapter.

It may be possible to create a site-specific design that uses cisterns to control stormwater flow, treat stormwater treatment, and rainwater reuse for irrigation or indoor uses (water harvesting). Such a design could expand the multiple benefits of LID to include water conservation. Keep the following factors in mind:

- Facilities must meet criteria for capturing and treating the volume of runoff specified by Equation 4-4 (see Step 6 under "Develop and Document Your Drainage Design," below). This volume must be allowed to empty within 24 hours so that runoff from additional storms that may follow can also be captured and treated. Additional volume may be required if the system also stores runoff for longer periods for reuse.
- Storing water for longer than 48 hours creates the potential to harbor mosquitoes. Cisterns and vaults must be designed to prevent entry by mosquitoes.

Some references and resources for water harvesting appear at the end of this chapter.

Finding the right location for treatment facilities on your site involves a careful and creative integration of several factors:

- To make the most efficient use of the site and maximize aesthetic value, integrate IMPs with site landscaping. Depending on City zoning codes, it may be possible to locate some or all of the site's treatment and flow control facilities within this same area, or within utility easements or other nonbuildable areas.
- Planter boxes and bioretention areas must be level or nearly level all the way around. Bioretention areas configured as swales may be gently sloped in the linear direction, but opposite sides must be at the same elevation.
- For effective, low-maintenance operation, locate facilities so that drainage into and out of the device is by gravity flow. Pumped systems are feasible but are expensive, require more maintenance, are prone to untimely failure, and can cause mosquito control problems. Most IMPs require 3 feet or more of head.
- If the property is being subdivided now or will be in the future, the facility should be in a common, accessible area. In particular, avoid locating facilities on private residential lots. Even if the facility will serve only one site owner or operator, make sure the facility is located for ready access by City or agency inspectors.
- The facility must be accessible to equipment needed for its maintenance. Access requirements for maintenance will vary with the type of facility selected. Planter boxes and bioretention areas will typically need access for the same types of equipment used for landscape maintenance.

Rationale

Pollutants in rainfall and windblown dust will tend to become entrained in the vegetation and soils of landscaped areas, so no additional treatment is needed. It is assumed that the self-treating landscaped areas will produce runoff less than or equal to the preproject site condition.

To complete the analysis, include a brief narrative documenting the site layout and site design decisions made within the WQTR. This will provide background and context for how the site design meets the quantitative LID design criteria.

Develop and Document Your Drainage Design

The design documentation procedure begins with careful delineation of pervious areas and impervious areas (including roofs) throughout the site. The procedure accounts for management of runoff from each delineated area. For areas draining to IMPs, the procedure ensures that each IMP is appropriately sized.

The procedure results in a space-efficient, cost-efficient LID design for meeting SUSMP requirements on most residential and commercial/industrial developments. The procedure arranges documentation of drainage design and IMP sizing in a consistent format for presentation and review.

This procedure is intended to facilitate, not substitute for, creative interplay among site design, landscape design, and drainage design. Several iterations may be needed to optimize the drainage design as well as the aesthetics, circulation, and use of available area for your site.

You should be able to complete the needed calculations using only the project's site development plan.

► STEP 1: DELINEATE DRAINAGE MANAGEMENT AREAS

This is the key first step. Divide the entire project area into individual, discrete DMAs. Typically, lines delineating DMAs follow grade breaks and roof ridgelines. The exhibit, tables, text, and calculations in the SUSMP project submittal will illustrate, describe, and account for runoff from each of these areas.

Use separate DMAs for each surface type (e.g., landscaping, pervious paving, or roofs). Each DMA must be assigned a single hydrologic soil group. Assign each DMA an identification number and determine its size in square feet.

► STEP 2: CLASSIFY DRAINAGE MANAGEMENT AREAS AND DETERMINE RUNOFF FACTORS

Next, determine how drainage from each DMA will be handled. Each DMA will be one of four types: a self-treating area, a self-retaining area (also called a "zero-discharge" area), an area that drains to self-retaining areas, or an area that drains to IMPs.

Self-treating areas are landscaped or turf areas that do not drain to IMPs, but rather drain directly off-site or to the storm drain system. Examples include upslope undeveloped areas that are ditched and drained around a development and grassed slopes that drain off-site to a street or storm drain. In general, self-treating areas include no impervious areas, unless the impervious area is very small (5% or less) relative to the receiving pervious area and slopes are gentle enough to ensure that runoff will be absorbed into the vegetation and soil. Criteria for self-treating areas are presented in the design sheet "Self-Treating and Self-Retaining Areas" at the end of this chapter.

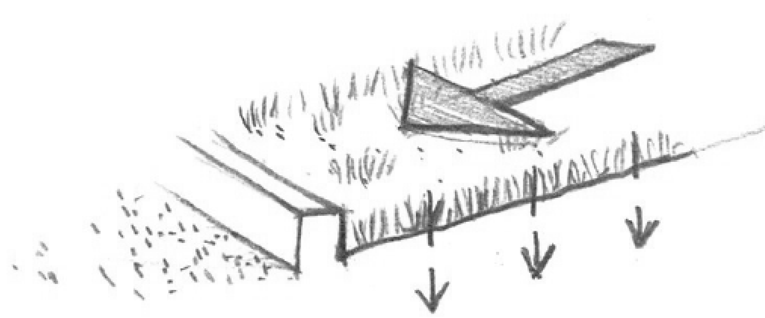


FIGURE 4-1. Self-treating areas are entirely pervious and drain directly off-site or to the storm drain system.

Self-retaining areas are designed to retain the first 1 inch of rainfall without producing any runoff. The technique works best on flat, heavily landscaped sites. It may be used on mild slopes if there is a reasonable expectation that a 1-inch rainfall event would produce no runoff.

To create self-retaining turf and landscape areas in flat areas or on terraced slopes, berm the area or depress the grade into a concave cross section so that these areas will retain the first inch of rainfall. Specify slopes, if any, toward the center of the pervious area. Inlets of area drains, if any, should be set 3 inches above the low point to allow ponding.

Criteria for self-retaining areas are in the design sheet "Self-Treating and Self-Retaining Areas" following this chapter.

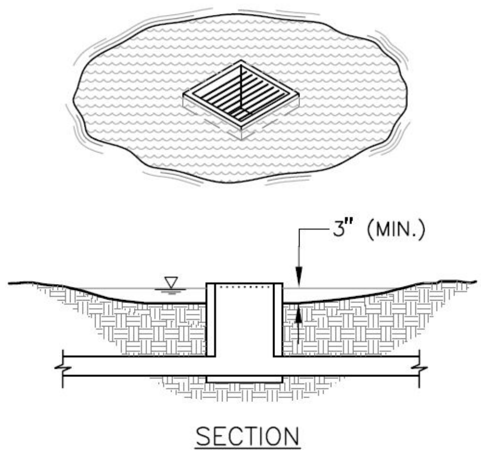


FIGURE 4-2. Self-retaining areas. Berm or depress the grade to retain at least an inch of rainfall and set inlets of any area drains at least 3 inches above low point to allow ponding.

Areas draining to self-retaining areas. Runoff from impervious or partially pervious areas can be managed by routing it to self-retaining pervious areas. For example, roof downspouts can be directed to lawns, and driveways can be sloped toward landscaped areas. The maximum ratio is 2 parts impervious area to 1 part pervious area.

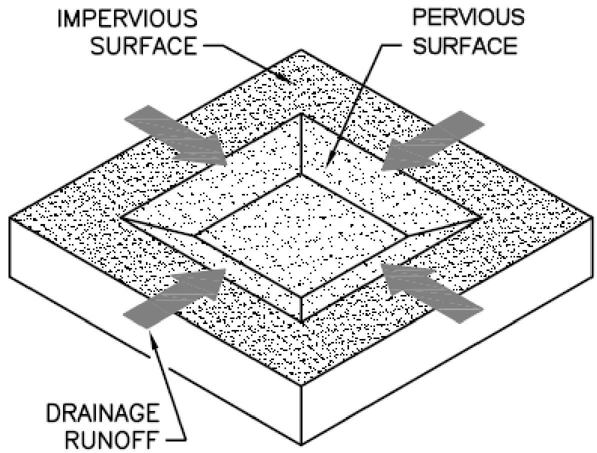


Figure 4-3. Relationship of impervious to pervious area for self-retaining areas. Ratio: Pervious ≥ ½ impervious

The drainage from the impervious area must be directed to and dispersed within the pervious area, and the entire area must be designed to retain an inch of rainfall without flowing off-site. For example, if the maximum ratio of two parts impervious area into one part pervious area is used, then the pervious area must absorb 3 inches of water over its surface before overflowing to an off-site drain.

A partially pervious area may be drained to a self-retaining area. For example, a driveway composed of unit pavers may drain to an adjacent lawn. In this case, the maximum ratios are:

(Runoff factor) x (tributary area) ≤ 2 x (self-retaining area) ***Equation 4-1***

Use the runoff factors shown in Table 4-2.

Prolonged ponding is a potential problem at higher impervious/pervious ratios. In your design, ensure that the soils in the pervious area can handle the additional run-on and are sufficiently well drained.

Under some circumstances, permeable pavement (e.g., crushed stone, pervious asphalt, or pervious concrete) can be self-retaining. Adjacent roofs or impermeable pavement may drain onto the permeable pavement in the same maximum ratios as described above.

To design a permeable pavement to be a self-treating area, ensure that:

- the gravel base course is 4 or more inches deep;
- the base course is not to be underdrained; and
- a qualified engineer has been consulted regarding infiltration rates, pavement stability, and suitability for the intended traffic.

Runoff from self-treating and self-retaining areas does not require any further treatment or flow control.

TABLE 4-2. Runoff Factors for Surfaces Draining to Integrated Management Practices

Surface	Factor
Roofs	1.0
Concrete	1.0
Pervious concrete	0.1
Porous asphalt	0.1
Grouted unit pavers	1.0
Solid unit pavers on granular base, minimum 3/16 inch joint space	0.2
Crushed aggregate	0.1
Turfblock	0.1
Amended, mulched soil	0.1
Landscape	0.1

Areas draining to IMPs are multiplied by a sizing factor to calculate the required size of the IMP. On most densely developed sites—such as commercial and mixed-use developments and small-lot residential subdivisions—most DMAs will drain to IMPs.

More than one drainage area can drain to the same IMP. However, because the minimum IMP sizes are determined by ratio to drainage area size, a drainage area may not drain to more than one IMP. See Figures 4-4 and 4-5.

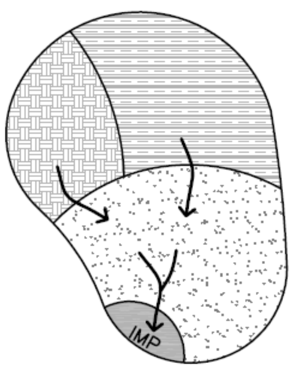


FIGURE 4-4. More than one drainage management area can drain to a single integrated management practice.

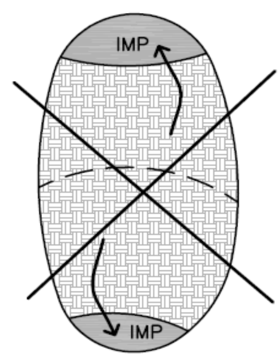


FIGURE 4-5. One drainage management area cannot drain to more than one integrated management practice. Use a grade break to divide the drainage management area.

Where possible, design site drainage so that only impervious roofs and pavement drain to IMPs. This yields a simpler, more efficient design and also helps protect IMPs from becoming clogged by sediment.

If it is necessary to include turf, landscaping, or permeable pavements within the area draining to an IMP, list each surface as a separate DMA. A runoff factor (similar to a "C" factor used in the Rational Method) is applied to account for the reduction in the quantity of runoff. For example, when a turf or landscaped drainage management area drains to an IMP, the resulting increment in IMP size is:

$$\Delta\ (\text{Area}) = (\text{pervious area}) \times (\text{runoff factor}) \times (\text{sizing factor}) \qquad \textit{Equation 4-2}$$

Use the runoff factors in Table 4-2.

► STEP 3: TABULATE DRAINAGE MANAGEMENT AREAS

- Tabulate self-treating areas in the format shown in Table 4-3.
- Tabulate self-retaining areas in the format shown in Table 4-4.
- Tabulate areas that drain to self-retaining areas in the format shown in Table 4-5. Check to be sure that the total product of (square feet of tributary area × runoff factor) for all DMAs draining to a receiving self-retaining area is no greater than a 2:1 ratio to the square footage of the receiving self-retaining area itself.
- Compile a list of DMAs that drain to IMPs. Proceed to Step 4 to check the sizing of the IMPs.

Table 4-3. Format for Tabulating Self-Treating Areas

DMA Name	Area (square feet)

Table 4-4. Format for Tabulating Self-Retaining Areas

DMA Name	Area (square feet)

Table 4-5. Format for Tabulating Areas Draining to Self-Retaining Areas

DMA Name	Area (square feet)	Postproject Surface Type	Runoff Factor	Receiving Self-Retaining DMA	Receiving Self-Retaining DMA Area (square feet)

► STEP 4: SELECT AND LAY OUT INTEGRATED MANAGEMENT PRACTICES ON SITE PLAN

Select from the list of IMPs in Table 4-6. Illustrations, designs, and design criteria for the IMPs are in the "IMP Design Details and Criteria" at the end of this chapter.

Once you have laid out the IMPs, calculate the square footage you have set aside on the site plan for each IMP.

► STEP 5: REVIEW SIZING FOR EACH INTEGRATED MANAGEMENT PRACTICE

For each of the IMPs, use the appropriate "water quality only" sizing factor from Table 4-6. Sizing factors for integrated facilities that provide both water quality treatment and hydromodification flow control are provided in Appendix H of the HMP

Table 4-6. Integrated Management Practice Sizing (Water Quality Treatment Only)

Bioretention Facilities	Sizing factor for area = 0.04
Flow-Through Planters	Sizing factor for area = 0.04
Dry Well or Infiltration Basin	See Step 6 to calculate minimum volume
Cistern or Vault with Bioretention	See Step 6 to calculate minimum volume of cistern or vault; then use 0.04 to calculate minimum size of bioretention area

► STEP 6: CALCULATE MINIMUM AREA AND VOLUME OF EACH IMP

The minimum area of bioretention facilities and flow-through planters is found by summing up the contributions of each tributary DMA and multiplying by the adjusted sizing factor for the IMP. Note that if the IMP is designed to provide hydromodification flow control, then separate sizing factors (provided in Appendix H of the HMP) should be used in lieu of the "water quality only" sizing factors presented in Table 4-6.

