APPENDIX A

Suggested Resources

SUGGESTED RESOURCES	HOW TO GET A COPY
Better Site Design: A Handbook for Changing Development Rules in Your Community (1998) Presents guidance for different model development alternatives.	Center for Watershed Protection 8391 Main Street Ellicott City, MD 21043 410-461-8323 www.cwp.org
California Regional Water Quality Control Board, San Diego Region. Order No. R9-2007-0001, NPDES No. CAS0108758. Waste Discharge Requirements for Discharges of Urban Runoff from the Municipal Separate Storm Sewer Systems (MS4S) Draining the Watersheds of the County of San Diego, the Incorporated Cities of San Diego County, the San Diego Unified Port District, and the San Diego County Regional Airport Authority	Insert info here
California Storm Water Best Management Practices Handbook for New Development and Redevelopment (2003) Provides "how to" guidance specifically for implementation of permanent BMP requirements typically required across the state, including the City of San Diego's Storm Water Standards Manual.	California Storm Water Quality Association 7000 East Avenue, L-627 Livermore, CA 94550-0234 Phone: (925) 423-6679 Fax: (925) 422-2748 Internet: www.cabmphandbooks.org/
California Urban runoff Best Management Practices Handbooks (1993) for Construction Activity, Municipal, and Industrial/Commercial Presents a description of a large variety of Structural BMPs, Treatment Control, BMPs and Source Control BMPs	Los Angeles County Department of Public Works Cashiers Office 900 S. Fremont Avenue Alhambra, CA 91803 626-458-6959
Caltrans Urban runoff Quality Handbook: Planning and Design Staff Guide (Best Management Practices Handbooks (1998) Presents guidance for design of urban runoff BMPs	California Department of Transportation P.O. Box 942874 Sacramento, CA 94274-0001 916-653-2975
Countywide Model SUSMP, Standard Urban Stormwater Mitigation Plan, Requirements for Development Applications. San Diego Copermittees, March 24, 2009.	Insert info here

SUGGESTED RESOURCES	HOW TO GET A COPY
Design Manual for Use of Bioretention in Stormwater Management (1993) Presents guidance for designing bioretention facilities.	Prince George's County Watershed Protection Branch 9400 Peppercorn Place, Suite 600 Landover, MD 20785
Design of Stormwater Filtering Systems (1996) by Richard A. Claytor and Thomas R. Schuler Presents detailed engineering guidance on ten different urban runoff-filtering systems.	Center for Watershed Protection 8391 Main Street Ellicott City, MD 21043 410-461-8323
Development Planning for Stormwater Management, A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), (May 2000)	Los Angeles County Department of Public Works http://dpw.co.la.ca.us/epd/ or http://www.888cleanLA.com
Draft Final Hydromodification Management Plan for San Diego County, San Diego Copermittees, October 21, 2009.	Insert info here
Evaluation and Management of Highway Runoff Water Quality U.S. Department of Transportation Federal Highway Administration Publication No. FHWA-PD-96-032	Office of Environmental Planning 400 7th Street SW Washington, D.C. 20590
Florida Development Manual: A Guide to Sound Land and Water Management (1988) Presents detailed guidance for designing BMPs	Florida Department of the Environment 2600 Blairstone Road, Mail Station 3570 Tallahassee, FL 32399 850-921-9472
Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters (1993) Report No. EPA–840-B-92-002. Provides an overview of, planning and design considerations, programmatic and regulatory aspects, maintenance considerations, and costs.	National Technical Information Service U.S. Department of Commerce Springfield, VA 22161 800-553-6847
Guide for BMP Selection in Urban Developed Areas (2001)	ASCE Envir. and Water Res. Inst. 1801 Alexander Bell Dr. Reston, VA 20191-4400 (800) 548-2723

SUGGESTED RESOURCES	HOW TO GET A COPY
Low-Impact Development Design Strategies - An Integrated Design Approach (June 1999)	Prince George's County, Maryland Department of Environmental Resource Programs and Planning Division 9400 Peppercorn Place Largo, Maryland 20774 http://www.co.pg.md.us/Government/DER/PPD/pgcounty/lidmain.htm
Maryland Stormwater Design Manual (1999) Presents guidance for designing urban runoff BMPs	Maryland Department of the Environment 2500 Broening Highway Baltimore, MD 21224 410-631-3000
National Stormwater Best Management Practices (BMP) Database, Version 1.0 Provides data on performance and evaluation of urban runoff BMPs	American Society of Civil Engineers 1801 Alexander Bell Drive Reston, VA 20191 703-296-6000
National Stormwater Best Management Practices Database (2001)	Urban Water Resources Research Council of ASCE Wright Water Engineers, Inc. (303) 480-1700
Operation, Maintenance and Management of Stormwater Management (1997) Provides a thorough look at storm water practices including, planning and design considerations, programmatic and regulatory aspects, maintenance considerations, and costs.	Watershed Management Institute, Inc. 410 White Oak Drive Crawfordville, FL 32327 850-926-5310
Potential Groundwater Contamination from Intentional and Non-Intentional Stormwater Infiltration	Report No. EPA/600/R-94/051, USEPA (1994).
Preliminary Data Summary of Urban runoff Best Management Practices (August 1999) EPA-821-R-99-012	http://www.epa.gov/ost/stormwater/
Reference Guide for Stormwater Best Management Practices (July 2000)	City of Los Angeles Urban Runoff Management Division 650 South Spring Street, 7th Floor Los Angeles, California 90014 http://www.lacity.org/san/swmd/

SUGGESTED RESOURCES	HOW TO GET A COPY
Second Nature: Adapting LA's Landscape for Sustainable Living (1999) by Tree People Detailed discussion of BMP designs presented to conserve water, improve water quality, and achieve flood protection.	Tree People 12601 Mullholland Drive Beverly Hills, CA 90210 (818) 623-4848 Fax (818) 753-4625
Start at the Source (1999) Detailed discussion of permeable pavements and alternative driveway designs presented.	Bay Area Stormwater Management Agencies Association 2101 Webster Street Suite 500 Oakland, CA 510-286-1255
Stormwater Management in Washington State (1999) Vols. 1-5 Presents detailed guidance on BMP design for new development and construction.	Department of Printing State of Washington Department of Ecology P.O. Box 798 Olympia, WA 98507-0798 360-407-7529
Stormwater, Grading and Drainage Control Code, Seattle Municipal Code Section 22.800-22.808, and Director's Rules, Volumes 1-4. (Ordinance 119965, effective July 5, 2000)	City of Seattle Department of Design, Construction & Land Use 700 5th Avenue, Suite 1900 Seattle, WA 98104-5070 (206) 684-8880 www.ci.seattle.wa.us/dclu/Codes/sgdccode.htm
Texas Nonpoint Source Book – Online Module (1998)www.txnpsbook.org Presents BMP design and guidance information on-line	Texas Statewide Urban runoff Quality Task Force North Central Texas Council of Governments 616 Six Flags Drive Arlington, TX 76005 817-695-9150
The County of San Diego Low Impact Development Handbook: Stormwater Management Strategies (2007)	County of San Diego Department of Planning and Land Use 5201 Ruffin Road, Suite B, San Diego, CA 92123 (858) 694-2960 http://www.sdcdplu.org/
The Practice of Watershed Protection by Thomas R. Schuler and Heather K. Holland	Center for Watershed Protection 8391 Main Street Ellicott City, MD 21043 410-461-8323 www.cwp.org

SUGGESTED RESOURCES	HOW TO GET A COPY
Urban Runoff Quality Management *WEF Manual of Practice, No. 23* *ASCE M&REP No. 87* ISBN 1-57278-039-8	Water Environment Foundation 601 Wythe Street Alexandria, VA 22314 (703) 684-2400
Urban Storm Drainage, Criteria Manual – Volume 3, Best Management Practices (1999) Presents guidance for designing BMPs	Urban Drainage and Flood Control District 2480 West 26th Avenue, Suite 156-B Denver, CO 80211 303-455-6277

APPENDIX B

Storm Water Requirements Applicability Checklist

THE CITY OF SAN DIEGO	City of San Diego **Development Services** 1222 First Ave., MS-302 San Diego, CA 92101 (619) 446-5000	**Storm Water Requirements Applicability Checklist**	FORM **DS-560** **Draft**

Project Address:	Assessor Parcel Number(s):	Project Number (*for city use Only)*:

This form must be completed and submitted with your permit application.

Section 1 - Permanent Storm Water BMP Requirements:

If any answers to Part A are answered "Yes," your project is subject to the "Priority Project Permanent Storm Water BMP Requirements," and "Standard Permanent Storm Water BMP Requirements" of the Storm Water Standards Manual. If all answers to Part A are "No," and any answers to Part B are "Yes," your project is only subject to the Standard Permanent Storm Water BMP Requirements. If every question in Part A and B is answered "No," your project is exempt from permanent storm water requirements.

Part A: Determine Priority Project Permanent Storm Water BMP Requirements.

Is the project in any of these categories?		
1. **Housing subdivisions of 10 or more dwelling units.** Examples: single-family homes, multi-family homes, condominiums, and apartments.	☐ Yes	☐ No
2. **Commercial development greater than one acre.** Examples: hospitals; laboratories and other medical facilities; educational institutions; recreational facilities; municipal facilities; commercial nurseries; multi-apartment buildings; car wash facilities; mini-malls and other business complexes; shopping malls; hotels; office buildings; public warehouses; automotive dealerships; airfields; and other light industrial facilities.	☐ Yes	☐ No
3. **Heavy industrial development greater than one acre.** Examples: manufacturing plants, food processing plants, metal working facilities, printing plants, and fleet storage areas (bus, truck, etc.).	☐ Yes	☐ No
4. **Automotive repair shops.** A facility categorized in any one of Standard Industrial Classification (SIC) codes 5013, 5014, 5541, 7532-7534, or 7536-7539.	☐ Yes	☐ No
5. **Restaurants.** 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 Model SUSMP requirements except for structural treatment BMP numeric sizing criteria requirements and hydromodification requirements.	☐ Yes	☐ No
6. **Hillside developments greater than 5,000 square feet.** Any development that creates 5,000 square feet of impervious surface and is located in an area with known erosive soil conditions or where the development will grade on any natural slope that is twenty-five percent or greater.	☐ Yes	☐ No
7. **Water Quality Sensitive Areas.** All development located within, directly adjacent to, or discharging directly to a Water Quality Sensitive Area (as depicted in Appendix C) in which the project either creates 2,500 square feet of impervious surface on a proposed project site or increases the area of imperviousness of a proposed project site to 10% or more of its naturally occurring condition. "Directly adjacent" is defined as being situated within 200 feet of the Water Quality Sensitive Area. "Discharging directly to" is defined as 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
8. **Parking lots with a minimum area of 5,000 square feet or a minimum of** 15 parking spaces and potential exposure to urban runoff.	☐ Yes	☐ No
9. **Street, roads, highways, and freeways.** Any new paved surface in excess of 5,000 square feet used for the transportation of automobiles, trucks, motorcycles, and other vehicles.	☐ Yes	☐ No

10. **Retail Gasoline Outlets (RGOs)** that are: (a) 5,000 square feet or more or (b) have a projected Average Daily Traffic (ADT) of 100 or more vehicles per day.	☐ **Yes**	☐ **No**
11. Significant Redevelopment; redevelopment that installs and/or replaces 5,000 square feet or more of impervious surface and the existing site meets at least one of the categories above.	☐ **Yes**	☐ **No**
12. **Other Pollutant Generating Project**. Does the project disturb one acre or more and not meet one of the exclusions listed below?	☐ **Yes**	☐ **No**

Exclusions: Projects creating less than 5,000 sf of impervious surface; projects that add landscaping that does not require regular use of pesticides and fertilizers such as a slope stabilization project using native plants; linear pathway projects that are for infrequent vehicle use, such as for emergency or maintenance access or for bicycle or pedestrian use, if they are built with pervious surfaces or if they sheet flow to surrounding pervious surfaces; and, projects that do not meet the definition of New Development or Significant Redevelopment in the Storm Water Standards.

Part B: Determine Standard Permanent Storm Water Requirements.

Does this project propose:

1. New impervious areas, such as rooftops, roads, parking lots, driveways, paths and sidewalks?	☐ **Yes**	☐ **No**
2. New pervious landscape areas and irrigation systems?	☐ **Yes**	☐ **No**
3. Permanent structures within 100 feet of any natural water body?	☐ **Yes**	☐ **No**
4. Trash storage areas?	☐ **Yes**	☐ **No**
5. Liquid or solid material loading and unloading areas?	☐ **Yes**	☐ **No**
6. Vehicle or equipment fueling, washing, or maintenance areas?	☐ **Yes**	☐ **No**
7. Require a General NPDES Permit for Storm Water Discharges Associated with Industrial Activities(visit the State Water Resources Control Board website)	☐ **Yes**	☐ **No**
8. Commercial or industrial waste handling or storage, excluding typical office or household waste?	☐ **Yes**	☐ **No**
9. Any grading or ground disturbance during construction?	☐ **Yes**	☐ **No**
10. Any new storm drains, or alteration to existing storm drains?	☐ **Yes**	☐ **No**

Part C: Hydromodification Requirements

	Yes	**No**
1. Is the project a Priority Development Project?	☐ Go to Box 2	☐ Exempt from HMP Criteria
2. For each discharge location from the proposed project site, has an adequately sized energy dissipation device been provided?	☐ Go to Box 3	☐ Resize and restart
3. Does the project increase the pre-project site impervious areas?	☐ Go to Box 5	☐ Go to Box 4
4. Does the project increase unmitigated peak flow to any discharge location?	☐ Go to Box 5	☐ Exempt
5. Does the project directly discharge to an exempt conveyance system (Pacific Ocean, San Diego Bay, major river system detailed in the HMP, reservoir system detailed in the HMP)?	☐ Exempt	☐ Go to Box 6
6. Does the project directly discharge to a lagoon area?	☐ Exempt	☐ Go to Box 7
7. Does the project discharge directly to a stabilized conveyance system that extends to an exempt conveyance system?	☐ Go to Box 8	☐ Go to Box 10
8. Does the stabilized conveyance system detailed in Question 7 have capacity to convey the 10-year ultimate condition flow?	☐ Exempt	☐ Go to Box 10
9. Does the project discharge to a highly urbanized watershed with an existing impervious area percentage > 70%?	☐ Exempt	☐ Go to Box 10

	Yes	No
10. Is the project an urban infill project discharging to a watershed with an existing impervious area > 40%	☐ Go to Box 11	☐ HMP Controls Required
11. Does the project discharge runoff to a stabilized conveyance system that extends beyond the Domain of Analysis?	☐ Go to Box 12	☐ HMP Controls Required
12. Does the natural channel to which the project eventually discharges have a LOW susceptibility to erosion?	☐ Go to Box 13	☐ HMP Controls Required
13. Do future cumulative watershed impervious area impacts account for < 3% impervious area increase?	☐ Exempt	☐ HMP Controls Required

Section 2 - Construction Storm Water BMP Requirements:

If any of the answers to the questions in Part C are "Yes," complete the construction site prioritization in Part D below.

