



C.3 Basic Training: Stormwater Controls for Development Projects

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SCVURPPP

Santa Clara Valley Urban Runoff Pollution Prevention Program

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Outline of Presentation

- Water quality impacts of urbanization
- Regulatory background
- Current stormwater control measure requirements
- Low Impact Development (LID) approach
- LID and non-LID control measure types and applications
- Green infrastructure requirements

Water Quality Impacts of Urbanization



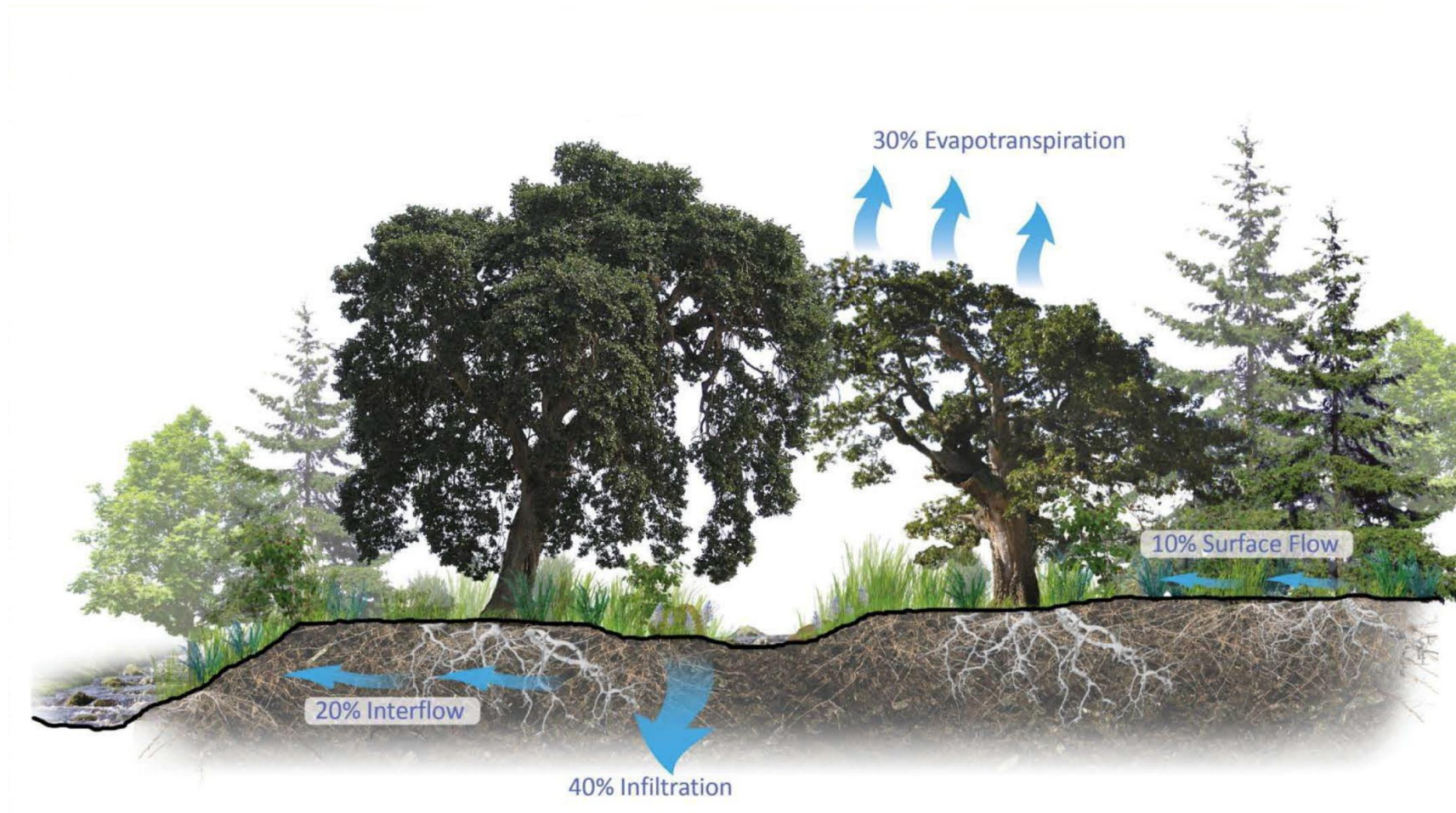
- Uses of San Francisco Bay and many local creeks are impaired by numerous pollutants
- Stormwater runoff is the largest pollutant conveyance
- Stormwater discharge regulations require pollutant and flow controls

What Happens During Land Development?