Equation 4-3

$$Min.\,IMP\,Area = \sum \begin{pmatrix} DMA & & DMA \\ Square & \times & Runoff \\ Footage & & Factor \end{pmatrix} \times \begin{pmatrix} IMP \\ Sizing \\ Factor \end{pmatrix}$$

Use the format shown in Table 4-7 to present the calculations of the required minimum area and volumes for bioretention areas and planter boxes.

Table 4-7. Format for Presenting Calculations of Minimum Integrated Management Practice Areas for Bioretention Areas and Planter Boxes

DMA Name	DMA Area (square feet)	Postproject surface type	DMA Runoff factor	DMA Area × runoff factor	Soil Type:	IMP Name			
					IMP Sizing factor (WQ only)		Minimum Area	Proposed Area	
			Total		0.04				IMP Area

To size dry wells, infiltration basins, or infiltration trenches for the "water quality treatment only" option, use the following procedure:

1. Use the County's 85th Percentile Isopluvial Map to determine the minimum unit volume.
2. Determine the weighted runoff factor ("C" factor) for the area tributary to the facility. The factors in Table 4-2 may be used.
3. Multiply the weighted runoff factor times the tributary area times the minimum unit volume, as shown in Equation 4-4.

Equation 4-4

$$Volume = [Tributary\ Area] \times [weighted\ runoff\ \ factor] \times [unit\ volume]$$

4. Select a facility depth.
5. Determine the required facility area. Dry wells may be designed as an open vault or with rock fill. If rock fill is used, assume a porosity of 40%.
6. Ensure that the facility can infiltrate the entire volume within 96 hours.

To size a cistern or vault in series with a bioretention facility (criteria below for "water quality treatment only" option):

1. Use Equation 4-4 to calculate the required cistern or vault volume.
2. Design a discharge orifice for a drawdown time of 24 hours.
3. Determine the maximum discharge from the orifice.

4. The minimum area of the bioretention facility must treat this flow based on a percolation rate of 5 inches per hour through the engineered soil.

If a facility is designed to provide both water quality treatment and hydromodification flow control, then refer to the appropriate tables in the HMP (Appendix H of the HMP) to determine the appropriate sizing factors for the IMP design.

► STEP 7: DETERMINE WHETHER AVAILABLE SPACE FOR THE IMP IS ADEQUATE

Sizing and configuring IMPs may be an iterative process. After computing the minimum IMP area using Steps 1–6, review the site plan to determine whether the reserved IMP area is sufficient. If so, the planned IMPs will meet the SUSMP sizing requirements. If not, revise the plan accordingly. Revisions may include:

- reducing the overall imperviousness of the project site,
- changing the grading and drainage to redirect some runoff toward other IMPs that may have excess capacity,
- making tributary landscaped DMAs self-treating or self-retaining, or
- expanding IMP surface area.

► STEP 8: COMPLETE THE DRAINAGE MANAGEMENT AREA AND IMP SIZING SUMMARY FOR INCORPORATION INTO THE WATER QUALITY TECHNICAL REPORT

Present IMP sizing calculations in tabular form. Adapt the following format as appropriate to your project. Coordinate the presentation of DMAs and calculation of minimum IMP sizes with the SUSMP project submittal drawing (labeled to show delineation of DMAs and locations of IMPs). It is also helpful to incorporate a brief description of each DMA and each IMP.

Sum the total area of all DMAs and IMPs listed and show that it is equal to the total project area. This step may include adjusting the square footage of some DMAs to account for area used for IMPs.

Format:

Project Name:

Project Location:

Assessor's Parcel Number or Subdivision Number:

Total Project Area (square feet):

Mean Annual Precipitation at Project Site:

I. Self-Treating Areas:

DMA Name	Area (square feet)

II. Self-Retaining Areas:

DMA Name	Area (square feet)

III. Areas Draining to Self-Retaining Areas:

DMA Name	Postproject Surface Type	Runoff factor	Area (Square Feet)	Receiving Self-Retaining DMA	Receiving Self-Retaining DMA Area (square feet)

IV. Areas Draining to IMPs (repeat for each IMP):

<table>
<tr><th>DMA Name</th><th>DMA Area (square feet)</th><th>Postproject surface type</th><th>DMA Runoff factor</th><th>DMA Area × runoff factor</th><th>Soil Type:</th><th colspan="3">IMP Name</th><th></th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td rowspan="3">IMP Sizing factor</td><td rowspan="3"></td><td rowspan="3">Minimum Area</td><td rowspan="3">Proposed Area</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="4">Total</td><td></td><td>0.04</td><td></td><td></td><td></td><td>IMP Area</td></tr>
</table>

Specify Preliminary Design Details

In the SUSMP project submittal, describe the project's IMPs in sufficient detail to demonstrate that the area, volume, and other criteria of each can be met within the constraints of the site.

Ensure that these details are consistent with preliminary site plans, landscaping plans, and architectural plans submitted with the application for planning and zoning approvals.

Following are design sheets for:

- self-treating and self-retaining areas,

- pervious pavements,
- bioretention facilities,
- a flow-through planter,
- dry wells and infiltration basins, and
- a cistern with bioretention facility.

These design sheets include recommended configurations and details, and example applications, for these IMPs. The information in these design sheets must be adapted and applied to the conditions specific to the development project, such as unstable slopes or the lack of available head. Designated City staff has final review and approval authority over the project design.

Keep in mind that proper and functional design of the IMP is the responsibility of the project applicant. Effective operation of the IMP throughout the project's lifetime will be the responsibility of the property owner.

Alternatives to Integrated LID Design

If the design of features and facilities as described above appears to be infeasible for your development site, consult with City staff before preparing an alternative design for stormwater treatment, flow control, and LID compliance.

For all alternative designs, the project applicant must prepare a complete SUSMP project submittal, including a drawing within the project's WQTR showing the entire site divided into discrete DMAs, text and tables showing how drainage is routed from each DMA to a treatment facility, and calculations demonstrating that the design achieves the applicable design criteria for each stormwater treatment facility. Alternative treatment facilities are limited to the circumstances and selection criteria identified beginning on page 18. The SUSMP project submittal must also show how the project meets the minimum LID criteria (page 21) and ensures that runoff rates, durations, and velocities are controlled to maintain or reduce downstream erosion conditions and protect stream habitat (Stormwater Permit Provision D.1.d[10]).

► DESIGN OF ALTERNATIVE TREATMENT FACILITIES

The criteria and design considerations described below apply to some alternative treatment facilities.

Sand Filters. To ensure that effectiveness is not compromised by compacting or clogging of the filter surface, sand filters must be maintained frequently. The following criteria apply to sand filters:

- The design flow should be calculated using the Rational Method with an intensity of 0.2 inch per hour and the "C" factors for "treatment only" from Table 4-2.

- To determine the required filter surface area, the design flow should be divided by an allowable design surface loading rate of 5 inches per hour.
- The minimum depth of filter media is 18 inches. The media should be washed sand, with gradation similar to that specified for fine aggregate in ASTM C-33.
- The entire filter area must be accessible for easy maintenance without the need to enter a confined space.

A typical filter design includes a gravel drain layer and a perforated pipe underdrain. Filter fabric may be used to prevent the filter media from entering the gravel layer.

The design should not include any permanent pool or other standing water. Instead of including a pretreatment basin, consider the following features in the area tributary to the filter to reduce the potential for filter clogging:

- Limit the size of the DMA.
- Include only impervious areas in the DMA.
- Stabilize slopes and eliminate sources of sediment in the DMA.

For additional design considerations and details, see *Design of Stormwater Filtering Systems* by Richard A. Claytor and Thomas R. Schueler at the Center for Watershed Protection (Claytor and Schueler 1996), and Fact Sheet TC-40, "Media Filter," in the *California Stormwater Best Management Practice Handbooks* (CASQA 2003). (Note that a subscription may be required to access these handbooks.)

Sand filters do not provide adequate hydromodification flow controls.

Extended ("Dry") Detention Basins. The required detention volume for water quality treatment is based on the 85th percentile 24-hour storm depth. The steps to calculate the required detention volume are:

1. Use the County's 85th Percentile Isopluvial Map to determine the unit basin volume.
2. Determine the weighted runoff factor ("C" factor) for the area tributary to the basin. The factors in Table 4-2 may be used.
3. Multiply the weighted runoff factor times the tributary area times the unit basin volume.

For maximum effectiveness, the basin should not be sized substantially larger than this volume. If the basin is to be used for hydromodification flow control, then the BMP Sizing Calculator pond sizer or a continuous simulation model must be used to prove the basin meets peak flow and flow duration criteria.

For design considerations and details, see Fact Sheet TC-22, "Extended Detention Basins," in the *California Stormwater Best Management Practice Handbooks* (CASQA 2003). The basin outlet should be designed for a 24-hour drawdown time.

As noted in Fact Sheet TC-22, "dry" detention basins may not be practicable for drainage areas less than 5 acres. The potential for harboring mosquitoes is a concern. In the design, do not create any areas that will hold standing water for time periods in excess of the maximum vector control detention time..

"Wet" Detention Ponds and Constructed Wetlands. The required water quality detention volume is determined as with a "dry" detention basin. Before proceeding with design, contact the local mosquito control agency to coordinate the design and ongoing inspection and maintenance plan for mosquito control. For design considerations and details, see Fact Sheet TC-20, "Wet Ponds," and Fact Sheet TC-21, "Constructed Wetlands," in the *California Stormwater Best Management Practice Handbooks* (CASQA 2003).

Vegetated Swales. Design recommendations for conventional vegetated swales are presented in the *California Stormwater Best Management Practice Handbooks* (CASQA 2003). The conventional swale design uses available on-site soils and does not include an underdrain system. Where soils are clayey, there is little infiltration. Treatment occurs as runoff flows through grass or other vegetation before exiting at the downstream end. Recommended detention times are on the order of 10 minutes. It should be noted that such designs would not provide the required hydromodification flow control benefit.

Conventional vegetated swales may be used to meet NPDES permit treatment requirements and LID requirements. The following steps should be incorporated into the design process:

- Determine the weighted runoff factor ("C" factor) for the area tributary to the swale. The factors shown in Table 4-2 may be used.
- Calculate the design flow by multiplying the weighted runoff factor times the tributary area times either (1) 0.2 inch of rainfall per hour, or (2) twice the 85th percentile hourly rainfall intensity.
- When sizing the swale, use a value of 0.25 for Manning's "n."
- Ensure that all flow enters the swale near its highest point and that no flow short-circuits treatment by entering the swale along its length. The swale should be at least 100 feet long.
- Ensure that longitudinal slopes do not exceed 2.5%; on flatter slopes, incorporate measures to avoid prolonged surface ponding.

Consider using linear-shaped bioretention areas (see page 71) in place of conventional vegetated swales because:

- Conventional swale design has resulted in standing water and associated nuisances;
- Conventional swales often do not obtain even the design residence time because of the length required, and because proper design requires that runoff enter the swale at the upstream end rather than at various locations along its length; and

- Bioretention areas provide a more flexible drainage design, more effective practicable treatment, more effective flow control, and could provide hydromodification flow control benefit within the same footprint.

In the western part of San Diego County (west of the Pacific Ocean drainage divide), rock swales would not generally provide adequate water quality treatment. In the eastern portion of the County, rock swales could potentially be used as part of the water quality treatment design given the prevalence of high-infiltration sandy soils and the harsh climatic conditions which prevent vegetation establishment. Implementation of rock swales would require approval from the governing municipality. The design of vegetated strips, if allowed by the governing municipality, should follow Caltrans design guidance.

► TREATMENT FACILITIES FOR SPECIAL CIRCUMSTANCES

Higher-rate surface filters and vault-based proprietary filters can be used only in the circumstances described beginning on page 18 and when sand filters, extended "dry" detention basins, and "wet" detention ponds or constructed wetlands have been found infeasible.

For surface filters, the grading and drainage design should minimize the area draining to each unit and maximize the number of discrete drainage areas and units. Proprietary facilities should be installed consistent with the manufacturer's instructions.

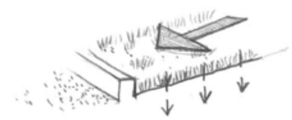
Such facilities do not provide hydromodification flow control benefit.

References and Resources:

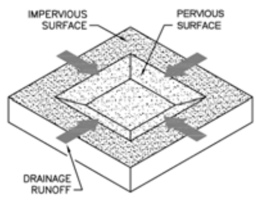
- San Diego RWQCB Order R9-2007-0001 (Stormwater Permit) (San Diego RWQCB 2007)
- Low Impact Development Center
- *County of San Diego Low Impact Development Handbook* (County of San Diego 2007)
- *California Stormwater Best Management Practices Handbooks* (CASQA 2003)
- *Design of Stormwater Filtering Systems* (Claytor and Schueler 1996)
- American Rainwater Catchment Systems Association
- Water Conservation Alliance of Southern Arizona
- *Rainwater Harvesting for Drylands and Beyond*
- *The Texas Manual on Rainwater Harvesting*
- *Managing Wet Weather With Green Infrastructure: Municipal Handbook, Rainwater Harvesting Policies* (Low Impact Development Center 2008)

Self-Treating and Self-Retaining Areas

► CRITERIA



Rainfall on self-treating areas infiltrates or, during intense storms, drains directly off-site or to the storm drain system.



Self-retaining areas are designed to retain the first 1 inch of rainfall without producing any runoff. During intense storms, runoff may drain off-site, to the storm drain system, or to IMPs.

Best Uses

- Heavily landscaped sites

Advantages

- No maintenance verification requirement
- Complements site landscaping

Limitations

- Requires substantial square footage
- Grading requirements must be coordinated with landscape design

LID design seeks to manage runoff from roofs and paving so that effects on water quality and hydrology are minimized. Runoff from landscaping, however, does not need to be managed in the same way. Runoff from landscaping can be managed by creating self-treating and self-retaining areas.

Self-treating areas are natural, landscaped, or turf areas that drain directly off-site or to the storm drain system. Examples include upslope undeveloped areas that are ditched and drained around a development and grassed slopes that drain off-site to a street or storm drain. Self-treating areas may not drain onto adjacent paved areas.

Where a landscaped area is upslope from or surrounded by paved areas, a self-retaining area (also called a zero-discharge area) may be created. Self-retaining areas are designed to retain the first 1 inch of rainfall without producing any runoff. The technique works best on flat, heavily landscaped sites. It may be used on mild slopes if there is a reasonable expectation that the first inch of rainfall would produce no runoff.

