C.3 Basic Training: Stormwater Controls for Development Projects

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San Mateo Countywide Water Pollution Prevention Program

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Outline of Presentation

- Water quality impacts of urbanization
- Regulatory background
- Types of post-construction controls
  - Source control measures
  - Site design measures
  - Treatment measures
- Hydromodification management

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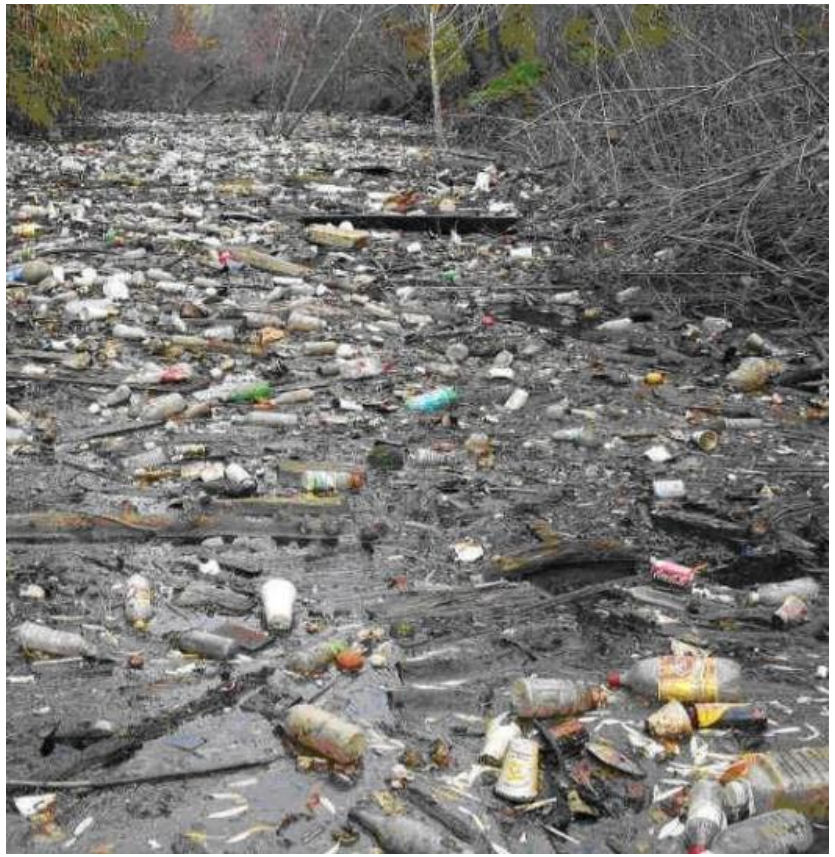
Why include stormwater controls in development projects?

- Uses of San Francisco Bay and many local creeks are impaired for numerous pollutants
- Stormwater runoff is the largest pollutant conveyance
- Stormwater discharge regulations require pollutant and flow controls



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What happens during land development?

- Natural landforms changed
- Soil moved and compacted
- Vegetation removed
- Impervious surface created
- Structures create barriers in floodplain
- Land uses generate pollutants

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The Biggest Culprit – Impervious Surface

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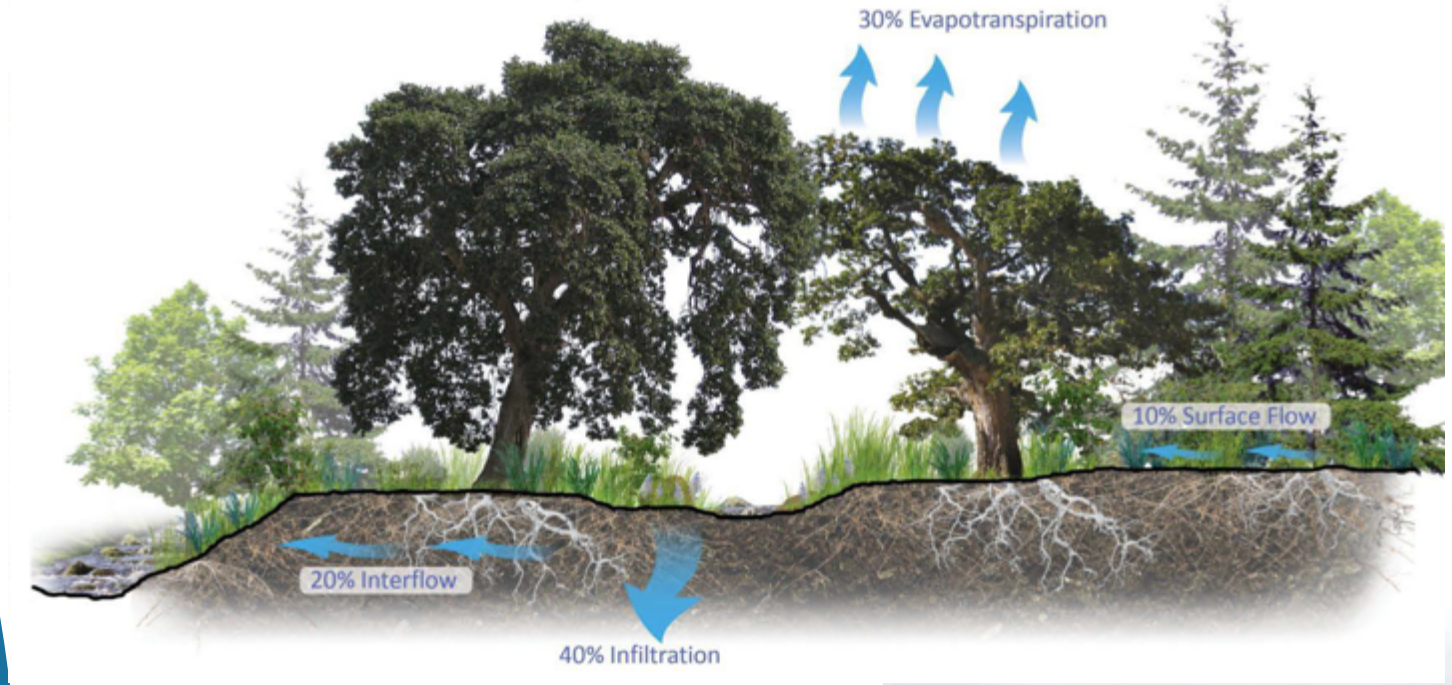
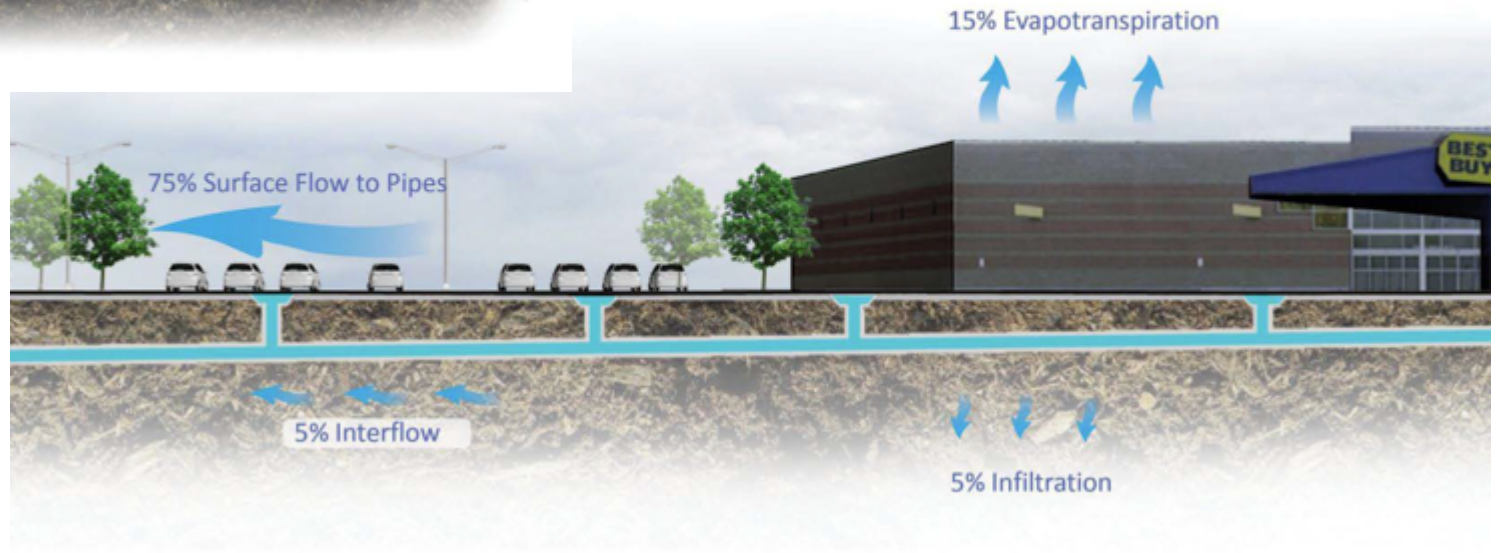
How does land development affect the hydrologic cycle?



