DEVELOPMENT AND REMODELING PROJECTS

Storm Water Best Management Practices For Private and Public Development Projects

Chapter 6B of the Best Management Practices Manual for the City's Storm Water Management Program

Planning Department

Public Works Department

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DEFINITIONS

Bioretention – A Storm Water Control Measure designed to retain storm water runoff using vegetated depressions and soils engineered to collect, store, treat, and infiltrate runoff. Bioretention designs generally do not include underdrains.

Biotreatment or Biofiltration Treatment –A Storm Water Control Measure designed to detain storm water runoff, filter storm water through soil media and plant roots, and release the treated storm water runoff to the storm drain system. Biotreatment systems include an underdrain.

Drainage Management Area (DMAs) – Following the low impact development principle of managing storm water through small-scale, decentralized measures, DMAs are designated individual drainage areas within a Regulated Project that typically follow grade breaks and roof ridge lines and account for each surface type (e.g., landscaping, pervious paving, or roofs).

Equivalent Impervious Surface Area – is equal to *Impervious Tributary Surface Area* (ft^2) + *Pervious Tributary Surface Area* (ft^2), where *Impervious Tributary Surface Area* is defined as the sum of all of the site's conventional impervious surfaces, and *Pervious Tributary Surface Area* is defined as the sum of all of the site's pervious surfaces, corrected by a factor equal to the surface's runoff coefficient.

Flow-Through Water Quality Treatment Systems – Storm Water Control Measures that are designed to treat storm water through filtration and/or settling. Flow-through systems do not provide significant retention or detention benefits for storm water volume control.

Impervious Surface – A hard, non-vegetated surface area that prevents or significantly limits the entry of water into the soil mantle, as would occur under natural conditions prior to development. Common impervious surfaces include, but are not limited to, roof tops, walkways, patios, driveways, parking lots or storage areas, concrete or asphalt paving, oiled, macadam or other surfaces which similarly impede the natural infiltration of storm water.

Low Impact Development (LID) – A storm water and land use management strategy that strives to mimic pre-disturbance hydrologic processes of infiltration, filtration, storage, evaporation, and transpiration by emphasizing conservation, use of on-site natural features, site planning, and distributed storm water management practices that are integrated into a project design.

Maximum Extent Practicable (MEP) - The MEP standard involves applying best management practices that are effective in reducing the discharge of pollutants in storm water runoff. In discussing the MEP standard, the State Board has said the following: "MEP requires applicants to choose effective BMPs, and to reject applicable BMPs only where other effective BMPs will serve the same purpose, the BMPs would not be technically feasible, or the cost would be prohibitive." (Order No. WQ 2000-11, at p.20.)

Net Impervious Area – The sum of new and replaced post-project impervious areas, minus any reduction in total imperviousness from the pre-project to post-project condition: *Net Impervious Area = (New and Replaced Impervious Area) – (Reduced Impervious Area Credit),* where *Reduced Impervious Area Credit* is the total pre-project to post-project reduction in impervious area, if any.

New Development – Land disturbing activities that include the construction or installation of buildings, roads, driveways and other impervious surfaces. Development projects with pre-existing impervious surfaces are not considered New Development.

Percentile Rainfall Event (e.g., 85th and 95th) – A percentile rainfall event represents a rainfall amount which a certain percent of all rainfall events for the period of record do not exceed.

Permeable or Pervious Surface – A surface that allows varying amounts of storm water to infiltrate into the ground (e.g. pasture, native vegetation areas, landscape areas, and permeable pavements).

Pre-Project – Storm water runoff conditions that exist onsite immediately before development activities occur. This definition is not intended to be interpreted as that period before any human-induced land activities occurred. This definition pertains to redevelopment as well as initial development.

Project Site – The area defined by the legal boundaries of a parcel or parcels of land within which the new development or redevelopment takes place and is subject to these requirements.

Rainwater Harvest – Capture and storage of rainwater or storm water runoff for later use, such as irrigation, domestic use (e.g. toilets), or storage for fire suppression.

Receiving Waters – Bodies of water, surface water systems or groundwater that receive surface water runoff through a point source, sheet flow or infiltration.

Redevelopment – On a site that has already been developed, construction or installation of a building or other structure subject to planning and building authority including: 1) the creation or addition of impervious surfaces; 2) the expansion of a building footprint or addition or replacement of a structure; or 3) structural development including construction, installation or expansion of a building or other structure. It does not include routine road maintenance, nor does it include emergency construction activities required to immediately protect public health and safety.

Replaced Impervious Surface – The removal of existing impervious surfaces down to bare soil or base course, and replacement with new impervious surface. Replacement of impervious surfaces that are part of routine road maintenance activities are not considered replaced impervious surfaces.

Self-Retaining Areas – (also called "zero discharge" areas), are designed to retain some amount of rainfall (by ponding and infiltration and/or evapotranspiration) without producing storm water runoff. Self-Retaining Areas may include graded depressions with landscaping or pervious pavement.

Self-Treating Areas – are a portion of a Regulated Project in which infiltration, evapotranspiration and other natural processes remove pollutants from storm water. The self-treating areas may include conserved natural open areas and areas of native landscaping. The self-treating area only treats the rain falling on itself and does not receive storm water runoff from other areas.

Storm Water Control Measures (SCMs) – Storm water management measures integrated into project designs that emphasize protection of watershed processes through replication of pre-development runoff patterns (rate, volume, duration).

Storm Water Control Plan – A plan detailing how a proposed project will achieve the applicable Post-Construction Storm Water Management Requirements.

CHAPTER 1.

Overview and Purpose

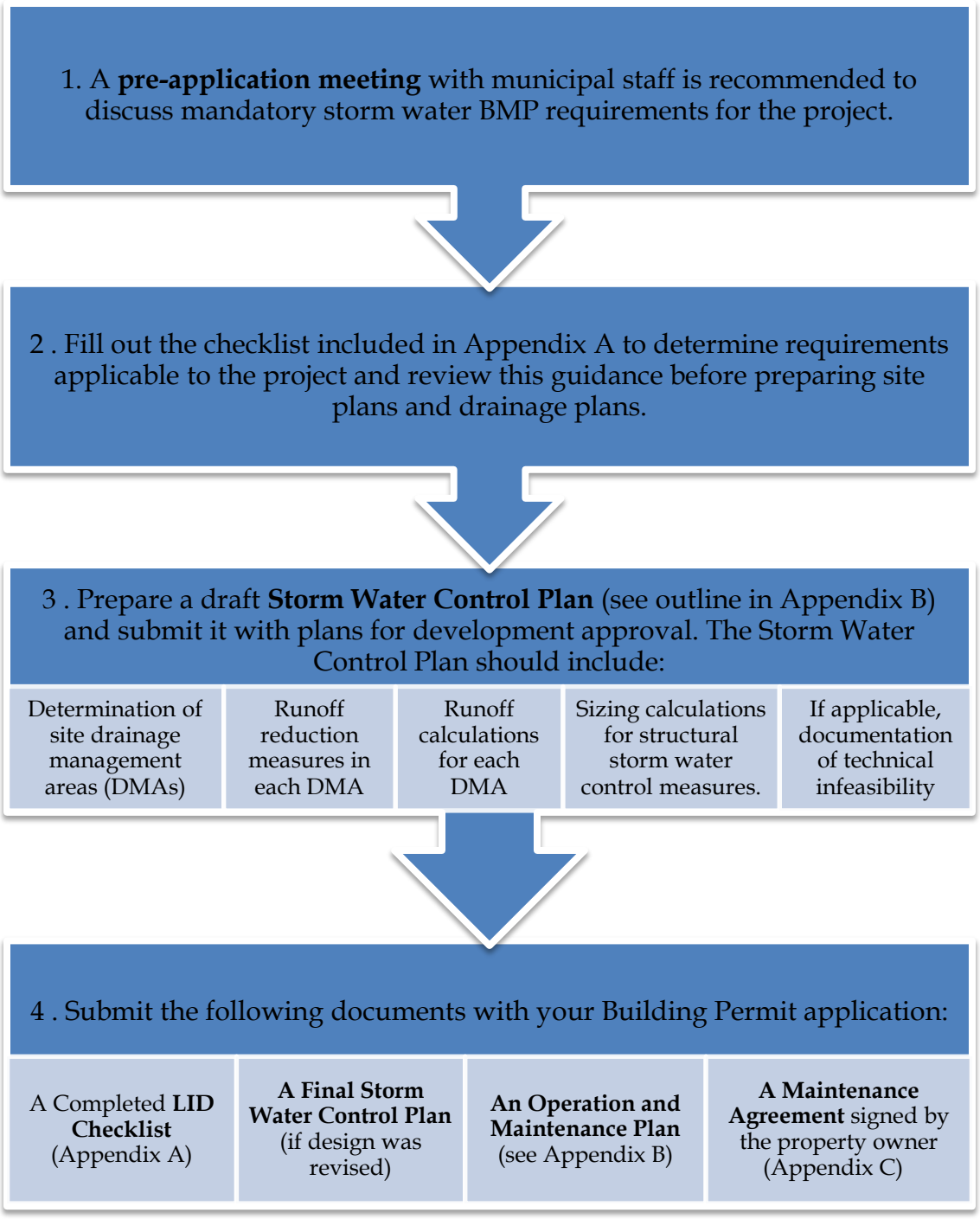
1.1. Regulatory Background

State and federal storm water regulations require development and remodeling projects to incorporate design standards and Best Management Practices (BMPs) in order to reduce pollutant and storm water discharges to the Maximum Extent Practicable. Therefore, the City developed these mandatory BMPs for private and public development projects based on (1) the minimum design standards from Chapter E.12.d. "Source Control Measures" of the State of California General Permit for Discharges of Storm Water from Small Municipal Separate Storm Sewer Systems (Water Quality Order No. 2013-0001-DWQ) and (2) the Central Coast Post-Construction Storm Water Management Requirements for Development Projects in the adopted by the Central Coast Regional Water Quality Control Board (Resolution No. R3-2013-0032). The Post-Construction Requirements emphasize protecting and, where degraded, restoring key watershed processes to create and sustain linkages between hydrology, channel geomorphology, and biological health necessary for healthy watersheds.

This document also provides guidance on (1) how to meet the mandatory BMP requirements through site planning and Low-Impact Development (LID) design, (2) selection and implementation of structural BMPs, and (3) maintenance procedures for long-term pollution control.

1.2. Compliance Process at a Glance

The process to determine applicable requirements and to conduct site design and structural BMP selection to comply with those requirements follows these general steps:



1.3 Purpose of Low-Impact Development Design and BMPs

Pre-urban Watershed Processes

Before urban development in the Central Coast, as much as 50% of rainwater was infiltrated into the soil, replenishing groundwater supplies, contributing to stream flows and sustaining vegetation; another 40% was released into the atmosphere through evapotranspiration. Only about 10% of rainwater contributed to storm water runoff (rainwater that flows over the land surface).

Urban Development Impacts

Today, our urban landscape has more impervious surfaces (hard surfaces that do not allow water to pass through) such as roofs, streets, sidewalks and parking areas. The increase in impervious surface areas has significantly increased the amount and rate of storm water runoff. These increased storm water flows can cause flooding and increase soil and stream channel erosion. Additionally, runoff from urban areas also carries other pollutants such as pesticides, bacteria, oils, metals, and trash that can impact aquatic habitats, and make waters unsafe for recreational use and wildlife.

Low-Impact Development Goals: Reduced Storm Water Flows, Improved Water quality, and Improved Ecosystem Health

The use of Low Impact Development (LID) strategies can help to protect and enhance the environmental quality of our rivers, creeks and watersheds. LID is a site design approach that uses techniques to slow and infiltrate storm water, mimicking the natural, pre-development hydrology. LID design strategies can be applied to most new or redevelopment projects to meet storm water regulations, reduce downstream flooding and protect natural resources.

CHAPTER 2.

Applicability of Mandatory Development Requirements

2.1. Regulated Projects

These mandatory BMPs apply to all regulated development and redevelopment projects except single-family homes on lots with <15,000 square feet of net impervious area. **Those Single-family homes are covered under Chapter 6A, BMP Requirements for Single-Family Homes on Small Lots.**

Regulated Projects do not include:

- ❑ Road and Parking Lot maintenance:
  a) Road surface repair including slurry sealing, fog sealing, and pothole and square cut patching
  b) Overlaying existing asphalt or concrete pavement with asphalt or concrete without expanding the area of coverage
  c) Shoulder grading
  d) Cleaning, repairing, maintaining, reshaping, or regrading drainage systems
  e) Repair or reconstruction of the road because of slope failures, natural disasters, acts of God or other man-made disaster
- ❑ Sidewalk and bicycle path or lane projects, where no other impervious surfaces are created or replaced, built to direct storm water runoff to adjacent vegetated areas
- ❑ Trails and pathways, where no other impervious surfaces are replaced or created, and built to direct storm water runoff to adjacent vegetated areas
- ❑ Underground utility projects that replace the ground surface with in-kind material or materials with similar runoff characteristics
- ❑ Curb and gutter improvement or replacement projects that are not part of any additional creation or replacement of impervious surface area (e.g., sidewalks, roadway)
- ❑ Second-story additions that do not increase the building footprint
- ❑ Raised (not built directly on the ground) decks, stairs, or walkways designed with spaces to allow for water drainage
- ❑ Photovoltaic systems installed on/over existing roof or other impervious surfaces, and panels located over pervious surfaces with well-maintained grass or vegetated groundcover, or panel arrays with a buffer strip at the most down gradient row of panels
- ❑ Temporary structures (in place for less than six months)
- ❑ Electrical and utility vaults, sewer and water lift stations, backflows and other utility devices
- ❑ Above-ground fuel storage tanks and fuel farms with spill containment system

2.2. Determining Project Requirements

These mandatory BMPs utilize (1) a tiered approach based on the impervious area created or replaced by a proposed project and (2) a geographic component based on the watershed properties of the project location to determine the types of BMP treatment required in Chapter 4 of this guide. Additionally, certain projects falling into specific categories are also subject to BMPs included in Chapter 5 of this guide. Please follow the steps below to determine the mandatory BMPs applicable to a proposed development or redevelopment project.

Step 1: Pre-Application Meeting

The City Department of Public Works is available to review proposed projects, answer questions about storm water BMP requirements and procedures to meet those requirements, and to confirm BMP tiers and special circumstances applicable to a proposed project.

Please contact the Public Works Environmental Project Analyst at 420-5160 to set up a meeting.

Step 2: Low-Impact Development Checklist

The Low-Impact Development (LID) worksheet in Appendix A has been developed to help guide the applicant through the process of determining the mandatory BMPs applicable to a proposed development or redevelopment project. **Download the fillable form in excel format at www.cityofsantacruz.com/LID.**

Please fill out the worksheet and submit it with pre-project plans. Elements of the LID worksheet are further described below.