- Natural landforms changed
- Soil moved and compacted
- Vegetation and topsoil removed
- Erosion of soil
- Chemicals used in construction
- Impervious surface created
- Natural drainage patterns are changed
- Land uses generate pollutants

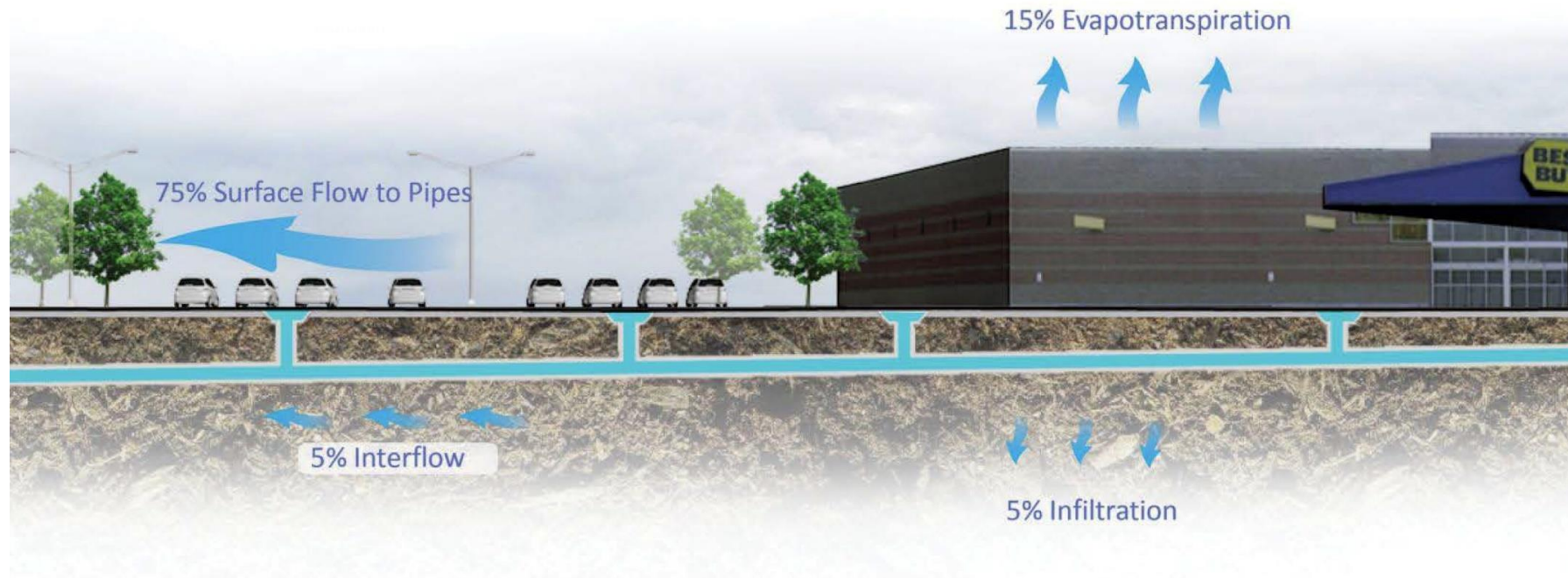


How Does Urban Development Affect the Hydrologic Cycle?