Little runoff before development

Lots of runoff after development



How do increases in flow affect creeks?

Yerba Buena Creek – upstream reach

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Channel incision on lower Yerba Buena Creek (tributary to Lower Silver Creek and Coyote Creek)

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Regulatory Background: Municipal Stormwater Permits

- Since 1987 the federal Clean Water Act has required municipalities to obtain permits to discharge stormwater from municipal storm drain systems
- These are National Pollutant Discharge Elimination System (NPDES) Municipal Stormwater Permits
- EPA has also established construction and industrial discharge standards

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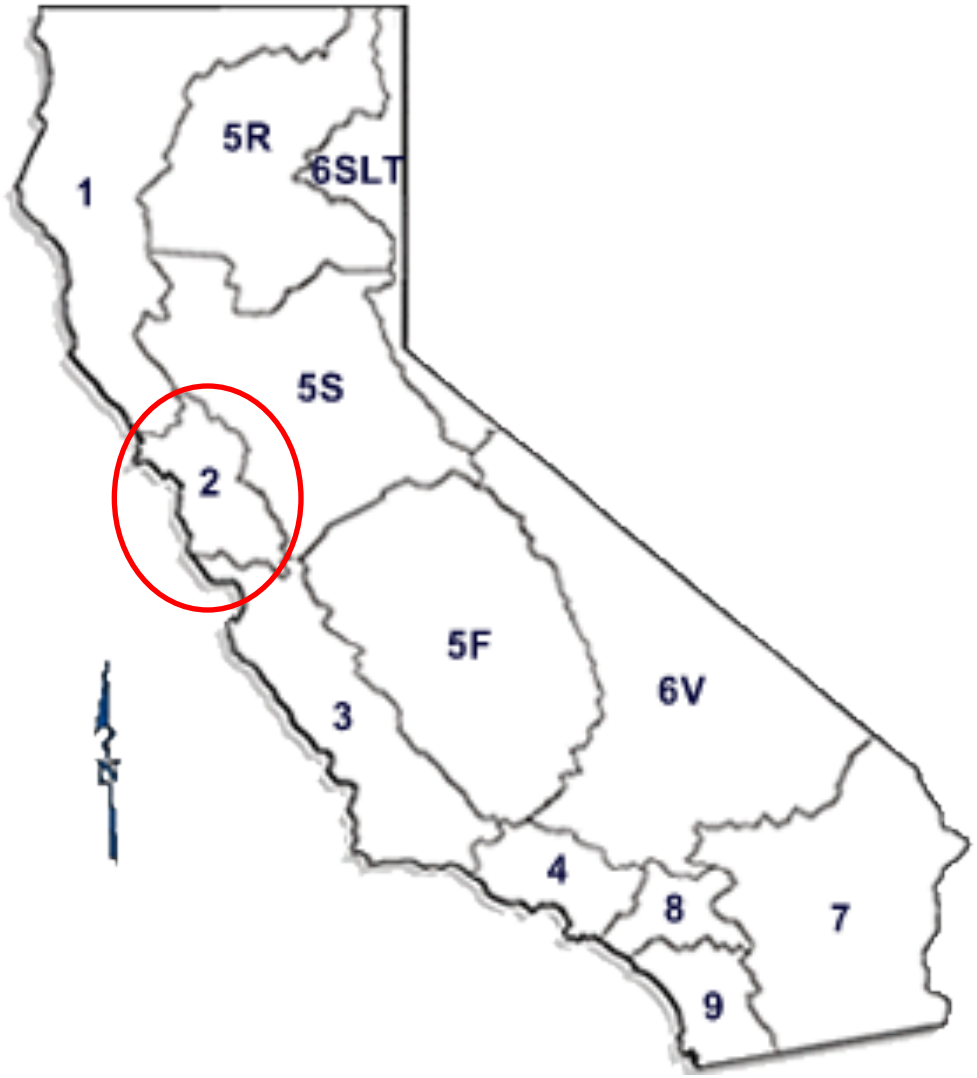
NPDES Permitting Authority