To create self-retaining turf and landscape areas in flat areas or on terraced slopes, berm the area or depress the grade into a concave cross section so that these areas will retain the first inch of rainfall. Inlets of area drains, if any, should be set 3 inches above the low point to allow ponding.

Drainage from roofs and paving can be directed to self-retaining areas and allowed to infiltrate into the soil. The maximum allowable ratio is two parts impervious to one part pervious.

The self-retaining area must be bermed or depressed to retain an inch of rainfall, including the flow from the tributary impervious area.

► DETAILS

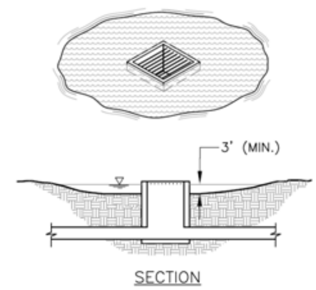
Drainage from self-treating areas must flow to off-site streets or storm drains without flowing onto paved areas.

Pavement within a self-treating area cannot exceed 5% of the total area.

In self-retaining areas, overflows and area drain inlets should be set high enough to ensure ponding over the entire surface of the self-retaining area.

Self-retaining areas should be designed to promote even distribution of ponded runoff over the area.

Enough reveal (from the pavement down to the landscaped surface) should be left to accommodate buildup of turf or mulch.



Set overflows and area drain inlets high enough to ensure ponding (3 inches deep) over the surface of the self-retaining area.

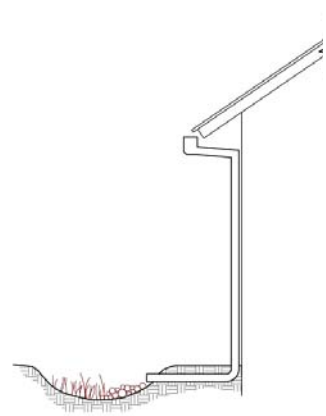
► APPLICATIONS

Lawn or landscaped areas adjacent to streets can be considered self-treating areas.

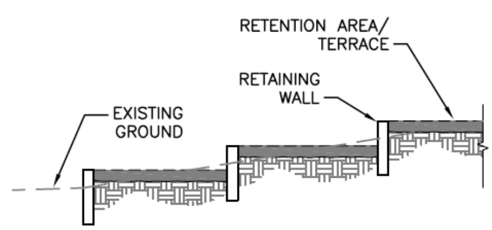
Self-retaining areas can be created by depressing the lawn and landscaping below surrounding sidewalks and plazas.

Runoff from walkways or driveways in parks and park-like areas can sheet-flow to self-retaining areas.

Roof leaders can be connected to self-retaining areas by piping beneath plazas and walkways. If necessary, a "bubble-up" can be used.


Connecting a roof leader to a self-retaining area. The head from the eave height makes it possible to route roof drainage some distance away from the building.

Self-retaining areas can be created by terracing mild slopes. The elevation difference promotes subsurface drainage.



Mild slopes can be terraced to create self-retaining areas.

► DESIGN CHECKLIST FOR SELF-TREATING AREAS

- ❒ The self-treating area is at least 95% lawn or landscaping (not more than 5% impervious).
- ❒ Regraded or relandscaped areas have amended soils, vegetation, and irrigation as may be required to maintain soil stability and permeability.
- ❒ Runoff from the self-treating area does not enter an IMP or another drainage management area, but goes directly to the storm drain system.

► DESIGN CHECKLIST FOR SELF-RETAINING AREAS

- ❒ The area is bermed all the way around or graded concave.
- ❒ Slopes do not exceed 4%.
- ❒ The entire area is lawn, landscaping, or permeable pavement (see criteria in Chapter 4).
- ❒ The area has amended soils, vegetation, and irrigation as may be required to maintain soil stability and permeability.
- ❒ Any area drain inlets are at least 3 inches above surrounding grade.

► DESIGN CHECKLIST FOR AREAS DRAINING TO SELF-RETAINING AREAS

- ❒ The ratio of tributary impervious area to self-retaining area is not greater than 2:1.
- ❒ Roof leaders collect runoff and route it to the self-retaining area.
- ❒ Paved areas are sloped so drainage is routed to the self-retaining area.
- ❒ Inlets are designed to protect against erosion and distribute runoff across the area.

Permeable Pavements

► CRITERIA

Impervious roadways, driveways, and parking lots account for much of the hydrologic impact of land development. In contrast, permeable pavements allow rainfall to collect in a gravel or sand base course and infiltrate into native soil.

Permeable pavements are designed to transmit rainfall through the surface to storage in a base course. For example, a 4-inch-deep base course provides approximately 1.6 inches of storage. Runoff stored in the base course infiltrates to native soils over time. Except in the case of solid pavers, the surface course provides additional storage.

Areas with the following permeable pavements may be regarded as "self-treating" and require no additional treatment or flow control if they drain off-site (not to an IMP):

- pervious concrete,
- porous asphalt,
- crushed aggregate (gravel),
- open pavers with grass or plantings,
- open pavers with gravel, and
- artificial turf.

Areas with these permeable pavements can also be self-retaining areas and may receive runoff from impervious areas if they are bermed or depressed to retain the first 1 inch of rainfall, including runoff from the tributary impervious area.

Solid unit pavers—such as bricks, stone blocks, or precast concrete shapes—are considered to reduce runoff compared to impermeable pavement, when the unit pavers are set in sand or gravel with 1/8- to 2-inch joints between the pavers. Joints must be filled with an open-graded aggregate free of fines.

When draining permeable pavements to an IMP, the runoff factors in Table 4-2 should be used.

Best Uses

- Areas with permeable native soils
- Low-traffic areas
- Areas where aesthetic quality can justify higher cost

Advantages

- No maintenance verification requirement
- Variety of surface treatments can complement landscape design

Limitations

- Initial cost
- Specially trained crews required for placement
- Geotechnical concerns, especially in clay soils
- Concerns about pavement strength and surface integrity
- Not allowed in public right-of-way by some municipalities

► DETAILS

Permeable pavements can be used in clay soils; however, special design considerations, including an increased depth of base course, typically apply and will increase the cost of this option. Geotechnical fabric between the base course and underlying clay soil is recommended.

Pavement strength and durability typically determine the required depth of the base course. If underdrains are used, the outlet elevation must be at least 3 inches above the bottom elevation of the base course.

Pervious concrete and porous asphalt must be installed by crews with special training and tools. Industry associations maintain lists of qualified contractors.

Parking lots with crushed aggregate or unit pavers may require signs or bollards to organize parking.

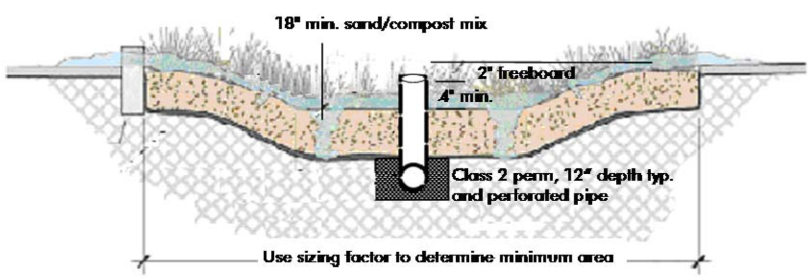
► DESIGN CHECKLIST FOR PERMEABLE PAVEMENTS

- ❒ No erodible areas drain onto pavement.
- ❒ Subgrade is uniform. Compaction is minimal.
- ❒ Reservoir base course is of open-graded crushed stone. Base depth is adequate to retain rainfall and support design loads.
- ❒ If a subdrain is provided, outlet elevation is at least 3 inches above the bottom of the base course.
- ❒ Subgrade is uniform and slopes are not so steep that subgrade is prone to erosion.
- ❒ A rigid edge is provided to retain granular pavements and unit pavers.
- ❒ Solid unit pavers are installed with open gaps filled with open-graded aggregate free of fines.
- ❒ Permeable pavements are installed by industry-certified professionals according to vendor's recommendations.
- ❒ Selection and location of pavements incorporate Americans with Disabilities Act requirements, site aesthetics, and uses.

Resources

- Southern California Concrete Producers (http://www.concreteresources.net)
- California Asphalt Pavement Association (http://www.californiapavements.org/stormwater.html)
- Interlocking Concrete Pavement Institute (http://www.icpi.org/)
- *Start at the Source Design Manual for Water Quality Protection* (http://www.basmaa.org) (BASMAA 1999), pages 47–53
- *Porous Pavements,* by Bruce K. Ferguson (Ferguson 2005)

Bioretention Facilities



Bioretention facility configured for treatment-only requirements. Bioretention facilities can be rectangular, linear, or nearly any shape.

Bioretention detains runoff in a surface reservoir, filters it through plant roots and a biologically active soil mix, and then infiltrates it into the ground. Where native soils are less permeable, an underdrain conveys treated runoff to the storm drain or surface drainage.

Bioretention facilities can be configured in nearly any shape. When configured as linear swales, they can convey high flows while percolating and treating lower flows.

Bioretention facilities can be configured as in-ground or aboveground planter boxes, with the bottom open to allow infiltration to native soils underneath. If infiltration cannot be allowed, use the sizing factors and criteria for the flow-through planter.

Best Uses

- Commercial areas
- Residential subdivisions
- Industrial developments
- Roadways
- Parking lots
- To fit in setbacks, medians, and other landscaped areas

Advantages

- Can be any shape
- Low maintenance
- Can be landscaped

Limitations

- 4% of tributary impervious square footage required
- 3–4 feet of head typically required
- Irrigation typically required

► CRITERIA

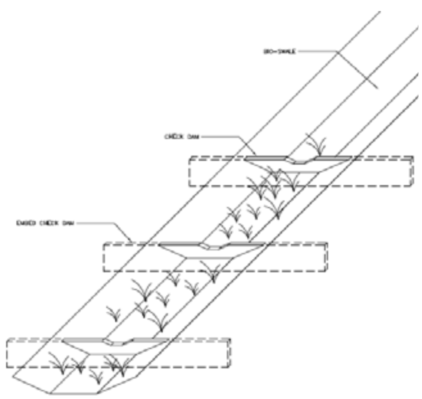
For development projects subject only to runoff treatment requirements, the following criteria apply:

Parameter	**Criterion**
Soil mix depth	18 inches minimum
Soil mix minimum percolation rate	5 inches per hour minimum sustained (10 inches per hour initial rate recommended)
Soil mix surface area	0.04 times tributary impervious area (or equivalent)

Parameter	Criterion
Surface reservoir depth	6 inches minimum; may be sloped to 4 inches where adjoining walkways.
Underdrain	Required in Group “C” and “D” soils. Perforated pipe embedded in gravel (“Class 2 permeable” recommended), connected to storm drain or other accepted discharge point.

► DETAILS

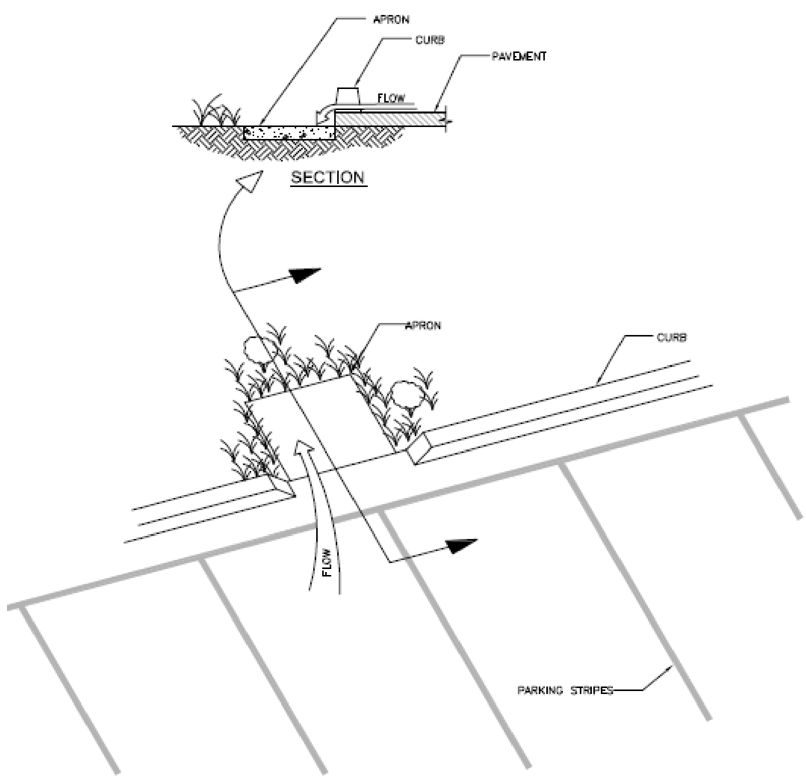
Plan. On the surface, a bioretention facility should be one level, shallow basin, or a series of basins. As runoff enters each basin, it should flood and fill throughout before runoff overflows to the outlet or to the next downstream basin. This will help prevent movement of surface mulch and soil mix.



Use check dams for linear bioretention facilities (swales) on a slope.

In a linear swale, check dams should be placed so that the lip of each dam is at least as high as the toe of the next upstream dam. A similar principle applies to bioretention facilities built as terraced roadway shoulders.

Inlets. Paved areas draining to the facility should be graded, and inlets should be placed, so that runoff remains as sheet flow or as dispersed as possible. Curb cuts should be wide (12 inches is recommended) to avoid clogging with leaves or debris. Allow for a minimum reveal of 4–6 inches between the inlet and soil mix elevations to ensure that turf or mulch buildup does not block the inlet. In addition, place an apron of stone or concrete, a foot square or larger, inside each inlet to prevent vegetation from growing up and blocking the inlet.



Recommended design details for bioretention facility inlets (see text).

Where runoff is collected in pipes or gutters and conveyed to the facility, protect the landscaping from high-velocity flows with energy-dissipating rocks. In larger installations, provide cobble-lined channels to better distribute flows throughout the facility.

Upturned pipe outlets can be used to dissipate energy when runoff is piped from roofs and upgradient paved areas.

Soil mix. The required soil mix is similar to a loamy sand. It must maintain a minimum percolation rate of 5 inches per hour throughout the life of the facility, and it must be suitable for maintaining plant life. Typically, on-site soils will not be suitable because of their clay content.

Storage and drainage layer. Class 2 permeable material, California Department of Transportation specification 68-1.025, is recommended. Open-graded crushed rock, washed, may be used, but requires that 4–6 inches of washed pea gravel be substituted at the top of the crushed rock gravel layers. Do not use filter fabric to separate the soil mix from the gravel drainage layer or the gravel drainage layer from the native soil.