Part D: Determine Construction Phase Storm Water Requirements.

If any of Part C is answered "Yes", then the project is subject to Section 5 of the Storm Water Standards Manual. If question 1 is answered "Yes" then a Storm Water Pollution Prevention Plan (SWPP) is required; otherwise a Water Pollution Control Plan (WPCP is required).

Would the project meet any of these criteria during construction?

1. Is the project subject to California's statewide General NPDES Permit for Storm Water Discharges Associated with Construction Activities?	☐ **Yes**	☐ **No**
2. Does the project propose grading or soil disturbance?	☐ **Yes**	☐ **No**
3. Would storm water or urban runoff have the potential to contact any portion of the construction area, including washing and staging areas?	☐ **Yes**	☐ **No**
4. Would the project use any construction materials that could negatively affect water quality if discharged from the site (such as, paints, solvents, concrete, and stucco)?	☐ **Yes**	☐ **No**

Part E: Determine Construction Site Priority

This prioritization must be completed with this form, noted on the plans, and included in the SWPPP or WPCP. The City reserves the right to adjust the priority of the projects both before and during construction. [Note: The construction priority does NOT change construction BMP requirements that apply to projects; rather, it determines the frequency of inspections that will be conducted by City staff.]

☐ 1) High Priority

- a) Projects where the site is 50 acres or more and grading will occur during the wet season
- b) Projects 1 acre or more and tributary to an impaired water body for sediment (e.g., Peñasquitos watershed)
- c) Projects 1 acre or more within or directly adjacent to or discharging directly to a coastal lagoon or other receiving water within a Water Quality Sensitive Area.
- d) Projects subject to phased grading or advanced treatment requirements

☐ 2) Medium Priority

Projects 1 acre or more but not subject to a high priority designation.

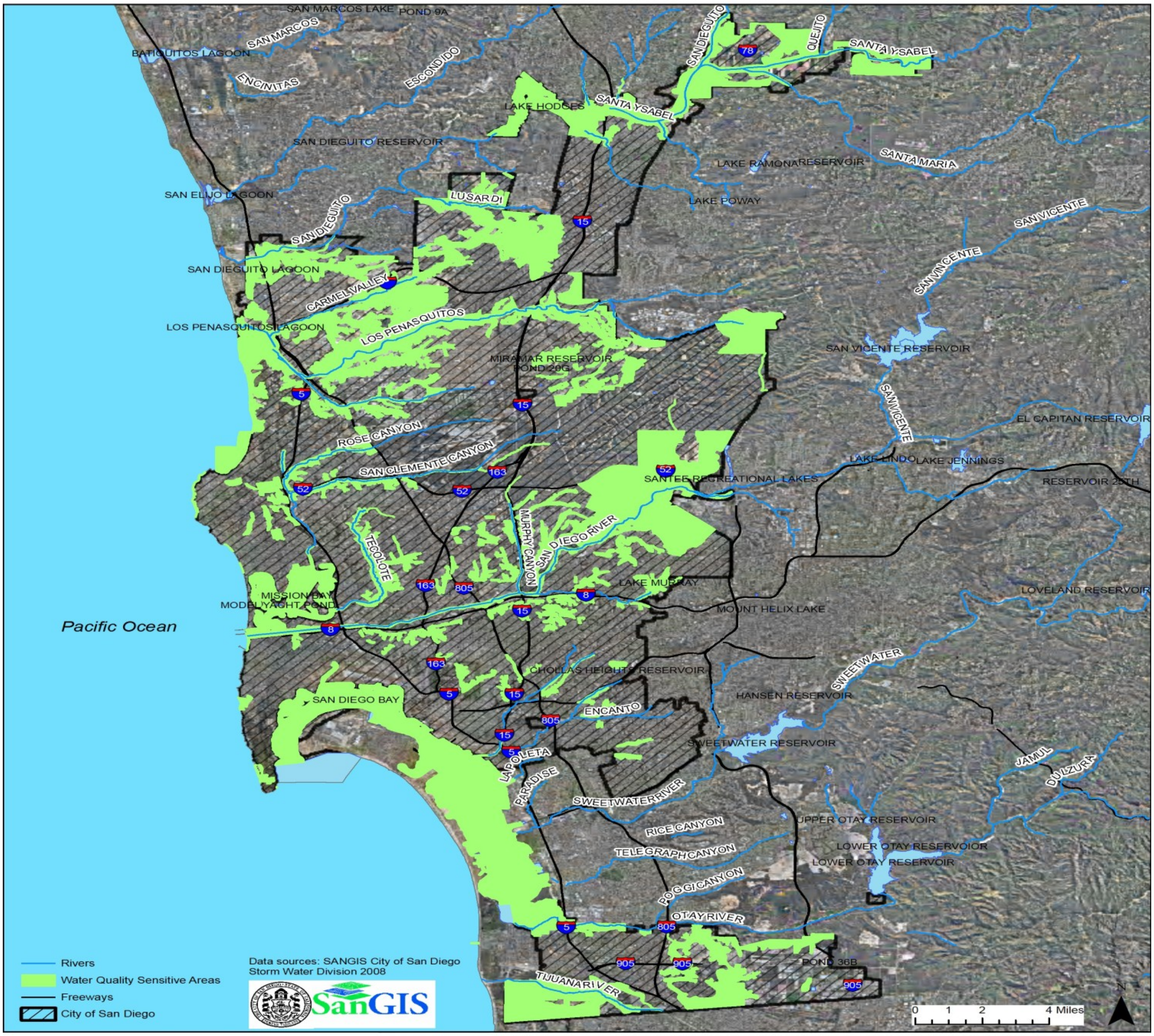
☐ 3) Low Priority

Projects requiring a Water Pollution Control Plan but not subject to a medium or high priority designation.

Name of Owner or Agent *(Please Print)*:	Title:
Signature:	Date:

APPENDIX C

Water Quality Sensitive Areas within the City Of San Diego



Water Quality Sensitive Areas within the City Of San Diego

Note: This map is printed here for reference only. A more detailed map with parcel lines is available utilizing the interactive map at the SanGIS website at, www.sangis.org, or by contacting SanGIS at 5469 Kearny Villa Road, Suite 102, San Diego, CA 92123, or by phone at (858) 874-7000. The Water Quality Sensitive Areas map has been produced under the direction of the City of San Diego solely for the purpose of assisting development project applicants in complying with the City's Storm Water Standards Manual. This map was prepared at a regional scale and may not accurately represent conditions on individual sites. Applicants may submit a proposal to refine the boundaries of the Water Quality Sensitive Areas with the project.

APPENDIX E

Example Permanent Storm Water Best Management Practices

Example Permanent Storm Water Best Management Practices

The following are a list of BMPs may be used to minimize the introduction of pollutants of concern that may result in significant impacts to receiving waters. Other BMPs approved by the Development Services Department as being equal or more effective in pollutant reduction than comparable BMPs identified below are acceptable. All BMPs must comply with local zoning and building codes and other applicable regulations.

Site Design BMPs

Applicants are required to incorporate Low Impact Development IMPs (Integrated Management Practices) and other BMPs which utilize infiltration as the preferred method for storm water flow control and treatment control.

Applicants should refer to The County of San Diego Low Impact Development Handbook and the included technical fact sheets (Appendix 4) for specific Low Impact Development IMP's for recommended site design BMPs

Minimizing Impervious Areas

- Reduce sidewalk widths
- Incorporate landscaped buffer areas between sidewalks and streets.
- Design residential streets for the minimum required pavement widths
- Minimize the number of residential street cul-de-sacs and incorporate landscaped areas to reduce their impervious cover.
- Use open space development that incorporates smaller lot sizes
- Increase building density while decreasing the building footprint
- Reduce overall lot imperviousness by promoting alternative driveway surfaces and shared driveways that connect two or more homes together
- Reduce overall imperviousness associated with parking lots by providing compact car spaces, minimizing stall dimensions, incorporating efficient parking lanes, and using pervious materials in spillover parking areas

Increase Rainfall Infiltration

- Use permeable materials for private sidewalks, driveways, parking lots, and interior roadway surfaces (examples: hybrid lots, parking groves, permeable overflow parking, etc.)
- Direct rooftop runoff to pervious areas such as yards, open channels, or vegetated areas, and avoid routing rooftop runoff to the roadway or the urban runoff conveyance system

Maximize Rainfall Interception

- Maximizing canopy interception and water conservation by preserving existing native trees and shrubs, and planting Additional native or drought tolerant trees and large shrubs.

Minimize Directly Connected Impervious Areas (DCIAs)

- Draining rooftops into adjacent landscaping prior to discharging to the storm water conveyance system
- Draining parking lots into landscape areas co-designed as biofiltration areas

- Draining roads, sidewalks, and impervious trails into adjacent landscaping

Slope and Channel Protection

Use of Natural Drainage Systems to the Maximum Extent Practicable

- Stabilized permanent channel crossings
- Planting native or drought tolerant vegetation on slopes
- Energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined Channels

Maximize Rainfall Interception

- Cisterns
- Foundation planting

Increase Rainfall Infiltration

- Dry wells

Source Control BMPs

- Storm water conveyance system stamping and signage
- Outdoor material and trash storage area designed to reduce or control rainfall runoff
- Efficient irrigation system
- Street and pavement sweeping

Treatment Control BMPs

Biofilters

- Grass swale
- Grass strip
- Wetland vegetation swale
- Bioretention

Detention Basins

- Extended/dry detention basin with grass lining
- Extended/dry detention basin with impervious lining

Infiltration

- Infiltration basin
- Infiltration trench

Pervious Paving

- Porous asphalt
- Porous concrete
- Porous modular concrete block

Wet Ponds and Wetlands

- Wet pond (permanent pool)
- Constructed wetland

Filtration Systems

- Media filtration
- Sand filtration

APPENDIX F

Water Quality Technical Report Guidelines

Purpose

To describe the permanent storm water Best Management Practices (BMPs) that will be incorporated in the project to mitigate the impacts of urban runoff due to the development.

Minimum Requirements

- Water Quality Technical Report prepared by Registered Civil Engineer registered in California
- Geologic Investigation Report prepared by a Registered Geotechnical Engineer, Registered Geologist, or Certified Engineering Geologist, registered in California.

Organization & Content

- Table of Contents
- Vicinity Map
- Project Description
  - Narrative of project activities
- Site Map
  - Entire property included on one map (use key map if multi-sheets)
  - Drainage areas and direction of flow
  - Private storm drain system(s)
  - Nearby water bodies and municipal storm drain inlets
  - Location of storm water conveyance systems (ditches, inlets, storm drains, etc.)
  - Location of existing and proposed storm water controls
  - Location of “impervious” areas- paved areas, buildings, covered areas
  - Locations where materials would be directly exposed to storm water
  - Location of building and activity areas (e.g. fueling islands, garages, waste container area, wash racks, hazardous material storage areas, etc.)
  - Areas of potential soil erosion (including areas downstream of project)
  - Location of existing drinking water wells
  - Location of existing vegetation to be preserved
- Pollutants and Conditions of Concern
  - Project located in which Watershed
  - Impaired water bodies downstream of the project and impairment
  - Impacts to hydrologic regime
  - Pollutants based upon land use
  - Drainage Study (may be appendix)
  - Geologic Study (may be appendix)
  - Hydromodification Element (may be appendix)
- Types of BMPs:

  - Low Impact Development BMPs
  - Source Control BMPs
  - Structural Treatment BMPs
    - Maintenance Conditions
- Drainage Study*
  - Purpose of report
  - Hydrologic models and/or methods used
  - Water Quality Design Storm
  - Pre-Development runoff volumes and peak flows
  - Post-project runoff volumes and peak flows
- Geologic Investigation Report
  - Purpose of Report
  - Investigation Methods
  - Areas selected for investigation.
  - Infiltration rates and capacities.
  - Lateral migration rates and issues.
  - Groundwater elevations, characterization, and maximum seasonal elevations.
  - Locations of drinking water wells.
  - Locations of features to be protected from infiltrated water.
  - Minimum distances between infiltration and site features.
  - Minimum distances between infiltration and existing features.
  - Mitigation requirements for lateral migration – i.e. minimum permeabilities of cutoff features, depths of cutoff features required, drainage requirements, etc.
  - Mapping of areas where infiltration is feasible
  - Mapping of areas where infiltration is infeasible.
  - Consideration of mitigating measures that may be employed and where.

APPENDIX G

Storm Water Pollution Prevention Plan / Water Pollution Control Plan Guidelines

Storm Water Pollution Prevention Plan / Water Pollution Control Plan Guidelines

At a minimum, the Storm Water Pollution Prevention Plan (SWPPP) or Water Pollution Control Plan (WPCP), whichever is required, must cover the areas listed below.