U.S. EPA

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State Water Resources Control Board

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Regional Water Quality Control Board (9 regions)

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Municipal Separate Storm Sewer System (MS4)

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Regulatory Framework for NPDES Permits in CA

- State Water Resources Control Board
  - Construction General Permit
  - Industrial General Permit
  - Municipal Phase II General Permit (Small MS4s)
- Regional Water Quality Control Boards
  - Municipal Phase I Stormwater Permits
  - Wastewater Treatment Plant Permits
  - Individual Industrial Permits

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Bay Area Municipal Regional Permit (MRP)

- One regional permit for urbanized areas (total of 79 permittees):
  - San Mateo, Santa Clara, Alameda, and Contra Costa Counties, Fairfield-Suisun, and Vallejo
- First MRP (1.0) effective 12/1/09
- Reissued MRP (2.0) effective 1/1/16
- MRP 3.0 expected effective date 7/1/21

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MRP Provisions

- Municipal Operations
- New Development and Redevelopment ("C.3")
- Industrial/Commercial Site Controls
- Illicit Discharge Controls
- Construction Site Controls
- Public Education/Outreach
- Water Quality Monitoring
- Pollutant of Concern Controls
  - Pesticides
  - Trash
  - Mercury
  - PCBs
  - Copper
- Exempted/Conditionally Exempted Non-Stormwater Discharges

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Provision C.3 Requirements

- Regulated Projects
  - Public and private
  - Projects above certain thresholds
  - Small projects
  - “Special Projects”
- Non-regulated Projects
  - Green infrastructure
  - Primarily public retrofit projects
  - More on GI in June 17th Workshop

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Regulated Project Requirements

- Must include permanent stormwater controls that are maintained for the life of the project
- Types of stormwater controls required:
  - Source control measures
  - Site design measures
  - Stormwater treatment
  - Hydromodification management

- Focus on Low Impact Development approach

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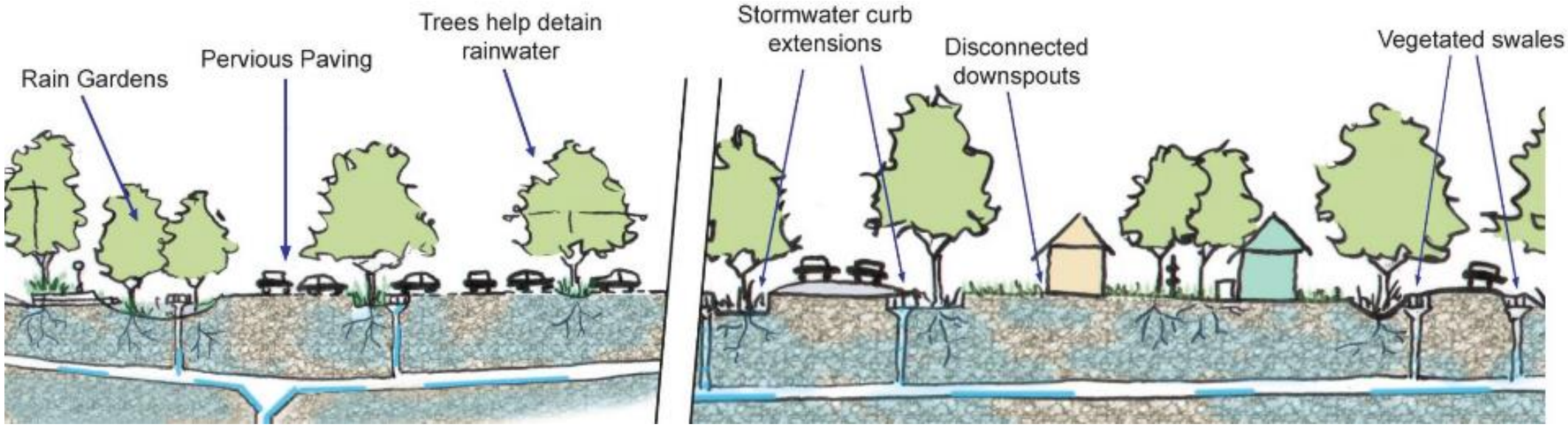
Low Impact Development (LID)

- Approach to reduce runoff and mimic a site's predevelopment hydrology:
  - Minimize disturbed areas and impervious surfaces
  - Retain and treat stormwater runoff using infiltration, evapotranspiration, rainwater harvesting/use or biotreatment



Source Control Measures

- **Structural Source Controls** are permanent design features that reduce pollutant sources
  - Covered trash enclosures
  - Storm drain labeling
  - Drought-tolerant native plants
- **Operational Source Controls** are practices to be conducted on an ongoing basis after construction is completed
  - Street sweeping
  - Catch basin cleaning
  - Reduced pesticide use

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Site Design Measures

- Permanent design features that:
  - Reduce impervious surfaces
  - Disconnect impervious surfaces
  - Preserve/protect natural features
- Examples include:
  - Runoff directed to landscaping
  - Pervious pavement

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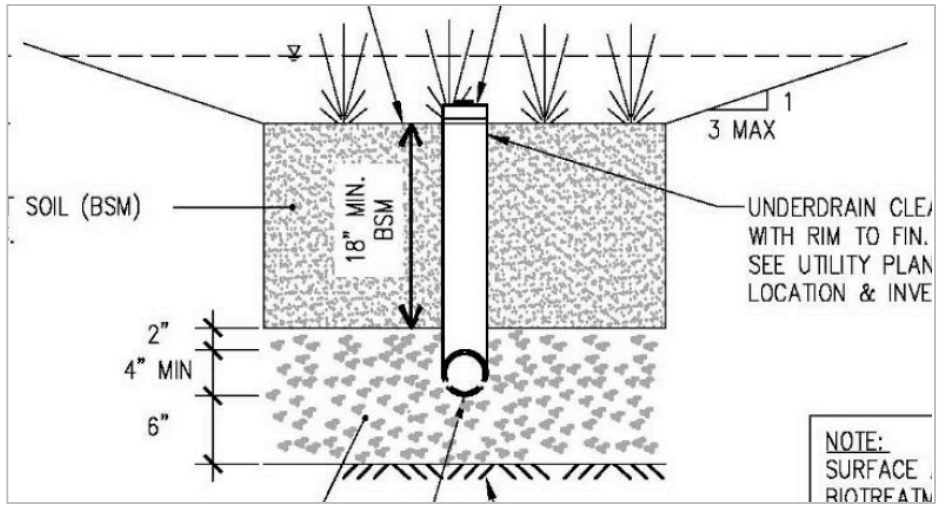
Treatment Measures



- Engineered systems that remove pollutants from stormwater
- Sized to treat stormwater runoff from **frequent, small storm events**
- Provision C.3.d of the MRP specifies numeric sizing criteria for water quality design
- Maintenance agreement required

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How Much Runoff Must Be Treated?