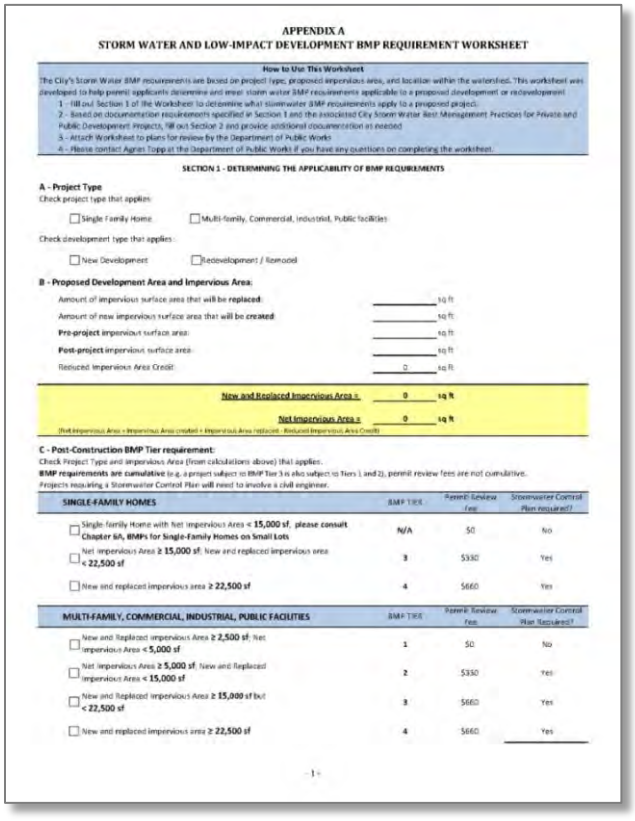
Impervious Area Calculations

LID BMPs required are based on the amount of impervious area created or replaced by a project. Below are key impervious area figures to identify as part of project planning:

New Impervious area = project area that was previously landscaped or vegetated that will be replaced with impervious surfaces including rooftops and walkways, parking lots, and driveways paved with surfaces such as asphalt and concrete that impede storm water infiltration. Do not include Green Roof areas in impervious areas.

Replaced Impervious area = the removal of existing impervious surfaces down to bare soil or base course, and replacement with new impervious surface. Replacement of impervious surfaces that are part of routine road maintenance activities are not considered replaced impervious surfaces.

Net Impervious Area = (New and Replaced Impervious Area) – (Reduced Impervious Area Credit), where *Reduced Impervious Area Credit* is the total pre-project to post-project reduction in impervious area, if any.



APPENDIX A

STORM WATER AND LOW-IMPACT DEVELOPMENT BMP REQUIREMENT WORKSHEET

How to Use This Worksheet

The City's Storm Water BMP requirements are based on project type, proposed impervious area, and location within the watershed. This worksheet was developed to help permit applicants determine and meet storm water BMP requirements applicable to a proposed development or redevelopment.

1 - Fill out Section 1 of the Worksheet to determine what stormwater BMP requirements apply to a proposed project.
2 - Based on documentation requirements specified in Section 1 and the associated City Storm Water Best Management Practices for Private and Public Development Projects, fill out Section 2 and provide additional documentation as needed.
3 - Attach Worksheet to plans for review by the Department of Public Works
4 - Please contact Agnes Topp at the Department of Public Works if you have any questions on completing the worksheet.

SECTION 1 - DETERMINING THE APPLICABILITY OF BMP REQUIREMENTS

A - Project Type

Check project type that applies:

☐ Single Family Home ☐ Multi-family, Commercial, Industrial, Public facilities

Check development type that applies:

☐ New Development ☐ Redevelopment / Remodel

B - Proposed Development Area and Impervious Area:

Amount of impervious surface area that will be **replaced**: _____ sq ft

Amount of new impervious surface area that will be **created**: _____ sq ft

Pre-project impervious surface area: _____ sq ft

Post-project impervious surface area: _____ sq ft

Reduced Impervious Area Credit: 0 sq ft

New and Replaced Impervious Area = 0 sq ft

Net Impervious Area = 0 sq ft

(Net Impervious Area = Impervious Area created + Impervious Area replaced - Reduced Impervious Area Credit)

C - Post-Construction BMP Tier requirement:

Check Project Type and Impervious Area (from calculations above) that applies.

BMP requirements are cumulative (e.g. a project subject to BMP Tier 3 is also subject to Tiers 1 and 2), permit review fees are not cumulative.

Projects requiring a Stormwater Control Plan will need to involve a civil engineer.

SINGLE-FAMILY HOMES	BMP TIER	Permit Review Fee	Stormwater Control Plan required?
☐ Single-family Home with Net Impervious Area < 15,000 sf, **please consult Chapter 6A, BMPs for Single-Family Homes on Small Lots**	N/A	$0	No
☐ Net Impervious Area ≥ 15,000 sf; New and replaced impervious area < 22,500 sf	3	$330	Yes
☐ New and replaced impervious area ≥ 22,500 sf	4	$660	Yes

MULTI-FAMILY, COMMERCIAL, INDUSTRIAL, PUBLIC FACILITIES	BMP TIER	Permit Review Fee	Stormwater Control Plan Required?
☐ New and Replaced Impervious Area ≥ 2,500 sf; Net Impervious Area < 5,000 sf	1	$0	No
☐ Net Impervious Area ≥ 5,000 sf; New and Replaced Impervious Area < 15,000 sf	2	$330	Yes
☐ New and Replaced Impervious Area ≥ 15,000 sf but < 22,500 sf	3	$660	Yes
☐ New and replaced impervious area ≥ 22,500 sf	4	$660	Yes

MANDATORY DEVELOPMENT REQUIREMENT TIERS

The matrix below shows the requirements that must be met by a proposed project based on its new, replaced, and net impervious area.

For projects subject to Tiers 1 and 2, the same performance requirements apply throughout the City. For projects subject to Tiers 3 and 4, performance requirements are also associated with specific Watershed Management Zones (WMZs) within the City. A key principle underpinning the WMZs is that every location does not require the same set of storm water mitigation measures, because of intrinsic differences in the key watershed processes at each location and the sensitivity to those processes of the downstream receiving water(s). The urbanized portions of the Central Coast Region are categorized into 10 WMZs, based on common key watershed processes and receiving water type (creek, ocean, lake, etc). Designated Groundwater Basins of the Central Coast Region underlie some but not all WMZs in urbanized portions of the Central Coast Region. Each WMZ and, where present, Groundwater Basin, is aligned with specific performance requirements to address the impacts of development on watershed processes and beneficial uses.

POST-CONSTRUCTION BMP REQUIREMENT TIERS				
Project Impervious Area	**Tier 1 Site Design and Runoff Reduction Requirement** (see p 16)	**Tier 2 Water Quality Treatment Requirement** (see p 18)	**Tier 3 Runoff Retention Requirement** (see p 23)	**Tier 4 Peak Management Requirement** (see p 28)
Project Type: Single-Family Homes				
≥ 2,500 SF new and replaced impervious area; < 15,000 SF of *net impervious area*	**Required (see Chapter 6A)**	Exempt	Exempt	Exempt
15,000 SF – 22,500 SF of *net impervious area*	**Required**	**Required**	**Required**	Exempt
≥ 22,500 SF of new and replaced impervious area	**Required**	**Required**	**Required**	**Required**
Project Type: all other Regulated Projects				
≥ 2,500 SF new and replaced impervious area; < 5,000 SF of *net impervious area*	**Required**	Exempt	Exempt	Exempt
5,000 SF *net impervious area*; < 15,000 SF of new and replaced impervious area	**Required**	**Required**	Exempt	Exempt
15,000 SF – 22,500 SF of new and replaced impervious area	**Required**	**Required**	**Required**	Exempt
≥ 22,500 SF of new and replaced impervious area	**Required**	**Required**	**Required**	**Required**

DEVELOPMENT REQUIREMENT SPECIAL CIRCUMSTANCES

Projects subject to Tiers 3 and 4 of the Post-Construction BMP requirements may qualify for Special Circumstances based on certain site and/or receiving water conditions. Special Circumstances include:

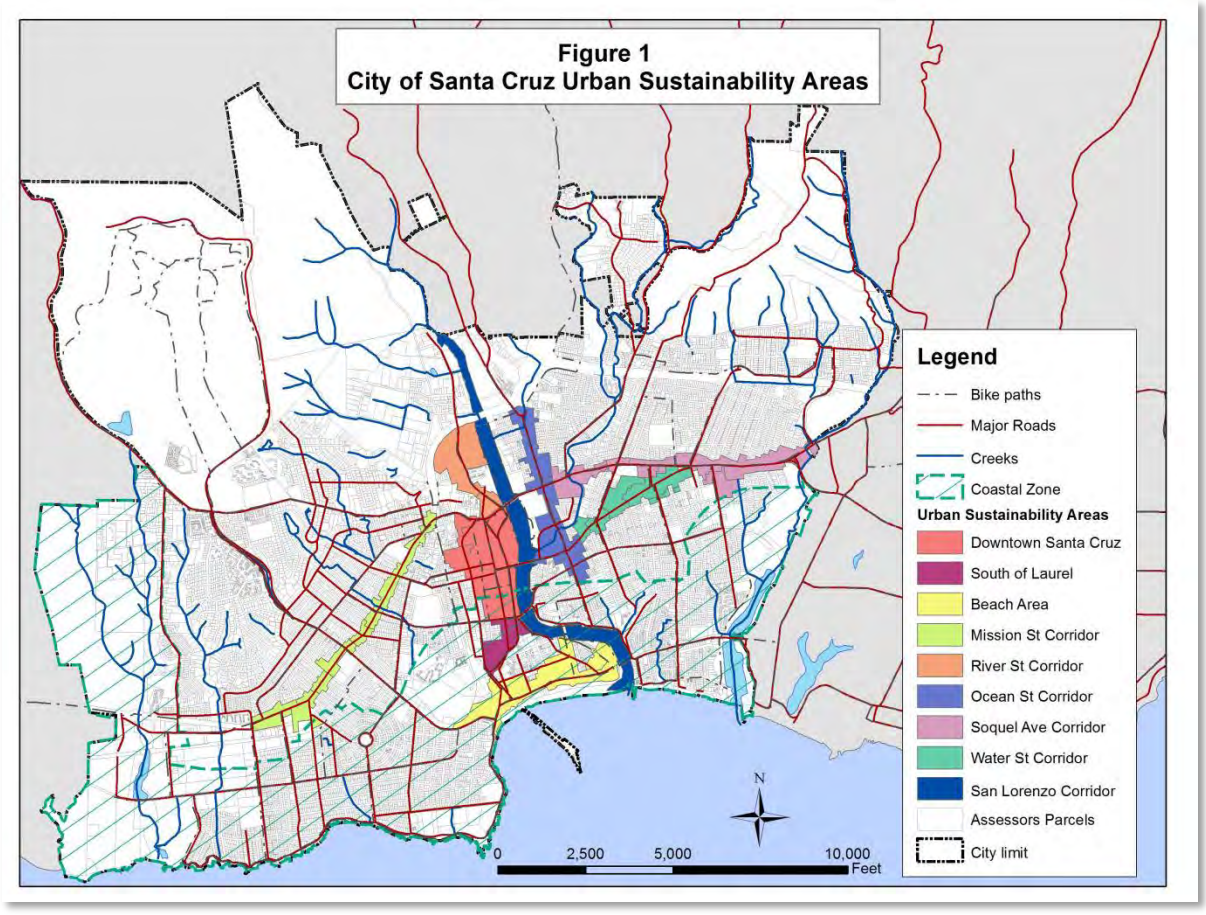
I. Urban Sustainability Area

The City of Santa Cruz Urban Sustainability Areas (USAs) encompass the City's business centers and primary transportation corridors where the City's General Plan 2030 vision is to promote "Smart Growth" concepts of high-density mixed-use development (see Figure 1 below). **USAs can also be found on the City's GIS at:**
http://gis.cityofsantacruz.com/gis/index.html

Within an Urban Sustainability Area, Tier 3 and Tier 4 redevelopment projects that meet the following density requirements may claim reduced retention requirements (see p.25):

Parcels less than 1 acre:

- Include no surface parking, except for incidental surface parking. Incidental surface parking is allowed only for emergency vehicle access, Americans with Disabilities Act (ADA) accessibility, and passenger and freight loading zones.
- Have at least 85% coverage for the entire project site by permanent structures. The remaining 15% portion of the site is to be used for safety access, parking structure entrances, trash and recycling service, utility access, pedestrian connections, public uses, landscaping, and storm water treatment.
- Within 0.25 miles of a local transit stop.



Parcels 1 to 2 acres in size:

- Meet the requirements for parcels less than 1 acre.
- Additional Density Factors:
    a. For commercial or mixed use: Floor Area Ratio (FAR) of at least 1.75
    b. For residential: density at least 30 Dwelling Units (DU)/Acre

II. Highly Altered Channels and Intermediate Flow Control Facilities

Projects subject to the Tier 4 peak management requirement with runoff discharging into: (a) concrete-lined or otherwise continuously armored stream channels, (b) continuous underground storm drain system that discharges directly to the San Lorenzo River or marine near-shore waters, or (c) an existing flow control facility that regulates flow volumes and durations *may be exempt from peak management requirements*.

Continuously armored stream channels within the City of Santa Cruz include the San Lorenzo River below Highway 1, and Branciforte Creek below the Market Street overpass.

Please confirm with City Public Works whether your project site is subject to this special circumstance.

City storm drains are mapped on the City's GIS at: http://gis.cityofsantacruz.com/PW/index.html

Additional Mandatory Storm Water BMP Requirements

Construction activity resulting in **land disturbance of one acre or more, or less than one acre but part of a larger common plan of development or sale** will be required to obtain coverage under the State's Construction Activities Storm Water General Permit.

New development and remodeling projects may also be required to comply with the source control requirements in Chapter 5 of these BMPs as they apply to:

- Commercial and industrial facilities
- Parking areas
- Pools, spas, and other water features
- Material storage areas
- Trash storage areas
- Equipment and accessory wash areas
- Restaurants and food processing or manufacturing facilities (incl. wineries)
- Vehicle fueling, maintenance, and wash areas
- Interior and parking garage floor drains
- Miscellaneous drain or wash water

Additionally, all development and remodeling projects shall meet the requirements specified in the **City-wide Creeks and Wetlands Management Plan**. Also, no City development projects on City-owned property shall be permitted within 30 feet of a wetland without an approved project-specific Habitat Management Plan and a Site-specific Water Quality Management Plan.

CHAPTER 3.

LID Structural Control Measures

3.1. Overview of LID Design and Structural Controls

Once applicable BMP requirements have been identified for a site, LID must be incorporated into site design. There are four LID strategies that can be used in combination to manage runoff from buildings and other impervious areas:

- Optimize the site layout by preserving natural drainage features and designing buildings and circulation to minimize impervious areas.
- Use pervious surfaces such as turf, gravel, or pervious pavement, or surfaces that retain rainfall such as "green roofs".
- Disperse runoff from impervious areas to adjacent pervious areas (e.g. downspouts to landscaping)
- Use engineered LID BMPs such as bioretention facilities to manage runoff from impervious surfaces.

LID strategies can help improve site design and provide several complementary benefits such as creating more attractive development, reducing irrigation water use, reducing heat island effects, and reducing the need for drainage infrastructure.

Table 3.1 provides an overview of the LID design and BMPs that can be used given particular site conditions and to address different BMP requirement tiers. The LID Design Fact Sheets in Section 3.2 provide general guidance on Structural Control Measure (SCM) design. Additional design guidance can be found in the resources listed in Appendix D.

Pervious concrete sidewalk and bioretention swale (Source: US EPA [Wikimedia Commons])

Table 3.1: LID Project Suitability Considerations

	LID BMPs							
	Optimize site layout	*Pervious pavement*	*Disperse runoff to landscape*	*Storage and reuse (cistern)*	*Bioretention facility*	*Flow-through planter*	*Infiltration Trench*	*Green Roof*
BMP requirement Tier								
Tier 1: Runoff Reduction	✓	✓	✓	✓				✓
Tier 2: Water Quality Treatment					✓	✓		
Tier 3: Runoff Retention		✓	✓	✓	✓		✓	
Site Features and Constraints								
Roof drainage	✓		✓		✓	✓	✓	
Parking lots	✓	✓	✓		✓	✓	✓	
Densely developed site		✓		✓		✓	✓	✓
Clayey native soils	✓		✓		✓	✓		✓
Steep slopes	✓					✓		✓
Shallow groundwater	✓			✓		✓		✓

3.2. LID BMP Design Fact Sheets

Natural Areas and Self-retaining Landscaping

Storm Water Benefits:
- ✓ Runoff Reduction
- ✓ Runoff Retention

Advantages:
- No maintenance verification requirement

Limitations:
- Requires substantial square footage

Purpose and Criteria:

Runoff from natural areas or landscaping that drains directly to a natural water body or to the storm drain system does not need any additional management.