If a project disturbs 1 acre or more, the applicant must provide a Storm Water Pollution Prevention Plan (SWPPP), which identifies all construction BMP requirements required by Section IV, in accordance with the State General Permit for Storm Water Discharges Associated with Construction Activity (State General Construction Permit). The SWPPP must be kept on site and made available upon request of a representative of the City of San Diego. Additionally, the State General Construction Permit has a requirement for a sampling and monitoring program to be implemented. Projects that are also required to obtain a general construction National Pollutant Discharge Elimination System (NPDES) Permit are encouraged to visit the State Water Resource Control Board's website for permit application instructions, NOI and NOT forms and guidance in preparing a Storm Water Pollution Prevention Plan (go to: http://www.swrcb.ca.gov/stormwtr/construction.html). A checklist to assist with the preparation of a SWPPP is also provided at the following website:

http://www.waterboards.ca.gov/stormwtr/docs/const_swppp.pdf

For projects that disturb less than 1 and are determined to have a potential to impact water quality during construction, the applicant must provide a Water Pollution Control Plan (WPCP), which identifies all construction BMP requirements required by Section IV, with the project submittal. The WPCP shall depict the BMPs to be implemented during construction to reduce/eliminate discharges of pollutants to the storm drain conveyance system. The WPCP shall include but not be limited to erosion and sediment control BMPs, phased grading, good housekeeping measures, and site and materials management.

Planning and Organization

- Identify the pollution prevention team members who will maintain and implement the SWPPP.
- If applicable, incorporate or reference the appropriate elements of other regulatory requirements.

Site Map

Features displayed on the map must include:

- An outline of the entire property
- Drainage areas on the property and direction of flow
- Areas of soil erosion
- Nearby water bodies and municipal storm drain inlets
- Location of waters on the 303(d) list for sedimentation or turbidity.
- Location of storm water conveyance systems (ditches, inlets, storm drains, etc.)
- Location of existing storm water controls (oil/ water separators, sumps, etc.)
- Location of "impervious" areas- paved areas, buildings, covered areas
- Locations where materials are directly exposed to storm water
- Locations where toxic or hazardous materials have spilled in the past

- Location of building and activity areas (e.g., fueling islands, garages, waste container area, wash racks, hazardous material storage areas, etc.)

List of Significant Materials

List materials stored and handled at the site. Include the location and typical quantities.

Description of Potential Pollutant Sources

- Provide a narrative description of the site's activities and list the potential pollutant sources and the potential pollutants that could be discharged in storm water discharges from each activity.
- List non-storm water discharges including the source, quantity, frequency, and characteristics of the discharges and drainage area.

Assessment of Potential Sources

Describe which activities are likely to be sources of pollution in storm water and which pollutants are likely to be present in storm water discharges.

Best Management Practices

Describe the BMPs that will be implemented at the site for each potential pollutant and its source.

Phased Grading

If the contractor/owner intends to have more than 5 acres graded during any part of a rainy season, the contractor/owner shall include in their weather triggered action plan a BMP Implementation Plan that shows the materials, equipment, and labor that will be on site to deploy BMPs sufficient to control erosion and sediment transport within 24 hours of a forecast of 40% probability of rain. The BMP Implementation Plan will show BMP types, locations, layout, water flow directions, and describe how the BMP will control erosion and sediment transport. This may include a limitation on grading, if that is the best way for the contractor to guarantee that they will deploy sufficient BMPs within 24 hours.

Source Control

If Source Control is used to prevent an exceptional threat to water quality, the SWPPP or WPCP shall include plans and specifications showing the items, features, materials, and descriptions of the source control measures to be implemented.

Advanced Treatment

If advanced treatment is required, the SWPPP or WPCP shall include

- Plans and specifications showing the advanced treatment system proposed including detention ponds, diversions for extreme events, treatment equipment, discharge locations, and other features,
- Verification that this advanced treatment system will achieve the effluent requirements,
- Verification that this advanced treatment system will not cause any impairment of water quality
- Test results,
- An Operations, Maintenance, and Monitoring Plan showing quantities of materials, including any chemicals proposed, operating conditions, instrumentation, operational procedures, waste management procedures, monitoring procedures, and reporting formats.
- Operator certifications.

APPENDIX H

Example Construction Best Management Practices

Appendix H
Example Construction Best Management Practices

A. Erosion Control

Physical stabilization BMPs, vegetation stabilization BMPs, or both, will be required to prevent erosion and sediment runoff from exposed graded areas. BMPs for physical and vegetation stabilization include:

1) Physical Stabilization
    a) Geotextiles
    b) Mats
    c) Fiber blankets
    d) Hydraulic mulch, Bonded Fiber Matrix
    e) Sprayed on binders
    f) Mulch on flat areas
    g) Other material approved by the City for use in specific circumstances

If physical stabilization is selected, materials must be appropriate to the circumstances in which they are deployed, and sufficient material must be deployed.

2) Vegetation Stabilization
    a) Preservation of existing vegetation
    b) Established interim vegetation (via Hydroseed, seeded mats, etc.)
    c) Established permanent landscaping

If vegetation stabilization is selected, the stabilizing vegetation must be installed, irrigated and established (uniform vegetative coverage with 70% coverage established) prior to October 1. In the event stabilizing vegetation has not been established by October 1, other forms of physical stabilization must be employed to prevent erosion until the stabilizing vegetation is established.

B. Sediment Control

1) Perimeter protection. Protect the perimeter of the site or exposed area from sediment ingress/discharge in sheet flows using:
    a) Silt fencing
    b) Gravel bag barriers
    c) Fiber rolls
    d) Compost Berms
    e) Compost Blankets
2) Resource protection. Protect water quality sensitive areas and watercourses from sediment in sheet flows by using:
    a) Silt fencing
    b) Gravel bag barriers
    c) Fiber rolls
    d) Compost terms
    e) Compost Blankets
3) Sediment Capture. Capture sediments in channeled storm water by using:
    a) Storm-drain inlet protection measures
    b) De-silting basins (Designed in accordance with an industry standard such as Caltrans, California Storm water BMP manual etc. If the project is 5 acres or greater

the desilting basin(s) must be designed in accordance with the State General Construction Permit, Order DWQ 99-08.)

4) Velocity Reduction. Reduce the velocity of storm water by using:
    a) Outlet protection (energy dissipater)
    b) Equalization basins
    c) Check dams
5) Off-site Sediment Tracking. Prevent sediment from being tracked off-site by using:
    a) Stabilized construction entrances/exits
    b) Construction road stabilization
    c) Tracking control (i.e., corrugated steel panels, wheel washes)
    d) Dust control

C. Materials Management

1) Prevent the contamination of storm water by wastes through proper management of the following types of wastes:
    a) Solid
    b) Sanitary
    c) Concrete
    d) Hazardous
    e) Equipment – related wastes
    f) Stock piles (protection from wind and rain)
2) Prevent the contamination of storm water by construction materials by:
    a) Covering and/or providing secondary containment of storage areas
    b) Taking adequate precautions when handling materials.

APPENDIX I

Low Impact Development Design Guide

Chapter 4

Low Impact Development Design Guide

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

Follow the Low Impact Development (LID) design in this SUSMP to achieve compliance with the stormwater treatment requirements as well as the LID requirements in the stormwater NPDES permit.

This will require careful documentation of:

- Pervious and impervious areas in the planned project.
- Drainage from each of these areas.
- Locations, sizes, and types of proposed treatment facilities.

Your Project Submittal must include calculations showing the site drainage and proposed LID treatment facilities meet the criteria in this *SUSMP*.

This Low Impact Development Design Guide 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.
- ***Specify preliminary design details*** and integrate your LID drainage design with your 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 roofs and paving.

2. ***Use pervious surfaces*** such as turf, gravel, or pervious 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 64). No further management of runoff is necessary. An emergency overflow should be provided for extreme events.

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

4. Drain impervious surfaces to engineered ***Integrated Management Practices*** (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. Depending on site conditions and local regulations, it may be possible to harvest and reuse rainwater in conjunction with IMPs.

A combination of two or more strategies may work best for your project. 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 natural character of the area. 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	Pervious Pavement	Bioretention Facility	Flow-through Planter	Dry Well	Cistern with bioretention
Clayey native soils	✓			✓	✓		✓
Permeable native soils	✓		✓	✓	✓	✓	
Very steep slopes	✓				✓		
Shallow groundwater	✓				✓		
Avoid saturating subsurface soils	✓		✓		✓		
Connect to roof downspouts		✓		✓	✓	✓	✓
Parking lots/islands and medians			✓	✓		✓	
Sites with extensive landscaping		✓	✓	✓			
Densely developed sites with limited space/landscape	✓		✓		✓	✓	✓
Fit IMPs into landscape and setback areas				✓			✓
Make drainage a design feature		✓		✓			✓
Convey as well as treat stormwater				✓			

► OPTIMIZE THE SITE LAYOUT

To minimize stormwater-related impacts, 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 guideline 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 non-native vegetation, disturbed habitats and eucalyptus woodlands where receiving waters are not present.
3. Areas of chamise or mixed chaparral, and non-native grasslands.
4. Areas containing coastal scrub communities.
5. All other upland communities.
6. Occupied habitat of sensitive species and all wetlands (as both are defined by the local jurisdiction).

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

Coordination

Chapter One includes a presentation of how review of your project's 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 back development 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.

For all types of development, ***limit overall coverage*** of paving and roofs. Where allowed by local zoning and design standards—and provided 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 www.greenroofs.org.

Consider permeable pavements and surface treatments. Inventory paved areas on your 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" 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 soils will drain adequately.

Under some circumstances, it may be allowable to direct runoff from impervious areas to pervious 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 compatible with infiltrating that volume without producing runoff.

► DIRECT RUNOFF TO INTEGRATED MANAGEMENT PRACTICES

Project Clean Water has developed design criteria for the following IMPs:

- ***Bioretention facilities***, which can be configured as swales, free-form areas, or planters to integrate with your 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.

- ***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 achieve stormwater flow control, 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 in mind:

- Facilities must meet criteria for capturing and treating the volume specified by Equation 4-8 below. This volume must be allowed to empty within 24 hours so runoff from additional storms, which may follow, is also captured and treated. Additional volume may be required if the system also stores runoff for longer periods for reuse.

- Storage of water for longer than minimum standards set forth by local jurisdictions (96 hours for County Department of Environmental Health) creates the potential for mosquito harborage. Cisterns and vaults must be designed to prevent entry by mosquitoes.

- Indoor uses of non-potable water may be restricted or prohibited. Check with municipal staff.

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 to maximize aesthetic value, ***integrate IMPs with site landscaping***. Many local zoning codes may require landscape setbacks or buffers, or may specify that a minimum portion of the site be landscaped. It may be possible to locate some or all of your site's treatment and flow-control facilities within this same area, or within utility easements or other non-buildable 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 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 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 inspectors from the local municipality and local mosquito control agency.

- 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.

To complete your analysis, if required by your municipality include in your Project Submittal a brief ***narrative*** documenting the site layout and site design decisions you made. This will provide background and context for how your 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 how runoff from each delineated area is managed. For areas draining to IMPs, the procedure ensures 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 your drainage design as well as 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. You must divide the ***entire project area*** into individual, discrete Drainage Management Areas (DMAs). Typically, lines delineating DMAs follow grade breaks and roof ridge lines. The Exhibit, tables, text, and calculations in your 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 DMAS AND DETERMINE RUNOFF FACTORS

Next, determine how drainage from each DMA will be handled. Each DMA will be one of the following four types:

1. Self-treating areas.
2. Self-retaining areas (also called "zero-discharge" areas).
3. Areas that drain to self-retaining areas.
4. Areas that drain to IMPs.

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 the self-treating landscaped areas will produce runoff less than or equal to the pre-project site condition.

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 which are ditched and drained around a development and grassed slopes which 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 percent or less) in relationship to the receiving pervious area and slopes are gentle enough to ensure runoff will be absorbed into the vegetation and soil. Criteria for self-treating areas are in the design sheet "Self Treating and Self-Retaining Areas" at the end of this chapter.

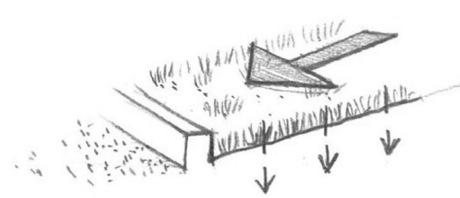


FIGURE 4-1. Self-treating areas are entirely pervious and drain directly off-site or to the storm drain system.

Self-retaining areas are designed to retain the first one 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 one-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.

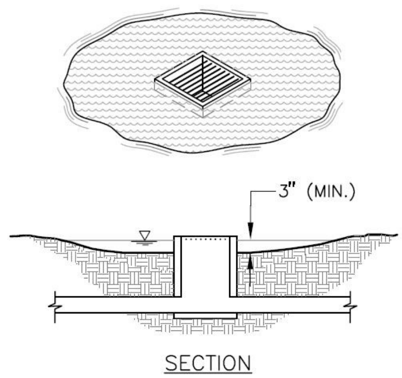


FIGURE 4-2. Self-retaining areas. Berm or depress the grade to retain at least an inch of rainfall and set inlets of any area drains at least 3 inches above low point to allow ponding.

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 for every 1 part pervious area.

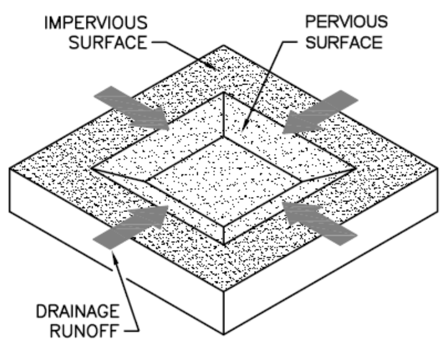


FIGURE 4-3. Relationship of impervious to pervious area for self-retaining areas. Ratio: ***pervious ≥ ½ impervious***

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 2 parts impervious area into 1 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) $\leq$ 2 x (self-retaining area) *Equation 4-1*

Use the runoff factors in Table 4-2.