- Must treat 100% of project but not 100% of runoff
- Focus on frequent, small storms
- Water quality design criteria*:
  - 80% of average annual runoff (for volume-based treatment measures)
  - Flow of runoff from a rain event of 0.2 inches per hour intensity (flow-based treatment measure)

* "C.3.d amount of runoff" OR "water quality design volume/flow"

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LID Treatment Requirements

- LID treatment methods required since 12/1/11
- LID treatment defined as:
  - Infiltration
  - Evapotranspiration
  - Rainwater harvesting/use
  - Biotreatment
- Non-LID treatment only allowed in certain cases

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Stormwater Treatment Measures
(required for "Regulated Projects")

- Required for projects that create and/or replace ≥ 10,000 sq. ft. of impervious surface
- Required for following types of projects that create and/or replace ≥ 5,000 sq. ft. of impervious surface
  - Restaurants
  - Retail gasoline outlets
  - Auto service facilities
  - Parking lots

Other C.3 Regulated Projects

- Road and trail projects that create and/or replace 10,000 sq. ft. of contiguous impervious surface
  - New roads, and sidewalks and bike lanes built as part of new roads
  - Widening of existing roads with traffic lane(s)
  - Trails >10 feet wide or < 50 feet from creek bank

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The following are NOT Regulated Projects
(do not require treatment):

- Detached single family home
- Roadway reconstruction within same footprint
- Road widening that does not add a travel lane
- Sidewalks and bike lanes along existing roads
- Impervious trails <10’ wide and >50’ from creek
- Sidewalks, bike lanes and trails that drain to vegetated areas or are constructed of pervious paving
- Interior remodels
- Routine maintenance and repair
- Pavement resurfacing within existing footprint

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Small Project and Single Family Home Requirements

- **Single family homes** (>2,500 sq. ft. of impervious area) and **small projects** (between 2,500 and 10,000 sq. ft. of impervious area) must implement at least 1 of 6 site design measures:
  - Direct roof runoff into cisterns or rain barrels
  - Direct roof runoff onto vegetated areas
  - Direct sidewalk and patio runoff onto vegetated areas
  - Direct driveway and parking lot runoff onto vegetated areas
  - Construct sidewalks and patios with pervious surfaces
  - Construct bike lanes, driveways, and parking lots with pervious surfaces

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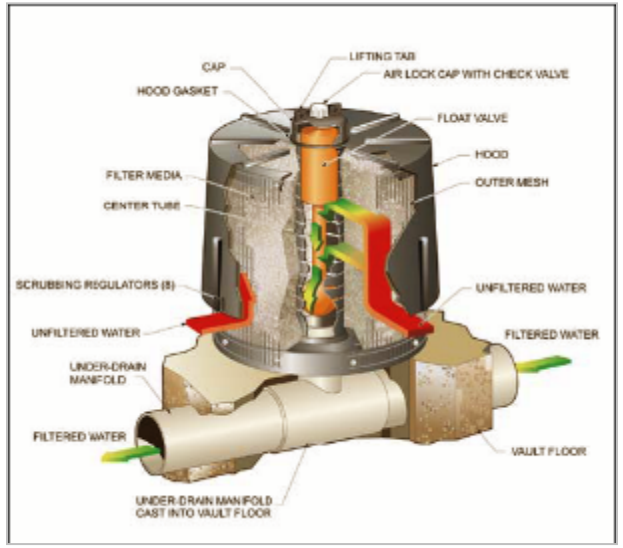
Types of Stormwater Treatment Measures

- LID Treatment Measures (required since 12/1/11)
  - Infiltration
  - Evapotranspiration
  - Rainwater harvesting/use
  - Biotreatment

- Non-LID Treatment Measures
  - High rate media filters and tree well filters
  - Allowed only for “Special Projects”



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“Special Projects”

- Special Projects are high density and transit oriented development projects that may receive LID treatment reduction credit, i.e., allowed limited use of “non-LID” treatment measures
- Amount of credit based on size of project, lot coverage, location, density, and amount of surface parking
- Non-LID measures are limited to tree box filters and media filters

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Biotreatment Measures

- Most Common
  - Bioretention areas/rain gardens
  - Linear bioretention areas
  - Flow-through planters

Bioretention Area in Burlingame

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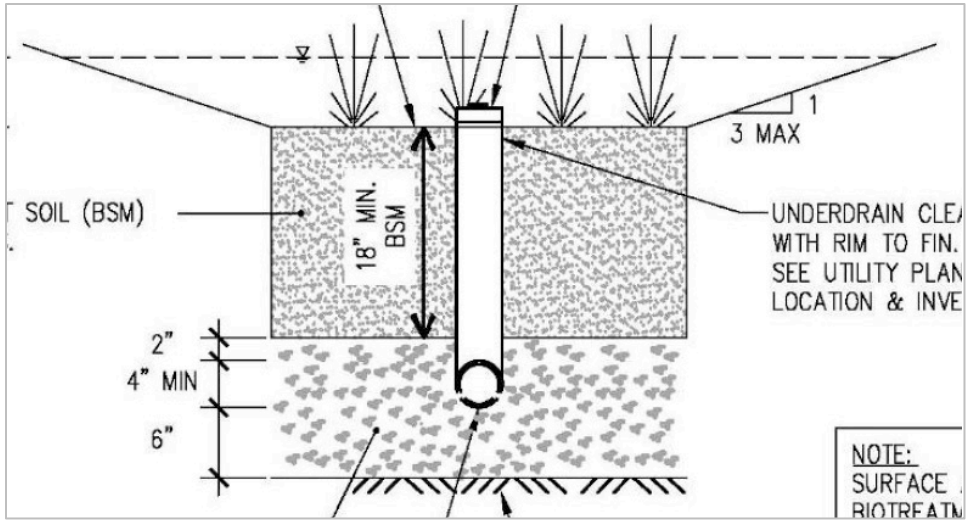
Bioretention Area/Rain Garden



- Concave landscaped area of any shape, with sloped sides
- Engineered biotreatment soil mix with specified long term infiltration rate (5 in/hr)
- Underdrain required if clayey underlying soils
- Raise underdrain to maximize infiltration, if conditions allow