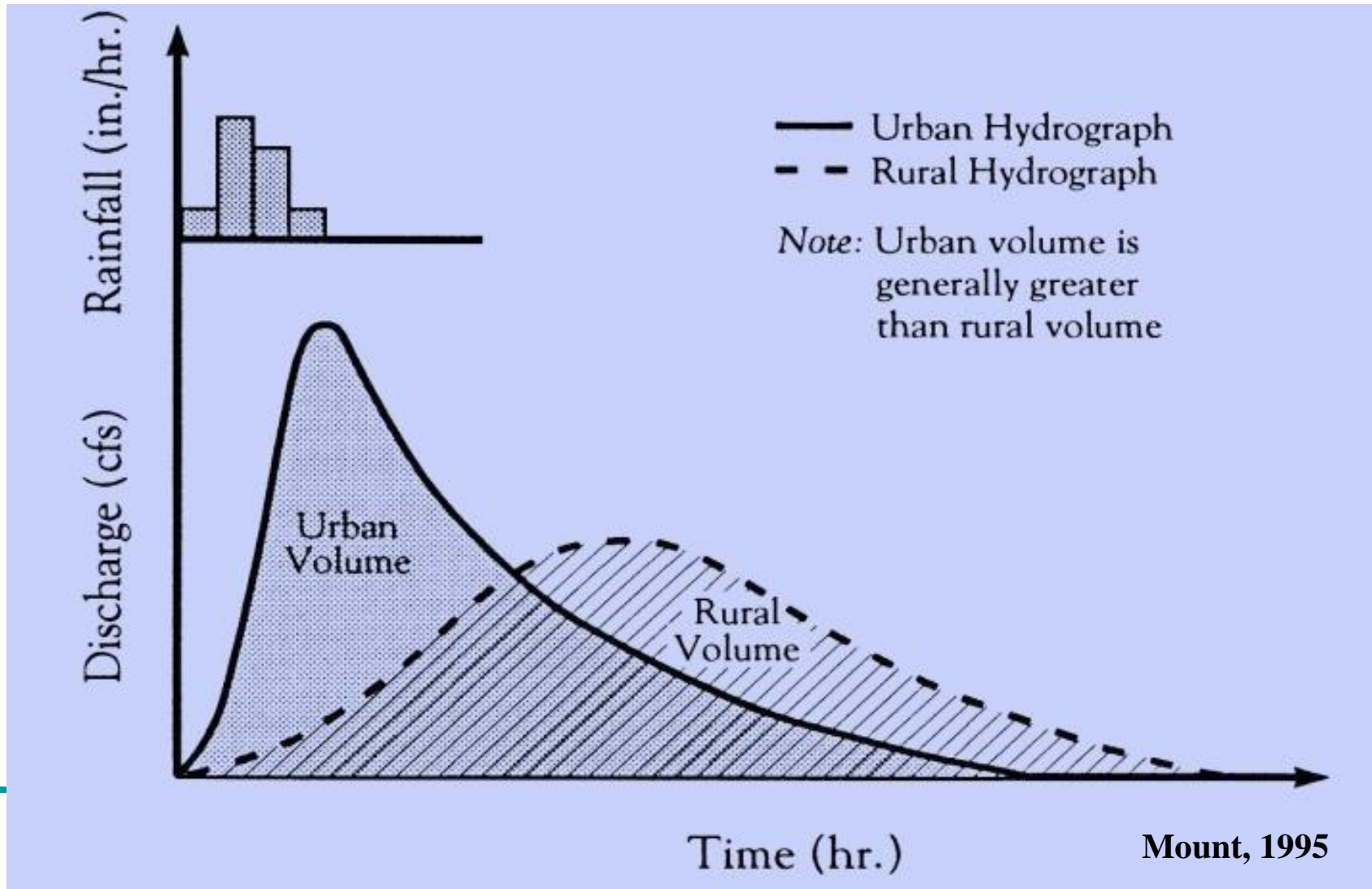
Pre-Urban Development

How Does Urban Development Affect the Hydrologic Cycle?



Urban Development

Urbanization Increases Volume and Peak Flows



How Do Increases in Flow Affect Creeks?



Yerba Buena Creek – upstream reach

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





Lower Silver Creek
(Erosion undermining outfall protection structure on left bank)