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

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

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

- The gravel base course is a minimum of four or more inches deep.
- The base course is not to be underdrained.
- 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 IMPs.

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, min. 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.

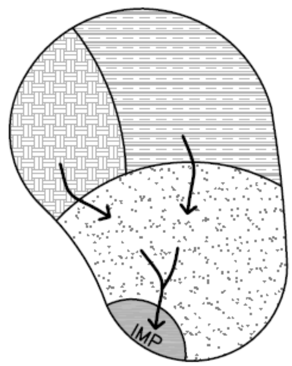


FIGURE 4-4. More than one Drainage Management Area can drain to a single IMP.

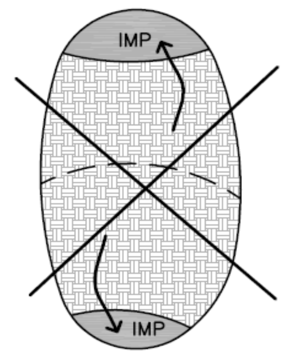


FIGURE 4-5. One Drainage Management Area cannot drain to more than one IMP. Use a grade break to divide the DMA.

Where possible, design site drainage so ***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 pervious 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:

$$\Delta \text{ (Area)} = \text{(pervious area)} \times \text{(runoff factor)} \times \text{(sizing factor)}.$$

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 draining to self-retaining areas in the format shown in Table 4-5. Check to be sure 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 draining 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)	Post-project surface type	Runoff factor	Receiving self-retaining DMA	Receiving self-retaining DMA Area (square feet)

► *STEP 4: SELECT AND LAY OUT IMPS 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 your site plan for each IMP.

► *STEP 5: REVIEW SIZING FOR EACH IMP*

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 presented in Tables 4-8 through 4-12.

TABLE 4-6. Sizing Factors

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 Min. Volume
Cistern and Vaults with Bioretention	See Step 6 to Calculate Min. 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 sizing factors from Tables 4-8 through 4-12 should be used in lieu of the “water quality only” sizing factors presented in Table 4-6.

Equation 4-7

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

Use the format of 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 IMP Areas for Bioretention Areas and Planter Boxes

DMA Name	DMA Area (square feet)	Post-project 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 of San Diego'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.

Equation 4-8

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

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 the facility can infiltrate the entire volume within the minimum drawdown time as determined by the governing jurisdiction.

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

1. Use Equation 4-8 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" 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 below (Tables 4-8 through 4-12) to determine the appropriate sizing factors for the IMP design.

TABLE 4-8. Sizing Factors – Bioretention Facilities (pending Copermittee approval)

Facility	Soil Group A	Soil Group B	Soil Group C	Soil Group D
Lindbergh Gauge				
$0.1Q_2 - Q_{10}$ A V_1 V_2				
$0.3Q_2 - Q_{10}$ A V_1 V_2				
$0.5Q_2 - Q_{10}$ A V_1 V_2				
Oceanside Gauge				
$0.1Q_2 - Q_{10}$ A V_1 V_2				

TABLE 4-8. Sizing Factors – Bioretention Facilities (pending Copermittee approval)

Facility	Soil Group A	Soil Group B	Soil Group C	Soil Group D
$0.3Q_2 - Q_{10}$ A V_1 V_2				
$0.5Q_2 - Q_{10}$ A V_1 V_2				
Lake Wohlford Gauge				
$0.1Q_2 - Q_{10}$ A V_1 V_2				
$0.3Q_2 - Q_{10}$ A V_1 V_2				
$0.5Q_2 - Q_{10}$ A V_1 V_2				
Lower Otay Gauge				
$0.1Q_2 - Q_{10}$ A V_1 V_2				
$0.3Q_2 - Q_{10}$ A V_1 V_2				
$0.5Q_2 - Q_{10}$ A V_1 V_2				

Q_2 = 2-year pre-project flow rate based upon partial duration analysis of long-term hourly rainfall records
Q_{10} = 10-year pre-project flow rate based upon partial duration analysis of long-term hourly rainfall records
A = Surface area sizing factor
V_1 = Surface volume sizing factor
V_2 = Subsurface volume sizing factor

TABLE 4-9. Sizing Factors – Bioretention Plus Cistern Facilities (pending Copermittee approval)

Facility	Soil Group A	Soil Group B	Soil Group C	Soil Group D
Lindbergh Gauge				
$0.1Q_2 - Q_{10}$ A V_1				
$0.3Q_2 - Q_{10}$ A V_1				
$0.5Q_2 - Q_{10}$ A V_1				
Oceanside Gauge				
$0.1Q_2 - Q_{10}$ A V_1				
$0.3Q_2 - Q_{10}$ A V_1				
$0.5Q_2 - Q_{10}$ A V_1				
Lake Wohlford Gauge				
$0.1Q_2 - Q_{10}$ A V_1				
$0.3Q_2 - Q_{10}$ A V_1				
$0.5Q_2 - Q_{10}$ A V_1				

TABLE 4-9. Sizing Factors – Bioretention Plus Cistern Facilities (pending Copermittee approval)

Facility	Soil Group A	Soil Group B	Soil Group C	Soil Group D
Lower Otay Gauge				
$0.1Q_2 - Q_{10}$ A V_1				
$0.3Q_2 - Q_{10}$ A V_1				
$0.5Q_2 - Q_{10}$ A V_1				

Q_2 = 2-year pre-project flow rate based upon partial duration analysis of long-term hourly rainfall records
Q_{10} = 10-year pre-project flow rate based upon partial duration analysis of long-term hourly rainfall records
A = Bioretention surface area sizing factor
V_1 = Cistern volume sizing factor

TABLE 4-10. Sizing Factors – Bioretention Plus Vault Facilities (pending Copermittee approval)

Facility	Soil Group A	Soil Group B	Soil Group C	Soil Group D
Lindbergh Gauge				
$0.1Q_2 - Q_{10}$ A V_1				
$0.3Q_2 - Q_{10}$ A V_1				
$0.5Q_2 - Q_{10}$ A V_1				
Oceanside Gauge				
$0.1Q_2 - Q_{10}$ A V_1				
$0.3Q_2 - Q_{10}$ A V_1				
$0.5Q_2 - Q_{10}$ A V_1				

TABLE 4-10. Sizing Factors – Bioretention Plus Vault Facilities (pending Copermittee approval)

Facility	Soil Group A	Soil Group B	Soil Group C	Soil Group D
Lake Wohlford Gauge				
$0.1Q_2 - Q_{10}$ A V_1				
$0.3Q_2 - Q_{10}$ A V_1				
$0.5Q_2 - Q_{10}$ A V_1				
Otay Gauge				
$0.1Q_2 - Q_{10}$ A V_1				
$0.3Q_2 - Q_{10}$ A V_1				
$0.5Q_2 - Q_{10}$ A V_1				

Q_2 = 2-year pre-project flow rate based upon partial duration analysis of long-term hourly rainfall records
Q_{10} = 10-year pre-project flow rate based upon partial duration analysis of long-term hourly rainfall records
A = Bioretention surface area sizing factor
V_1 = Cistern volume sizing factor

TABLE 4-11. Sizing Factors – Flow-through Planter Box Facilities (pending Copermittee approval)

Facility	Soil Group A	Soil Group B	Soil Group C	Soil Group D
Lindbergh Gauge				
$0.1Q_2 - Q_{10}$ A V_1 V_2				
$0.3Q_2 - Q_{10}$ A V_1 V_2				
$0.5Q_2 - Q_{10}$ A V_1 V_2				

TABLE 4-11. Sizing Factors – Flow-through Planter Box Facilities (pending Copermittee approval)

Facility	Soil Group A	Soil Group B	Soil Group C	Soil Group D
Oceanside Gauge				
$0.1Q_2 - Q_{10}$ A V_1 V_2				
$0.3Q_2 - Q_{10}$ A V_1 V_2				
$0.5Q_2 - Q_{10}$ A V_1 V_2				
Lake Wohlford Gauge				
$0.1Q_2 - Q_{10}$ A V_1 V_2				
$0.3Q_2 - Q_{10}$ A V_1 V_2				
$0.5Q_2 - Q_{10}$ A V_1 V_2				

TABLE 4-11. Sizing Factors – Flow-through Planter Box Facilities (pending Copermittee approval)

Facility	Soil Group A	Soil Group B	Soil Group C	Soil Group D
Lower Otay Gauge				
$0.1Q_2 - Q_{10}$ A V_1 V_2				
$0.3Q_2 - Q_{10}$ A V_1 V_2				
$0.5Q_2 - Q_{10}$ A V_1 V_2				

Q_2 = 2-year pre-project flow rate based upon partial duration analysis of long-term hourly rainfall records
Q_{10} = 10-year pre-project flow rate based upon partial duration analysis of long-term hourly rainfall records
A = Surface area sizing factor
V_1 = Surface volume sizing factor
V_2 = Subsurface volume sizing factor

TABLE 4-12. Sizing Factors – Dry Well/Infiltration Facilities (pending Copermittee approval)

Facility	Soil Group A	Soil Group B	Soil Group C	Soil Group D
Lindbergh Gauge				
$0.1Q_2 - Q_{10}$ A V_1				
$0.3Q_2 - Q_{10}$ A V_1				
$0.5Q_2 - Q_{10}$ A V_1				
Oceanside Gauge				
$0.1Q_2 - Q_{10}$ A V_1				
$0.3Q_2 - Q_{10}$ A V_1				

TABLE 4-12. Sizing Factors – Dry Well/Infiltration Facilities (pending Copermittee approval)

Facility	Soil Group A	Soil Group B	Soil Group C	Soil Group D
$0.5Q_2 - Q_{10}$ A V_1				
Lake Wohlford Gauge				
$0.1Q_2 - Q_{10}$ A V_1				
$0.3Q_2 - Q_{10}$ A V_1				
$0.5Q_2 - Q_{10}$ A V_1				
Otay Gauge				
$0.1Q_2 - Q_{10}$ A V_1				
$0.3Q_2 - Q_{10}$ A V_1				
$0.5Q_2 - Q_{10}$ A V_1				

Q_2 = 2-year pre-project flow rate based upon partial duration analysis of long-term hourly rainfall records
Q_{10} = 10-year pre-project flow rate based upon partial duration analysis of long-term hourly rainfall records
A = Surface area sizing factor
V_1 = Infiltration volume sizing factor

► STEP 7: DETERMINE IF AVAILABLE SPACE FOR 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 if 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 which may have excess capacity.

- Making tributary landscaped DMAs self-treating or self-retaining.
- Expanding IMP surface area.

► ***STEP 8: COMPLETE YOUR SUMMARY REPORT***

Present your IMP sizing calculations in tabular form. Adapt the following format as appropriate to your project. Coordinate your presentation of DMAs and calculation of minimum IMP sizes with the 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 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:

APN 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	*Post-project 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):

DMA Name	*DMA Area (square feet)*	*Post-project surface type*	*DMA Runoff factor*	*DMA Area × runoff factor*
			Total	

Soil Type:	*IMP Name*			
IMP Sizing factor		*Minimum Area or Volume*	*Proposed Area or Volume*	
				IMP Area

Specify Preliminary Design Details

In your Project Submittal, describe your IMPs in sufficient detail to demonstrate the area, volume, and other criteria of each can be met within the constraints of the site.

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

Following are design sheets for:

- Self-treating and self-retaining areas
- Pervious pavements
- Bioretention facilities
- Flow-through planter
- Dry wells and infiltration basins
- 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 municipal staff have 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 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 you believe design of features and facilities as described above is infeasible for your development site, consult with municipal staff before preparing an alternative design for stormwater treatment, flow control, and LID compliance.

Local Requirements

Cities or the County may have requirements that differ from, or are in addition to, this countywide model SUSMP. Check with local planning and community development staff.

For all alternative designs, the applicant must prepare a complete Project Submittal, including a drawing showing the entire site divided into discrete Drainage Management Areas, 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 36. The Project Submittal must also show how the project meets the minimum LID criteria (page 40) and ensures runoff rates, durations, and velocities are controlled to maintain or reduce downstream erosion conditions and protect stream habitat (NPDES Permit Provision D.1.d.(10)).

► DESIGN OF ALTERNATIVE TREATMENT FACILITIES

Here are criteria and design considerations for some alternative treatment facilities:

Sand Filters. To ensure 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:

- Calculate the design flow using the rational method with an intensity of 0.2"/hour and the "C" factors for "treatment only" from Table 4-2.
- To determine the required filter surface area, divide the design flow by an allowable design surface loading rate of 5"/hour.
- The minimum depth of filter media is 18". 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 Drainage Management Area.
- Include only impervious areas in the DMA.
- Stabilize slopes and eliminate sources of sediment in the DMA.
- Provide screens for trash and leaves at storm drain inlets (if allowed by municipality).

For additional design considerations and details, see *Design of Stormwater Filtering Systems* by Richard A. Claytor and Thomas R. Schueler, The Center for Watershed Protection, 1996, and *California Stormwater BMP Handbooks* Fact Sheet TC-40, Media Filter.

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 of San Diego'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 the *California Stormwater Best Management Practice Handbooks*, Fact Sheet TC-22, "Extended Detention Basins." 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 mosquito harborage 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 (96 hours for the County of San Diego).

"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 plan ongoing inspection and maintenance of the facility for mosquito control. For design considerations and details, see the

California Stormwater Best Management Practices Handbooks, Fact Sheet TC-20, "Wet Ponds," and Fact Sheet TC-21, "Constructed Wetlands."

Vegetated Swales. Design recommendations for conventional vegetated swales are in the *California Stormwater Best Management Practices Handbooks*. 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 (see page 25). The following should be incorporated in the design:

- Determine the weighted runoff factor ("C" factor) for the area tributary to the swale. The factors 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 inches 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 a minimum 100 feet in length.
- Longitudinal slopes should 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 don't obtain even the design residence time because of the length required and because proper design requires 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, and more effective flow control 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 only be used in the circumstances described beginning on page 35 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.