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Bioretention Areas

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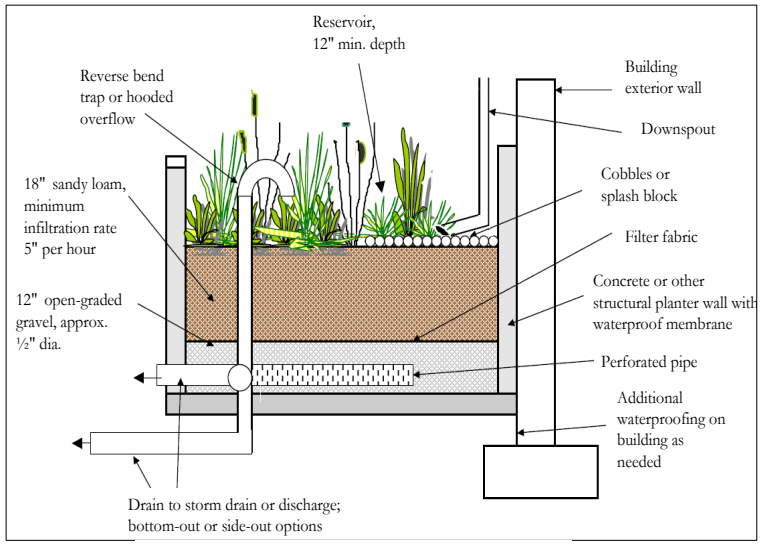
Flow-through Planter



Source: Dan Cloak Environmental Consulting, 2010, with modifications

- Lined planter box with vertical sides
- No infiltration to underlying soils
- Stormwater filters through specified biotreatment soil mix and released through underdrain
- OK to place next to building or on podium if waterproofed

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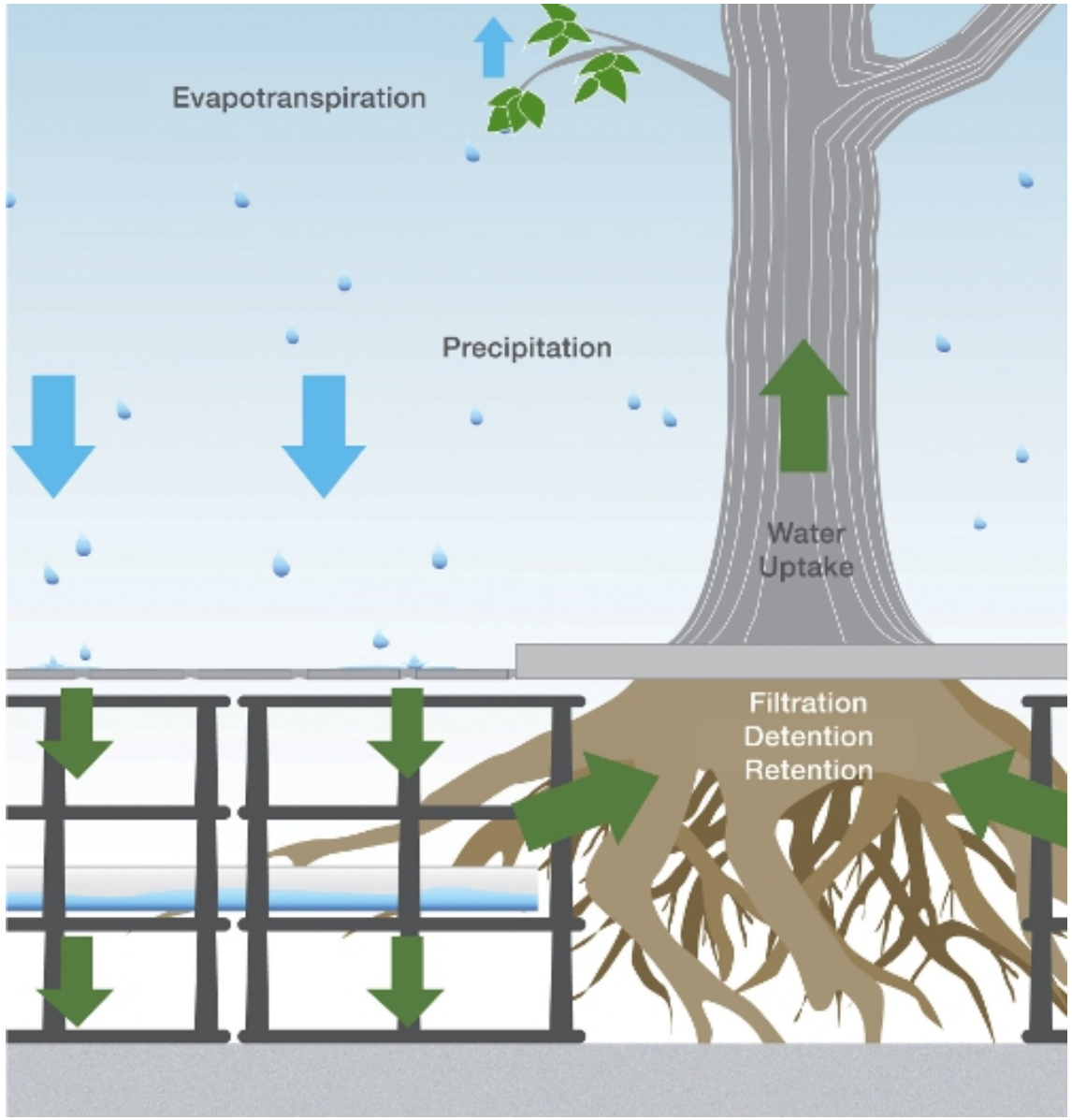
Biotreatment in Tree Trench



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Rainwater Harvesting and Use

- Captured stormwater used for non-potable uses, such as:
  - Toilet flushing
  - Irrigation

Cisterns installed underground

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Rainwater Harvesting

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Infiltration Trench

- Store water in void space of rocks, allowing it to infiltrate to surrounding soils
- Requires well-draining soils