Where a landscape area is surrounded by impervious areas, a self-retaining area may be created by berming or depressing the landscape ground surface to retain the volume of runoff from the design storm (85th or 95th percentile storm), including the runoff from tributary impervious areas.

In a self-retaining area, overflows must be placed high enough to allow ponding.

Self-Retaining Area Applications:

Self-retaining areas are best used on flat and heavily landscaped sites. Self-retaining areas can be created by depressing lawn and landscape below the surrounding paved areas; runoff from buildings, walkways and driveways in park-like settings can be directed to self-retaining areas.

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 or landscaping.
- ❑ Area has amended soils, vegetation, and irrigation as may be required to maintain soil stability and permeability.
- ❑ Area drain inlets are sufficiently high to allow ponding and retention of the design storm (including for connected impervious areas).

PERVIOUS PAVEMENTS

Purpose and 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 include pervious asphalt/concrete, porous pavers, open pavers, or crushed aggregate.

STORM WATER BENEFITS:

✓ Runoff Reduction

✓ Runoff Retention

ADVANTAGES:

- Can be used in areas with limited landscaping

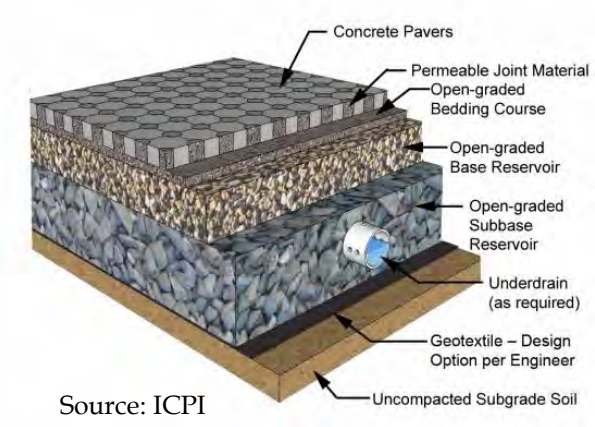
LIMITATIONS:

- Potential geotechnical concerns in clay soils
- Pavement strength and surface integrity considerations

Applications:

Permeable pavements are best used on grades from flat to approximately 2%. 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.

Design Checklist for pervious pavements:



Source: ICPI

- ❑ 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 an underdrain is provided, outlet elevation is a minimum of 3 inches above bottom of base course.
- ❑ Use on grades from flat to 2% to the extent possible.
- ❑ Rigid edge is provided to retain granular pavements and unit pavers.
- ❑ Joints between solid unit pavers are filled with an open-graded aggregate free of fines.
- ❑ Permeable pavements are installed by industry-certified professionals according to vendor's recommendations.

BIORETENTION AND RAIN GARDENS

Purpose and Criteria:

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. A layer of aggregate provides a storm water reservoir beneath the bioretention soil with an underdrain near the top of the aggregate layer to convey treated runoff that does not infiltrate to a storm drain. Standard details for bioretention facilities are available in the City's updated Standard Details and available online at http://www.cityofsantacruz.com/index.aspx?page=90.

In residential settings, rain gardens are the simplest form of bioretention with a depressed surface reservoir and 6-12 inches of amended soil.

STORM WATER BENEFITS:

✓ Water Quality Treatment

✓ Runoff Retention

ADVANTAGES:

- Various shapes and sizes possible
- Can be incorporated in landscape design

LIMITATIONS:

- Requires stair stepping on slopes
- Infiltration limitations near buildings

Applications:

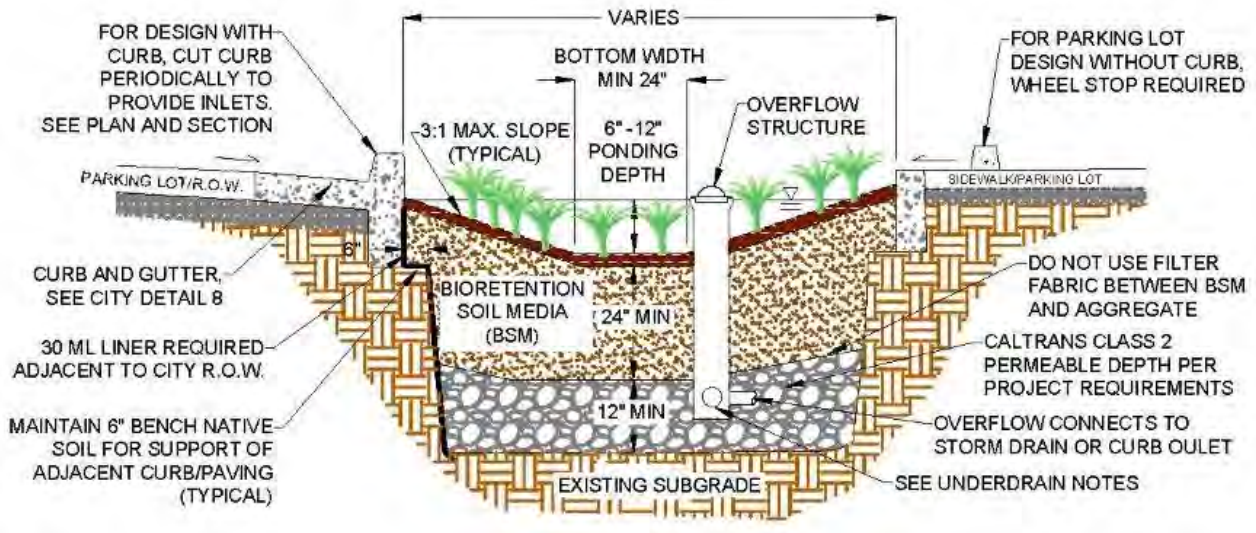
Bioretention can be achieved in a variety of landscape configurations, including parking lot landscaping, medians, and setbacks. Bioretention requires check dams or stair-stepping on slopes.

Design Checklist for Bioretention:

Source: Architectsea (Wikimedia Commons)

- ❑ Design facility to prevent erosion, scour and channeling within the bioretention treatment system itself
- ❑ Sizing guidance: 1) minimum 4% of tributary impervious area, 2) see Chapter 4 for specific sizing guidance to meet the retention requirement (Tier 3 requirement).
- ❑ Ponding depth - Min. 6", max. 12"
- ❑ Allowable standing water duration – 72 hours
- ❑ See Appendix E for recommended bioretention plants.
- ❑ Side slope - 4:1 preferred. Max. 3:1 allowed.
- ❑ Longitudinal slope – Max. 6% longitudinal slope of bottom. Use stair-stepping planters on a slope to provide flat bottomed cells separated by check dam/weir overflows.
- ❑ Bioretention soil mix depth: minimum 24 inches

- ❑ Bioretention soil mix must sustain a minimum infiltration rate of 5 inches per hour throughout the life of the project and must maximize runoff retention and pollutant removal. A mixture of concrete sand (60%-70%) meeting the specifications of American Society for Testing and Materials (ASTM) C33 and compost (30%-40%) may be used.
- ❑ No compaction of soils beneath the bioretention facility (ripping/loosening of soils required if compacted)
- ❑ No liners or other barriers interfering with infiltration, except for situations where lateral infiltration is not technically feasible.
- ❑ Subsurface aggregate layer for storage and drainage of storm water with an area equal to the biofiltration treatment system surface area and having a minimum depth of 12 inches
- ❑ Underdrain Notes:
  - Use 4" diameter, PVC SDR 35 perforated pipe installed near the top of the aggregate layer with holes facing down.
  - Underdrain discharge elevation shall be no lower than the top of the aggregate layer. Underdrain discharge elevation may be up to 12 inches below the soil surface in the bioretention cell.
  - Underdrain slope may be flat.
  - Provide capped, threaded PVC cleanout for underdrain, 4" min. dia. with sweep bend.
  - Connects to approved discharge point.
- ❑ In limited cases where offsite drainage causes technical infeasibility, the underdrain may be omitted.
- ❑ Capped pipes or arches may be used in gravel bed to increase retention volume



FLOW-THROUGH PLANTER

Purpose and Criteria:

Flow-through planters treat and detain runoff without allowing infiltration in the underlying soil. Flow-through planters can be set above ground to receive runoff from downspouts or in-ground to receive sheet flow from surrounding 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 must be connected to a storm drain or other discharge point. An overflow outlet conveys flows which exceed the capacity of the planter.

STORM WATER BENEFITS:

✓ Water Quality Treatment

ADVANTAGES:

- Can be used adjacent to buildings and on slopes
- Can be used in dense urban areas
- Can be used in areas with high groundwater
- Low maintenance

LIMITATIONS:

- Cannot be used to meet the retention requirement (Tier 3)

Applications:

Flow-through planters can be used to treat storm water runoff along buildings, on slopes, in areas where mobilization of pollutants in soil or groundwater is a concern, and where potential geotechnical hazards are associated with infiltration.

Design Checklist for Flow-Through Planters:

- ❑ Surface reservoir depth: min. 6", max. 12"
- ❑ Soil mix depth: minimum 24 inches
- ❑ See Appendix E for recommended plants.
- ❑ Soil mix must sustain a minimum infiltration rate of 5 inches per hour throughout the life of the project and must maximize runoff retention and pollutant removal. A mixture of sand (60%-70%) meeting the specifications of American Society for Testing and Materials (ASTM) C33 and compost (30%-40%) may be used.
- ❑ Sizing guidance: surface area minimum 4% of tributary impervious area.
- ❑ Allowable standing water duration – 72 hours
- ❑ Underdrain – use 4" diameter, PVC SDR 35 perforated pipe with holes facing down embedded in "Class 2 permeable" drain rock, connected to storm drain or approved discharge point.

CHAPTER 4.

Mandatory Low Impact Development Requirements

4.1. Tier 1 Requirements: Site Design and Runoff Reduction

Tier 1 Mandatory Requirements are applicable **to all regulated projects creating or replacing over 2,500 SF of Net Impervious Area**. **For single-family homes, see Storm Water BMP Chapter 6A.** The following elements are required:

A – Fill out the Storm Water and Low-Impact Development Worksheet in Appendix A and submit to the Department of Public Works with Project Plans.

B - Site Design and Runoff Reduction measures shall be applied to the project site and shown on Project Plans.

Design Objectives

1) Maximize rainfall infiltration
2) Reduce downstream runoff volume and speed
3) Reduce pollutant loading and development impacts to receiving streams
4) Reduced size of downstream storm water Treatment Control Measures

Design Considerations

Identify at the Site Analysis Stage:

1) Areas of highly permeable soils
2) Erosion-prone areas
3) Natural drainage features
4) Native vegetation and trees to protect

Incorporate in Site Design:

1) Limit disturbance of creeks and natural drainage features. Additionally, all development and remodeling projects shall meet the requirements specified in the **City-wide Creeks and Wetlands Management Plan**.
2) Define the development envelope and protected areas, identifying areas that are

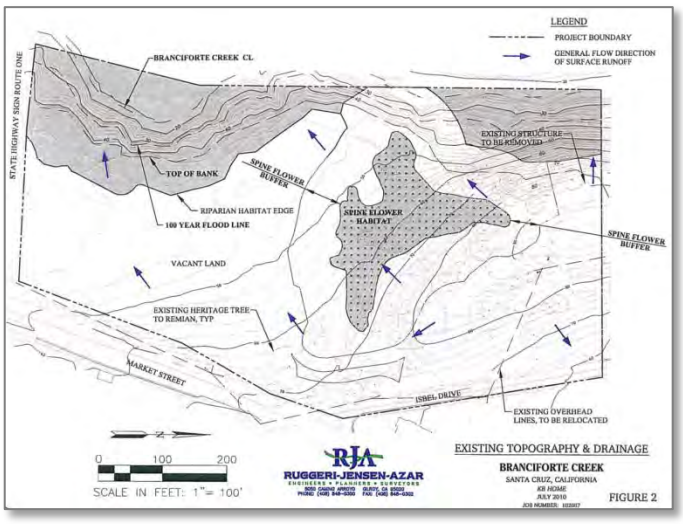


Figure 4.1 Site Analysis
Source: RJA-Ruggeri Jensen Azar

most suitable for development and sensitive areas to be left undisturbed. Reserve areas with high permeability soils for either open space or Infiltration BMPs.

3) Limit clearing and grading of native vegetation at a site to the minimum amount needed to build lots, allow access, and provide fire protection. Conserve natural areas, including existing trees, other vegetation, and soils. Set back development from creeks, wetlands, and riparian habitats.

4) Limit the overall impervious footprint of the project and direct runoff from impervious areas to adjacent landscaping and vegetated storm water treatment systems.

5) Consider the use of alternative building materials, including pervious pavement and green roofs, instead of conventional materials for new construction and renovation.

6) Minimize storm water runoff by implementing at least one of the following site design BMP measures:

- Direct roof runoff into cisterns or rain barrels for reuse
- Direct roof runoff onto vegetated areas safely away from building foundations and footings, consistent with California building code
- Direct runoff from sidewalks, walkways, and/or patios onto vegetated areas safely away from building foundations and footings, consistent with California building code
- Direct runoff from driveways and/or uncovered parking lots onto vegetated areas safely away from building foundations and footings, consistent with California building code
- Construct bike lanes, driveways, uncovered parking lots, sidewalks, walkways, and patios with permeable surfaces

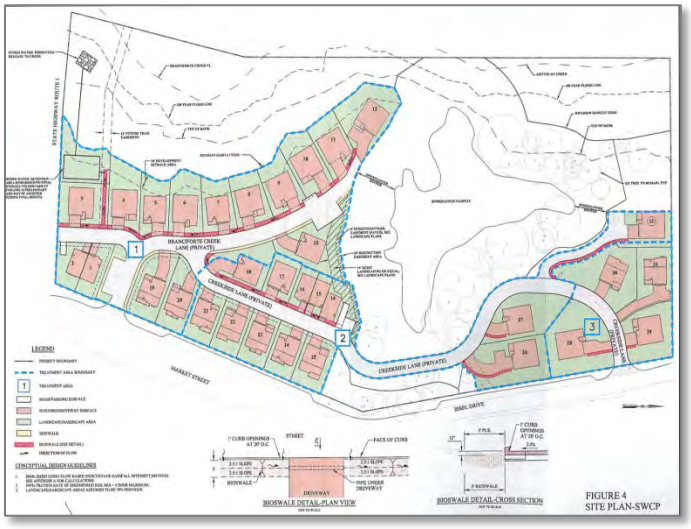


Figure 4.2 Site Design
Source: RJA-Ruggeri Jensen Azar

C - Drainage and Landscape Planning:

1) Maintain existing topography and existing drainage divides to encourage dispersed flow.

2) Convey runoff safely from the tops of slopes and stabilize disturbed slopes.

3) Plant slopes with native or drought tolerant vegetation, as appropriate.

4) Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, or conduits that enter unlined channels to minimize erosion.