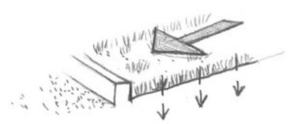
Such facilities do not provide hydromodification flow control benefit.

References and Resources:

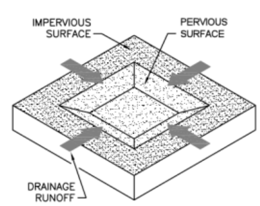
- RWQCB Order R9-2007-0001 (Stormwater NPDES Permit)
- Low Impact Development Center
- *County of San Diego Low Impact Development Handbook*
- *California Best Management Practices Handbooks*
- *Design of Stormwater Filtering Systems* (Claytor and Scheuler, 1996)
- American Rainwater Catchment Systems 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 one inch of rainfall without producing any runoff. During intense storms, runoff may drain off-site, to the storm drain system, or to IMPs.

LID design seeks to manage runoff from roofs and paving so effects on water quality and hydrology are minimized. Runoff from landscaping, however, does not need to be managed the same way.

Runoff from landscaping can be managed by creating self-treating and self-retaining areas.

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

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 offsite to a street or storm drain. Self-treating areas may not drain on to 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 one 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.

Areas draining to self retaining areas. Drainage from roofs and paving can be directed to self-retaining areas and allowed to infiltrate into the soil. The maximum allowable ratio is 2 parts impervious: 1 part pervious.

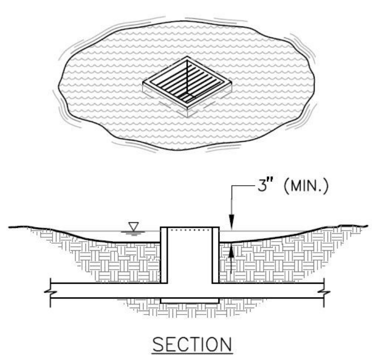
The self-retaining area must be bermed or depressed to retain an inch of rainfall including the flow from the tributary impervious area.

► ***DETAILS***

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



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

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

Leave enough reveal (from pavement down to landscaped surface) to accommodate buildup of turf or mulch.

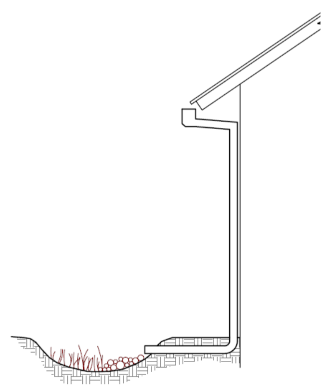
► ***APPLICATIONS***

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

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

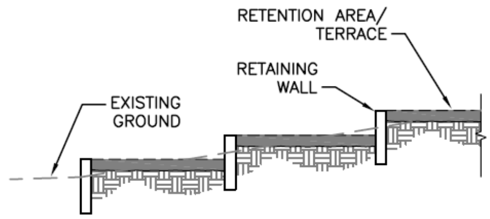
Runoff from walkways or driveways in parks and park-like areas can sheet-flow to self-retaining areas.

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).
- ❒ Re-graded or re-landscaped 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

- ❒ Area is bermed all the way around or graded concave.
- ❒ Slopes do not exceed 4%.
- ❒ Entire area is lawn, landscaping, or pervious pavement (see criteria in Chapter 4).
- ❒ 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

- ❒ 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.

Pervious Pavements

► ***CRITERIA***

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

Pervious 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 pervious 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
- Artificial turf

Areas with these pervious pavements can also be ***self-retaining areas*** and may receive runoff from impervious areas if they are bermed or depressed to retain the first one 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 impervious pavement, when the unit pavers are set in sand or gravel with d" gaps between the pavers. Joints must be filled with an open-graded aggregate free of fines.

Best Uses

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

Advantages

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

Limitations

- Initial cost
- Placement requires specially trained crews
- Geotechnical concerns, especially in clay soils
- Concerns about pavement strength and surface integrity
- Some municipalities do not allow in public right of way

When draining pervious pavements to an IMP, use the runoff factors in Table 4-2.

► *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 determines the required depth of base course. If underdrains are used, the outlet elevation must be a minimum of 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.

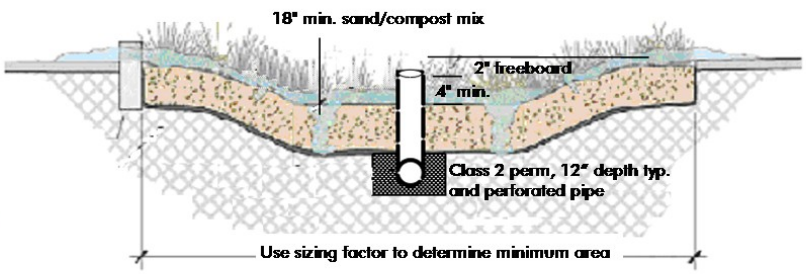
► *DESIGN CHECKLIST FOR PERVIOUS PAVEMENTS*

- ❒ No erodible areas drain on to 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 a minimum of 3 inches above bottom of base course.
- ❒ Subgrade is uniform and slopes are not so steep that subgrade is prone to erosion.
- ❒ 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 incorporates Americans with Disabilities Act requirements, site aesthetics, and uses.

Resources

- Southern California Concrete Producers 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,* pp. 47-53. www.basmaa.org
- *Porous Pavements,* by Bruce K. Ferguson. 2005. ISBN 0-8493-2670-2.

Bioretention Facilities



Bioretention facility configured for treatment-only requirements. Bioretention facilities can 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 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 above-ground 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.

► *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)

Best Uses

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

Advantages

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

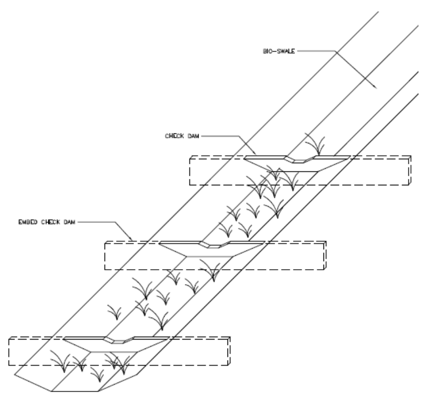
Limitations

- Require 4% of tributary impervious square footage
- Typically requires 3-4 feet of head
- Irrigation typically required

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***

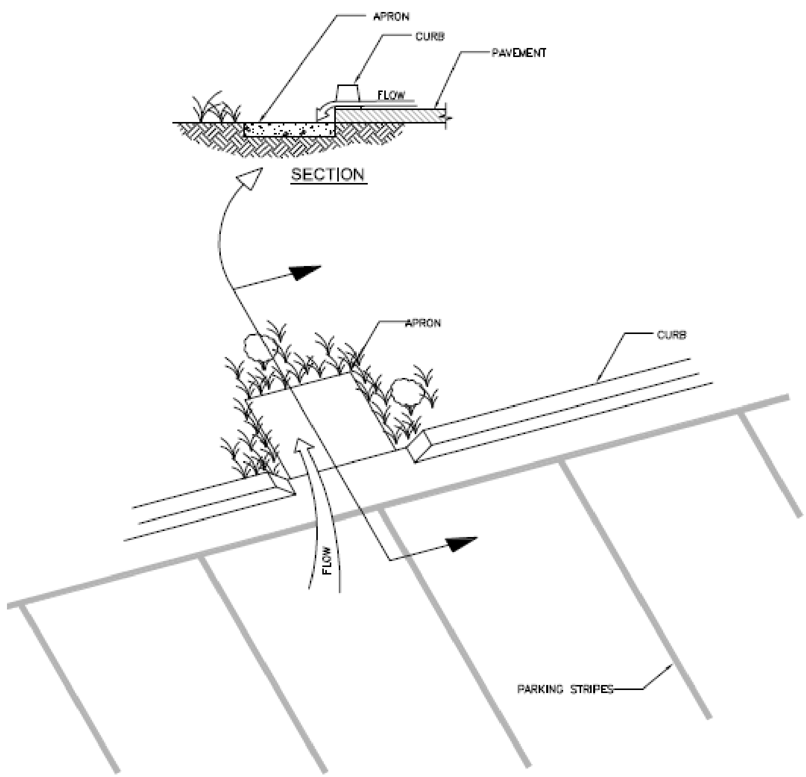
Plan. On the surface, a bioretention facility should be one level, shallow basin—or a series of basins. As runoff enters each basin, it should flood and fill throughout before runoff overflows to the outlet or to the next downstream basin. This will help prevent movement of surface mulch and soil mix.



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" is recommended) to avoid clogging with leaves or debris. Allow for a minimum reveal of 4"-6" between the inlet and soil mix elevations to ensure 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" 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 due to clay content.

Storage and drainage layer. "Class 2 permeable," Caltrans specification 68-1.025, is recommended. Open-graded crushed rock, washed, may be used, but requires 4"-6" 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 the surface reservoir fills and the entire surface area of soil mix is flooded before the outlet elevation is reached. In swales, this can be achieved with appropriately placed check dams.

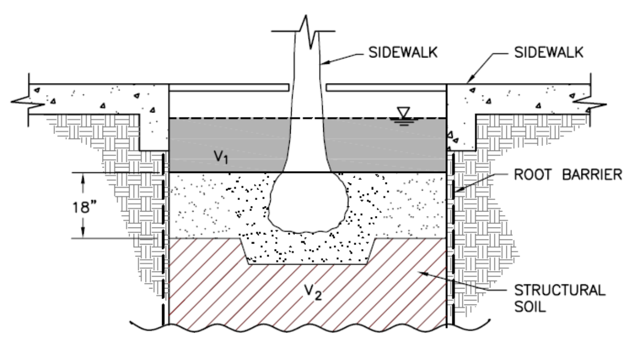
The outlet should be designed to exclude floating mulch and debris.

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 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 lifespan.

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.



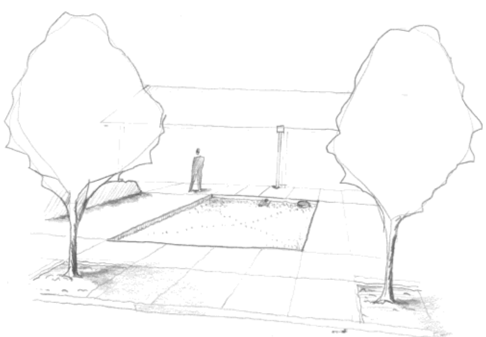
Bioretention facility configured as a tree well.
The root barrier is optional.

► *APPLICATIONS*

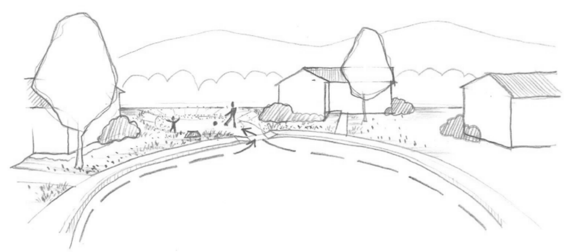
Multi-purpose landscaped areas. Bioretention facilities are easily adapted to serve multiple purposes. The loamy sand soil mix will support turf or a plant palette suitable to the location and a well-drained soil.

Example landscape treatments:

- Lawn with sloped transition to adjacent landscaping.
- Swale in setback area
- Swale in parking median
- Lawn with hardscaped edge treatment
- Decorative garden with formal or informal plantings
- Traffic island with low-maintenance landscaping
- Raised planter with seating
- Bioretention on a terraced slope



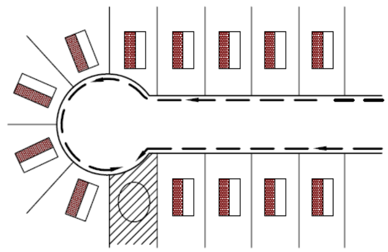
Bioretention facility configured as a recessed decorative lawn with hardscaped edge.



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

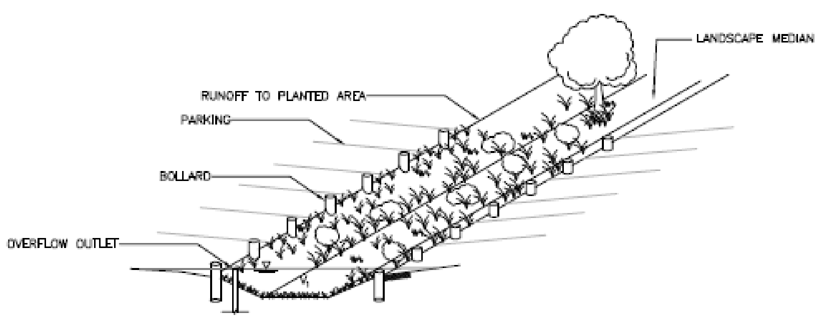
Residential subdivisions. Some subdivisions are designed to drain roofs and driveways to the streets (in the conventional manner) and then drain the streets to bioretention areas, with one bioretention area for each 1 to 6 lots, depending on subdivision layout and topography.

If allowed by the local jurisdiction, 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.