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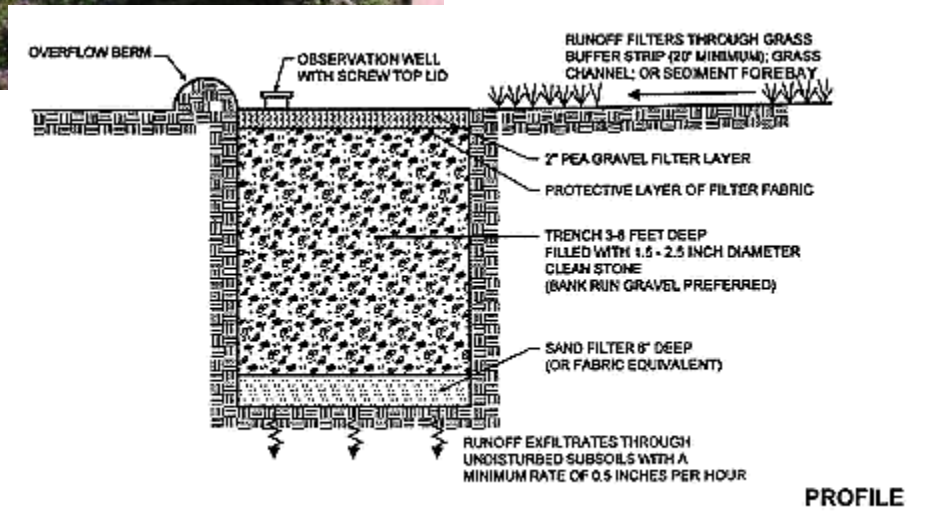
Infiltration Trenches



A schematic of an infiltration trench (Source: MDE, 2000)

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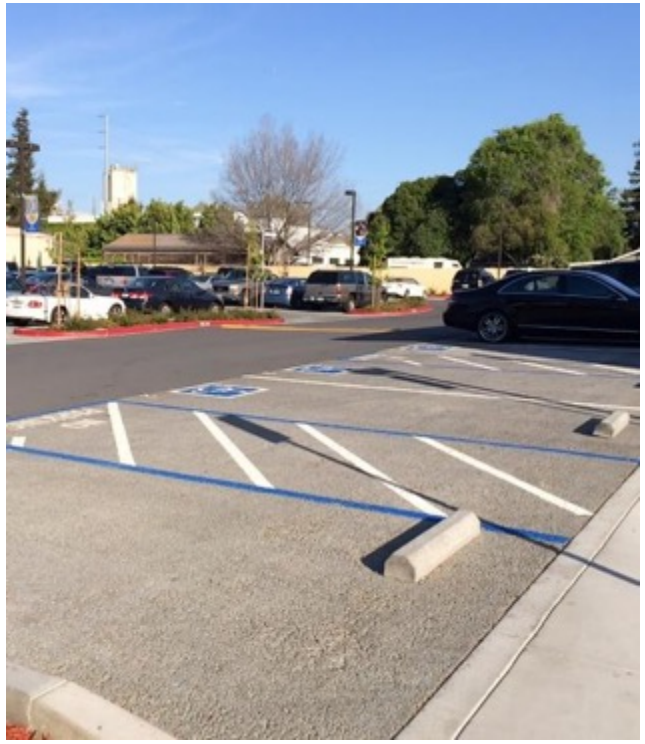
Pervious Pavement



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Green Roofs

- Green roofs are site design measures that remove runoff largely through plant evapotranspiration processes
- Planting media needs to be sufficiently deep to:
  - Provide capacity within the pore space of the media for the water quality design volume (typically < 3”)
  - Support the long term health of the vegetation selected for the green roof, as specified by a landscape architect or other

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Green Roofs

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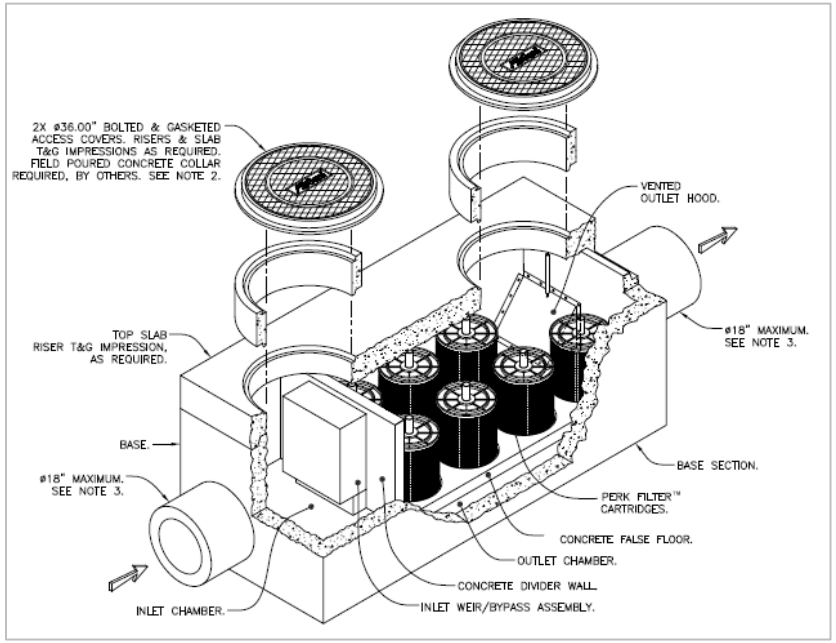
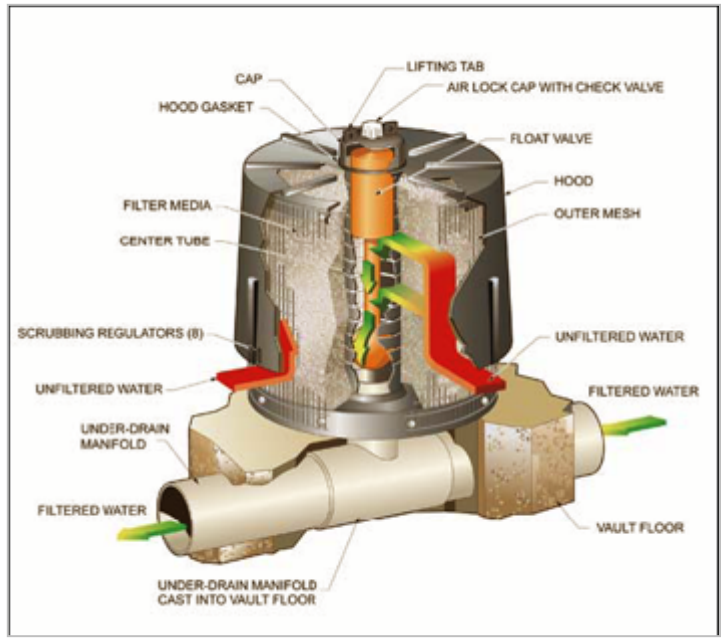
Non-LID: Media Filters

(Limited use ONLY in "Special Projects")



- Media cartridges installed in manholes or in vaults
- Vaults designed to allow settling of large particles before water enters the filter

- Fine particles are filtered by filter media (example cartridge to right)



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Non-LID Tree Well Filters

(Limited use ONLY in "Special Projects")

Example of a Manufactured Tree Well Filter

- Manufactured tree well filter with proprietary planting media
- Planting media has extremely high infiltration rate (50-100 in/hr)
- Unit now available with biotreatment soil to meet LID requirements (but treats smaller area).