Underdrains. No underdrain is required where native soils beneath the facility are Hydrologic Soil Group A or B. For treatment-only facilities where native soils are Group C or D, a perforated pipe must be bedded in the gravel layer and must terminate at a storm drain or other approved discharge point.

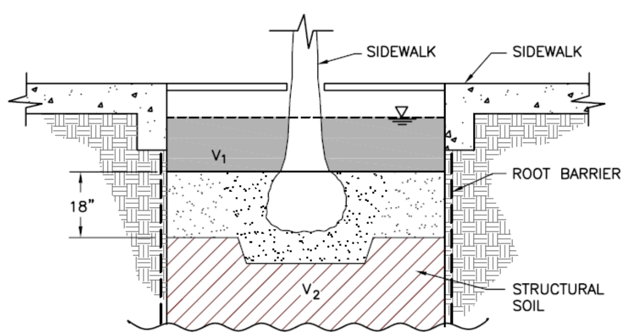
Outlets. In treatment-only facilities, outlets must be set high enough to ensure that the surface reservoir will fill and the entire surface area of soil mix will be flooded before the outlet elevation is reached. In swales, this can be achieved with appropriately placed check dams. The outlet should be designed to exclude floating mulch and debris.

Vaults, utility boxes, and light standards. It is best to locate utilities outside the bioretention facility, in adjacent walkways or in a separate area set aside for this purpose. If utility structures are to be placed within the facility, the locations should be anticipated and adjustments made to ensure that the minimum bioretention surface area and volumes are achieved. Leaving the final locations to each individual utility can produce a haphazard, unaesthetic appearance and make the bioretention facility more difficult to maintain.

Emergency overflow. The site grading plan should anticipate extreme events and potential clogging of the overflow and route emergency overflows safely.

Trees. Bioretention areas can accommodate small or large trees. There is no need to subtract the area taken up by roots from the effective area of the facility. Extensive tree roots maintain soil permeability and help retain runoff. Normal maintenance of a bioretention facility should not affect tree life span.

The bioretention facility can be integrated with a tree pit of the required depth and filled with structural soil. If a root barrier is used, it can be located to allow tree roots to spread throughout the bioretention facility while protecting adjacent pavement. Locations and planting elevations should be selected to avoid blocking the facility's inlets and outlets.



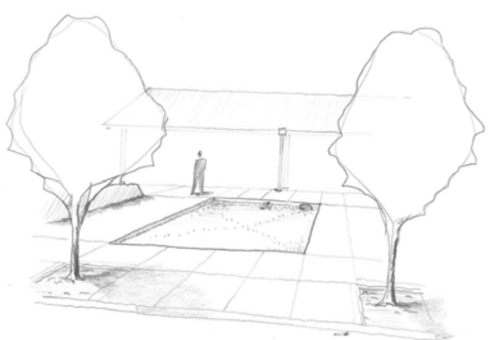
Bioretention facility configured as a tree well.
The root barrier is optional.

► APPLICATIONS

Multipurpose landscaped areas. Bioretention facilities are easily adapted to serve multiple purposes. The loamy sand soil mix will support turf or a plant palette suitable to the location and a well-drained soil.

Example landscape treatments include:

- lawn with a sloped transition to adjacent landscaping,
- a swale in the setback area,
- a swale in the parking median,
- lawn with hardscaped edge treatment,
- a decorative garden with formal or informal plantings,
- a traffic island with low-maintenance landscaping,
- a raised planter with seating, and
- bioretention on a terraced slope.

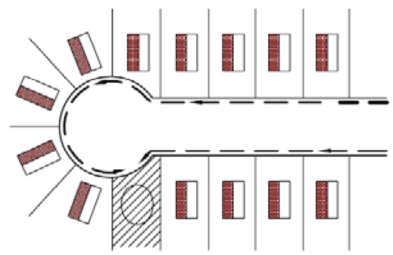


Bioretention facility configured as a recessed decorative lawn with hardscaped edge.

Bioretention facility configured and planted as a lawn/play area.

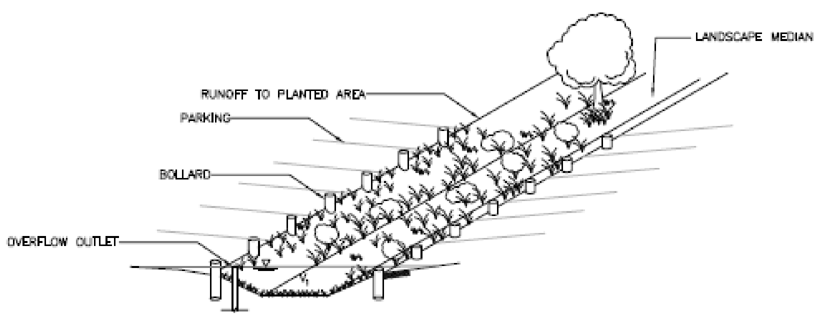
Residential subdivisions. Some subdivisions are designed to drain roofs and driveways to the streets (in the conventional manner) and then drain the streets to bioretention areas, with one bioretention area for each one to six lots, depending on subdivision layout and topography.

Bioretention areas can be placed on a separate, dedicated parcel with joint ownership.



Bioretention facility receiving drainage from individual lots and the street in a residential subdivision.

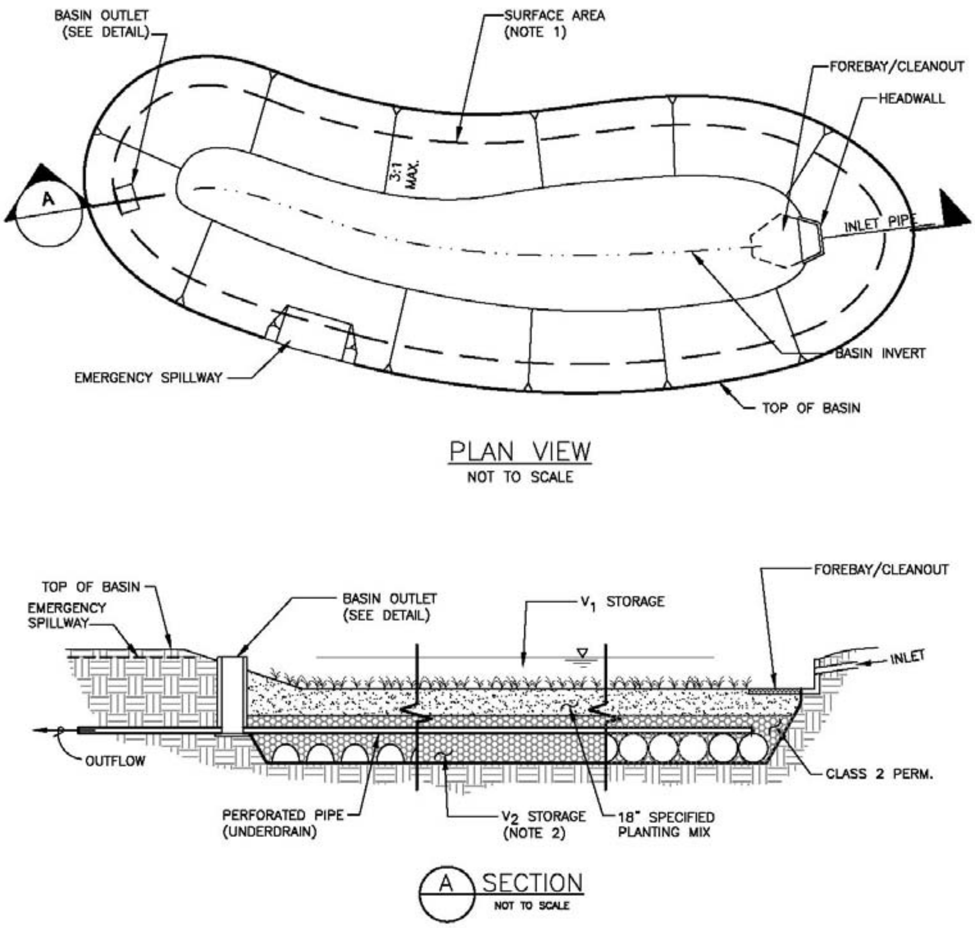
Sloped sites. Bioretention facilities must be constructed as a basin, or series of basins, with the circumference of each basin set level. It may be necessary to add curbs or low retaining walls.



Bioretention facility configured as a parking median.
Note the use of bollards in place of curbs, eliminating the need for curb cuts.

Design Checklist for Bioretention

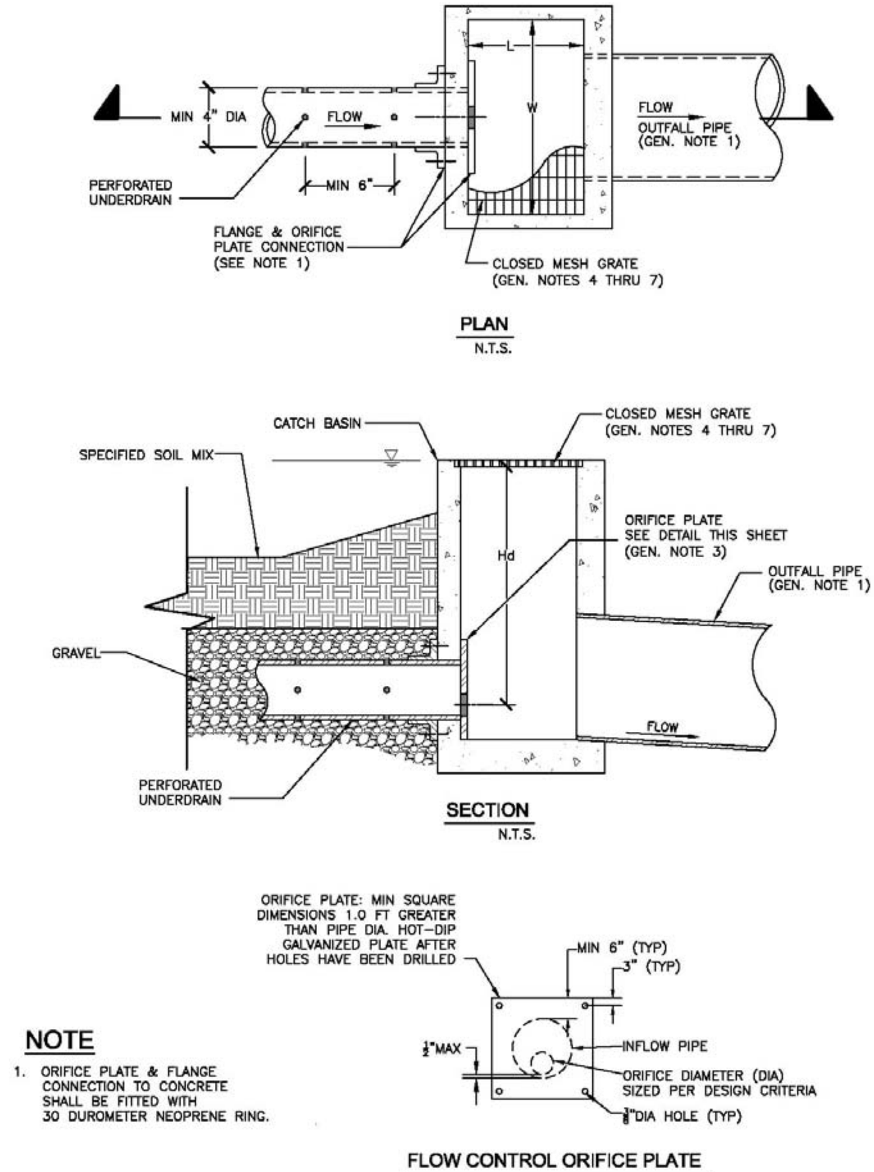
- ❒ The volume or depth of the surface reservoir meets or exceeds the minimum.
- ❒ An 18-inch-deep "loamy sand" soil mix is used with a minimum long-term percolation rate of 5 inches per hour.
- ❒ The area of soil mix meets or exceeds the minimum.
- ❒ A perforated-pipe underdrain is bedded in a "Class 2 perm" drainage layer with connection and sufficient head to the storm drain or discharge point (except in "A" or "B" soils).
- ❒ No filter fabric is being used.
- ❒ The underdrain has a clean-out port consisting of a vertical, rigid, nonperforated PVC pipe, with a minimum diameter of 6 inches and a watertight cap.
- ❒ The location and footprint of the facility are shown on the site plan and landscaping plan.
- ❒ The bioretention area is designed as a basin (level edges) or a series of basins, and the grading plan is consistent with these elevations. If the facility is designed as a swale, check dams are set so the lip of each dam is at least as high as the toe of the next upstream dam.
- ❒ Inlets are 12 inches wide, have 4–6 inches of reveal and an apron or other provision to prevent blockage when vegetation grows in, and energy dissipation as needed.
- ❒ Overflow is connected to a downstream storm drain or approved discharge point.
- ❒ Emergency spillage will be safely conveyed overland.
- ❒ Plantings are suitable to the climate and a well-drained soil.
- ❒ An irrigation system is in use with connection to a water supply.
- ❒ Vaults, utility boxes, and light standards are located outside the minimum soil mix surface area.
- ❒ When excavating, the soils are not smeared on the bottom and side slopes. Compaction of native soils and "rip" soils is minimized if soils are clayey and/or compacted. The area is protected from construction site runoff.



NOTE

1. SURFACE AREA LIMIT DETERMINED BY EXTENT OF SPECIFIED PLANTING MIX, WHICH IS GOVERNED BY THE OUTLET SPILL ELEVATION. FOR REQUIRED SURFACE AREA REFER TO THE FACTORS AND EQUATIONS IN THE STORMWATER C.3 GUIDEBOOK.
2. V_2 STORAGE ACCOMPLISHED WITH INFILTRATION ARCHES, PERFORATED PIPES, CLASS 2 PERM OR OTHER AT THE DESIGNERS DISCRETION.

Bioretention Facility



Bioretention Facility Outlet Detail - A

Flow-Through Planter


Source: City of Portland 2004

Flow-through planters treat and detain runoff without allowing seepage into the underlying soil. They can be used next to buildings and on slopes where stability might be affected by adding soil moisture.

Flow-through planters typically receive runoff via downspouts leading from the roofs of adjacent buildings. However, they can also be set in-ground and receive sheet flow from adjacent paved areas.

Pollutants are removed as runoff passes through the soil layer and is collected in an underlying layer of gravel or drain rock. A perforated-pipe underdrain is typically connected to a storm drain or other discharge point. An overflow inlet conveys flows that exceed the capacity of the planter.