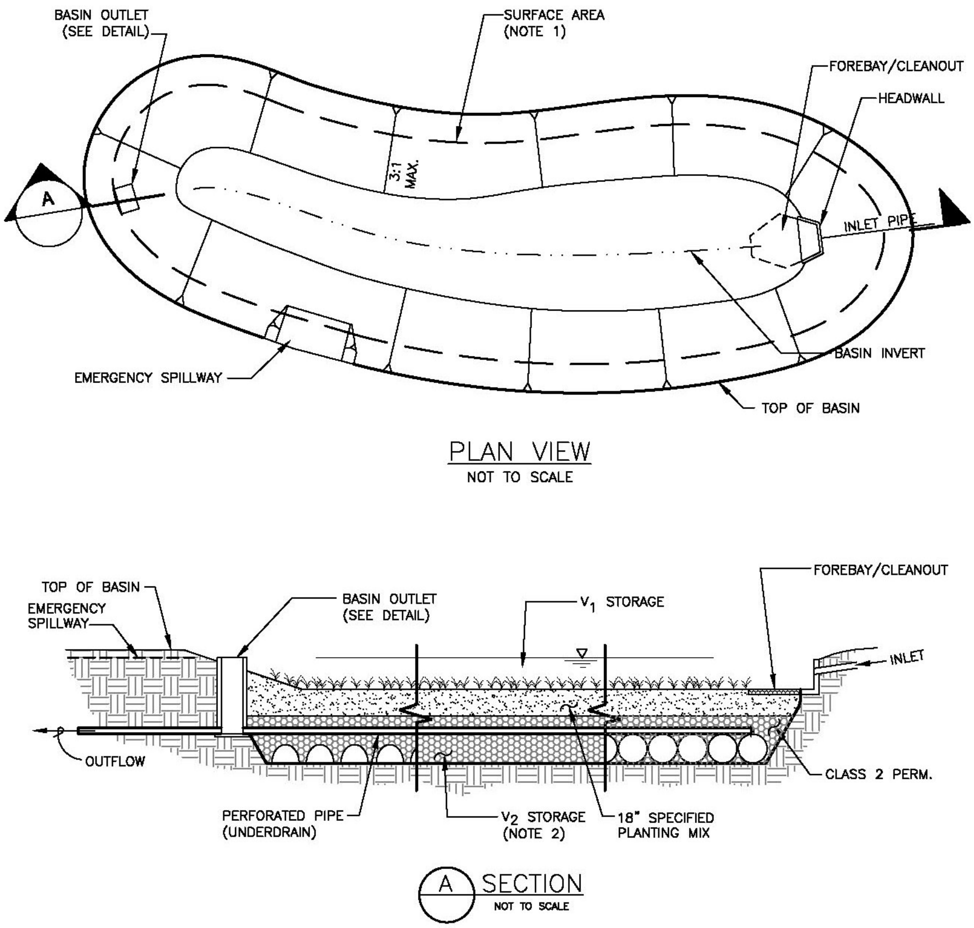
Sloped sites. Bioretention facilities must be constructed as a basin, or series of basins, with the circumference of each basin set level. It may be necessary to add curbs or low retaining walls.



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

Design Checklist for Bioretention

- ❐ Volume or depth of surface reservoir meets or exceeds minimum.
- ❐ 18" depth "loamy sand" soil mix with minimum long-term percolation rate of 5"/hour.
- ❐ Area of soil mix meets or exceeds minimum.
- ❐ Perforated pipe underdrain bedded in "Class 2 perm" with connection and sufficient head to storm drain or discharge point (except in "A" or "B" soils).
- ❐ No filter fabric.
- ❐ Underdrain has a clean-out port consisting of a vertical, rigid, non-perforated PVC pipe, with a minimum diameter of 6 inches and a watertight cap.
- ❐ Location and footprint of facility are shown on site plan and landscaping plan.
- ❐ Bioretention area is designed as a basin (level edges) or a series of basins, and grading plan is consistent with these elevations. If 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" wide, have 4"-6" reveal and an apron or other provision to prevent blockage when vegetation grows in, and energy dissipation as needed.
- ❐ Overflow 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.
- ❐ Irrigation system with connection to water supply.
- ❐ Vaults, utility boxes, and light standards are located outside the minimum soil mix surface area.
- ❐ When excavating, avoid smearing of the soils on bottom and side slopes. Minimize compaction of native soils and "rip" soils if clayey and/or compacted. Protect the area 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

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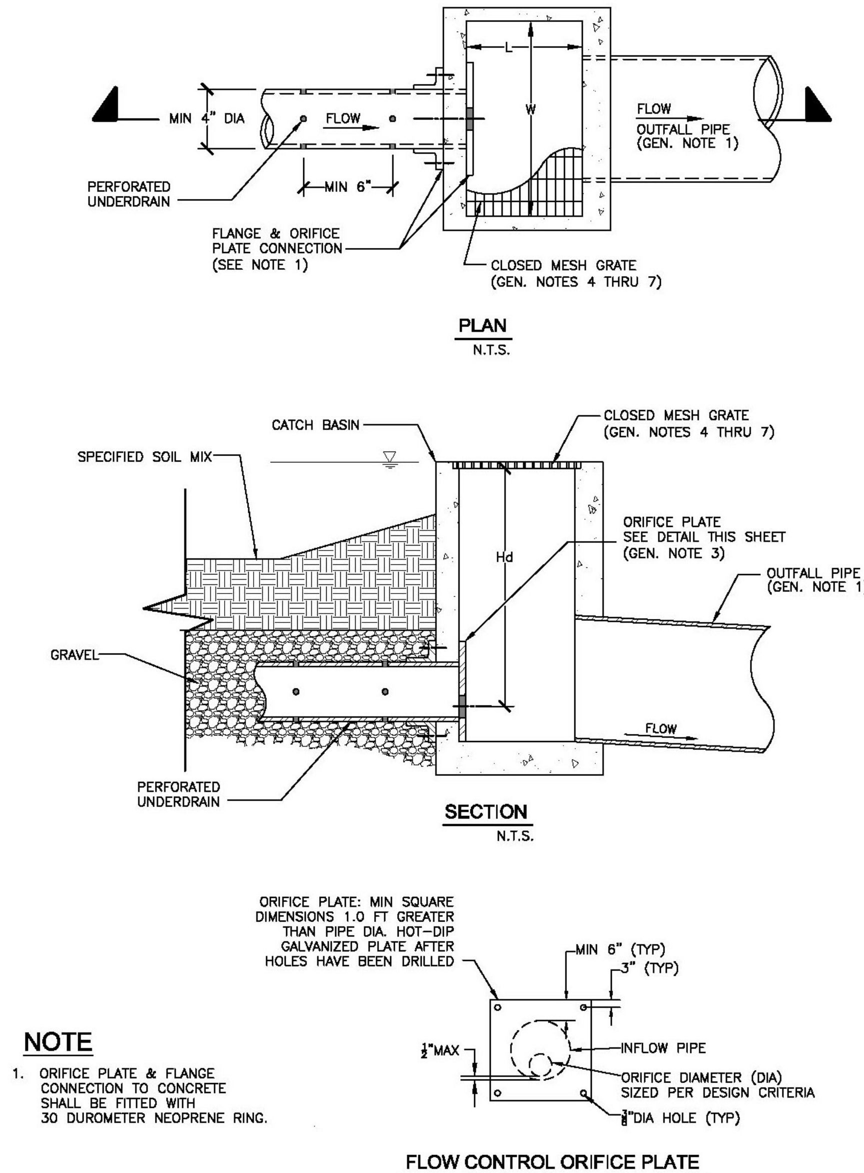


Bioretention Facility Outlet Detail - A

Flow-through Planter

Portland 2004 Stormwater Manual

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 which 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 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)

Parameter	Criterion
Soil mix surface area	0.04 times tributary impervious area (or equivalent)
Surface reservoir depth	6" minimum; may be sloped to 4" 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, set the perforated pipe underdrain and orifice as nearly flush with the planter bottom as possible.

Inlets. Protect plantings 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" 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 due to clay content.

Gravel storage and drainage layer. "Class 2 permeable," Caltrans specification 68-1.025, is recommended. Open-graded crushed rock, washed, may be used, but requires 4"-6" 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.

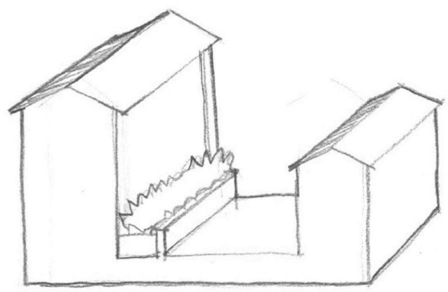
Emergency overflow. The planter design and installation should anticipate extreme events and potential clogging of the overflow and route emergency overflows safely.

► ***APPLICATIONS***

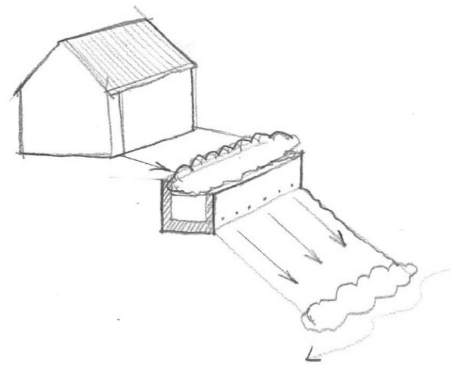
Adjacent to buildings. Flow-through planters may be located adjacent to buildings, where the planter vegetation can soften the visual effect of the building wall. A setback with a raised planter box may be appropriate even in some neo-traditional pedestrian-oriented urban streetscapes.

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 local requirements. It is sometimes possible to disperse these flows to the downgradient hillside.



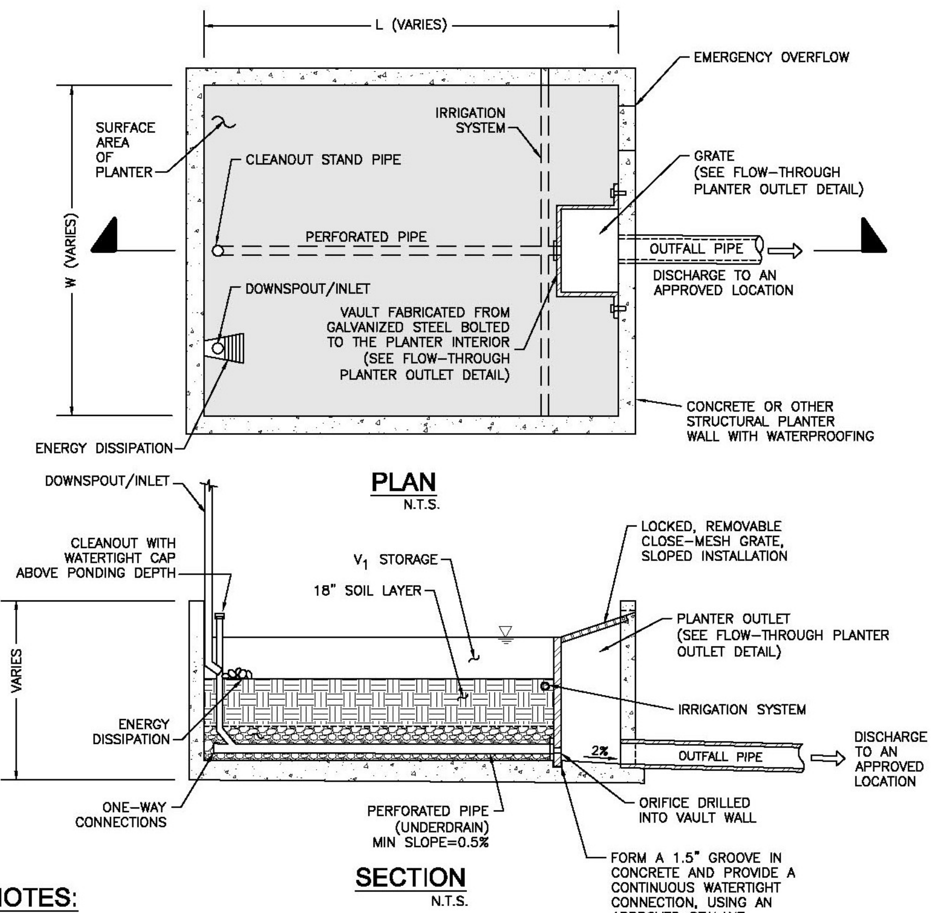
Flow-through planter on the plaza level of a podium-style development.



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

Design Checklist for Flow-through Planter

- ❒ Reservoir depth is 4-6" minimum.
- ❒ 18" depth "loamy sand" soil mix with minimum long-term infiltration rate of 5"/hour.
- ❒ Area of soil mix meets or exceeds minimum.
- ❒ "Class 2 perm" drainage layer.
- ❒ No filter fabric.
- ❒ Perforated pipe underdrain with outlet located flush or nearly flush with planter bottom. Connection with sufficient head to storm drain or discharge point.
- ❒ Underdrain has a clean-out port consisting of a vertical, rigid, non-perforated PVC pipe, with a minimum diameter of 6 inches and a watertight cap.
- ❒ Overflow connected to a downstream storm drain or approved discharge point.
- ❒ Location and footprint of facility are shown on site plan and landscaping plan.
- ❒ Planter is set level.
- ❒ Emergency spillage will be safely conveyed overland.
- ❒ Plantings are suitable to the climate and a well-drained soil.
- ❒ Irrigation system with connection to 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

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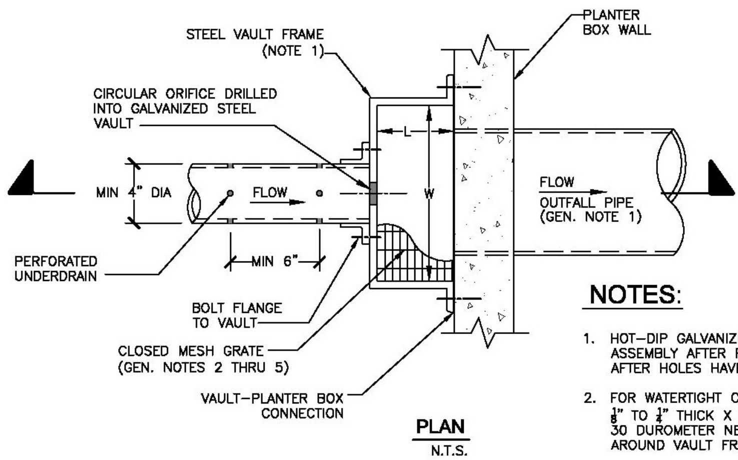
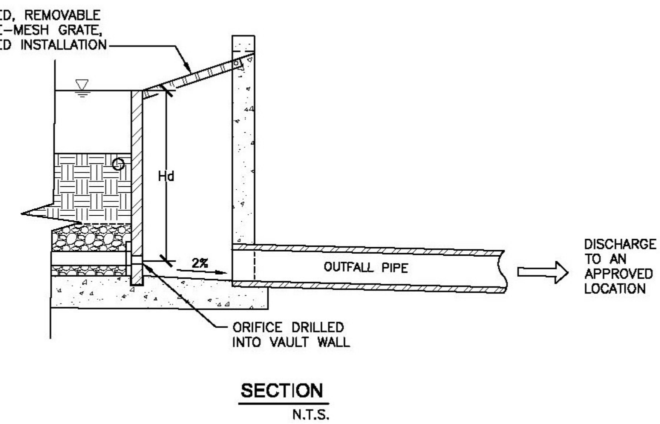


NOTES:

1. HOT–DIP GALVANIZE ENTIRE FRAME ASSEMBLY AFTER FABRICATION AND AFTER HOLES HAVE BEEN DRILLED.
2. FOR WATERTIGHT CONNECTION, INSTALL ⅛" TO ¼" THICK X 2" WIDE CONTINUOUS 30 DUROMETER NEOPRENE GASKET, ALL AROUND VAULT FRAME.