4.2. Tier 2 Requirements: Water Quality Treatment

Tier 2 Mandatory Requirements are applicable to regulated projects, except single-family homes, with ≥ 5,000 SF of Net Impervious Area and detached single-family homes with ≥ 15,000 SF of Net Impervious Area. The following elements are required:

A – In addition to the runoff reduction requirement, the Water Quality Treatment requirement must be met using one of the following methods (in order of preference):

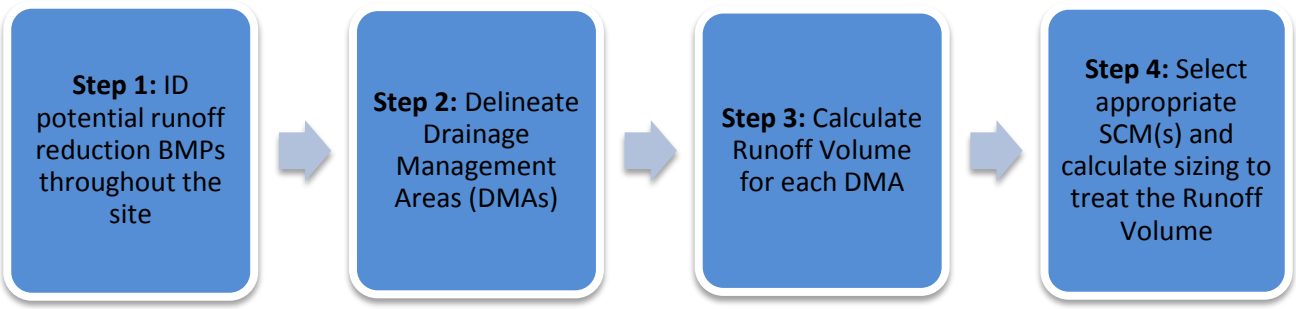
- Onsite retention of the 85th percentile 24hr storm event via rainwater harvesting, infiltration, and/or evapotranspiration.
- Biofiltration using a SCM designed to filter the runoff produced by a rain event with (a) 0.2 inches/hour intensity or (b) 2x the 85th percentile hourly rainfall intensity.
- Non-retention based treatment system whose primary mode of action depends on volume capacity, designed to treat storm water runoff from the 85th percentile 24hr storm event.
- Non-retention based treatment system whose primary mode of action depends on flow capacity, sized to treat the runoff produced by a rain event with (a) 0.2 inches/hour intensity or (b) 2x the 85th percentile hourly rainfall intensity.

On sites where runoff from existing impervious surfaces cannot be separated from runoff from new and replaced impervious surfaces, the Water Quality Treatment requirement applies to the runoff from existing, new, and replaced impervious surfaces.

B – A Storm Water Control Plan shall be submitted with plan designs demonstrating that the Regulated Project meets the Water Quality Treatment Performance Requirements. The Storm Water Control Plan shall follow the outline included in Appendix B.

Structural Storm Water Control Measure Design Steps for Tier 2

The flow chart below is intended to illustrate the process for projects where the Water Quality Treatment requirement applies and where an event-based approach will be used to size structural storm water control measures (SCMs). Items in the flow chart correspond to steps further detailed in the following subsections.



Step 1: Runoff Reduction BMPs

Follow the guidance under Tier 1: Site Design and Runoff Reduction to minimize site runoff. Document runoff reduction BMPs incorporated in site design in the Storm Water Control Plan.

Step 2: Drainage Management Area Delineation

Following the low impact development principle of managing stormwater through small-scale, decentralized measures, Drainage Management Areas (DMAs) are designated individual drainage areas within a Regulated Project that typically follow grade breaks and roof ridge lines and account for each surface type (e.g., landscaping, pervious paving, or roofs). The **entire project area** must be divided into individual, discrete DMAs. Storm Water Control Measures for runoff reduction and structural facilities are designed for each DMA.

Use separate DMAs for each surface type (e.g., landscaping, pervious paving, or roofs). Each DMA must be assigned a single hydrologic soil group.

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 structural Storm Water Control Measures (SCMs).

Self-treating areas are landscaped or turf areas that do not drain to structural BMPs, 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 that drain offsite to an existing public street or storm drain. In general, self-treating areas include no impervious areas, unless the impervious area is very small (5% or less) in relationship to the receiving pervious area and slopes are gentle.

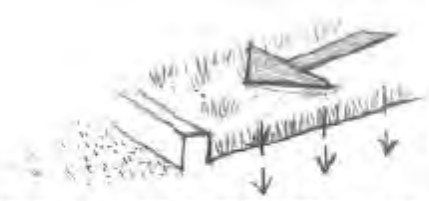


Figure 4.3 SELF-TREATING AREAS are entirely pervious and drain directly off-site or to the storm drain system.

Self-retaining areas are designed to retain the runoff from the 85th/95th percentile storm without producing any runoff. The applicant needs to demonstrate that runoff generated by the 85th and/or 95th percentile rainfall events as applicable can be infiltrated and will not produce runoff to the storm drain system, or a surface receiving water body, or create nuisance ponding that may affect vegetation health or contribute to vector problems. 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.

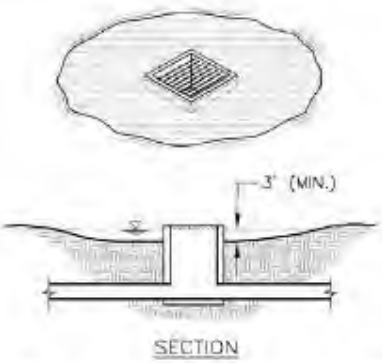


Figure 4.4 SELF-RETAINING AREAS. Berm or depress the grade to retain at least an inch of rainfall and set inlets of any area drains at least 3 inches above low point to allow ponding.

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. **Green roofs** and areas from which runoff is captured for harvest and use are considered self-retaining areas.

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 drainage from the impervious area must be directed to and dispersed within the pervious area, and the self-retaining area must be designed to retain the 85th and/or 95th percentile rainfall event as applicable.

Note: rainfall depth maps for 85th and 95th percentile 24-hour storm events can be found on the City's website at: www.cityofsantacruz.com/LID

Central Coast regional rainfall depth maps can be found on the website of the Central Coast RWQCB at: http://www.waterboards.ca.gov/centralcoast/water_issues/programs/stormwater/docs/lid/lid_hydromod_charette_index.shtml

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.

Areas draining to structural Storm Water Control Measures (SCMs) are used to calculate the required size of each SCM. Several DMAs can flow to one SCM.

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

In the Storm Water Control Plan, assign each DMA an identification number and determine its size, its surface type(s), its corresponding Runoff Coefficient "C", whether it is self-treating, self-retaining, drains to a self-retaining area, or to a SCM. For each impervious DMA also note whether it is new, replaced, or existing impervious area. Where runoff from existing paved areas cannot be separated from runoff from new and replaced impervious surfaces, SCMs must be sized to treat the combined runoff from existing and new/replaced surfaces.

The Runoff Coefficient "C" is computed using the equation:

$$C = 0.858i^3 - 0.78i^2 + 0.774i + 0.04$$

Where "i" is the fraction of the DMA that is impervious

After completing DMA calculations, site design should be reconsidered to identify any opportunities for runoff reduction, which will help reduce the size of retention and treatment systems needed.

Step 3: Runoff Volume Calculation For Water Quality

For each SCM that will be needed to meet the water quality treatment requirement, the following runoff volume information shall be incorporated in the storm water control plan:

- Determine the SCM's tributary area, which is the sum of DMAs draining to the SCM and the area of the SCM itself.
- Determine the 85th percentile 24-hr rainfall event depth using the maps on the City's website at: www.cityofsantacruz.com/LID

- Compute the water quality treatment volume:

For onsite retention and volume capture-based treatment systems:

Water Quality Treatment Volume = C x 24hr Rainfall Depth$_{85th}$ x SCM Tributary Area

For biofiltration and flow-based treatment systems:

Runoff treatment capacity = C x 0.2 inches/hr x SCM Tributary Area

STEP 4: WATER QUALITY SCM SIZING.

Mandatory Water Quality Treatment BMPs shall treat runoff using the onsite measures below, listed in the order of preference:

Bioretention Design

Bioretention facilities shall be designed to retain storm water runoff equal to the volume of runoff generated by the 85th percentile 24-hour storm event, based on local rainfall data.

See the bioretention fact sheet in Chapter 3 for detailed design parameters.

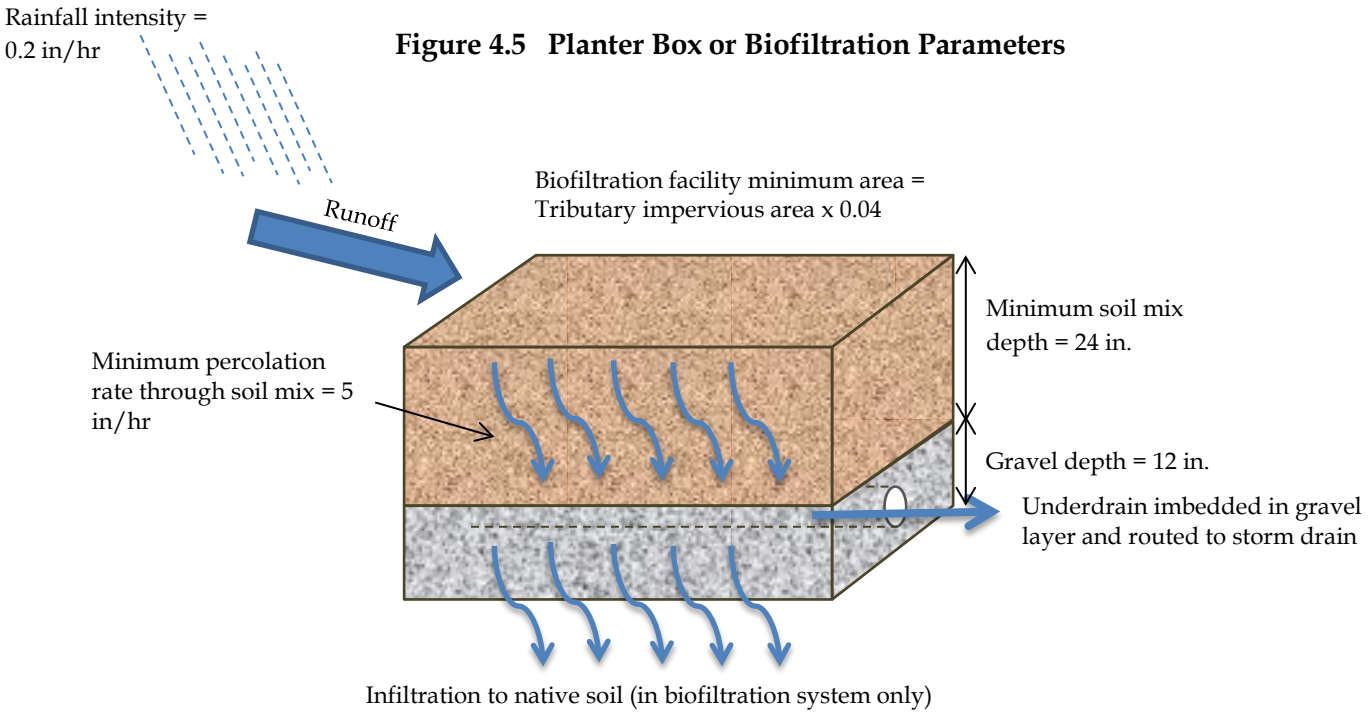
Planter Box or Biofiltration Design

Planter boxes and biofiltration treatment systems shall follow the design parameters in the Bioretention/Biofiltration fact sheet or the Planter Box fact sheet in Chapter 3.

Biofiltration or planter box facility sizing:

Biofiltration facility minimum area = Tributary impervious area x 0.04

Figure 4.5 Planter Box or Biofiltration Parameters



Non-retention Based Treatment Systems

Non-retention based treatment systems include structures such as tree box filters and other proprietary filtration systems. Implement SCMs that collectively achieve at least one of the following hydraulic sizing criteria for non-retention based treatment systems:

a) Hydraulic Sizing Criteria for Non-Retention Based Treatment Systems:
   i) Volume Hydraulic Design Basis – Treatment systems whose primary mode of action depends on volume capacity shall be designed to treat storm water runoff equal to the volume of runoff generated by the 85th percentile 24-hour storm event, based on local rainfall data.

   ii) Flow Hydraulic Design Basis – Treatment systems whose primary mode of action depends on flow capacity shall be sized to treat the flow of runoff produced by a rain event equal to at least 0.2 inches per hour intensity.

4.3. TIER 3 REQUIREMENTS: RUNOFF RETENTION

Tier 3 Mandatory Requirements are applicable to all regulated projects, except detached single-family homes, that create and/or replace >15,000 square feet of impervious surface (collectively over the entire project site), and detached single-family homes with over 15,000 square feet of Net Impervious Area. The following elements are required:

A – In addition to the Runoff Reduction and Water Quality requirements, projects shall meet the following Performance Requirements in the specified Watershed Management Zones (WMZs). A Runoff Retention WMZ map is shown in Figure 4.6 below and in the Storm Water and LID worksheet in Appendix A. An overall WMZ map and summary characteristics for the Central Coast Region is available on the website of the Regional Water Quality Control Board at http://www.waterboards.ca.gov/centralcoast/water_issues/programs/stormwater/docs/lid/lid_hydromod_charette_index.shtml.

WMZ 1, AND PORTIONS OF 4, 7, AND 10 OVERLYING GROUNDWATER BASIN:

1) Retain 95th Percentile Rainfall Event – Prevent offsite discharge from events up to the 95th percentile 24-hour rainfall event.

2) Compliance must be achieved by optimizing infiltration. Compliance for retention of the remaining volume must be achieved via storage, rainwater harvesting and/or evapotranspiration.

WMZ 2:

1) Retain 95th Percentile Rainfall Event – Prevent offsite discharge from events up to the 95th percentile 24-hour rainfall event.

2) Compliance must be achieved via storage, rainwater harvesting, infiltration, and/or evapotranspiration

WMZ 5 AND 8:

1) Retain 85th Percentile Rainfall Event – Prevent offsite discharge from events up to the 85th percentile 24-hour rainfall event.

2) Compliance must be achieved by optimizing infiltration. Compliance for retention of the remaining volume must be achieved via storage, rainwater harvesting and/or evapotranspiration.

WMZ 6 AND 9:

1) Retain 85th Percentile Rainfall Event – Prevent offsite discharge from events up to the 85th percentile 24-hour rainfall event.

2) Compliance must be achieved via storage, rainwater harvesting, infiltration, and/or evapotranspiration

B – A Storm Water Control Plan shall be submitted with plan designs demonstrating that the Regulated Project meets the Water Quality Treatment and Runoff Retention Requirements. The Storm Water Control Plan shall follow the outline included in Appendix B.