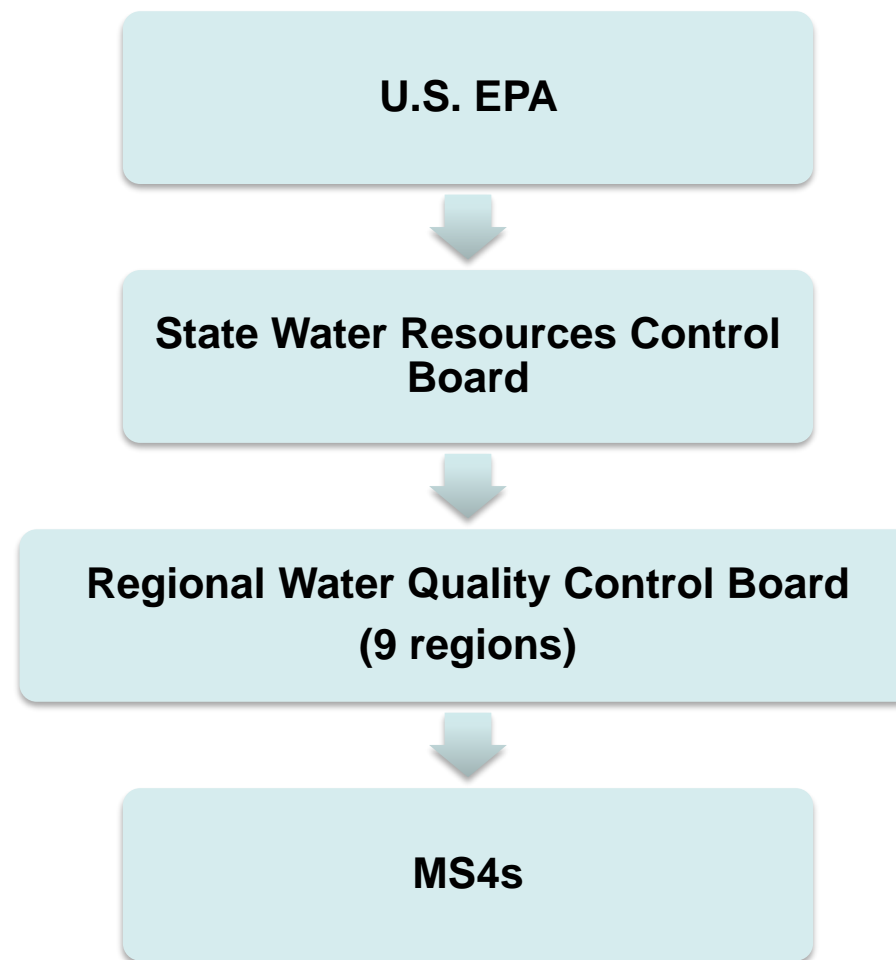
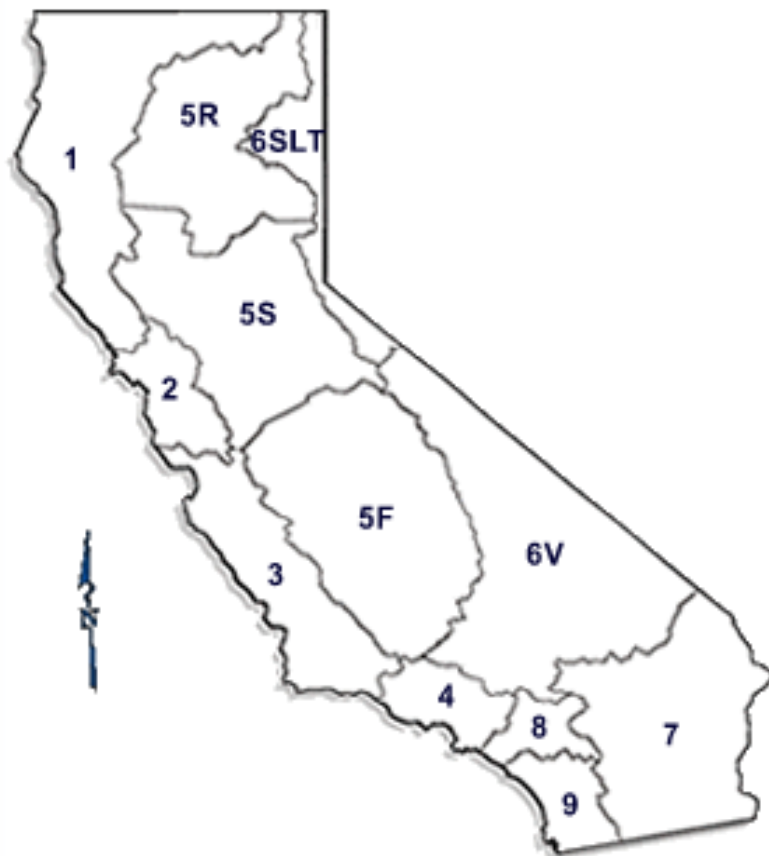
Concrete Lining with Floodwall in Lower Matadero Creek

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
- Phase I permits are for large “municipal separate storm sewer systems” in urban areas (MS4s)
- Phase II permits are for small MS4s and non-traditional permittees that discharge to MS4s



NPDES Permitting Authority



MS4 = Municipal separate storm sewer system

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)
 - Caltrans Statewide Permit
- Regional Water Quality Control Boards
 - Municipal Phase I Stormwater Permits
 - Wastewater Treatment Plant Permits
 - Individual Industrial Permits
 - Permit Enforcement within Region