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

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 4-8 using a unit volume based on the County of San Diego's 85th Percentile Isopluvial Map.

Consult with the local jurisdiction engineer regarding the need to verify soil permeability and other site conditions are suitable for dry wells and infiltration basins. Some proposed criteria are on Page 5-12 of Caltrans' 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 over-excavated by two 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' 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

- ❒ Volume and infiltrative area meet or exceed minimum.
- ❒ Overflow connected to a downstream storm drain or approved discharge point.
- ❒ Emergency spillage will be safely conveyed overland.
- ❒ Depth from bottom of the facility to seasonally high groundwater elevation is ≥10'.
- ❒ Areas tributary to the facility do not include automotive repair shops; car washes; fleet storage areas (Bus, truck, etc.); nurseries, or other uses that may present an exceptional threat to groundwater quality.
- ❒ Underlying soils are in Hydrologic Soil Group A or B. Infiltration rate is sufficient to ensure a full basin will drain completely within 72 hours. Soil infiltration rate has been confirmed.
- ❒ Set back from structures 10' 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.

► ***CRITERIA***

Cistern. The cistern must detain the volume calculated by Equation 4-8 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" 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.

Best Uses

- In series with a bioretention facility to meet treatment requirement in limited space.
- Management of roof runoff
- Dense urban areas

Advantages

- Storage volume can be in any configuration

Limitations

- Somewhat complex to design, build, and operate
- Requires head for both cistern and bioretention facility

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 mosquitoes can enter through openings 1/16" or larger and will fly for many feet through pipes as small as ¼".

Exclude debris. Provide leaf guards and/or screens to prevent debris from accumulating in the cistern.

Ensure access for maintenance. Design the cistern to allow for cleanout. Avoid creating the need for maintenance workers to enter a confined space. Ensure the outlet orifice can 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 of San Diego'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.

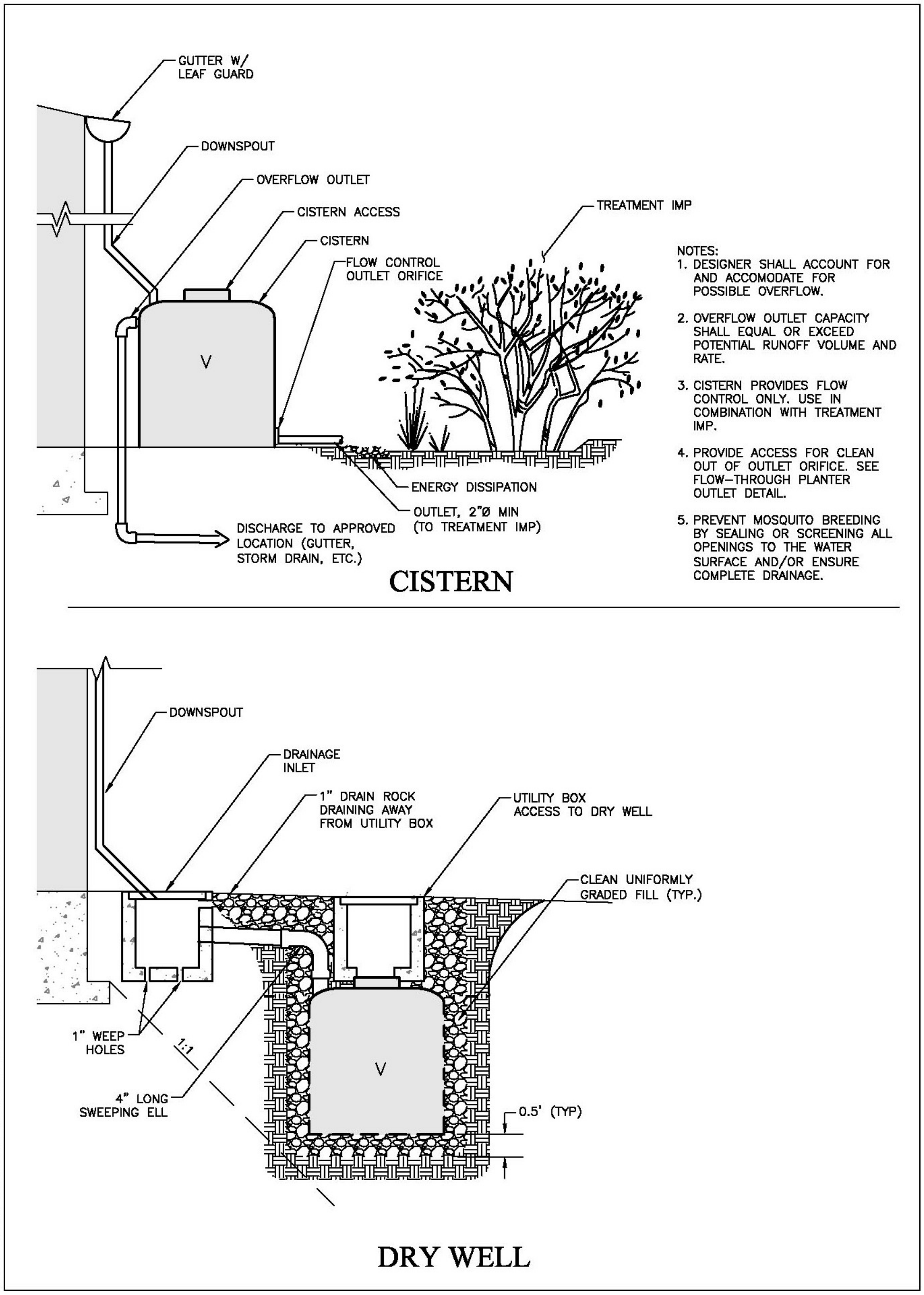
Water harvesting or graywater reuse. It may be possible to create a site-specific design that uses cisterns to achieve stormwater flow control, stormwater treatment, and rainwater reuse for irrigation or indoor uses (***water harvesting***). Facilities must meet criteria for capturing and treating the volume specified by Equation 4-8. This volume must be allowed to empty within 24 hours so runoff from additional storms, which may follow, is also captured and treated. Additional volume may be required if the system also stores runoff for longer periods for reuse. Indoor uses of non-potable water may be restricted or prohibited. Check with municipal staff.

Design Checklist for Cistern

- ❒ Volume meets or exceeds minimum.
- ❒ Outlet with orifice or other flow-control device restricts flow and is designed to provide a 24-hour drawdown time.
- ❒ Outlet is piped to a bioretention facility designed to treat the maximum discharge from the cistern orifice.
- ❒ Cistern is designed to drain completely and/or sealed to prevent mosquito harborage.
- ❒ Design provides for exclusion of debris and accessibility for maintenance.

❒ Overflow connected to a downstream storm drain or approved discharge point.

❒ Emergency spillage will be safely conveyed overland.



APPENDIX J

Definitions

APPENDIX J

Definitions

"Advanced Treatment" means to use mechanical or chemical means to flocculate and remove suspended sediment from runoff from construction sites prior to discharge. Advanced treatment is required if there were exceptional threats to water quality.

"Attached Residential Development" means 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" means 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 Practices" 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).

"Commercial Development" means 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, automotive dealerships, commercial airfields, and other light industrial complexes.

"Commercial Development greater than one acre" means any commercial development that with a project footprint of at least one acre.

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.

Construction Permits. Any building, electrical, plumbing/mechanical, demolition/removal, grading, public right-of-way, and sign permits, reviewed in accordance with Process One by the Development Services Department, as described in Chapter 12, Article 9, Divisions 1 through 8 of the Land Development Code.

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.

Directly Connected Impervious Area (DCIA). 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).

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.

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.

"Discretionary Actions" means 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 permits reviewed by Development Services staff, as described in Chapter 12, Articles 2 through 6 of the Land Development Code.

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.

Housing development greater than 10 dwelling units. This category includes single-family homes, multi-family homes, condominiums, and apartments.

Hydromodification. The change in the natural watershed 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 stream flows and sediment transport. In addition, alteration of stream and river channels, installation of dams and water impoundments, and excessive stream-bank and shoreline erosion are also considered hydromodification, due to their disruption of natural watershed hydrologic processes.

Hydromodification Management Plan (HMP). A Plan implemented by the dischargers so that post-project runoff shall not exceed estimated pre-project 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.

"Industrial development greater than one acre." This category includes, but is not limited to, manufacturing plants, food processing plants, metal working facilities, printing plants, and fleet storage areas (bus, truck, etc.).

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.

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.

Interim Hydromodification Criteria. Pursuant to NPDES permit Provision D.1.d.g.(6), the Copermittees prepared Interim Hydromodification Management criteria, which apply to projects disturbing 50 acres or more. The criteria are described in Chapter 2 and in memoranda on the Project Clean Water website.

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.

"New Development" means land disturbing activities; structural development, including construction or installation of a building or structure, the creation of impervious surfaces; and land subdivision.

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.

"Pollutant" is any agent that may cause or contribute to the degradation of water quality such that a condition of pollution or contamination is created or aggravated.

"Pollutants of Concern." For the purposes of identifying pollutants of concern and associated storm water BMPs, pollutants are grouped in nine general categories as follows:

General Categories of Water Pollution:

1. **Sediments -** 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 young aquatic organisms survival rates, smother bottom dwelling organisms, and suppress aquatic vegetation growth.

2. **Nutrients -** 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 aquatic algae and plant growth. 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.

3. **Metals -** Metals are raw material components in non-metal products such as fuels, adhesives, paints, and other coatings. Primary source of metal pollution in storm water 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 impacted from contaminated groundwater resources, and bioaccumulation of metals in fish and shellfish. Environmental concerns, regarding the potential for release of metals to the environment, have already led to restricted metal usage in certain applications.

4. **Organic Compounds -** Organic compounds are carbon-based. Commercially available or naturally occurring organic compounds are found in pesticides, solvents, and hydrocarbons. Organic compounds can, at certain concentrations, indirectly or directly constitute a hazard to life or health. When rinsing off objects, 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.

5. **Trash & Debris -** 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 & debris may have a significant impact on the recreational value of a water body and aquatic habitat. Excess organic matter can create a high biochemical oxygen demand in a stream and thereby lower 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.

6. **Oxygen-Demanding Substances -** This category includes 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.

7. **Oil and Grease -** Oil and grease are characterized as high-molecular weight organic compounds. 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. Introduction of these pollutants to the water bodies are very possible due to 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.

8. **Bacteria and Viruses -** 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. Water containing excessive bacteria and viruses 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.

9. **Pesticides -** 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.

"Pollution Prevention" means practices and processes that reduce or eliminate the generation of pollutants, in contrast to source control, treatment, or disposal. Pollution prevention is generally the best "first line of defense" and should be used in conjunction with site design, source control, and treatment control BMPs.

"Post-Project Flows" means the peak runoff flows and runoff volume anticipated after the project has been constructed taking into account all permeable and impermeable surfaces, soil and vegetation types and conditions after landscaping is complete, detention or retention basins or other water storage elements incorporated into the site design, and any other site features that would affect runoff volumes and peak flows.

"Pre-Development Hydrologic Conditions" means hydrologic conditions that would exist assuming no pavement, structures or hardened surfaces, site vegetation typical of native conditions in the climate and ecological zone of the site, topography similar to current conditions without structures, pavements, or artificially hardened surfaces, and soil types similar to current conditions without structures, pavements, or artificially hardened surfaces. The terms "pre-development runoff", "pre-development flow", or "pre-development volume", are the quantitative measures associated with this definition.

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.

"Projects Discharging to Receiving Waters within Water Quality Sensitive Areas" means all development and significant redevelopment that would create 2,500 square feet of impervious surfaces or increase the area of imperviousness of a project site to 10% or more of its naturally occurring condition, and either discharge urban runoff to a receiving water within a water quality sensitive area (where any portion of the project footprint is located within 200 feet of the water quality sensitive area), or discharge to a receiving water within an water quality sensitive area without mixing with flows from adjacent lands (where the project footprint is located more than 200 feet from the water quality sensitive area).

"Project Footprint" means the limits of all grading and ground disturbance, including landscaping, associated with a project.

Proprietary. A proprietary device is one marketed under legal right of the manufacturer.

"Residential Development" means 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, multi-family homes, condominiums, and apartments.

"Restaurant" means 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 (SIC code 5812).

"Significant Redevelopment" means development that would create, replace, or add at least 5,000 square feet of impervious surfaces on an already developed site. Significant redevelopment includes, but is not limited to: the expansion of a building footprint; addition to or replacement of a structure; replacement of an impervious surface that is not part of a routine maintenance activity; and land disturbing activities related with structural or 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. Significant redevelopment does not include trenching and resurfacing associated with utility work; resurfacing and reconfiguring surface parking lots; new sidewalk construction, pedestrian ramps, or bike lane on existing roads; and replacement of damaged pavement.