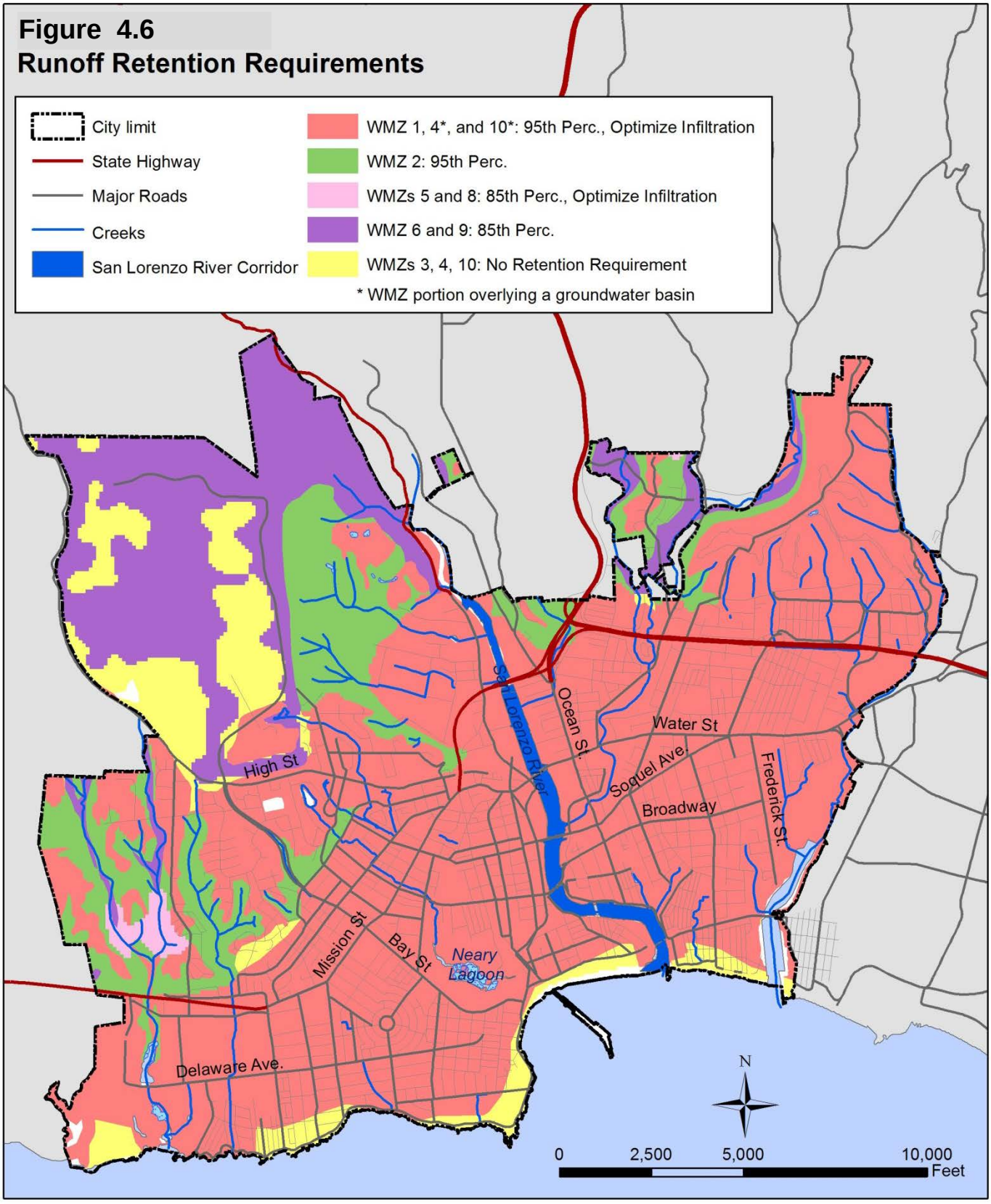
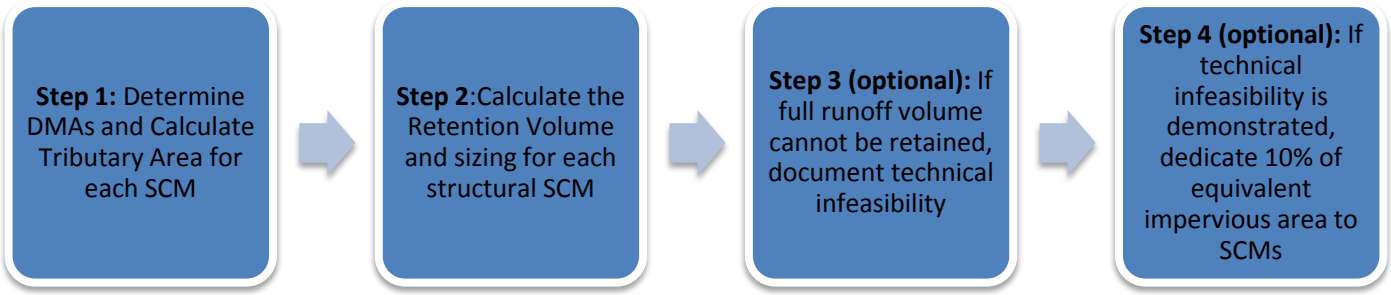


Figure 4.6
Runoff Retention Requirements
City limit
State Highway
Major Roads
Creeks
San Lorenzo River Corridor
WMZ 1, 4*, and 10*: 95th Perc., Optimize Infiltration
WMZ 2: 95th Perc.
WMZs 5 and 8: 85th Perc., Optimize Infiltration
WMZ 6 and 9: 85th Perc.
WMZs 3, 4, 10: No Retention Requirement
* WMZ portion overlying a groundwater basin
High St
San Lorenzo River
Ocean St.
Water St
Soquel Ave.
Broadway
Frederick St.
Mission St.
Bay St
Neary Lagoon
Delaware Ave.
N
0
2,500
5,000
10,000
Feet

Structural Storm Water Control Measure Design Steps for Tier 3

The flow chart below is intended to illustrate the process for projects where the Runoff Retention requirement applies and where an event-based approach will be used to size structural storm water control measures (SCMs). Runoff reduction and drainage management area delineation and classification steps were discussed previously in Sections 4.1 (Tier 1 Requirements) and 4.2 (Tier 2 Requirements). Items in the flow chart correspond to steps further detailed in the following subsections.



Step 1 – Tributary Area Calculation

Determine the tributary area for each SCM. The tributary area is the sum of Drainage Management Areas (DMAs) draining to the SCM and the area of the structure itself. See Section 4.2 for details on how to determine DMAs.

Runoff Adjustments for Redevelopment Project Retention Tributary Areas

Where the Regulated Project includes replaced impervious surface, the following Tributary Area adjustments apply:

- Outside Urban Sustainability Areas (USAs): The total amount of replaced impervious surface area shall be multiplied by 0.5 when calculating the Retention Tributary Area.
- Within an approved USA: The total amount of runoff volume to be retained from replaced impervious surfaces shall be equivalent to the pre-project runoff volume retained.

After completing DMA tributary calculations, site design should be reconsidered to identify any opportunities for runoff reduction, which will help reduce the size of retention and treatment systems needed.

Step 2 – Retention Volume and SCM Sizing Calculation

The Retention Volume shall be calculated for each SCM using one of the following methods.

A – Simple Method:

For Projects required to retain the 95th Percentile 24-hr Storm:

$$Retention\ Volume = C \times Rainfall\ Depth_{95th} \times Tributary\ Area$$

For Projects required to retain the 85th Percentile 24-hr Storm:

$$Retention\ Volume = C \times Rainfall\ Depth_{85th} \times Tributary\ Area$$

B – Routing Method:

Enter the following information into the Central Coast routing calculator provided at www.cityofsantacruz.com/lid:

- New tributary impervious area
- Replaced tributary impervious area qualifying for USA runoff adjustment
- Replaced tributary impervious area not qualifying for USA runoff adjustment
- Design storm depth (see storm depth maps at www.cityofsantacruz.com/lid)
- Hydrologic soil group or design infiltration rate for subsurface soils (see discussion below)
- Facility infiltration area (area in contact with subsurface soils – minimum is 4% of tributary impervious area)

The calculator performs the following tasks:

- Distributes the design storm depth over time increments according to a Type 1 unit hydrograph
- Calculates facility inflow rate and volume for each time increment
- Calculates facility infiltration rate and infiltration volume for each time increment
- Calculates incremental increase or decrease in storage and cumulative storage for each time increment
- Tracks and outputs time for facility to drain fully

The calculator outputs the maximum cumulative storage volume required to retain the design storm. As required by the PCRs, the calculator multiplies this volume by 1.2 when the drawdown time exceeds 48 hours. This is the minimum storage volume to be used for design of the SCM.

The minimum storage volume required and required depth of facility change as the facility infiltration area is adjusted. By entering different facility infiltration areas into the calculator, one can assess the minimum storage volume options that may be feasible at a site. The calculator also facilitates the exploration of options to delineate DMAs differently and associate DMAs with different LID facilities.

Infiltration rate for routing method: you may use the default option or, alternatively, submit data from onsite testing.

Default option: use the Hydrologic Soil Group (HSG) that best characterizes site soils. To support your selection of an HSG, provide onsite boring logs or other information such as a geotechnical report for the site as an attachment to your Storm Water Control Plan. In the calculator, HSG A/B soils are assigned an infiltration rate of 0.75 in/hr. and HSG C/D soils are assigned an infiltration rate of 0.25 in/hr.

Onsite Testing option: the method provided in Appendix VII of the Orange County Technical Guidance Document (http://ocwatersheds.com/documents/wqmp/tgd/) or other approved method may be used to determine the design infiltration rate. Because of limitations in the precision of infiltration rate testing at low rates, this option may only be used to document infiltration rates greater than 0.5 in/hr. Acceptance of results is at the discretion of municipal staff.

For LID facilities other than bioretention, such as infiltration trenches or basins, divide the infiltration rate by a safety factor of 2 to account for potential reductions in infiltration rates over time (this is already accounted for in the calculator). This factor may be waived by municipal staff if a treatment system is installed upstream of the treatment facility.

Step 3 (Optional): Document Runoff Retention Infeasibility

Technical Infeasibility may be caused by site conditions including:

1. Depth to seasonal high groundwater limits infiltration and/or prevents construction of subgrade storm water control measures
2. Depth to an impervious layer such as bedrock limits infiltration
3. Sites where soil types significantly limit infiltration
4. Sites where pollutant mobilization in the soil or groundwater is a documented concern
5. Space constraints (e.g., infill projects, some redevelopment projects, high density development)
6. Geotechnical hazards
7. Storm water control measures located within 100 feet of a groundwater well used for drinking water

Technical infeasibility must be clearly documented with supporting evidence such as geotechnical reports, hydrological analysis, documentation of pollutant concerns on the property, etc. Technical infeasibility determination will only be granted after demonstration that site layout has been optimized and all storm water retention options have been considered.

Step 4 (Optional): Dedicate 10% of Project's Equivalent Impervious Area to SCMs

Retention of the full runoff volume as described above is not required where technical infeasibility is demonstrated to limit on-site compliance with the Runoff Retention

Performance Requirement AND ten percent (10%) of a project's Equivalent Impervious Surface Area has been dedicated to retention-based SCMs. The Water Quality Treatment Performance Requirement is not subject to this adjustment, i.e., mitigation to achieve full compliance with the Water Quality Treatment Performance Requirement is required.

Calculating Ten Percent of a Project's Equivalent Impervious Surface Area

The project's Equivalent Impervious Surface Area is defined as:

> *Equivalent Impervious Surface Area (ft^2) = Impervious Tributary Surface Area (ft^2) + Pervious Tributary Surface Area (ft^2)*

Impervious Tributary Surface Area is defined as the sum of all of the site's conventional impervious surfaces. When calculating Impervious Tributary Area:

- Do include: concrete, asphalt, conventional roofs, metal structures and similar surfaces
- Do not include: green roofs

Pervious Tributary Surface Area is defined as the sum of all of the site's pervious surfaces, corrected by a factor equal to the surface's runoff coefficient. When calculating Pervious Tributary Surface Area:

- Do include surfaces such as: unit pavers on sand; managed turf; disturbed soils; and conventional landscaped areas (see Table 1 for correction factors).

- Do not include: Infiltration SCM surfaces; natural and undisturbed landscape areas, or landscape areas compliant with the Model Water Efficient Landscape Ordinance (California Code of Regulations, Title 23. Waters, Division 2. Department of Water Resources, Chapter 2.7.), or a local ordinance at least as effective as the Model Water Efficient Landscape Ordinance.

TABLE 4.1: Correction Factors for Use in Calculating Equivalent Impervious Surface Area

Pervious Surface	Correction Factor
Disturbed Soils/Managed Turf (dependent on original Hydrologic Soil Group)	A: 0.15 B: 0.20 C: 0.22 D: 0.25
Pervious Concrete	0.60
Cobbles	0.60
Pervious Asphalt	0.55
Natural Stone (without grout)	0.25
Turf Block	0.15
Brick (without grout)	0.13
Unit Pavers on Sand	0.10
Crushed Aggregate	0.10
Grass	0.10

4.4. TIER 4 REQUIREMENTS: PEAK MANAGEMENT

Tier 4 Mandatory Requirements are applicable to all regulated projects that create and/or replace >22,500 square feet of impervious surface (collectively over the entire project site). The following elements are required:

A – In addition to the Runoff Reduction, Water Quality and Runoff Retention requirements, projects are required to manage the following peak storm water runoff:

Post-development peak flows, discharged from the site, shall not exceed pre-project peak flows for a 10-year 24-hour storm event. The City may require additional peak flow management in sensitive flooding areas.

B – A Storm Water Control Plan shall be submitted with plan designs demonstrating that the Regulated Project meets the Water Quality Treatment, Runoff Retention and Peak Management Performance Requirements. The Storm Water Control Plan shall follow the outline included in Appendix B.

SPECIAL CIRCUMSTANCES

Highly Altered Channel and Intermediate Flow Control Facility Special Circumstances:

Regulated Projects may be *exempt* from the Peak Management requirement under the following conditions:

1) Project runoff discharges into a stream channel that is concrete-lined or otherwise continuously armored from the discharge point to the channel's confluence with a lake or marine near-shore waters.
2) Project runoff discharges to a continuous underground storm drain system that discharges to a lake, the San Lorenzo River in the City of Santa Cruz, or marine near-shore waters.
3) Project runoff discharges to an existing pump station facility that regulates flow volumes and durations to levels that have been demonstrated to be protective of beneficial uses of the receiving water downstream of the facility.

The Plan Review or Building Permit applicant for a project that is anticipated to create and/or replace >22,500 square feet of impervious surface must coordinate with the City's Department of Public Works to determine whether the project will be subject to this special circumstance.

STRUCTURAL STORM WATER CONTROL MEASURE TIER 4 CALCULATIONS

Runoff reduction, drainage management area delineation and tributary area calculation steps were discussed previously in Sections 4.1 through 4.3.

The volume that shall be detained in onsite facilities to meet Tier 4 requirements shall be calculated using the Rational Method utilizing the rainfall intensity duration curves in Part 3 Stormwater Management of the County of Santa Cruz Design Criteria. Minimum time of concentration used for intensity calculations shall be 15 minutes.

If runoff will be routed through retention facilities prior to entering the onsite detention facilities, credit may be given for the stormwater volume that will be detained in the gravel bed beneath the underdrain of a retention facility.

CHAPTER 5.

Additional Storm Water Requirements

5.1. State Construction Storm Water General Permit

Please be aware that the State of California requires that **construction activity resulting in land disturbance of one acre or more, or less than one acre but part of a larger common plan of development or sale** obtain coverage under the state's Construction Activities Storm Water General Permit. Construction activity includes clearing, grading, excavation, stockpiling, and reconstruction of existing facilities involving removal and replacement. **The landowner is responsible for filing a Notice of Intent (NOI) with the State Regional Water Quality Control Board (RWQCB) and for developing a Storm Water Pollution Prevention Plan (SWPPP)** prior to commencement of any soil disturbing activities. For more information about the Construction Activities Storm Water General Permit, please refer to the State Water Quality Control Board website at:

http://www.swrcb.ca.gov/stormwtr/construction.html.

In order to obtain a construction or building permit from the City for a construction site that falls into this category, an applicant must provide the City with proof of coverage under the state's Construction Activities Storm Water General Permit. **Proof of coverage shall include a copy of the letter of receipt and Waste Discharger Identification (WDID) number issued by the State Water Quality Control Board (SWQCB)** that acknowledges the property owner's submittal of a complete Notice of Intent (NOI) package. Therefore, please allow sufficient time for the RWQCB/SWQCB to process your NOI package prior to applying for a construction or building permit from the City.