Best Uses

- Management of roof runoff
- Next to buildings
- Dense urban areas
- Where infiltration is not desired

Advantages

- Can be used next to structures
- Versatile
- Can be any shape
- Low maintenance

Limitations

- Can be used for flow control only on sites with “C” and “D” soils
- Requires underdrain
- Requires 3–4 feet of head

► CRITERIA

Treatment only. For development projects subject only to runoff treatment requirements, the criteria listed below apply.

Parameter	Criterion
Soil mix depth	18 inches minimum
Soil mix minimum percolation rate	5 inches per hour minimum sustained (10 inches per hour initial rate recommended)
Soil mix surface area	0.04 times tributary impervious area (or equivalent)
Surface reservoir depth	6 inches minimum; may be sloped to 4 inches where adjoining walkways
Underdrain	Typically used. Perforated pipe embedded in gravel ("Class 2 permeable" recommended), connected to storm drain or other accepted discharge point

► DETAILS

Configuration. The planter must be level. To avoid standing water in the subsurface layer, the perforated pipe underdrain and orifice should be set as nearly flush with the planter bottom as possible.

Inlets. Plantings should be protected from high-velocity flows by adding rocks or other energy-dissipating structures at downspouts and other inlets.

Soil mix. The required soil mix is similar to a loamy sand. It must maintain a minimum percolation rate of 5 inches per hour throughout the life of the facility, and it must be suitable for maintaining plant life. Typically, on-site soils will not be suitable because of their clay content.

Gravel storage and drainage layer. Class 2 permeable material, California Department of Transportation specification 68-1.025, is recommended. Open-graded crushed rock, washed, may be used, but requires that 4–6 inches of washed pea gravel be substituted at the top of the crushed rock layer. Do not use filter fabric to separate the soil mix from the gravel drainage layer.

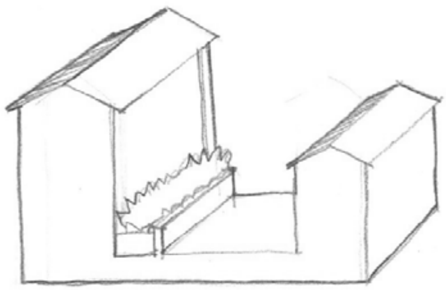
Emergency overflow. The planter design and installation should anticipate extreme events and potential clogging of the overflow and route emergency overflows safely.

► APPLICATIONS

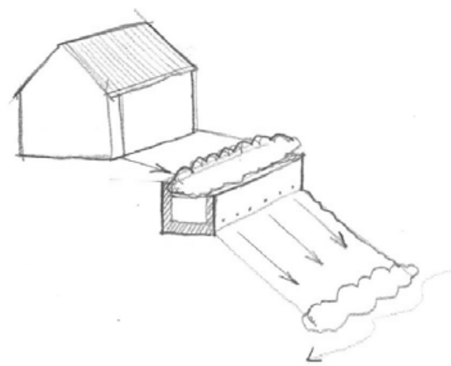
Adjacent to buildings. Flow-through planters may be located adjacent to buildings, where the planter vegetation can soften the visual effect of the building wall. A setback with a raised planter box may be appropriate even in some neotraditional pedestrian-oriented urban streetscapes.

At plaza level. Flow-through planters have been successfully incorporated into podium-style developments, with the planters placed on the plaza level and receiving runoff from the tower roofs above. Runoff from the plaza level is typically managed separately by additional flow-through planters or bioretention facilities located at street level.

Steep slopes. Flow-through planters provide a means to detain and treat runoff on slopes that cannot accept infiltration from a bioretention facility. The planter can be built into the slope, similar to a retaining wall. The design should consider the need to access the planter for periodic maintenance. Flows from the planter underdrain and overflow must be directed in accordance with City requirements. It is sometimes possible to disperse these flows to the downgradient hillside.



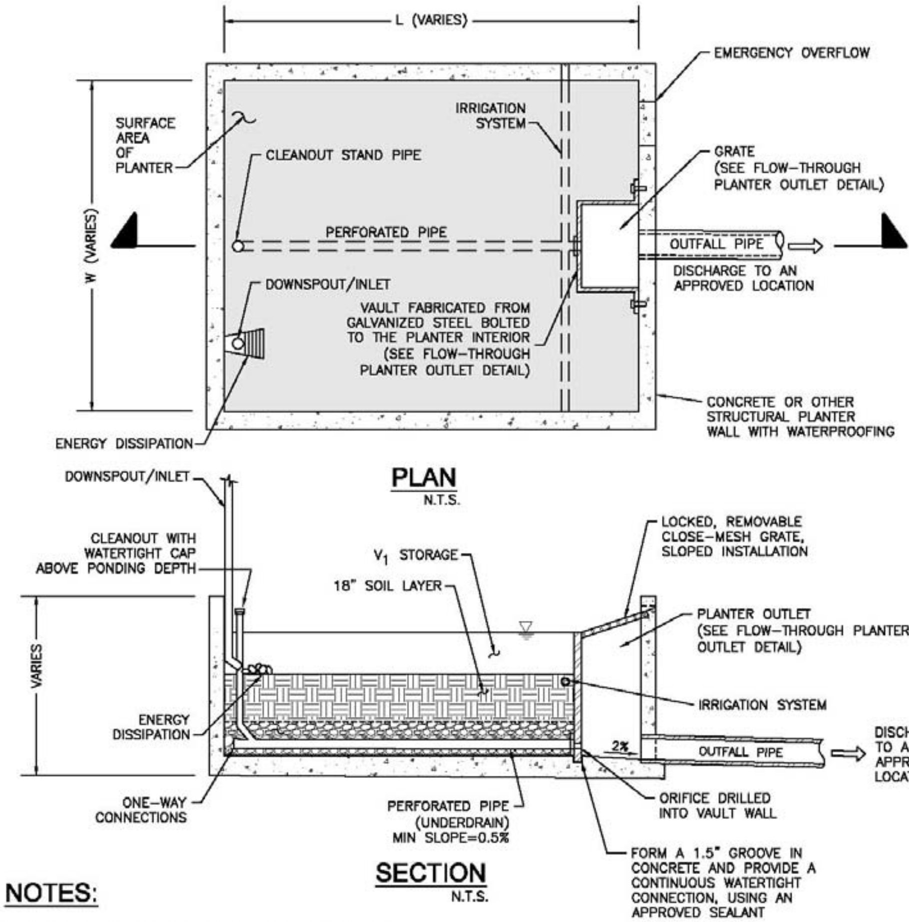
Flow-through planter on the plaza level of a podium-style development.



Flow-through planter built into a hillside. Flows from the underdrain and overflow must be directed in accordance with City requirements.

Design Checklist for Flow-Through Planter

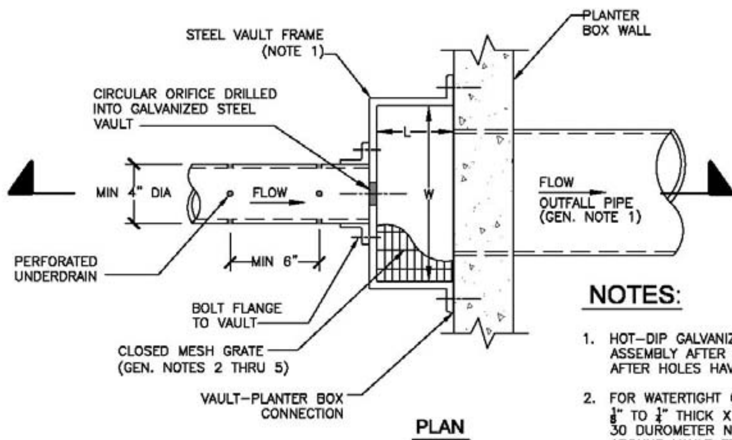
- ❒ Reservoir depth is at least 4–6 inches.
- ❒ An 18-inch-deep "loamy sand" soil mix is used with a minimum long-term infiltration rate of 5 inches per hour.
- ❒ The area of soil mix meets or exceeds the minimum.
- ❒ The drainage layer is composed of Class 2 permeable material.
- ❒ No filter fabric is being used.
- ❒ A perforated-pipe underdrain with outlet is located flush or nearly flush with the planter bottom, with connection and sufficient head to the storm drain or discharge point.
- ❒ The underdrain has a clean-out port consisting of a vertical, rigid, nonperforated PVC pipe, with a minimum diameter of 6 inches and a watertight cap.
- ❒ Overflow connected to a downstream storm drain or approved discharge point.
- ❒ The location and footprint of the facility are shown on the site plan and landscaping plan.
- ❒ The planter is set level.
- ❒ Emergency spillage will be safely conveyed overland.
- ❒ Plantings are suitable to the climate and a well-drained soil.
- ❒ An irrigation system is in use with connection to a water supply.



NOTES:

1. FLOW–THROUGH PLANTER SHALL BE SIZED TO MEET CCCWP CRITERIA FOR TREATMENT AND/OR FLOW CONTROL.
2. MINIMUM SURFACE AREA OF PLANTER IS 4% OF TRIBUTARY IMPERVIOUS AREA FOR TREATMENT ONLY DESIGN. FOR FLOW CONTROL AND TREATMENT, REFER TO CCCWP SIZING TOOL CRITERIA.
3. SHAPE OF PLANTER CAN VARY TO MEET PROJECT DESIGN REQUIREMENTS AND LOCATION.
4. CLASS 2 PERMEABLE MATERIAL
5. DOWNSPOUTS/INLET PIPES REQUIRE ENERGY DISSIPATION.
6. USE COUNTY APPROVED ADDITIVE MIXTURE FOR WATERPROOFING CONCRETE.
7. PLANTINGS: SEE CCCWP RECOMMENDED PLANT LIST AND GUIDELINES.
8. PLANTER DESIGN MAY REQUIRE STRUCTURAL ENGINEERING DESIGN.
9. AREA = W x L (ABOVE). EXCLUDES AREA OF VAULT

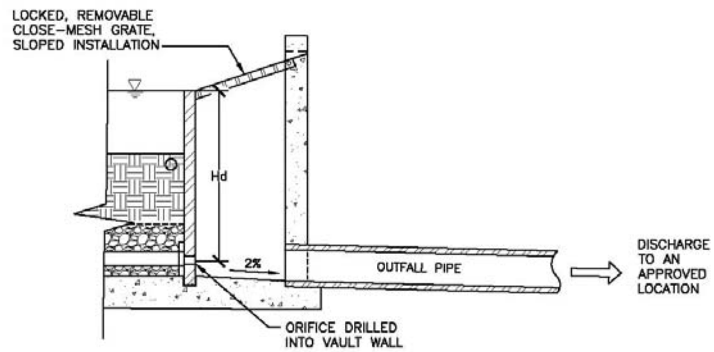
Flow-Through Planter Detail



PLAN
N.T.S.

NOTES:

1. HOT–DIP GALVANIZE ENTIRE FRAME ASSEMBLY AFTER FABRICATION AND AFTER HOLES HAVE BEEN DRILLED.
2. FOR WATERTIGHT CONNECTION, INSTALL 1/8" TO 1/4" THICK X 2" WIDE CONTINUOUS 30 DUROMETER NEOPRENE GASKET, ALL AROUND VAULT FRAME.



SECTION
N.T.S.

GENERAL OUTLET DETAIL NOTES:

1. OUTFALL PIPE SHALL BE SIZED TO CONVEY DESIGN STORM PER CCCWP DESIGN CRITERIA.
2. GRATE SHALL BE MOUNTED USING STAINLESS STEEL HARDWARE AND PROVIDED WITH HINGED AND LOCKABLE OR BOLTABLE ACCESS PANELS.
3. GRATE SHALL BE STAINLESS STEEL, ALUMINUM OR STEEL. STEEL GRATES SHALL BE HOT DIP GALVANIZED AND MAY BE HOT POWDER PAINTED AFTER GALVANIZING.
4. GRATE SHALL BE DESIGNED SUCH THAT THE DIAGONAL DIMENSION OF EACH OPENING IS SMALLER THAN THE DIAMETER OF THE OUTLET PIPE.
5. STRUCTURAL DESIGN OF GRATE SHALL BE BASED ON FULL HYDROSTATIC HEAD WITH ZERO HEAD DOWNSTREAM OF GRATE.

Flow-Through Planter Outlet Detail

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Dry Wells and Infiltration Basins

The typical dry well is a prefabricated structure, such as an open-bottomed vault or box, placed in an excavation or boring. The vault may be empty, which provides maximum space efficiency, or may be filled in rock.

An infiltration basin has the same functional components—a volume to store runoff and sufficient area to infiltrate that volume into the native soil—but is open rather than covered.

► CRITERIA

Dry wells and infiltration basins must be designed with the minimum volume calculated by Equation 4-4, using a unit volume based on the County's 85th Percentile Isopluvial Map.

The City engineer may need to verify that soil permeability and other site conditions are suitable for dry wells and infiltration basins. Some proposed criteria are on Page 5-12 of the California Department of Transportation's 2004 *BMP Retrofit Pilot Study Final Report* (CTSW-RT-01-050).

The infiltration rate and infiltrative area must be sufficient to drain a full facility within 72 hours.

► DETAILS

Dry wells should be sited to allow for the potential future need for removal and replacement.

In locations where native soils are coarser than a medium sand, the area directly beneath the facility should be overexcavated by 2 feet and backfilled with sand as a groundwater protection measure.

Best Uses

- Alternative to bioretention in areas with permeable soils

Advantages

- Compact footprint
- Can be installed in paved areas

Limitations

- Can be used only on sites with "A" and "B" soils
- Requires minimum of 10 feet from bottom of facility to seasonal high groundwater
- Not suitable for drainage from some industrial areas or arterial roads
- Must be maintained to prevent clogging.

Design Checklist for Dry Well

- ❐ The volume and infiltrative area meet or exceed minimum.
- ❐ Overflow is connected to a downstream storm drain or approved discharge point.
- ❐ Emergency spillage will be safely conveyed overland.
- ❐ Depth from the bottom of the facility to the seasonally high groundwater elevation is ≥10 feet.
- ❐ Areas tributary to the facility do not include automotive repair shops, car washes, fleet storage areas (e.g., bus, truck), nurseries, or other uses that may present an exceptional threat to groundwater quality.
- ❐ Underlying soils are in Hydrologic Soil Group A or B. The infiltration rate is sufficient to ensure that a full basin will drain completely within 72 hours. The soil infiltration rate has been confirmed.
- ❐ The dry well is set back from structures 10 feet or as recommended by structural or geotechnical engineer.