"Site Design BMP" means any project design feature that reduces the creation or severity of potential pollutant sources or reduces the alteration of the project site's natural flow regime. Redevelopment projects that are undertaken to remove pollutant sources (such as existing surface parking lots and other impervious surfaces) or to reduce the need for new roads and other impervious surfaces (as compared to conventional or low-density new development) by incorporating higher densities and/or mixed land uses into the project design, are also considered site design BMPs.

"Source Control BMP (both structural and non-structural)" means land use or site planning practices, or structures 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. Examples include roof structures over trash or material storage areas, and berms around fuel dispensing areas.

"Steep hillside development greater than 5,000 square feet" means any development that would create more than 5,000 square feet of impervious surfaces in hillsides with known erosive soil conditions.

"Steep hillside" means lands that have a natural gradient of 25 percent (4 feet of horizontal distance for every 1 foot of vertical distance) or greater and a minimum elevation differential of 50 feet, or a natural gradient of 200 percent (1 foot of horizontal distance for every 2 feet of vertical distance) or greater and a minimum elevation differential of 10 feet.

"Retail Gasoline Outlets (RGO)." This category includes RGOs that meet the following criteria: (a) 5,000 square feet or more or (b) a projected Average Daily Traffic (ADT) of 100 or more vehicles per day.

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, which directly or indirectly receive discharges from urban runoff conveyance systems, including naturally occurring wetlands, streams (perennial, intermittent, and ephemeral (exhibiting bed, bank, and ordinary high water mark)), creeks, rivers, reservoirs, lakes, lagoons, estuaries, harbors, bays and the Pacific Ocean. The City shall determine the definition for wetlands and the limits thereof for the purposes of this definition, which shall be as protective as the Federal definition utilized by the United States Army Corps of Engineers and the United States Environmental Protection Agency. Constructed wetlands are not considered wetlands under this definition, unless the wetlands were constructed as mitigation for habitat loss. Other constructed BMPs are not considered receiving waters under this definition, unless the BMP was originally constructed in receiving waters.

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.

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

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.

"Storm Water Best Management Practice (BMP)" means any schedules of activities, prohibitions of practices, general good house keeping practices, pollution prevention and educational practices, maintenance procedures, structural treatment BMPs, and other management practices to prevent or reduce to the maximum extent practicable the discharge of pollutants directly or indirectly to receiving waters. Storm Water BMPs also include treatment requirements, operating procedures and practices to control site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage. This manual groups development-related storm water BMPs into two categories:

(1) **Construction Storm Water BMPs**, which are practices, procedures, devices or materials used to prevent the transport and introduction of pollutants both on and from a project site during construction; and

(2) **Permanent Storm Water BMPs**, which are the site design features, source control features, and treatment control BMPs that become a permanent part of a project's design and remain functioning throughout the "use" phase of a project site. (See the definitions for site design, source control, and treatment control BMPs in this appendix).

"Stormwater Conveyance System" means private and public drainage facilities by which storm water may be conveyed to Receiving Waters, such as: natural drainages, ditches, roads, streets, constructed channels, aqueducts, storm drains, pipes, street gutters, or catch basins.

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.

"Streets, Roads, Highways, and Freeways" means 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 used for the transportation of automobiles, trucks, motorcycles and other vehicles. For the purposes of Storm Water Standards Manual requirements, Streets, Roads, Highways and Freeways do not include trenching and resurfacing associated with utility work; applying asphalt overlay to existing pavement; new sidewalk, pedestrian ramps, or bike lane construction on existing roads; and replacement of damaged pavement.

Treatment. Removal of pollutants from runoff, typically by filtration or settling.

"Treatment Control (Structural) BMP" means any engineered system designed and constructed to remove pollutants from urban runoff. Pollutant removal is achieved by simple gravity settling of particulate pollutants, filtration, biological uptake, media adsorption, or any other physical, biological, or chemical process.

Water Board. See Regional Water Quality Control Board.

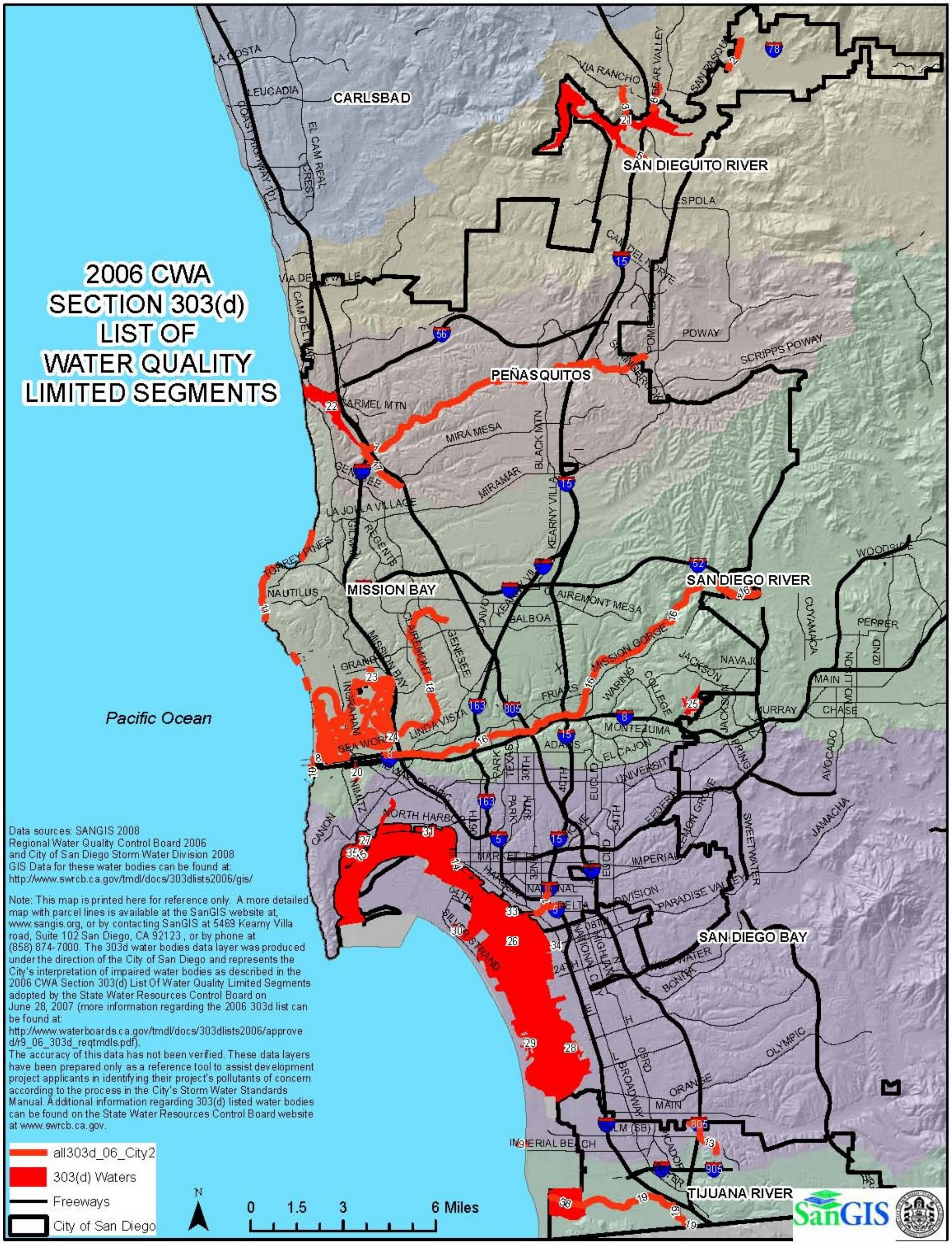
"Water Quality Sensitive Areas" means areas that include, but are not limited to, all Clean Water Act 303(d) impaired water bodies ("303[d] water bodies"); areas designated as an "Area of Special Biological Significance" (ASBS) by the State Water Resources Control Board (Water Quality Control Plan for the San Diego Basin (1994) and amendments); water bodies designated as having a RARE beneficial use by the State Water Resources Control Board (Water Quality Control Plan for the San Diego Basin (1994) and amendments), or areas designated as preserves or their equivalent under the Multiple Species Conservation Program (MSCP) within the Cities and County of San Diego. The limits of Areas of Special Biological Significance are those defined in the Water Quality Control Plan for the San Diego Basin (1994 and amendments). Water quality sensitive area is defined for the purposes of implementing Storm Water Standards Manual requirements, and does not replace or supplement other environmental resource-based terms, such as "Environmentally Sensitive Lands," employed by the City in their land development review processes. Water quality sensitive areas is synonymous with Environmental sensitive areas term used in the Municipal Storm Water National Pollutant Discharge Elimination System (NPDES) Permit (Municipal Permit), issued on January 24, 2007. A reference map depicting the Water Quality Sensitive Areas in the City of San Diego is included in Appendix B.

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.

APPENDIX D

Map and Tables

Note: ID numbers denoting "2006 CWA Section 303(d) List of Water Quality Segments" are illustrated on the following map. These ID numbers may be cross-referenced with the tables following the map.



You may cross reference the tables below with the map on the previous page with regard to the ID# in the column to the left. Information listed in the tables below may also be viewed at: http://www.waterboards.ca.gov/tmdl/docs/303dlists2006/approved/r9_06_303d_reqtmdls.pdf

TABLES

ID	NAME	Cadmium	Copper	Lead	Zinc	Nickel	Aluminum	Thalium	Mercury	Manganese	Trace Elements	Sediment Toxicity*	Toxicity*	Fecal Coliform	Indicator Bacteria	Ph	Total Dissolved Solids	Dissolved Oxygen	Low Dissolved Oxygen*	Eutrophic*	PCP (Pentachlorophenol)	Pesticides	Choride	Chlordane	Lindane/Hexachlorocyclohexane (HCH)	DDT	PCBs (Polychlorinated biphenyls)	PAHs (Polycyclic Aromatic	Sedimentation/Siltation	Turbidity	Color	Trash	Solids	Synthetic Organics	Phosphorous	Nitrogen	Sulfates	Benthic Community Effects*
1	Chollas Creek		X	X	X										X																							
2	Cloverdale Creek																X																		X			
3	Felicita Creek						X										X																					
4	Forester Creek													X		X	X	X																	X			
5	Green Valley Creek									X											X		X														X	
6	Kit Carson Creek																X				X																	
7	Los Penasquitos Creek																X																		X			
8	Mission Bay Shoreline														X																							
9	Pacific Ocean Shoreline, Imperial Beach Pier																										X											
10	Pacific Ocean Shoreline, San Diego HU														X																							
11	Pacific Ocean Shoreline, Scripps HA														X																							
12	Pacific Ocean Shoreline, Tijuana HU														X																							
13	Pogi Canyon Creek																									X												
14	San Diego Bay Shoreline, G Street Pier														X																							
15	San Diego Bay Shoreline, Shelter Island Shoreli														X																							
16	San Diego River (Lower)													X			X		X																X			
17	Soledad Canyon											X																										
18	Tecolote Creek	X	X	X	X								X		X															X					X			
19	Tijuana River										X				X				X	X		X										X	X	X				
20	Famosa Slough and Channel																			X																		
21	Hodges, Lake									X						X														X	X				X	X		
22	Los Penasquitos Lagoon																												X									
23	Mission Bay (area at mouth of Rose Creek only)			X																X																		
24	Mission Bay (area at mouth of Tecolote Creek only)			X																X																		
25	Murray Reservoir															X																						
26	San Diego Bay																										X											
27	San Diego Bay Shoreline, at Americas Cup Harbor		X																																			
28	San Diego Bay Shoreline, at Bayside Park (J Street)														X																							
29	San Diego Bay Shoreline, at Coronado Cays		X																																			
30	San Diego Bay Shoreline, at Glorietta Bay		X																																			
31	San Diego Bay Shoreline, at Harbor Island (East Basin)		X																																			

2006 CWA Section 303(d) List of Water Quality Limited Segments

ID	NAME	Cadmium	Copper	Lead	Zinc	Nickel	Aluminum	Thalium	Mercury	Manganese	Trace Elements	Sediment Toxicity*	Toxicity*	Fecal Coliform	Indicator Bacteria	Ph	Total Dissolved Solids	Dissolved Oxygen	Low Dissolved Oxygen*	Eutrophic*	PCP (Pentachlorophenol)	Pesticides	Choride	Chlordane	Lindane/Hexachlorocyclohexane (HCH)	DDT	PCBs (Polychlorinated biphenyls)	PAHs (Polycyclic Aromatic	Sedimentation/Siltation	Turbidity	Color	Trash	Solids	Synthetic Organics	Phosphorous	Nitrogen	Sulfates	Benthic Community Effects*
32	San Diego Bay Shoreline, at Harbor Island (West Basin)		X																																			
33	San Diego Bay Shoreline, between Sampson and 28th Streets		X		X				X																		X	X										
34	San Diego Bay Shoreline, Seventh Street Channel											X																									X	X
35	San Diego Bay, Shelter Island Yacht Basin																																					
36	Tijuana River Estuary			X		X		X							X				X	X		X								X		X						
	Not provided by RWQCB in GIS																																					
	San Diego Bay Shoreline, near sub base											X																									X	X
	San Diego Bay Shoreline, Shelter Island Shoreline Park														X																							
	San Diego Bay Shoreline, North of 24th Street Marine Terminal											X																									X	X
	San Diego Bay Shoreline, at Marriott Marina		X																																			
	San Diego Bay Shoreline, Downtown Anchorage											X																									X	X
	San Diego Bay Shoreline, near Switzer Creek																							X	X			X										
	San Diego Bay Shoreline, Vicinity of B St and Broadway Piers											X			X																						X	X
	San Diego Bay Shoreline, 32nd St San Diego Naval Station											X																									X	X
	San Diego Bay Shoreline, near Chollas Creek											X																									X	X
	San Diego Bay Shoreline, near Coronado Bridge											X																									X	X
	San Diego Bay Shoreline, Chula Vista Marina		X																																			
	Pacific Ocean Shoreline, San Diequito HU														X																							

* see Table 3. For all others see Table 5.

2006 CWA Section 303(d) List of Water Quality Limited Segments