Bay Area Municipal Regional Permit (MRP)

- Regional Phase I stormwater NPDES permit for urban areas (79 permittees):
 - San Mateo, Santa Clara, Alameda, and Contra Costa Counties, Fairfield-Suisun, and Vallejo
- “MRP 1.0” adopted in 2009
- Reissued “MRP 2.0” in 2016
- Third reissuance “MRP 3.0” adopted May 11, 2022, and effective July 1, 2022 with Provision C.3 effective July 1, 2023



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
- Unsheltered Homeless Populations
- Cost Reporting
- Asset Management

Stormwater Control Measures: Construction-phase vs. Post-construction



Construction best management practice (BMP) is temporary (construction-phase only)



Post-construction stormwater control measure is permanent (for the life of the project)

Provision C.3 Regulated Project Overview

- Regulated project categories
 - Parcel-based public and private development projects (includes frontage)
 - Roads, trails, and pavement projects
- Threshold criteria
 - Impervious surface created and/or replaced (and contiguous or cumulative)
 - Depth of pavement work (at surface or below)
 - Type of pavement surface (soil, gravel, asphalt etc.)
 - Stand-alone or part of a larger plan of development
- Non-regulated project categories
 - Projects below thresholds, non-regulated types or maintenance activities

The Following Categories are NOT Regulated Projects (Do Not Require Treatment):

- Small and medium-sized detached single-family homes that are not part of a larger plan of development
- Impervious trails less than 10' wide and/or greater than 50' from creek;
- Sidewalks, bike lanes and trails that drain to vegetated areas or made of pervious pavement
- Interior remodels (e.g., tenant improvement projects)
- Routine surface-level maintenance (e.g., slurry seal or striping work)

Small Project Requirements

- Non-regulated single-family homes and small projects must implement at least one of six 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