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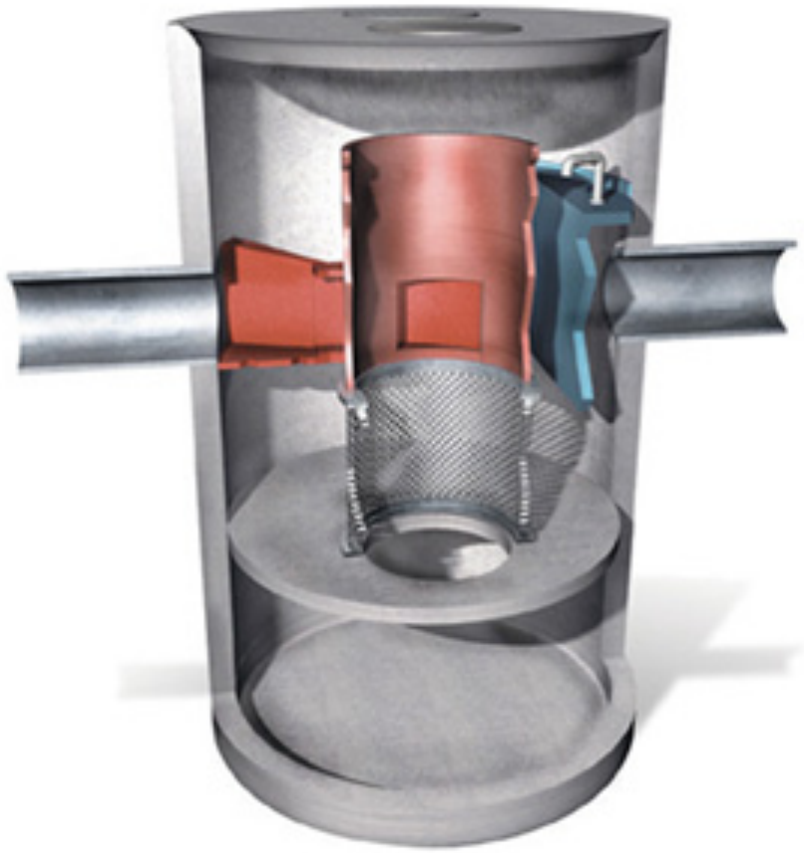
Non-LID: Hydrodynamic Separators

(NOT a stand-alone treatment measure)



- Vault system
- Settling or separation unit to remove sediments
- Effective for trash and large particles
- Not designed to remove finer particles

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Non-LID: Vegetated Swale

(NOT a stand-alone treatment measure)

- Linear, shallow, vegetated channel
- Filters stormwater as it flows through dense vegetation on the surface
- Relatively short detention time prior to discharge into storm drain inlet
- Not as effective as a linear bioretention system

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Non-LID: Detention Basin

(NOT a stand-alone treatment measure)

- Basin with specially designed outlet to detain stormwater for at least 48 hours
- Used to be allowed to treat stormwater by settling out solids/sediments
- OK if used for storage upstream of LID measure or hydromodification control.

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Hydromodification Management

- **Purpose:** Reduce erosive flows in creeks.
- **Goal:** Match post-project runoff rates, volumes and durations to pre-project condition for a range of storms.

- Required for projects that:
  - Create/replace 1 acre or more of impervious area,
  - Increase impervious area over pre-project condition, AND
  - Drain to creeks susceptible to erosion.

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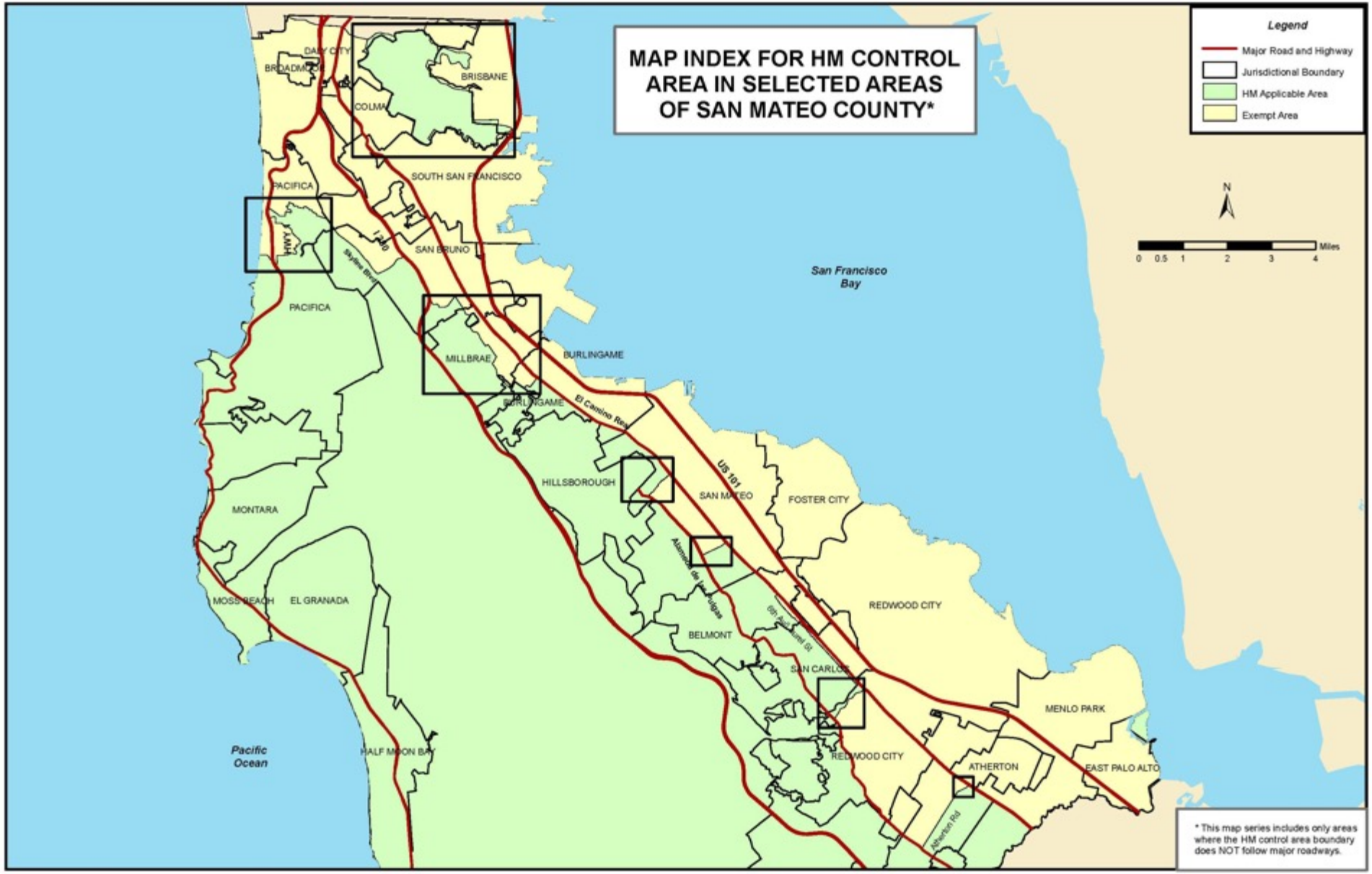
Areas Susceptible to HM Shown in Green