5.2. Source Control BMP Requirements

Proposed projects that include any of the following special site conditions shall incorporate the following source control measures in their storm water control plans, and operation and maintenance plans.

Commercial and Industrial Facilities

Storm Drain Stenciling

Storm Drain System Stenciling and Signage: storm drain stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets. The stencil shall consist of a brief statement prohibiting the dumping of improper materials into the storm drain system. Graphical icons, either illustrating anti-dumping symbols or images of receiving water fauna (i.e. native fish), are effective supplements to the anti-dumping message. All storm drain inlets and catch basins within the project area must be stenciled with prohibitive language (such as: No Dumping–Drains To Bay) and/or graphical icons to discourage illegal dumping. Signs and prohibitive language or graphical icons, which prohibit illegal dumping, must be posted at public access points along channels and creeks within the project area. Legibility of stencils and signs must be maintained.

Landscaping

a) Design landscaping to minimize the use of fertilizers and pesticides that can contribute to storm water pollution.

b) Consider using pest-resistant plants, especially adjacent to hardscape.

Loading Docks

Loading dock areas must include the following in order to minimize the potential for spills to be quickly transported to the storm drain system:

a) Cover loading dock areas or design drainage to minimize run-on and runoff of storm water, and

b) Direct connections to a storm drain from depressed loading docks (truck wells) are prohibited.

Operation & Maintenance

Incorporate applicable operational BMPs from the City's Mandatory Storm Water BMPs for Retail and Commercial Businesses (Chapter 3 of City BMP Manual) or the City's Mandatory Storm Water BMPs for Industrial Facilities (Chapter 5 of City BMP Manual).

Parking Areas

a) Mark all inlets with the words "No Dumping! Flows to Bay" or similar.

b) Sweep plazas, sidewalks, and parking lots regularly to prevent accumulation of litter and debris.

c) Collect debris from pressure washing to prevent entry into the storm drain system. Collect washwater containing any cleaning agent or degreaser and discharge to the sanitary sewer not to a storm drain.

Pools, Spas and Other Water Features

See applicable operational BMPs in Fact Sheet SC-72, "Fountain and Pool Maintenance," in the CASQA Stormwater Quality Handbook (Appendix F).

Material Storage Areas

Improper storage of materials outdoors may provide an opportunity for toxic compounds, oil and grease, heavy metals, nutrients, suspended solids, and other pollutants to enter the storm water conveyance system. If project plans include a material storage area(s), the following is required:

a) If the storage area may contain materials with the potential to contaminate storm water, the area must be located indoors. The floor must be constructed of material

sufficiently impervious to contain leaks and spills.

b) Tallow drum storage areas must be located indoors.

c) See the applicable chemicals, materials, and waste storage operational BMPs from the City's Mandatory Storm Water BMPs for Retail and Commercial Businesses (Chapter 3 of City BMP Manual).

Trash Storage Areas

A trash storage area refers to an area where a trash receptacle or receptacles (dumpsters) are located for use as a repository for solid wastes. All trash storage areas, except those at a single-family residence, must meet the following requirements:

a) The trash storage area must have drainage from adjoining roofs and pavement diverted around the area.

b) The trash storage area must be screened or

walled to prevent off-site transport of trash.

c) The trash storage area shall have a roof to prevent storm water from entering.

d) The trash storage area shall be paved and impervious to leaks and spills.

e) Storm drains are prohibited in a trash storage area.

f) The trash storage area must have a drain to the sanitary sewer so that wastewater from the cleaning of this area may be drained to the sanitary sewer unless exempted by the Department of Public Works.

g) The trash storage area must be large enough to accommodate projected amounts of both refuse and recyclable materials.

If project plans include an outdoor grease interceptor, trash enclosure, or wash area, these areas shall be located and designed in such a manner that an accidental overflow, blockage, leak, or spill cannot discharge or runoff into a storm drain inlet. Project design shall incorporate proper sloping, berming, and/or channeling.

Restaurants and Food Processing/Manufacturing Facilities (Incl. Wineries)

Project plans must include an area for the washing/steam cleaning of equipment and accessories including floor mats. The wash area must be:

a) Self-contained, equipped with a grease trap or interceptor, and properly connected to the sanitary sewer. Food processing/manufacturing facilities including wineries may be exempted from this specific requirement by the Department of Public Works.

b) If the wash area is to be located outdoors, it must be covered, paved, have secondary containment, and be connected to the sanitary sewer.

c) Whether located inside or outdoors, the wash area drain shall have a screen to retain particles larger than one-half inch in order to prevent the discharge of these particles to the sanitary sewer.

d) See the applicable operational BMPs in the City's Mandatory Storm Water BMPs for Food Service Facilities (Chapter 2 of the City's BMP Manual).

If project plans include an outdoor grease interceptor, trash enclosure, or wash area, these areas shall be located and designed in such a manner that an accidental overflow, blockage, leak, or spill cannot discharge or runoff into a storm drain inlet. Project design shall incorporate proper sloping, berming, and/or channeling.

Vehicle Fueling, Maintenance and Wash Areas

Properly Design Fueling Areas

The fueling area shall be properly designed to minimize the potential for gasoline, oil and grease, solvents, car battery acids, and coolants to reach the storm drain system. Project plans for a fueling area must include the following:

a) The fuel dispensing area must be covered with an overhanging roof structure or canopy. The canopy's minimum dimensions must be equal to or greater than the area within the grade break. The canopy must not drain onto the fuel dispensing area, and the canopy downspouts must be routed to prevent drainage across the fueling area.

b) The fuel dispensing area must be paved with Portland cement concrete (or equivalent smooth impervious surface approved by the City). The use of asphalt concrete is prohibited.

c) The fuel dispensing area must have a 2% to 4% slope to prevent "ponding," and must be separated from the rest of the site by a grade break that prevents run-on of storm water to the maximum extent practicable.

d) At a minimum, the concrete fuel dispensing area must extend 6.5 feet (2.0 meters) from the corner of each fuel dispenser, or the length at which the hose and nozzle assembly may be operated plus 1 foot (0.3 meter), whichever is less.

Properly Design Maintenance Bays

Design plans for repair and maintenance bays must include the following:

a) Repair and maintenance bays must be located indoors.

b) Floor drains connected to the sanitary sewer or storm drain system are prohibited.

Properly Design Vehicle and Equipment Wash Areas

Project plans must include an area for the washing and/or steam cleaning of vehicles and equipment. This wash area design must include the following:

a) If only washing is conducted (not steam cleaning), the wash area must be self-contained and equipped with a clarifier or other pretreatment system (i.e. interceptor). The pretreatment system must be properly connected to either the sanitary sewer, as permitted by the Department of Public Works, or to a recycling system, holding tank, or some other type of "zero discharge" system.

b) If steam cleaning is conducted or if the wash area will be used for engine or parts cleaning, the wash area must be self-

contained and all drains directed to a closed-loop recycling system or a holding tank for disposal off-site. If no drains are installed, then the area must be bermed or sloped and trenched (with no exit) to allow for the capture and collection of the wastewater. No wastes, including rinse water, from any engine or parts cleaning may be discharged to the sanitary sewer or storm drain system.

c) The wash pad area must be sloped and bermed to prevent discharge to the storm drain and to prevent excess storm water from running to the wash pad drain. The wash pad must be covered.

Operation & Maintenance

See the applicable operational BMPs in the City's Mandatory Storm Water BMPs for Vehicle Service Facilities (Chapter 1 of the City's BMP Manual).

Interior and Parking Garage Floor Drains

Parking garage floor drains shall be plumbed to the sanitary sewer through an approved and appropriately maintained pre-treatment system that also excludes excess storm water from entering the sanitary sewer system. Floor drains shall be inspected and maintained to prevent blockages and overflow.

Miscellaneous Drain or Wash Water

Boiler drain lines shall be directly or indirectly connected to the sanitary sewer system and may not discharge to the storm drain system.

Condensate drain lines may discharge to landscaped areas if the flow is small enough that runoff will not occur.

Condensate drain lines may not discharge to the storm drain system. Rooftop equipment with potential to produce pollutants shall be roofed and/or have secondary containment.

Fire sprinkler drain lines shall be directly or indirectly connected to the sanitary sewer system and may not discharge to the storm drain system.

Any drainage sumps on-site shall feature a sediment sump to reduce the quantity of sediment in pumped water.

Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff.

CHAPTER 6.

Operation and Maintenance

An Operation & Maintenance Plan and Maintenance Agreement is required for all Regulated Projects with structural Water Quality Treatment, Runoff Retention, and/or Peak Management controls.

I. Operation & Maintenance Plan and Maintenance Agreement

The Regulated Project applicant shall develop and implement a written Operation & Maintenance (O&M) Plan that, at a minimum, includes each component listed below. If desired, the O&M Plan may be included in the Storm Water Control Plan in place of developing a separate document (see Appendix B). The O&M Plan must be approved by the City prior to final approval/occupancy. The O&M Plan must include, at minimum:

a) A site map identifying all structural SCMs requiring O&M practices to function as designed.

b) O&M procedures for each SCM including, but not limited to, LID facilities, retention/detention basins, and proprietorship devices.

c) O&M procedures for source control BMPs.

d) Short-and long-term maintenance requirements, recommended frequency of maintenance, and estimated cost for maintenance.

e) A statement signed by the property owner accepting responsibility for the on-going maintenance of SCMs until such responsibility is legally transferred to another entity when the property is sold (Maintenance Agreement). See Appendix C for a Maintenance Agreement template. **A fillable Maintenance Agreement in PDF format can also be downloaded at http://www.cityofsantacruz.com/LID.**

O&M guidance resources for LID are listed in Appendix D.

APPENDIX A

Storm Water & LID Checklist

APPENDIX A
STORM WATER AND LOW-IMPACT DEVELOPMENT BMP REQUIREMENT WORKSHEET

How to Use This Worksheet

The City's Storm Water BMP requirements are based on project type, proposed impervious area, and location within the watershed. This worksheet was developed to help permit applicants determine and meet storm water BMP requirements applicable to a proposed development or redevelopment

1 - Download this fillable form online at **www.cityofsantacruz.com/LID**
2 - Fill out the Worksheet to determine what stormwater BMP requirements apply to a proposed project.
3 - Attach Worksheet and additional documentation required as listed in the City Storm Water Best Management Practices for Private and Public Development Projects to plans for review by the Department of Public Works
4 - Please contact the Public Works Environmental Project Analyst at 420-5160 if you have any questions on completing the worksheet.

Project Address: _____ **Bldg Permit #:** _____

A - Project Type

Check project type that applies:

☐ Single Family Home ☐ Multi-family, Commercial, Industrial, Public facilities

Check development type that applies:

☐ New Development ☐ Redevelopment / Remodel

B - Proposed Development Area and Impervious Area:

Pre-project impervious surface area:	_____	sq ft
Post-project impervious surface area:	_____	sq ft
Amount of impervious surface area that will be **replaced**:	_____	sq ft
Amount of new impervious surface area that will be **created**:	_____	sq ft
Reduced Impervious Area Credit:	0	sq ft

New and Replaced Impervious Area = **0** **sq ft**

Net Impervious Area = **0** **sq ft**

(Net Impervious Area = Impervious Area created + Impervious Area replaced - Reduced Impervious Area Credit)

C - Post-Construction BMP Tier requirement:

Check Project Type and Impervious Area (from calculations above) that applies.
BMP requirements are cumulative (e.g. a project subject to BMP Tier 3 is also subject to Tiers 1 and 2), permit review fees are not cumulative.
Projects requiring a Stormwater Control Plan will need to involve a civil engineer.

SINGLE-FAMILY HOMES	BMP TIER	Permit Review Fee	Stormwater Control Plan required?
☐ Single-family Home with Net Impervious Area **< 15,000 sf**, **please consult Chapter 6A, BMPs for Single-Family Homes on Small Lots**	**N/A**	$0	No
☐ Net Impervious Area **≥ 15,000 sf**; New and replaced impervious area **< 22,500 sf**	**3**	$330	Yes
☐ New and replaced impervious area **≥ 22,500 sf**	**4**	$550	Yes

MULTI-FAMILY, COMMERCIAL, INDUSTRIAL, PUBLIC FACILITIES	BMP TIER	Permit Review Fee	Stormwater Control Plan Required?
☐ New and Replaced Impervious Area **≥ 2,500 sf**; Net Impervious Area **< 5,000 sf**	**1**	$0	No
☐ Net Impervious Area **≥ 5,000 sf**; New and Replaced Impervious Area **< 15,000 sf**	**2**	$330	Yes
☐ New and Replaced Impervious Area **≥ 15,000 sf** but **< 22,500 sf**	**3**	$550	Yes
☐ New and replaced impervious area **≥ 22,500 sf**	**4**	$550	Yes

If the proposed project is only subject to BMP Tiers 1 or 2, skip to Step F.

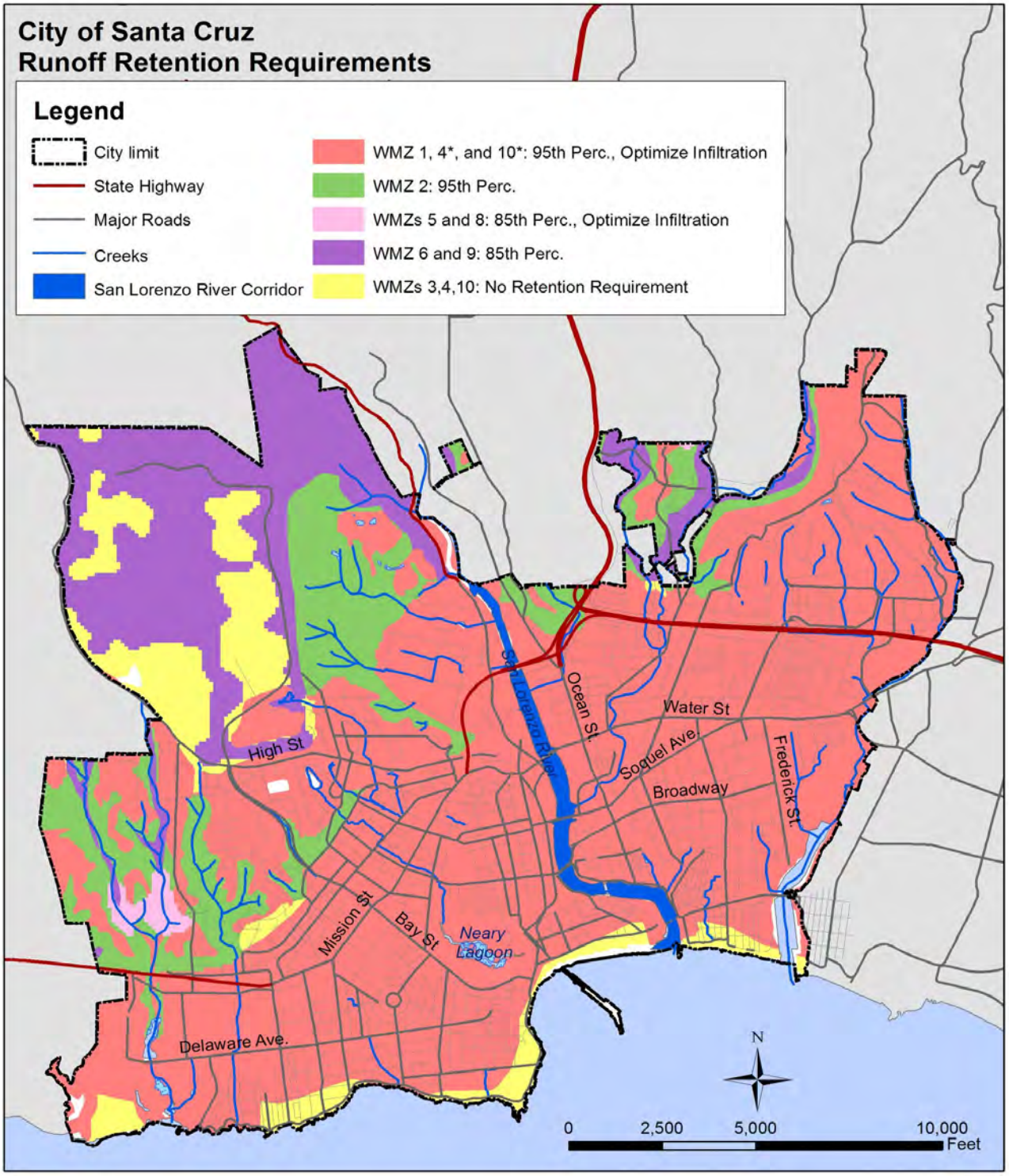
D - Watershed Management Zones - For projects subject to Tiers 3 Post-Construction BMP requirements only.