Cistern with Bioretention Facility

A cistern in series with a bioretention facility can meet treatment requirements where space is limited. In this configuration, the cistern is equipped with a flow control orifice and the bioretention facility is sized to treat a trickle outflow from the cistern.

Best Uses

- In series with a bioretention facility to meet treatment requirement in limited space
- For management of roof runoff
- In dense urban areas

Advantages

- Storage volume can be in any configuration

Limitations

- Somewhat complex to design, build, and operate
- Head required for both the cistern and the bioretention facility

► CRITERIA

Cistern. The cistern must detain the volume calculated by Equation 4-4 and must include an orifice or other device designed for a 24-hour drawdown time.

Bioretention facility. See the design sheet for bioretention facilities. The area of the bioretention facility must be sized to treat the maximum discharge flow, assuming a percolation rate of 5 inches per hour through the engineered soil.

Use with sand filter. A cistern in series with a sand filter can meet treatment requirements. See the discussion of treatment facility selection in Chapter 2 and the design guidance for sand filters in Chapter 4.

► DETAILS

Flow control orifice. The cistern must be equipped with an orifice plate or other device to limit flow to the bioretention area.

Preventing mosquito harborage. Cisterns should be designed to drain completely, leaving no standing water. Drains should be located flush with the bottom of the cistern. Alternatively or in addition, all entry and exit points should be provided with traps or sealed or screened to prevent mosquito entry. Note that mosquitoes can enter through openings $^1/_{16}$ inch or larger and will fly for many feet through pipes as small as ¼ inch.

Exclude debris. Leaf guards and/or screens should be provided to prevent debris from accumulating in the cistern.

Ensure access for maintenance. The cistern should be designed to allow for cleanout. The need for maintenance workers to enter a confined space should be avoided. The outlet orifice should be easily accessed for cleaning and maintenance.

► APPLICATIONS

Shallow ponding on a flat roof. The "cistern" storage volume can be designed in any configuration, including simply storing rainfall on the roof where it falls and draining it away slowly. See the County's 85th percentile isopluvial diagrams for required average depths.

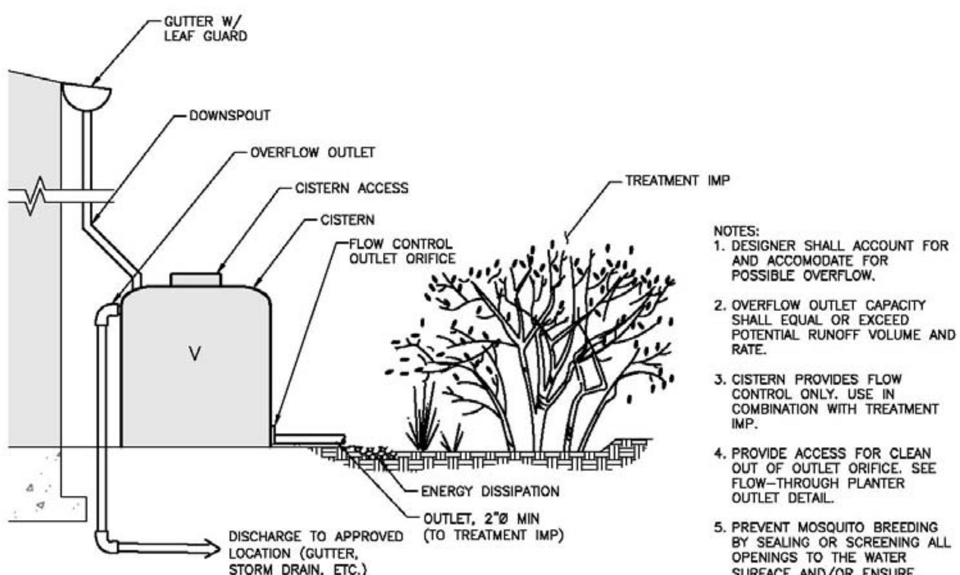
Cistern attached to a building and draining to a planter. This arrangement allows a planter box to be constructed with a smaller area.

Vault with pumped discharge to bioretention facility. In this arrangement, runoff from a parking lot and/or building roofs can be captured and detained underground and then pumped to a bioretention facility on the surface. Alternatively, treatment can be accomplished with a sand filter. See the discussion of selection of stormwater treatment facilities in Chapter 2.

Water harvesting or graywater reuse. It may be possible to create a site-specific design that uses cisterns to achieve stormwater flow control, stormwater treatment, and rainwater reuse for irrigation or indoor uses (water harvesting). Facilities must meet criteria for capturing and treating the volume specified by Equation 4-4. This volume must be allowed to empty within 24 hours so that runoff from additional storms that may follow can also be captured and treated. Additional volume may be required if the system also stores runoff for longer periods for reuse.

Design Checklist for Cistern

- ❒ The volume meets or exceeds the minimum.
- ❒ An outlet with an orifice or other flow control device restricts flow and is designed to provide a 24-hour drawdown time.
- ❒ The outlet is piped to a bioretention facility designed to treat the maximum discharge from the cistern orifice.
- ❒ The cistern is designed to drain completely and/or sealed to avoid harboring mosquitoes.
- ❒ The design provides for exclusion of debris and accessibility for maintenance.
- ❒ Overflow is connected to a downstream storm drain or approved discharge point.
- ❒ Emergency spillage will be safely conveyed overland.



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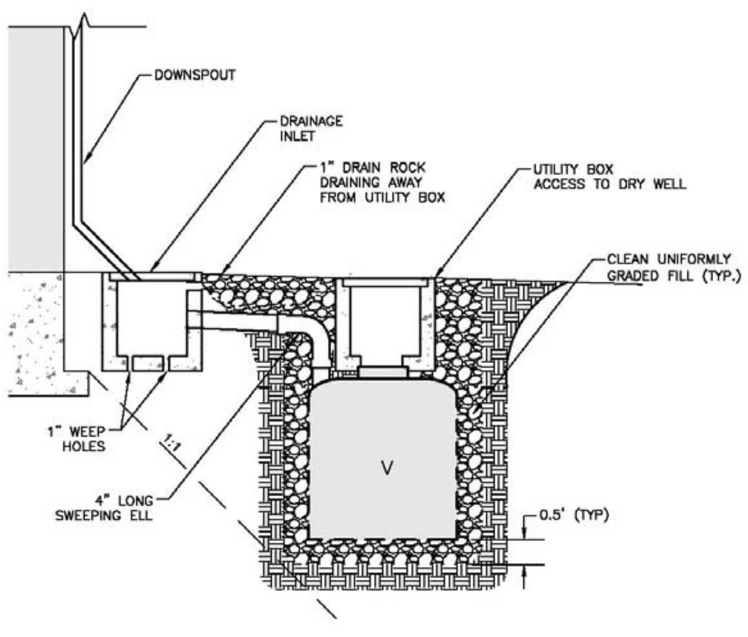

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Chapter

5

Operation and Maintenance of Stormwater Facilities

How to prepare a customized stormwater maintenance plan for the treatment BMPs on your site.

The Stormwater Permit requires the City to verify that all treatment and flow control facilities are adequately maintained. Facilities installed as part of your project will be verified for effectiveness and proper performance. You may also need to verify the ongoing function of stormwater management features that are not treatment or flow control facilities, such as permeable pavements and limitations on impervious area.

Operation and maintenance of stormwater facilities is a six-stage process:

1. Determine who will own the facility and be responsible for maintaining treatment facilities. Identify the means by which ongoing maintenance will be assured (for example, a maintenance agreement that runs with the land).

2. Identify typical maintenance requirements, and allow for these requirements in project planning and preliminary design.

3. Prepare a maintenance plan for the site incorporating detailed requirements for each treatment and flow control facility.

4. Maintain the facilities from the time they are constructed until ownership and maintenance responsibility is formally transferred.

5. Formally transfer operation and maintenance responsibility to the site owner or occupant. A warranty, secured by a bond, or other financial instrument, may be required to secure against lack of performance caused by flaws in design or construction.

6. Maintain the facilities in perpetuity and comply with the City's self-inspection, reporting, and verification requirements.

See the schedule for these stages in Table 5-1.

Stage 1: Ownership and Responsibility

A means of ensuring maintenance of treatment and flow control facilities in perpetuity must be specified. Depending on the intended use of the site and City policies, this may require one or more of the following:

- execution of a maintenance agreement that "runs with the land";
- creation of a homeowners association and execution of an agreement by the homeowners association to maintain the facilities and pay an annual inspection fee;
- formation of a new community facilities district or other special district, or addition of the properties to an existing special district; or
- dedication of fee title or easement transferring ownership of the facility (and the land under it) to the City.

Ownership and maintenance responsibility for treatment and flow control facilities should be discussed at the beginning of project planning, typically at the preapplication meeting for planning and zoning review. Experience has shown that provisions to finance and implement maintenance of treatment and flow control facilities can be a major stumbling block to project approval, particularly for small residential subdivisions. (See "New Subdivisions" in Chapter 1.)

► PRIVATE OWNERSHIP AND MAINTENANCE

The City may require that a maintenance agreement be executed as a condition of project approval.

Table 5-1. Schedule for Planning Operation and Maintenance of Stormwater Treatment Best Management Practices

Stage	Description	Schedule
1	Determine facility ownership and maintenance responsibility.	To be discussed with City planning staff at preapplication meeting
2	Identify typical maintenance requirements.	To be coordinated with the planning and zoning application in the initial submittal
3	Develop a detailed operation and maintenance plan.	As required by the City
4	Perform interim operation and maintenance of facilities.	During and after construction, including the warranty period
5	Formally transfer responsibility for operation and maintenance.	On sale and transfer of the property or permanent occupancy
6	Ongoing maintenance and compliance with inspection and reporting requirements.	In perpetuity

The City may collect a management and/or inspection fee established by a standard fee schedule as part of these agreements. In addition, the agreement may provide that, if the property owner fails to maintain the stormwater facility, the City may enter the property; restore the stormwater facility to good working order; and obtain reimbursement, including administrative costs, from the property owner.

► TRANSFER TO PUBLIC OWNERSHIP

The City may sometimes choose to have a treatment and flow control facility deeded to the public in fee or as an easement and to maintain the facility as part of the municipal storm drain system. The City may recoup the costs of maintenance through a special tax, assessment district, or similar mechanism.

Locating an IMP in a public right-of-way or easement creates an additional design constraint, along with hydraulic grade, aesthetics, landscaping, and circulation. However, because sites typically drain to the street, it may be possible to locate a bioretention swale parallel with the edge of the parcel. The facility may complement or substitute for an underground storm drain system.

Even if the facility is to be conveyed to the City after construction is complete, it is still the builder's responsibility to identify general operation and maintenance requirements, prepare a detailed operation and maintenance plan, and maintain the facility until that responsibility is formally transferred.

Stage 2: General Maintenance Requirements

The SUSMP project submittal should include a general description of anticipated facility maintenance requirements. This will help ensure that:

- the ongoing costs of maintenance have been considered in facility selection and design,
- site and landscaping plans provide for access for inspections and by maintenance equipment,
- landscaping plans incorporate irrigation requirements for facility plantings, and
- initial maintenance and replacement of facility plantings is incorporated into landscaping contracts and guarantees.

Fact sheets available on the Project Clean Water Web site (http://www.projectcleanwater.com) describe general maintenance requirements for the types of stormwater facilities featured in the LID design guide (Chapter 4). This information can be used to specify general maintenance requirements in the SUSMP project submittal.

Maintenance fact sheets for conventional stormwater facilities are available in the *California Stormwater Best Management Practice Handbooks* **http://www.cabmphandbooks.org** (CASQA 2003). A subscription fee may apply to access these handbooks.

Stage 3: Detailed Maintenance Plan

A detailed maintenance plan should be prepared and submitted as required by the City. A detailed maintenance plan should be included with the initial SUSMP project submittal. Modifications to the plan may be required by the City to incorporate solutions to any problems or changes that occurred during project construction.

The detailed maintenance plan should be kept on-site for use by maintenance personnel and during site inspections. It is also recommended that a copy of the initial SUSMP project submittal be kept on-site as a reference.

► THE DETAILED MAINTENANCE PLAN: STEP BY STEP

Preparing a detailed maintenance plan will require familiarity with your stormwater facilities as they have been or will be constructed and a fair amount of "thinking through" plans for their operation and maintenance. The following step-by-step guidance will help you prepare the plan.

► STEP 1: DESIGNATE RESPONSIBLE INDIVIDUALS

First, designate and identify:

- the individual who will be direct responsible for maintaining stormwater controls, and who should be the designated contact with City inspectors and sign self-inspection reports and correspondence with the City regarding verification inspections;
- employees or contractors who will report to the designated contact and be responsible for carrying out BMP operation and maintenance;
- the corporate officer authorized to negotiate and execute any contracts that might be necessary for future changes to operation and maintenance, or to implement remedial measures if problems occur; and
- the designated respondent to problems, such as clogged drains or broken irrigation mains, that would require immediate response should they occur during off-hours.

Updated contact information must be provided to the City immediately whenever a property is sold and whenever designated individuals or contractors change.

Draw or sketch an organization chart to show the relationships of authority and responsibility between the individuals responsible for maintenance. This need not be elaborate, particularly for smaller organizations.

Describe how funding for BMP operation and maintenance will be assured, including sources of funds, the budget category for expenditures, the process for establishing the annual maintenance budget, and the process for obtaining authority should unexpected expenditures for major corrective maintenance be required.

Describe how your organization will initially train staff or contractors regarding the purpose, mode of operation, and maintenance requirements for the stormwater facilities on the site. Also, describe how the organization will ensure that ongoing training is provided as needed and in response to staff changes.

► STEP 2: SUMMARIZE DRAINAGE AND BEST MANAGEMENT PRACTICES

Incorporate the following information from the SUSMP project submittal into the maintenance plan:

- figures delineating and designating pervious and impervious areas,
- figures showing locations of stormwater facilities on the site, and
- tables of pervious and impervious areas served by each facility.

Review the narrative in the SUSMP project submittal, if any, that describes each facility and its tributary drainage area. Update the text to incorporate any changes that may have occurred during planning and zoning review, building permit review, or construction. Incorporate the updated text into the maintenance plan.

► STEP 3: DOCUMENT FACILITIES "AS BUILT"

Include the following information from final construction drawings:

- plans, elevations, and details of all facilities, annotating if necessary with designations used in the initial SUSMP project submittal;
- design information or calculations submitted in the detailed design phase (i.e., not included in the initial SUSMP project submittal); and
- specifications of construction for facilities, including sand or soil, compaction, pipe materials, and bedding.