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Hydromodification Management Control Measures

- Hydrologic source controls
  - Site design measures to reduce imperviousness
  - LID treatment measures
- Flow duration controls
  - Pond, detention basin, tank or vault
  - Specialized outlet to control rate and duration of flow

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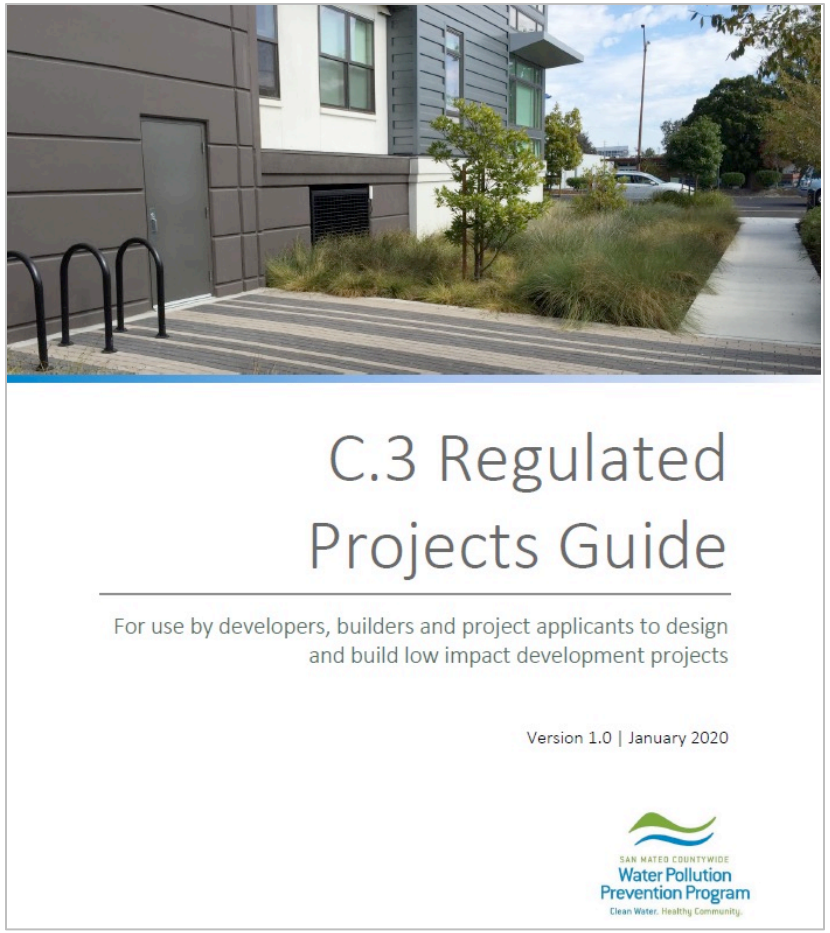
For More Information:

- SMCWPPP C.3 Regulated Projects Guide (February 2020) https://www.flowstobay.org/preventing-stormwater-pollution/with-new-redevelopment/c-3-regulated-projects/



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For More Information:

- C3-C6 Regulated Projects Checklist
- Biotreatment Soil Mix
  - Supplier List
  - Compliance Statement
  - Verification Checklist
- C.3 Sizing Worksheets
  - Volume Based Criteria
  - Combination Based Criteria
- Flyers & Fact Sheets

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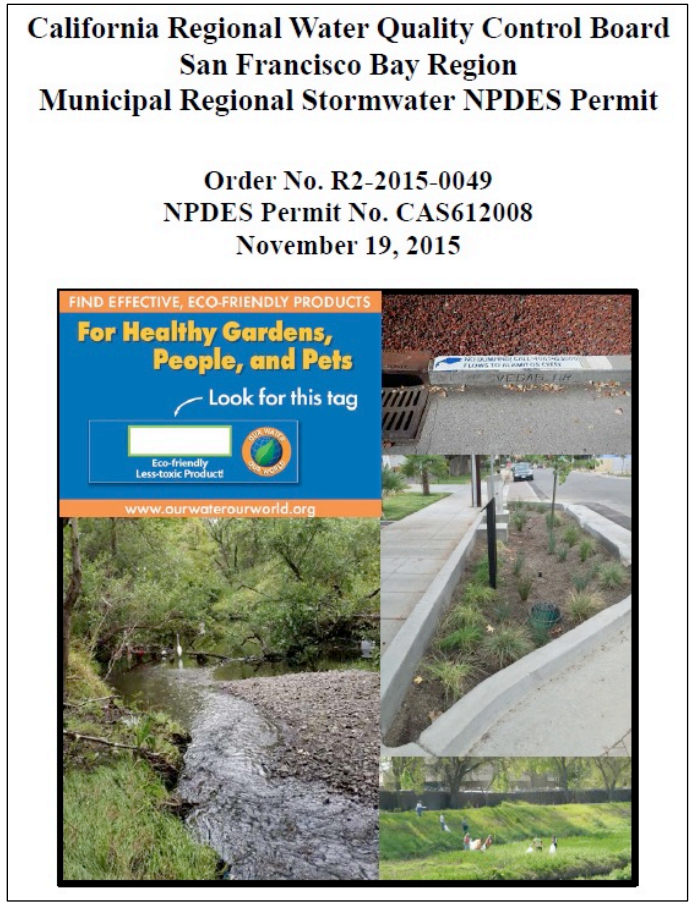
For More Information:

- Municipal Regional Stormwater Permit
  http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/stormwater/Municipal/R2-2015-0049.pdf

  (Google “SF Bay Municipal Regional Permit”)



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