Watershed Management Zones are viewable online on the City of Santa Cruz GIS website at: http://gis.cityofsantacruz.com/gis/index.html

Watershed Management Zones and associated Tier 3 (Runoff Retention) Post-Construction BMP requirements

If Tier 3 BMP requirements are applicable to the project, check the watershed management zone area where the project is located.

- ☐ WMZ 1, and portions of 4, and 10 overlying groundwater basin
- ☐ WMZ 2
- ☐ WMZ 5 and 8
- ☐ WMZ 6 and 9
- ☐ WMZ 3, 4 and 10



E - Special Circumstances - For projects subject to Tiers 3 and 4 Post-Construction BMP requirements only.
Check if special circumstance applies to the project

- ☐ Highly Altered Channel and Intermediate Flow Control Facility
- ☐ Urban Sustainability Area

F - Additional Stormwater BMP Requirements for Multi-family, Commercial and Industrial projects
Check if additional BMP requirements apply to the project

a) State Construction Activities Storm Water General Permit

- ☐ Construction activity resulting in land disturbance of one acre or more, or part of a larger common plan of development

b) Additional Source Control BMP requirements for specific facilities

- ☐ Commercial or industrial facility
- ☐ Material Storage Areas
- ☐ Vehicle fueling, maintenance and wash areas
- ☐ Equipment and accessory wash areas
- ☐ Interior and parking garage floor drains
- ☐ Parking areas
- ☐ Pools, spas and other water features
- ☐ Trash Storage Areas
- ☐ Restaurants and food processing or manufacturing facilities
- ☐ Miscellaneous drain or wash water

G - Complete if your project is <u>only</u> subject to Tier 1 Requirements - Site planning and LID design measures.
LID design measures shall be clearly marked on site plans

Check applicable boxes and provide short description of measure and location

☐ Conserve natural areas, riparian areas and wetlands

Description: _____

☐ Concentrate improvements on the least-sensitive portions of the site and minimize grading

Description: _____

☐ Direct roof runoff into cisterns or rain barrels

Description: _____

☐ Direct roof downspouts to landscaped areas or rain gardens

Description: _____

☐ Use pervious pavement (pervious concrete or asphalt, turf block, crushed aggregate, etc.)

Description: _____

☐ Disperse runoff from paved areas to adjacent pervious areas

Description: _____

APPENDIX B

Storm Water Control Plan Outline

Appendix B

Storm Water Control Plan Outline

I. Project Information

A. Project name, application number, location including address and assessor's parcel number
B. Name of applicant
C. Project phase number (if project is being constructed in phases)
D. Project description

II. Project Site Assessment Summary

A. Site topography

B. Geology and soil types
Description of site soil conditions based on geotechnical analysis, hydrologic soil groups, presence of unique geology (e.g., karst), geotechnical hazards.

C. Hydrologic Considerations
Description and map of wetlands, watercourses, seeps, springs, depth to seasonal high groundwater, depth to an impervious layer such as bedrock, nearby drinking water wells.

D. Natural Areas
Description and map of protected undisturbed natural areas and trees.

E. Other Site Features and Constraints
Including existing drainage infrastructure for the site and nearby areas, run-on characteristics (source and estimated runoff from offsite which discharges to the project area), documented soil and/or groundwater contamination, structures including retaining walls, other utilities, easements and setbacks, zoning/land use and covenants.

III. Project Storm Water Performance Criteria and Drainage Management

A. Development Area and BMP Requirement Tier
Information that must be included in this section:

- Total project site area and project type
- From LID Worksheet: Pre-project impervious area
  Post-project impervious area
  Amount of existing impervious area that will be replaced
  Amount of new impervious area
  Total new and replaced impervious area
  Net impervious area
- Mandatory Development requirement tier and Special Circumstances (including Urban Sustainability Area, drainage to highly altered channel) applicable to the project

B. Drainage Management Areas

Map and tabulation of DMAs including:

- DMA identification number
- DMA type (self-treating areas, self-retaining areas, areas that drain to self-retaining areas, areas that drain to SCMs)
- DMA area (SF) and surface type
- For DMAs that are not self-treating or self-retaining, runoff coefficient, and receiving DMA or SCM

IV. Site Design and SCMs

A. Summary of Site Design and Runoff Reduction measures included in the project

B. Description of each SCM, including:

- Tributary DMAs and total tributary area
- Tier 2 (Water Quality) runoff volume calculations (see BMP Manual Section 4.2, Step 3)
- *(if applicable)* Tier 3 (Runoff Retention) runoff volume calculations (See BMP Manual Section 4.3, Step 1)
- SCM sizing calculations to meet the water quality requirement and runoff retention requirement (*if applicable*)
- (*if applicable*) Documentation of runoff retention technical infeasibility where retention of the full volume is not practicable.
- (*if applicable*) Where technical infeasibility is documented, calculations for dedicating 10% of the project's equivalent impervious area to SCMs.
- (*if applicable*) SCM sizing calculations to meet the peak management requirement.
- Certification that the selection, sizing, and design of the Storm Water Control Measures meet the applicable Performance Requirements

V. BMP Operation and Maintenance Plan

A. Location on a site map of all structural Storm Water Control Measures requiring O&M practices to function as designed.

B. O&M procedures for each structural stormwater control measure including, but not limited to, LID facilities, retention/detention basins, and proprietorship devices.

C. Short-and long-term maintenance requirements, recommended frequency of maintenance, and estimated cost for maintenance.

D. Signed Maintenance Agreement (see Appendix C)

APPENDIX C

Maintenance Agreement Template

Appendix C

Maintenance Agreement Regarding Maintenance of Structural or Treatment Control Best Management Practices (BMPs)

for: Address _____ *APN#* _____

I, _____, being the owner of the real property, APN No. _____, which is located at _____, Santa Cruz, California, consent and agree to inspect and maintain any and all structural or treatment control Best Management Practices (BMPs) a minimum of once per year prior to **October 1** on the subject property. The structural or treatment control BMPs on the subject property include(s):

_____

_____.

I agree to send a letter that provides proof of inspection and maintenance to the City of Santa Cruz Department of Public Works prior to December 1 of each year. Proof of inspection and maintenance shall include a log of inspection and maintenance dates for the past year, and receipts if conducted by a hired service. The log should also indicate any significant observations or repairs made. **The proof of inspection and maintenance should be sent to: Environmental Projects Analyst, Department of Public Works, City of Santa Cruz, 809 Center Street, Room 201, Santa Cruz, CA 95060.**

In the event that the property is sold, transferred, or leased, the obligations hereby imposed on the property owner shall be assumed by subsequent property owners and lessees. To this end, property owner, in any deed transferring an ownership interest in the property or in any lease agreement for the property, shall include a term by which the subsequent property owner or lessee acknowledges his or her understanding of the obligations imposed by this agreement and expressly agrees to accept and assume responsibility for complying with all said obligations imposed by this agreement.

In addition, I will provide printed information to the new property owner or lessee regarding proper BMP inspection and maintenance frequency and methods. The information shall accompany the first deed transfer. This information shall include the following:

(1) a description of any and all storm water structural or treatment control BMPs;
(2) a map of the property indicating the BMP locations; and
(3) a description of how inspections and necessary maintenance can be performed.

The transfer of this information shall also be required with any subsequent sale of the property.

Failure to comply with the provisions of this Maintenance Agreement may result in enforcement actions including assessment of civil penalties as allowed by the City's Municipal Code, Chapter 16.19.190 Administrative Remedies.

I have read the above agreement and understand it.

Owner Name: _____ Signature: _____

Date: _____

Owner Address: _____

Phone: _____ Email: _____

APPENDIX D

Design Guidance Resources

LID Guidance Resources

RESOURCES	HOW TO GET A COPY
LID Guidance Manuals and References	
CASQA California LID Portal	CA Storm Water Quality Association: http://www.casqa.org
Central Contra Costa County Stormwater C.3 Guidebook 5th Edition	Central Contra Costa County: http://www.cccleanwater.org/c3-guidebook.html
City of Santa Barbara Technical Guidance Manual Post-Construction Stormwater Management (Chapter 6: Stormwater Runoff BMP Options)	City of Santa Barbara Storm Water Management Program Page http://www.santabarbaraca.gov/gov/depts/parksrec/creeks/quality/storm/default.asp
Storm Water Quality Manual for Development Projects in Marin County (Version 6, Feb 2008)	Marin County Storm Water Pollution Prevention Program: http://mcstoppp.org/acrobat/GuidanceforApplicantsv_2-5-08.pdf
Bioretention Standard Details, Plant Guidance, Soil Guidance, Complete/Green Street Checklist	Low Impact Design Initiative http://centralcoastlidi.org/Central_Coast_LIDI/Home.html
San Mateo County Sustainable Green Streets and Parking Lots Design Guidebook	San Mateo County Water Pollution Prevention Program http://www.flowstobay.org/greenstreets
LID Operation & Maintenance Guidance	
Seattle Public Utilities Green Storm Water Operations and Maintenance Manual	Seattle Public Utilities: http://www.seattle.gov/util/groups/public/@spu/@usm/documents/webcontent/spu02_020023.pdf
Oregon State University Field Guide: Maintaining Rain Gardens, Swales and Stormwater Planters (2013)	Oregon State University Stormwater Solutions: http://extension.oregonstate.edu/stormwater/sites/default/files/fieldguide.pdf
Regular Inspection and Maintenance Guidance for Bioretention Systems / Tree Filters	University of New Hampshire Stormwater Center: http://www.unh.edu/unhsc/sites/unh.edu.unhsc/files/UNHSC%20Biofilter%20Maintenance%20Guidance%20and%20Checklist%201-11_0.pdf

Regular Inspection and Maintenance Guidance for Porous Pavements	University of New Hampshire Stormwater Center: http://www.unh.edu/unhsc/sites/unh.edu.unhsc/files/UNHSC%20Porous%20Pavement%20Routine%20Maintenance%20Guidance%20and%20Checklist%202-11.pdf
Other References	
Slow It. Spread It. Sink It! A Homeowner's Guide to Greening Storm Water Runoff	Santa Cruz Resource Conservation District: http://www.rcdsantacruz.org/media/brochures/pdf/HomeDrainageGuide.v25.pdf
Start at the Source (1999) Discussion of permeable pavements and alternative driveway designs	Bay Area Stormwater Management Agencies Association (510) 286-1255
California Storm Water Best Management Practices Handbook for New Development and Redevelopment	CA Storm Water Quality Association: http://www.casqa.org

APPENDIX E

LID Plant Guidance for Bioretention

Central California Coast

Technical Assistance Memo (TAM)

LID Plant Guidance for Bioretention

Low Impact Development

This Technical Assistance Memo (TAM) provides plant selection guidance for the most common bioretention features, such as bioretention swales, stormwater planters and rain gardens. Bioretention systems are low impact development (LID) features that use landscaped areas to slow, treat, retain and infiltrate stormwater runoff, mimicking the natural, pre-development hydrology of a site.

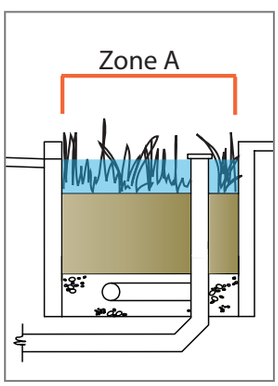
The intent of this TAM is to offer designers, municipalities, developers and homeowners with guidelines for selecting plants for bioretention areas, including a list of appropriate species for the Central Coast. Bioretention systems look like regular landscaped areas, but are designed (engineered) to manage stormwater runoff created by urbanization. Specifying the appropriate plants and soil mix for a bioretention system is critical to its function.

This step-by-step guidance is specific to LID landscapes and will take you from plant selection and layout to installation and on-going maintenance. This guidance is intended to accompany standard landscape methods and point out areas where LID methods may differ.

Step 1: LID Type and Plant Selection

Surface grade and **ponding area** of a bioretention structure are the first factors to consider when choosing which plants to specify. Is the soil surface of the structure sloped or uniform? Stormwater planters and some rain gardens have uniform surface grades. In these designs, ponding will be equal across the structure and all plants will have the same conditions (Zone A). In bioretention swales and some rain gardens, soil surface is sloped, resulting in differing planting conditions across the structure (Zones A and B). Plants located at the bottom where ponding occurs, will have different requirements than those placed on the sideslopes, which receive runoff, but not ponding. A third planting area may occur outside of Zones A and B, on the upper edges of rain gardens and bioswales. This area is not a functional component of the bioretention area, and therefore can be treated as a traditional landscape area.

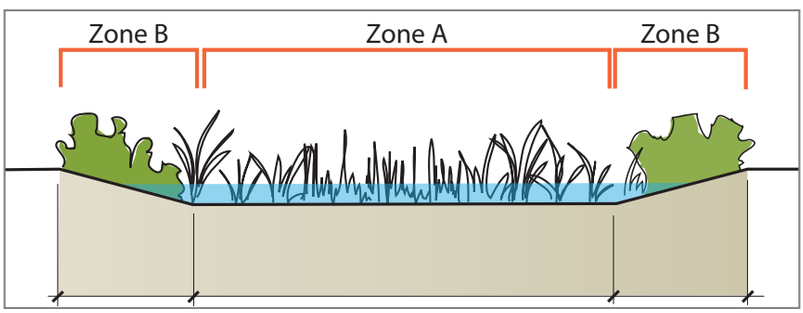
Source: AHBE Landscape Architects



Uniform surface grade: This stormwater planter has a flat bottom with consistent depth of ponding across the structure. All of the plants selected for this design must be tolerant of periodic inundation (**Zone A**).

Varying slope and ponding levels: Varying slope and ponding levels: This bioretention planting area has sloped edges. Plants in the bottom area will be inundated during storms (**Zone A**). Those planted on the sideslopes are above the level of ponding, but will experience seasonally wet conditions (**Zone B**).