In the maintenance plan, note field changes to design drawings, including changes to any of the following:

- location and layouts of inflow piping, flow splitter boxes, and piping to off-site discharge;
- depths and layering of soil, sand, or gravel;
- placement of filter fabric or geotextiles;
- changes or substitutions in soil or other materials; or
- natural soils encountered (e.g., sand or clay lenses).

► STEP 4: PREPARE MAINTENANCE PLANS FOR EACH FACILITY

Prepare a maintenance plan, schedule, and inspection checklists (routine, annual, and after major storms) for each facility. Plans and schedules for two or more similar facilities on the same site may be combined.

Use the following resources to prepare a customized maintenance plan, schedule, and checklists:

- specific information noted in Steps 2 and 3, above;
- other input from the facility designer, City staff, or other sources; and
- operation and maintenance fact sheets (available on the Project Clean Water Web site, **http://www.projectcleanwater.org**).

Note any particular characteristics or circumstances that could require attention in the future, and include any troubleshooting advice. Also include manufacturer's data, operating manuals, and maintenance requirements for any pumps or other mechanical equipment and proprietary devices used as BMPs.

Manufacturers' publications should be referenced in the text (including models and serial numbers where available). Copies of the manufacturers' publications should be included as an attachment in the back of the maintenance plan or as a separate document.

► STEP 5: COMPILE MAINTENANCE PLAN

The following general outline is provided as an example to assist in developing a maintenance plan.

I. Inspection and Maintenance Log

II. Updates, Revisions, and Errata

III. Introduction (narrative overview describing the site; drainage areas, routing, and discharge points; and treatment facilities)

IV. Responsibility for Maintenance

    A. General

        1. Name and contact information for responsible individual(s)

        2. Organization chart or charts showing organization of the maintenance function and location within the overall organization

        3. Reference to operation and maintenance agreement (if any), and attached copy of the agreement

        4. Maintenance funding

(a) Sources of funds for maintenance

(b) Budget category or line item

(c) Description of procedure and process for ensuring adequate funding for maintenance

B. Staff Training Program

C. Records

D. Safety

V. Summary of Drainage Areas and Stormwater Facilities

A. Drainage Areas

1. Drawings showing pervious and impervious areas (copied or adapted from initial SUSMP project submittal)

2. Designation and description of each drainage area and how flow is routed to the corresponding facility

B. Treatment and Flow Control Facilities

1. Drawings showing location and type of each facility

2. General description of each facility (consider a table if more than two facilities)

(a) Area drained and routing of discharge

(b) Facility type and size

VI. Facility Documentation

A. “As-Built” Drawings of Each Facility (design drawings in the draft plan)

B. Manufacturer’s Data, Manuals, and Maintenance Requirements for Pumps, Mechanical or Electrical Equipment, and Proprietary Facilities (include a “placeholder” in the draft plan for information not yet available)

C. Specific Operation and Maintenance Concerns and Troubleshooting

VII. Maintenance Schedule or Matrix

A. Maintenance Schedule for Each Facility with Specific Requirements for:

1. Routine inspection and maintenance

2. Annual inspection and maintenance

3. Inspection and maintenance after major storms

B. Service Agreement Information

Assemble and make copies of the maintenance plan. One copy must be submitted to the City, and at least one copy kept on-site. The following are some suggestions for formatting the maintenance plan:

- Format plans to 8½ x 11 inches to facilitate duplication, filing, and handling.
- Include the revision date in the footer on each page.
- Scan graphics and incorporate with text into a single electronic file. Keep the electronic file backed up so that copies of the maintenance plan can be made if the hard copy is lost or damaged.

► STEP 6: UPDATES

The maintenance plan will be a living document. Operation and maintenance personnel may change, mechanical equipment may be replaced, and additional maintenance procedures may be needed. Throughout these changes, the maintenance plan must be kept up to date. Updates may be transmitted to the City at any time. However, at a minimum, updates to the maintenance plan must accompany the annual inspection report.

Stage 4: Interim Maintenance

The City may require applicants to warranty stormwater facilities against lack of performance caused by flaws in design or construction. The warranty may need to be secured by a bond or other financial instrument.

Stage 5: Transfer Responsibility

The detailed maintenance plan should note the expected date when responsibility for operation and maintenance will be transferred. Notify the City when this transfer of responsibility takes place.

Stage 6: Verification of Operation and Maintenance

The City implements an operation and maintenance verification program, including periodic site inspections. City staff should be contacted to determine the frequency of inspections, whether self-inspections are allowed, and applicable fees, if any.

References and Resources

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- *Stormwater Management Manual* (City of Portland 2004), Chapter 3.
- *California Stormwater Best Management Practice Handbooks* (CASQA 2003).
- *Best Management Practices Guide* (HR STORM 2002).
- *Operation, Maintenance, and Management of Stormwater Management Systems* (Watershed Management Institute 1997)

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Glossary

Attached Residential Development	Any development that provides 10 or more residential units that share an interior/exterior wall. This category includes but is not limited to dormitories, condominiums, and apartments.
Automotive Repair Shop	A facility that is categorized in any one of the following Standard Industrial Classification (SIC) codes: 5013, 5014, 5541, 7532-7534, or 7536–7539.
Best Management Practice (BMP)	Any procedure or device designed to minimize the quantity of pollutants entering the storm drain system.
Bioretention	An upland water quality and water quantity control practice that uses the chemical, biological, and physical properties of plants, microbes, and soils to remove pollutants from stormwater runoff.
California Association of Stormwater Quality Agencies (CASQA)	Publisher of the *California Stormwater Best Management Practice Handbooks*, available at http://www.cabmphandbooks.com. Successor to the Storm Water Quality Task Force (SWQTF).
Commercial Development	Any development on private land that is not exclusively heavy industrial or residential uses. The category includes but is not limited to mini-malls and other business complexes, shopping malls, hotels, office buildings, public warehouses, hospitals, laboratories and other medical facilities, educational institutions, recreational facilities, plant nurseries, car wash facilities, and other light industrial complexes.
Conditions of Approval (COAs)	Requirements a municipality 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.
Continuous Simulation Modeling	A method of hydrological analysis in which a set of rainfall data (typically hourly for 30 years or more) is used as input, and runoff rates are calculated on the same time step. The output is then analyzed statistically for the purposes of comparing runoff patterns under different conditions (for example, predevelopment and postdevelopment).
Copermittees	See dischargers.
Detached Residential Development	Any development that provides 10 or more freestanding residential units separated by a minimum of 10 feet. This category includes but is not limited to detached homes, such as single-family homes and detached condominiums.
Detention	The practice of holding stormwater runoff in ponds or vaults, within berms, or in depressed areas and letting it discharge slowly to the storm drain system. See infiltration and retention.

Directly Connected Impervious Area	Any impervious surface that drains into a catch basin, area drain, or other conveyance structure without first allowing flow across pervious areas (e.g., lawns).
Dischargers	The agencies named in the San Diego Regional Water Quality Control Board's Stormwater Permit (see definition): the County of San Diego; the Cities of Carlsbad, El Cajon, La Mesa, Poway, Solana Beach, Chula Vista, Encinitas, Lemon Grove, San Diego, Vista, Coronado, Escondido, National City, San Marcos, Del Mar, Imperial Beach, Oceanside, and Santee; the San Diego Unified Port District, and the San Diego County Regional Airport Authority.
Discretionary Action	Any adoption or amendment of a land use plan, zoning or rezoning action, development agreement, subdivision of land in accordance with the Subdivision Map Act, or development permit reviewed by Planning Division staff.
Drainage Management Areas	Areas delineated on a map of the development site showing how drainage is detained, dispersed, or directed to integrated management practices. There are four types of drainage management areas, and specific criteria apply to each type of area. See Chapter 4.
Drawdown Time	The time required for a stormwater detention or infiltration facility to drain and return to the dry-weather condition. For detention facilities, drawdown time is a function of basin volume and outlet orifice size. For infiltration facilities, drawdown time is a function of basin volume and infiltration rate.
Environmentally Sensitive Areas	Areas that include but are not limited to all water bodies listed as impaired under Clean Water Act Section 303(d); areas designated as Areas of Special Biological Significance by the State Water Resources Control Board (*Water Quality Control Plan for the San Diego Basin* [1994] and amendments); water bodies designated with the RARE beneficial use by the State Water Resources Control Board (*Water Quality Control Plan for the San Diego Basin* [1994] and amendments); areas designated as preserves or their equivalent under the Multi Species Conservation Program within the cities and the County of San Diego; and any other equivalent environmentally sensitive areas that have been identified by the copermittees.
Flow Control	Control of runoff rates and durations as required by the *Draft Hydromodification Management Plan.*
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).
Higher-Rate Biofilter	A biofilter with a design surface loading rate higher than 5 inches per hour, the rate specified in this document for bioretention facilities and planter boxes.
Hillside	Lands that have a natural gradient of 15% or greater.
Hydrograph	Runoff flow rate plotted as a function of time.
Hydrologic Soil Group	Classification of soils by the U.S. Natural Resources Conservation Service (NRCS) into groups A, B, C, and D according to infiltration capacity.

Hydromodification	The change in the natural hydrologic processes and runoff characteristics (i.e., interception, infiltration, overland flow, interflow, and groundwater flow) caused by urbanization or other land use changes that result in increased streamflows and changes in sediment transport. Alternation of stream and river channels, installation of dams and water impoundments, and excessive streambank and shoreline erosion are also considered hydromodification because they disrupt a watershed's natural hydrologic processes.
Hydromodification Management Plan (HMP)	A plan implemented by the dischargers so that postproject runoff shall not exceed estimated preproject rates and/or durations, where increased runoff would result in increased potential for erosion or other adverse impacts on beneficial uses. Also see flow control.
Impervious Surface	Any material that prevents or substantially reduces infiltration of water into the soil. See discussion of imperviousness in Chapter 2.
Infeasible	As applied to a BMP, impossible to implement because of technical constraints specific to the site.
Infiltration	Seepage of runoff into soils underlying the site. See retention.
Infiltration Device	Any structure, such as a dry well, that is designed to infiltrate stormwater into the subsurface and, as designed, bypasses the natural groundwater protection afforded by surface or near-surface soil. See direct infiltration.
Integrated Management Practice (IMP)	A facility (BMP) that provides small-scale treatment, retention, and/or detention and is integrated into site layout, landscaping, and drainage design. See Low Impact Development.
Interim Hydromodification Criteria	Criteria prepared pursuant to Stormwater Permit Provision D.1.d.g.(6) that apply to projects disturbing 50 acres or more. The criteria are described in Chapter 2 and in memoranda on the Project Clean Water Web site.
Low Impact Development	An integrated site design methodology that uses small-scale detention and retention (IMPs) to mimic preexisting site hydrological conditions.
Maximum Extent Practicable (MEP)	A standard, established by the 1987 amendments to the Clean Water Act, for the implementation of municipal stormwater pollution prevention programs. According to the Clean Water Act, 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."
National Pollutant Discharge Elimination System (NPDES)	A permitting system established by Congress as part of the 1972 Clean Water Act to regulate the discharge of pollutants from municipal sanitary sewers and industries. The NPDES was expanded in 1987 to incorporate permits for stormwater discharges as well.
Natural Drainage	A natural swale or topographic depression that gathers and/or conveys runoff to a permanent or intermittent watercourse or water body.

New Development	Land-disturbing activities; structural development, including construction or installation of a building or structure; the creation of impervious surfaces; and land subdivision.
Numeric Sizing Criteria	Sizing requirements for stormwater treatment facilities established in Provision D.1.d.(6)(c) of the San Diego Regional Water Quality Control Board's stormwater permit.
Operation and Maintenance (O&M)	Refers to requirements in the Stormwater Permit to inspect treatment BMPs and implement preventative and corrective maintenance in perpetuity. See Chapter 5.
Parking Lot	A land area or facility for the temporary parking or storage of motor vehicles used personally, for business, or for commerce.
Permeable Pavements	Pavements for roadways, sidewalks, or plazas that are designed to infiltrate a portion of rainfall, including pervious concrete, pervious asphalt, unit-pavers-on-sand, and crushed gravel.
Priority Development Project	A project subject to the requirements of this standard urban stormwater mitigation plan (SUSMP). Defined in Stormwater Permit Provision D.1.d.(1). See Chapter 1, Table 1.1.
Project Area	All areas to be altered or developed by the project, plus any additional areas that drain onto areas to be altered or developed.
Proprietary Device	A device marketed under legal right of the manufacturer.
Rational Method	A method of calculating runoff flows based on rainfall intensity, tributary area, and a factor representing the proportion of rainfall that runs off.
Receiving Waters	Surface bodies of water that directly or indirectly receive discharges from urban runoff conveyance systems, including naturally occurring wetlands, creeks, rivers, reservoirs, lakes, lagoons, estuaries, harbors, bays, and the Pacific Ocean. For purposes of this definition, the City of Escondido shall define wetlands and the limits thereof. Constructed wetlands are not considered wetlands under this definition.
Redevelopment	The creation, addition, and/or replacement of impervious surface on an already developed site. Examples include the expansion of a building footprint, road widening, the addition to or replacement of a structure, and creation or addition of impervious surfaces. Replacement of impervious surfaces includes any activity that is not part of a routine maintenance activity where impervious material(s) are removed, exposing underlying soil during construction. Redevelopment does not include trenching and resurfacing associated with utility work; resurfacing and reconfiguring surface parking lots and existing roadways; constructing new sidewalks, pedestrian ramps, or bike lanes on existing roads; and routinely replacing damaged pavement, such as repairing potholes.
Regional Water Quality Control Board (RWQCB)	Any one of nine entities in California responsible for implementing pollution control provisions of the Clean Water Act and California Water Code within its jurisdiction.
Residential Development	Any development on private land that provides living accommodations for one or more persons. This category includes but is not limited to single-family homes, multifamily homes, condominiums, and apartments.