Source: Rana Creek



Step 2: Plant Species Selection

Once the plant zones are identified (Zone A only or both Zone A and Zone B) for a structure, the plants may be selected. This TAM includes a plant list for bioretention areas (Table 1). There exist other LID plant lists for California and the Central Coast, but this "short list" was refined based on the following criteria: 1) Tolerant of varied moisture conditions (wet and dry), 2) tolerant of varied soil types and growing conditions, 3) available in Central Coast plant nurseries, 4) low maintenance requirements, 5) are not invasive weeds, 6) do not have aggressive/invasive root systems, and 6) exhibit an attractive appearance. When selecting plants from a list, additional site-specific information, such as tolerance to high and low temperatures, coastal conditions and prevailing winds should be considered. In addition, project specific aspects of the design, for example right-of-way vegetation height limits, approved street and parking lot tree lists and fire hazard landscape requirements may further influence selection. Although this plant list includes some non natives, using native plants is highly recommended because of the wide range of benefits they offer (food and forage for native wildlife, adaptation to local climate, low/no water use once established). Knowledge of invasive species is constantly evolving. To avoid specifying noxious plants on a project, check the California inventory at www.cal-ipc.org. Local agencies may also track potential invasives for your area.

Leymus condensatus 'Canyon Prince': This selection grows to 3' and is tolerant of a wide range of conditions, including drought, seasonal wet conditions, poor soils and some shade.

Achillea millefolium: A native perennial that attracts polinators and is tolerant of poor soils, seasonal flooding and deer. Available in many flower colors.

Source : Native Sons Nursery

Muhlenbergia rigens: A native grass with dense bright, grey-green, evergreen foliage. It tolerates a range of soils, sun to part-shade, seasonal flooding and drought.

Source unless noted: Los Filtros Nursery

Juncus patens: An easy to grow native rush. It tolerates poor drainage, flooding, drought and shade. A strong performer in bioretention areas, more drought tolerant than J. effusus.

Step 3: Soil Specification for Biofiltration

Specifying the correct soils for bioretention areas is critical in order to achieve stormwater objectives and plant health. Soils must balance three primary design objectives: 1) High enough infiltration rates to meet surface water draw down requirements, 2) infiltration rates that are not so high that they preclude pollutant removal function of soils and 3) soil composition that supports plant establishment and long-term health.

Landscape design documents for LID projects must include a bioretention soil specification that specifies the exact materials to be used in the mix (aggregates and compost), the percent of each material included in the mix, how they are to be placed (i.e. in 8" to 12" lifts) and the soil mix depth. Sample bioretention soil specifications and detailed information on BMP design and construction may be found in the LID documents listed under Additional Resources in this TAM.

Organic Compost: A main ingredient of biofiltration soil mixes, compost is the product of natural decomposition of organic wastes by bacteria, fungi, worms and other beneficial organisms. Compost increases the soil's water holding capacity and improves soil structure, nutrient levels and biology, all of which support plant health.

► GENERAL BIORETENTION SOIL SPECIFICATION

Bioretention soils should meet the following criteria.

1. General Requirements

Bioretention soil shall achieve a long-term, in-place infiltration rate of at least 5 inches per hour. Bioretention soil shall also support vigorous plant growth.

Bioretention Soil shall be a well-blended mixture of mineral aggregate and compost, measured on a volume basis. Bioretention soil shall consist of two parts compost (approximately 35 to 40 percent) by volume and three parts Mineral Aggregate (approximately 60 to 65 percent), by volume. The mixture shall be well blended to produce a homogeneous mix.

Bioretention Soil Mix: Construction documents for any LID project should include specifications for the bioretention soil mix that define the ratio of materials in the mix, and the content, gradation, quality analysis and other requirements for each of the materials. Specifications will also provide guidelines for blending and placement of the soil mix.

Table 1. Plants for Bioretention Areas[1]

Zone A: Periodic inundation, area ponds following storm events (24 - 72 hours).
Zone B: Above area of ponding, side slope areas receive runoff, but are never inundated.

Common Name	Scientific Name	Zone(s)	Height/ Width	Light	Notes:	Climate Zones[2]
Trees						
Western Redbud	*Cercis occidentalis*	B	20'/20'	sun	small tree or large shrub, tolerates clay, winter wet, drought, flowers stronger with frost	all but coastal
Desert Willow	*Chilopsis linearis*	B	25'/30'	sun	tolerates alkaline soil, sand, clay, seasonal flooding and drought, not coastal condition	all, but 1A-3A
Western Sycamore	*Platanus racemosa*	B	40'-80'/40'-70'	sun	tolerates sand and clay soils, seasonal flooding, needs space to grow, avoid underground water/sewer pipes	all, but 1A-3A
Coast Live Oak	*Quercus agrifolia*	B	25'-60'/40'-70'	sun - shade	tolerates drought and winter wet conditions, mature trees produce significant litter limiting understory plantings, need space to grow	all, but 1A-3A
Large Shrubs						
Toyon, Christmas Berry	*Heteromeles arbutifolia*	B	8'-20'/8'-20'	sun-pt shade	tolerates sand, clay and serpentine soils, seasonal water with good drainage	all, but 1A-3A
Pacific Wax Myrtle	*Myrica californica*	B	10'-30'/10'-30'	sun-pt shade	large shrub or small tree, tolerates coastal conditions, sand, clay and seasonal inundation	all, but 1A-3A
Western Elderberry	*Sambucus mexicana*	B	10'-30'/8'-20'	sun-pt shade	large shrub to tree, tolerates clay, seasonal flooding and drought, good wildlife food source	all, but 1A-3A
Shrubs and Subshrubs						
Coyote Brush	*Baccharis pilularis*	B	wide variation	sun	adaptable evergreen shrub, provides quick cover and bank stabilization, tolerant of coastal conditions, alkaline soil, sand, clay and seasonal wet	all, but 1A-3A
California Wild Rose	*Rosa californica*	A,B	3'-6'/spreads	sun-pt shade	tolerates a wide variety of soils, seasonal flooding and some drought, spreads aggresively, avoid edges of walkways because of thorns	all
Perennials						
Yarrow	*Achillea millefolium*	B	1'-3'/2'	sun-pt shade	tolerates alkaline soil, sand, clay, seasonal wet conditions, foot traffic and deer, will self sow	all
Beach Strawberry	*Fragaria chiloensis*	B	2-4"/spreads	sun-pt shade	vigorous spreading groundcover, tolerates sand, clay, wet conditions, prefers good drainage	all, but 1A-3A
Douglas Iris	*Iris douglasiana*	B	1.5'-3'/spreads	sun - shade	tolerates sand, clay and serpentine soils, seasonal wet (but not soggy) soils and drought	all, but 1A-3A
Hummingbird Sage	*Salvia spathacea*	B	1'-3'/4'-5'	pt sun-pt shade	low growing perennial, tolerates clay, winter wet, summer drought, prefers light shade, provides nectar for birds and insects, does well under oaks	all, but 1A-3A
Bog Sage	*Salvia uliginosa**	B	3'-6'/spreads	sun	quick growing, spreading perennial, tolerates wet to dry, cut back winter, divide rhizomes	all, but 1A-3A
Blue-eyed Grass	*Sisyrinchium bellum*	B	6"-1'/6"-1'	sun	a semi-evergreen perennial, tolerates sand, clay, seasonal wet soils and deer, dormant in summer, but can be delayed with supplemental irrigation	all, but 1A-3A
California Goldenrod	*Solidago californica*	B	1'-4'/1'-4'	sun-pt shade	tolerates poor soils, seasonal wet and drought, can spread aggressively if over irrigated	all, but 24
Grasses and Grass-like Plants						
Berkeley Sedge, Grey Sedge	*Carex divulsa**	A,B	12"-18"/12"-18"	sun-pt shade	tolerates foot traffic, some drought and boggy soils	all, but 1A-3A
California Meadow Sedge	*Carex pansa*	A,B	6"-12"/spreads	sun - shade	good lawn substitute, tolerates wide range of growing conditions, seasonal inundation, drought, foot traffic and mowing	all, but 1A-3A
Clustered Field Sedge	*Carex praegracilis*	A	1'/spreads	sun-pt shade	useful lawn substitute and bank stabilizer, good planted in masses, tolerates wide range of growing conditions, foot traffic and mowing, may look weedy when mixed with other plants	all, but 1A-3A
San Diego Sedge	*Carex spissa*	A	3'-6'/2'-5'	pt sun-shade	a large grass, tolerates alkaline soil, clay, serpentine, seasonal inundation, and deer	all, but 1A-3A
Small Cape Rush	*Chondropetalum tectorum**	A,B	2'-3'/3'-4'	sun-pt shade	A tough, attractive reed-like plant, tolerates boggy or clay soils and drought once established, Chondropetalum elephantinum is a much larger species	all, but 1A, 2A, 3A, 7
Molate Red Fescue	*Festuca rubra 'Molate'*	A,B	8"-12" /spreads	pt sun-shade	a tufted, spreading bunchgrass, good lawn substitute, provides erosion control, tolerates wet conditions, but looks best with regular water, tolerates drought once established	all
Soft Rush	*Juncus effusus*	A	2'-3'/2'-3'	sun-pt shade	tolerates poor drainage, heavy soils, needs more supplemental water than Juncus patens	all
Wire Grass, Blue Rush	*Juncus patens*	A	1'-2'/1'-2'	sun - shade	strong performance in bioretention ares, tolerates poor drainage, seasonal inundation, drought, shade	all, but 1A-3A
Canyon Prince Wild Rye	*Leymus condensatus 'Canyon Prince'*	B	2'-3'/spreads	sun-pt shade	tolerates drought, wet, but not soggy soils, looks best with supplemental irrigation, spreads by rhizomes	all, but 1A-3A
Deer Grass	*Muhlenbergia rigens*	B	4'-5'/4'-6'	sun-pt shade	a large grass, tolerates sandy and clay soils, seasonal inundation, best when cut back annually to remove old thatch	all, but 1A-3A

[1] See: **www.centralcoastlidi.org** for a photo gallery of the plants in this list.
[2] Refers to Sunset Western Garden Book Climate Zones. The Central Coast includes Zones 1A, 2A, 3A, 7, 9, and 14-24. www.sunset.com/garden/climate-zones
* Indicates non native species. Non natives are only recommended for use in urbanized settings and should not be used on sites in proximity to natura areas.

Source unless noted: Las Pilitas Nursery

Step 4: Plant Establishment and Care

Like traditional landscapes, LID planting areas require care and ongoing maintenance for optimal health. Due to the functional nature of LID landscapes and their connectivity to natural receiving water bodies, there are some differences between conventional landscape maintenance and LID maintenance.

Irrigation is an important aspect of any landscape establishment. Typically new plantings need two to three years of irrigation to become established. After that period, native plants will need little to no supplemental irrigation to survive. Plants may enter a dry season dormancy, which affects their appearance. Where this "dry look" is not desired, summer irrigation may be utilized. Systems should include a weather-based controller to avoid watering

during wet weather. Because bioretention soils are formulated to infiltrate, irrigation application rates must be properly designed to avoid overwatering and prevent potential discharges via underdrains.

Compost Mulch (1" - 2") should be applied to bioretention areas to retain moisture, prevent erosion and suppress weed growth. Reapply annually as the mulch breaks down. Use a specified compost mulch and avoid bark mulches that can float during storm events.

Fertilizer should not be used in bioretention areas. Instead, a compost top dressing or application of compost tea can be used to introduce nutrients and beneficial microorganisms to the soil. Apply compost mulch once per year in spring or fall or spray apply compost tea once per year between March and June.

Synthetic herbicides and pesticides should not be used in bioretention areas because of their potential toxicity risk to aquatic organisms. There are a variety of natural methods and products that can be used to control weeds and pests. See the technical manuals included under Additional Resources.

Plant Establishment and Care (cont.)

Source: SvR Design Company

Provide extra support to trees planted in bioretention areas, especially in high wind areas. They should be securely staked during establishment and inspected once or twice a year and following storm events. Stakes should be removed as soon as they are no longer needed to stabilize the tree (between one and two years).

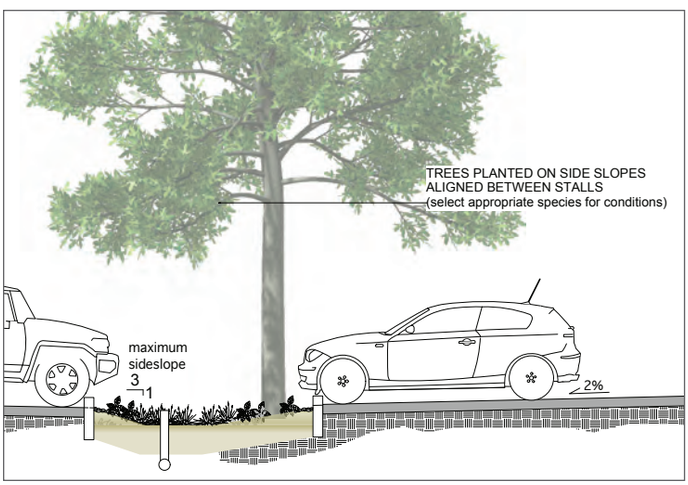
Weeds compete with plants for nutrients, water and sunlight. They should be regularly removed, with their roots, by hand pulling or with manual pincer-type weeding tools. Care should be given to avoid unnecessary compaction of soils while weeding.

Replace plants that die due to unsuitable plant conditions, disease, underwatering or other unforeseen issues. Dead and dying plants must be removed and replaced to avoid spreading disease, establishment of weeds in bare areas and reduced LID function. Before replacing with the same species, determine if another species may be better suited to the conditions.

Tree Placement Guidance

Including trees in bioretention areas provides additional aesthetic and performance benefits. Following these guidelines will maximize their success and survival:

- Provide sufficient landscape width (a rule of thumb is 8' min.)
- Locate trees on the side slopes (Zone B), not in areas that pond (Zone A). Trees improperly located, in narrow planters that pond, are unlikely to thrive and may eventually fail.
- Select trees that will tolerate seasonally wet soils.
- Do not specify trees with invasive roots.



Guidelines for Municipalities

Project managers who are preparing RFPs or bid packages for public projects that include bioretention systems should clearly define expectations for the following:

- Bioretention soil mix specification
- Guidance for plant species selection
- Appropriate plant zone placement
- Operations and maintenance protocols

To assist in defining vegetative requirements for LID projects, Central Coast municipalities may use this TAM as a reference or attachment to their project description.

Plant Nurseries

This is a partial list of Central Coast nurseries who regularly stock the plants included in this TAM.

Source: Las Pilitas Nursery

- Central Coast Wilds, Santa Cruz
  831-459-0656
  www.centralcoastwilds.com
- Last Pilitas, Santa Margarita
  805-438-5992
  www.laspilitas.com
- Native Sons, Arroyo Grande
  805-481-5996
  www.nativesonsnursery.com
- Rana Creek, Carmel Valley
  831-659-3820
  www.ranacreeknursery.com
- San Marcos Growers, Santa Barbara
  805-683-1561
  www.sanmarcosgrowers.com
- Santa Barbara Natives, Santa Barbara
  805-698-4994
  www.sbnatives.com

Additional Resources

- The Low Impact Development Manual for Southern California: Technical Guidance and Site Planning Strategies
  http://www.casqa.org/LID/tabid/186/Default.aspx
- The California Stormwater Quality Association (CASQA) BMP Handbook for New Development and Redevelopment
  http://www.cabmphandbooks.com/
- Contra Costa Clean Water Program (C3 Guidebook)
  http://www.cccleanwater.org/c3.html
- City of Santa Barbara: Storm Water BMP Guidance Manual
  http://www.santabarbaraca.gov/Resident/Major_Planning_Efforts/Storm_Water_Management_Program/

For additional resources on bioretention plant guidance:

www.centralcoastlidi.org

For questions or to contact the
Central Coast Low Impact Development Initiative:

info@centralcoastlidi.org

Central Coast Water Board

UC Davis LID Initiative

APPENDIX F

CASQA Source Control BMPs