Term	Definition
Restaurant	A stand-alone facility that sells prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption (Standard Industrial Classification code 5812), where the land area for development is greater than 5,000 square feet. Restaurants where land development is less than 5,000 square feet shall meet all requirements of this standard urban stormwater mitigation plan except the requirements for structural treatment BMP and numeric sizing criteria and hydromodification.
Retention	The practice of holding stormwater in ponds or basins, or within berms or depressed areas, and allowing it to slowly infiltrate into underlying soils. Some portion will evaporate. See infiltration and detention.
Self-Retaining Area	An area designed to retain runoff. Self-retaining areas may include graded depressions with landscaping or permeable pavements and may also include tributary impervious areas up to a 2:1 impervious-to-pervious ratio.
Self-Treating Area	A natural, landscaped, or turf area that drains directly off-site or to the public storm drain system.
Source Control	Land use or site planning practices, or structural or nonstructural measures that aim to prevent urban runoff pollution by reducing the potential for contamination at the source of pollution. Source control BMPs minimize the contact between pollutants and urban runoff.
Standard Industrial Classification (SIC)	A federal government system for classifying industries by four-digit code. This system is being supplanted by the North American Industrial Classification System, but SIC codes are still referenced by the RWQCBs in identifying development sites subject to regulation under stormwater permits. Information and an SIC search function are available at http://www.bls.gov/bls/NAICS.htm
Standard Urban Stormwater Mitigation Plan (SUSMP)	Various documents prepared in connection with implementation of the Stormwater Permit mandate to control pollutants from new development and redevelopment. Applicants for development project approvals will use the local standard urban stormwater mitigation plan to prepare a submittal for each priority development project they propose.
Stormwater Permit	A permit issued by a regional water quality control board to local government agencies (dischargers) placing provisions on allowable discharges of municipal stormwater to waters of the state.
Storm Water Pollution Prevention Plan (SWPPP)	A plan providing for temporary measures to control sediment and other pollutants during construction as required by the statewide stormwater permit for construction activities.
Stormwater Treatment Facility	A facility that treats runoff from more than one project or parcel.
Streets, Roads, Highways, and Freeways	Any project that is not part of a routine maintenance activity, and would create a new paved surface that is 5,000 square feet or greater and used to transport automobiles, trucks, motorcycles, and other vehicles. For the purposes of standard urban stormwater mitigation plan requirements, streets, roads, highways, and freeways do not include trenching and resurfacing associated with utility work; applying asphalt overlay to existing pavement; constructing new sidewalks, pedestrian ramps, or bike lanes on existing roads; and replacing damaged pavement.

SUSMP Project Submittal	Documents submitted to a municipality in connection with an application for development approval and demonstrating compliance with stormwater permit requirements for the project. Specific requirements vary from municipality to municipality.
Treatment	Removal of pollutants from runoff, typically by filtration or settling.

Appendix

A

Stormwater Pollutant Sources/ Source Control Checklist

Appendix A. Stormwater Pollutant Sources/Source Control Checklist

How to use this worksheet (also see instructions in Step 4 of Chapter 3 of this Manual):

1. Review Column 1 and identify which of these potential sources of storm water pollutants apply to your site. Check each box that applies.
2. Review Column 2 and incorporate all of the corresponding applicable BMPs in your Project-Specific SUSMP drawings.
3. Review Columns 3 and 4 and incorporate all of the corresponding applicable permanent controls and operational BMPs in a table in your Project-Specific SUSMP (i.e. Water Quality Technical Report). Use the format shown in Table 3-1 in Step 4 of Chapter 3 of this BMP Manual. Describe your specific BMPs in an accompanying narrative, and explain any special conditions or situations that required omitting BMPs or substituting alternatives.

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR STORMWATER CONTROL PLAN SHOULD INCLUDE THESE SOURCE CONTROL BMPs		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on Project Drawings	3 Permanent Controls—List in WQTR Table and Narrative	4 Operational BMPs—Include in WQTR Table and Narrative
❑ A. **On-site storm drain inlets**	❑ **Locations of inlets.**	❑ **Mark all inlets with the words "No Dumping! Flows to Bay" or similar.**	❑ **Maintain and periodically repaint or replace inlet markings.** ❑ **Provide storm water pollution prevention information to new site owners, lessees, or operators.** ❑ **See applicable operational BMPs in Fact Sheet SC-44, "Drainage System Maintenance," in the** CASQA **Stormwater Quality Handbooks at www.cabmphandbooks.com** ❑ **Include the following in lease**

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			agreements: "Tenant shall not allow anyone to discharge anything to storm drains or to store or deposit materials so as to create a potential discharge to storm drains."
❑ B. **Interior floor drains and elevator shaft sump pumps**	None needed.	❑ State that interior floor drains and elevator shaft sump pumps will be plumbed to sanitary sewer.	❑ Inspect and maintain drains to prevent blockages and overflow.
❑ C. **Interior parking garages**	None needed.	❑ State that parking garage floor drains will be plumbed to the sanitary sewer.	❑ Inspect and maintain drains to prevent blockages and overflow.
❑ D1. **Need for future indoor & structural pest control**	None needed.	❑ Note building design features that discourage entry of pests.	❑ Provide Integrated Pest Management information to owners, lessees, and operators.
❑ D2. **Landscape/ Outdoor Pesticide Use**	❑ Show locations of native trees or areas of shrubs and ground cover to be undisturbed and retained. ❑ Show self-retaining landscape areas, if any. ❑ Show storm water treatment facilities.	State that final landscape plans will accomplish all of the following. ❑ Preserve existing native trees, shrubs, and ground cover to the maximum extent possible. ❑ Design landscaping to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to storm water pollution. ❑ Where landscaped areas are used to retain or detain storm water, specify	❑ Maintain landscaping using minimum or no pesticides. ❑ See applicable operational BMPs in Fact Sheet SC-41, "Building and Grounds Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com ❑ Provide IPM information to new owners, lessees, and operators.

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		plants that are tolerant of saturated soil conditions. ❑ Consider using pest-resistant plants, especially adjacent to hardscape. ❑ To insure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.	
❑ E. **Pools, spas, ponds, decorative fountains, and other water features.**	❑ Show location of water feature, nearest landscaped areas, and nearest storm drains.	❑ Describe how water removed from the water feature would drain to nearby landscaping or be dechlorinated before discharge in accordance with City requirements.	❑ See applicable operational BMPs in Fact Sheet SC-72, "Fountain and Pool Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com
❑ F. **Food service**	❑ For restaurants, grocery stores, and other food service operations, show location (indoors or in a covered area outdoors) of a floor sink or other area for cleaning floor mats, containers, and equipment. ❑ On the drawing, show a note that this drain will be connected to a grease interceptor before discharging to the sanitary sewer.	❑ Describe the location and features of the designated cleaning area. ❑ Describe the items to be cleaned in this facility and how it has been sized to insure that the largest items can be accommodated.	❑
❑ G. **Refuse areas**	❑ Show where site refuse and recycled materials will be	❑ State how site refuse will be handled and provide supporting detail to	❑ State how the following will be implemented:

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	handled and stored for pickup. See local municipal requirements for sizes and other details of refuse areas. ❑ If dumpsters or other receptacles are outdoors, show how the designated area will be covered, graded, and paved to prevent run-on and show locations of berms to prevent runoff from the area. ❑ Any drains from dumpsters, compactors, and tallow bin areas shall be connected to a grease removal device before discharge to sanitary sewer.	what is shown on plans. ❑ State that signs will be posted on or near dumpsters with the words "Do not dump hazardous materials here" or similar.	Provide adequate number of receptacles. Inspect receptacles regularly; repair or replace leaky receptacles. Keep receptacles covered. Prohibit/prevent dumping of liquid or hazardous wastes. Post "no hazardous materials" signs. Inspect and pick up litter daily and clean up spills immediately. Keep spill control materials available on-site. See Fact Sheet SC-34, "Waste Handling and Disposal" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com
❑ H. Industrial processes.	❑ Show process area.	❑ If industrial processes are to be located on site, state: "All process activities to be performed indoors. No processes to drain to exterior or to storm drain system."	❑ See Fact Sheet SC-10, "Non-Stormwater Discharges" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com
❑ I. Outdoor storage of equipment or materials. (See rows J and K for source control measures for vehicle cleaning, repair, and maintenance.)	❑ Show any outdoor storage areas, including how materials will be covered. Show how areas will be graded and bermed to prevent run-on or run-off from area. ❑ Storage of non-hazardous liquids shall be covered by a roof and/or drain to the sanitary sewer system, and be contained by	❑ Include a detailed description of materials to be stored, storage areas, and structural features to prevent pollutants from entering storm drains. Where appropriate, reference documentation of compliance with the requirements of local Hazardous Materials Programs for:	❑ See the Fact Sheets SC-31, "Outdoor Liquid Container Storage" and SC-33, "Outdoor Storage of Raw Materials " in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

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	berms, dikes, liners, or vaults. ❑ Storage of hazardous materials and wastes must be in compliance with the local hazardous materials ordinance and a Hazardous Materials Management Plan for the site.	▪ Hazardous Waste Generation ▪ Hazardous Materials Release Response and Inventory ▪ California Accidental Release (CalARP) ▪ Aboveground Storage Tank ▪ Uniform Fire Code Article 80 Section 103(b) & (c) 1991 ▪ Underground Storage Tank	
❑ J. Vehicle and Equipment Cleaning	❑ Show on drawings as appropriate: (1) Commercial/industrial facilities having vehicle/ equipment cleaning needs shall either provide a covered, bermed area for washing activities or discourage vehicle/equipment washing by removing hose bibs and installing signs prohibiting such uses. (2) Multi-dwelling complexes shall have a paved, bermed, and covered car wash area (unless car washing is prohibited on-site and hoses are provided with an automatic shut-off to discourage such use). (3) Washing areas for cars, vehicles, and equipment shall be	❑ If a car wash area is not provided, describe measures taken to discourage on-site car washing and explain how these will be enforced.	Describe operational measures to implement the following (if applicable): ❑ Wash water from vehicle and equipment washing operations shall not be discharged to the storm drain system. ❑ See Fact Sheet SC-21, "Vehicle and Equipment Cleaning," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

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	paved, designed to prevent run-on to or runoff from the area, and plumbed to drain to the sanitary sewer. (4) Commercial car wash facilities shall be designed such that no runoff from the facility is discharged to the storm drain system. Wastewater from the facility shall discharge to the sanitary sewer, or a wastewater reclamation system shall be installed.		
❑ K. **Vehicle/Equipment Repair and Maintenance**	❑ Accommodate all vehicle equipment repair and maintenance indoors. Or designate an outdoor work area and design the area to prevent run-on and runoff of storm water. ❑ Show secondary containment for exterior work areas where motor oil, brake fluid, gasoline, diesel fuel, radiator fluid, acid-containing batteries or other hazardous materials or hazardous wastes are used or stored. Drains shall not be installed within the secondary containment areas. ❑ Add a note on the plans that states either (1) there are no floor drains, or (2) floor drains are connected to	❑ State that no vehicle repair or maintenance will be done outdoors, or else describe the required features of the outdoor work area. ❑ State that there are no floor drains or if there are floor drains, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements. ❑ State that there are no tanks, containers or sinks to be used for parts cleaning or rinsing or, if there are, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements.	In the SUSMP report, note that all of the following restrictions apply to use the site: ❑ No person shall dispose of, nor permit the disposal, directly or indirectly of vehicle fluids, hazardous materials, or rinse water from parts cleaning into storm drains. ❑ No vehicle fluid removal shall be performed outside a building, nor on asphalt or ground surfaces, whether inside or outside a building, except in such a manner as to ensure that any spilled fluid will be in an area of secondary containment. Leaking vehicle fluids shall be contained or

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	wastewater pretreatment systems prior to discharge to the sanitary sewer and an industrial waste discharge permit will be obtained.		drained from the vehicle immediately. ❑ No person shall leave unattended drip parts or other open containers containing vehicle fluid, unless such containers are in use or in an area of secondary containment.
❑ L. **Fuel Dispensing Areas**	❑ Fueling areas[1] shall have impermeable floors (i.e., portland cement concrete or equivalent smooth impervious surface) that are: a) graded at the minimum slope necessary to prevent ponding; and b) separated from the rest of the site by a grade break that prevents run-on of storm water to the maximum extent practicable. ❑ Fueling areas shall be covered by a canopy that extends a minimum of ten feet in each direction from each pump. [Alternative: The fueling area must be covered and the cover's minimum dimensions must be equal to or greater than the area within the grade break or		❑ The property owner shall dry sweep the fueling area routinely. ❑ See the Business Guide Sheet, "Automotive Service—Service Stations" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

[1] The fueling area shall be defined as the area extending a minimum of 6.5 feet from the corner of each fuel dispenser or the length at which the hose and nozzle assembly may be operated plus a minimum of one foot, whichever is greater.

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	fuel dispensing area[1].] The canopy [or cover] shall not drain onto the fueling area.		
❑ M. **Loading Docks**	❑ **Show a preliminary design for the loading dock area, including roofing and drainage. Loading docks shall be covered and/or graded to minimize run-on to and runoff from the loading area. Roof downspouts shall be positioned to direct storm water away from the loading area. Water from loading dock areas should be drained to the sanitary sewer where feasible. Direct connections to storm drains from depressed loading docks are prohibited.** ❑ **Loading dock areas draining directly to the sanitary sewer shall be equipped with a spill control valve or equivalent device, which shall be kept closed during periods of operation.** ❑ **Provide a roof overhang over the loading area or install door skirts (cowling) at each bay that enclose the end of the trailer.**		❑ **Move loaded and unloaded items indoors as soon as possible.** ❑ **See Fact Sheet SC-30, "Outdoor Loading and Unloading," in the** CASQA **Stormwater Quality Handbooks at www.cabmphandbooks.com**
❑ N. **Fire Sprinkler Test Water**		❑ **Provide a means to drain fire sprinkler test water to the sanitary sewer.**	❑ **See the note in Fact Sheet SC-41, "Building and Grounds Maintenance," in the** CASQA **Stormwater Quality Handbooks at**

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			www.cabmphandbooks.com
O. **Miscellaneous Drain or Wash Water** ❑ **Boiler drain lines** ❑ **Condensate drain lines** ❑ **Rooftop equipment** ❑ **Drainage sumps** ❑ **Roofing, gutters, and trim.**		❑ **Boiler drain lines shall be directly or indirectly connected to the sanitary sewer system and may not discharge to the storm drain system.** ❑ **Condensate drain lines may discharge to landscaped areas if the flow is small enough that runoff will not occur. Condensate drain lines may not discharge to the storm drain system.** ❑ **Rooftop mounted equipment with potential to produce pollutants shall be roofed and/or have secondary containment.** ❑ **Any drainage sumps on-site shall feature a sediment sump to reduce the quantity of sediment in pumped water.** ❑ **Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff.**	
❑ P. **Plazas, sidewalks, and parking lots.**			❑ **Plazas, sidewalks, and parking lots shall be swept regularly to prevent the accumulation of litter and debris. Debris from pressure washing shall be collected to prevent entry into the storm drain system. Wash water containing any cleaning agent or degreaser shall be collected and discharged to the sanitary sewer and not discharged to**

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			a storm drain.

Appendix

B

Hydromodification Management Plan