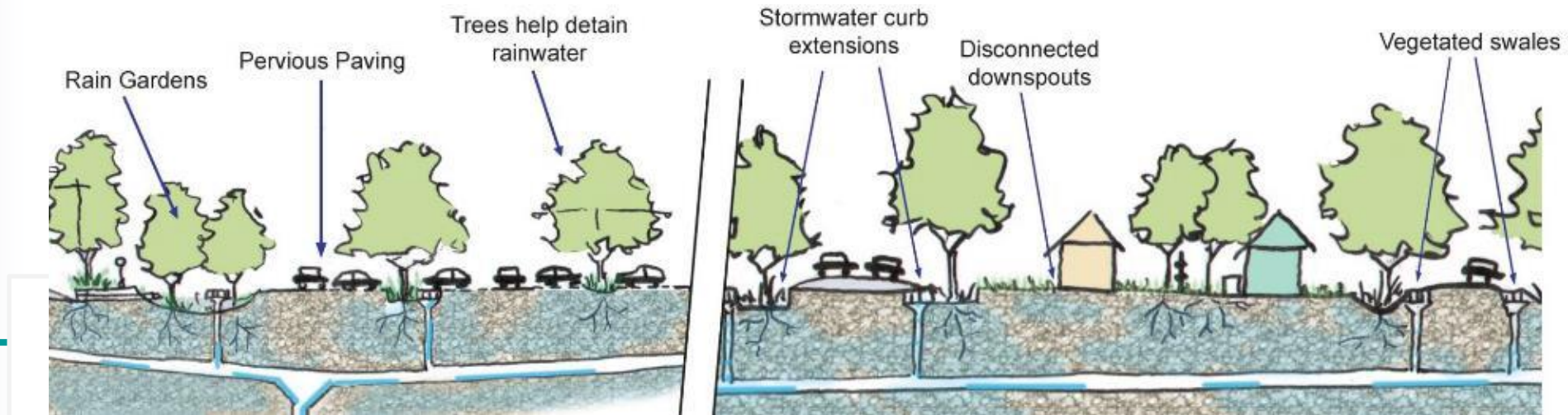
Regulated Project Requirements

- 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



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



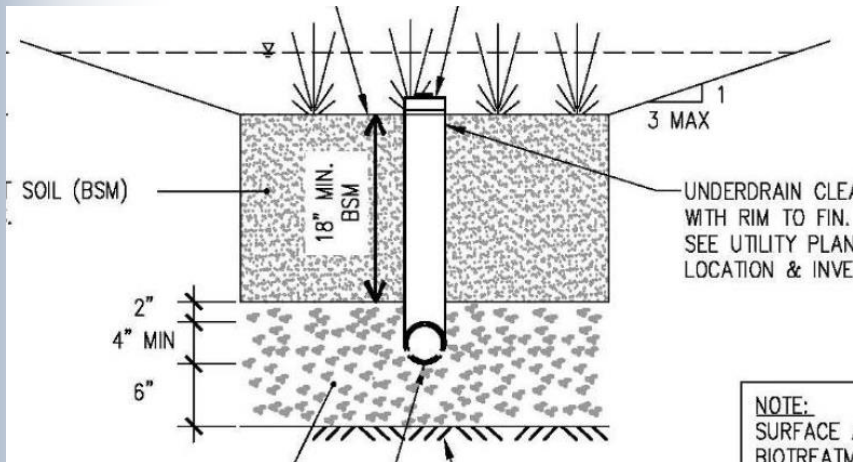
- **Structural Source Controls** are permanent design features that reduce pollutant sources:
 - Covered trash enclosures
 - Storm drain labeling
 - Installing Bay-Friendly landscaping with reduced pesticide, fertilizer & water needs
- **Operational Source Controls** are practices to be conducted on an ongoing basis after construction is completed
 - Street sweeping
 - Catch basin cleaning
 - Landscape maintained by a Green Gardener

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



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 based on flow and/or volume
- Maintenance assurance required for life of project

How Much Runoff Must Be Treated?



- Must treat 100% of project area but not 100% of runoff
- Focus on frequent, small storm events
- 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 (for flow-based treatment measures)

LID Treatment Requirements

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

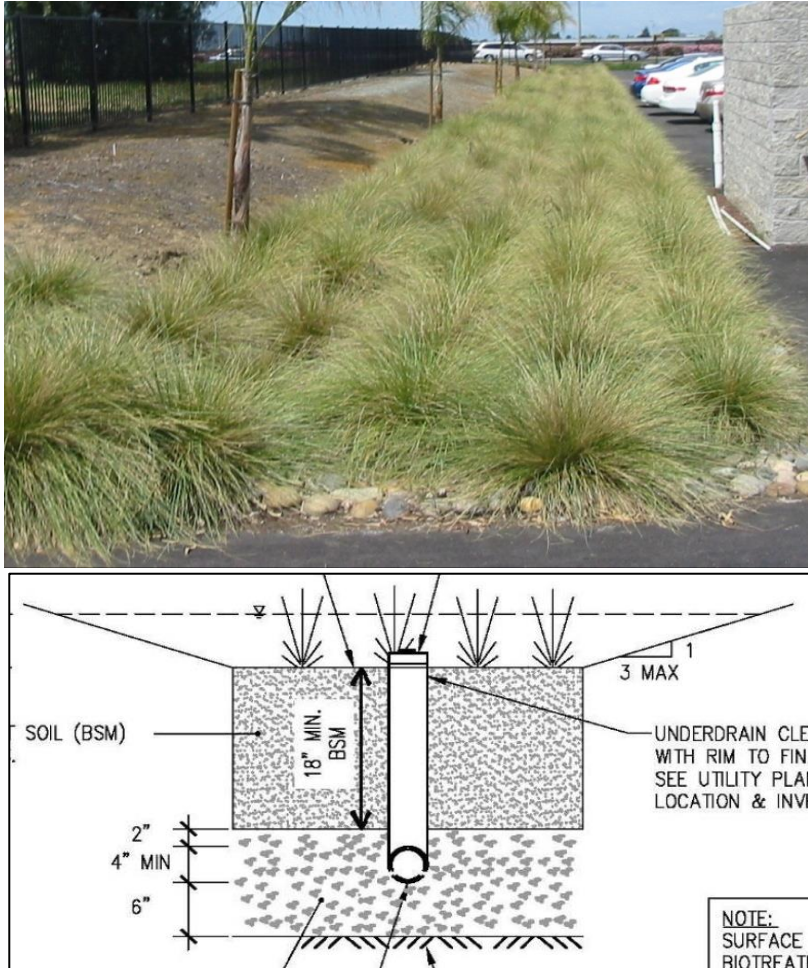


Biotreatment Measures

- Most common treatment measures:
 - Bioretention areas/rain gardens
 - Linear bioretention areas (aka stormwater planters or “bioswales”)
 - Flow-through planters



Bioretention Area/Rain Garden



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

Bioretention Areas

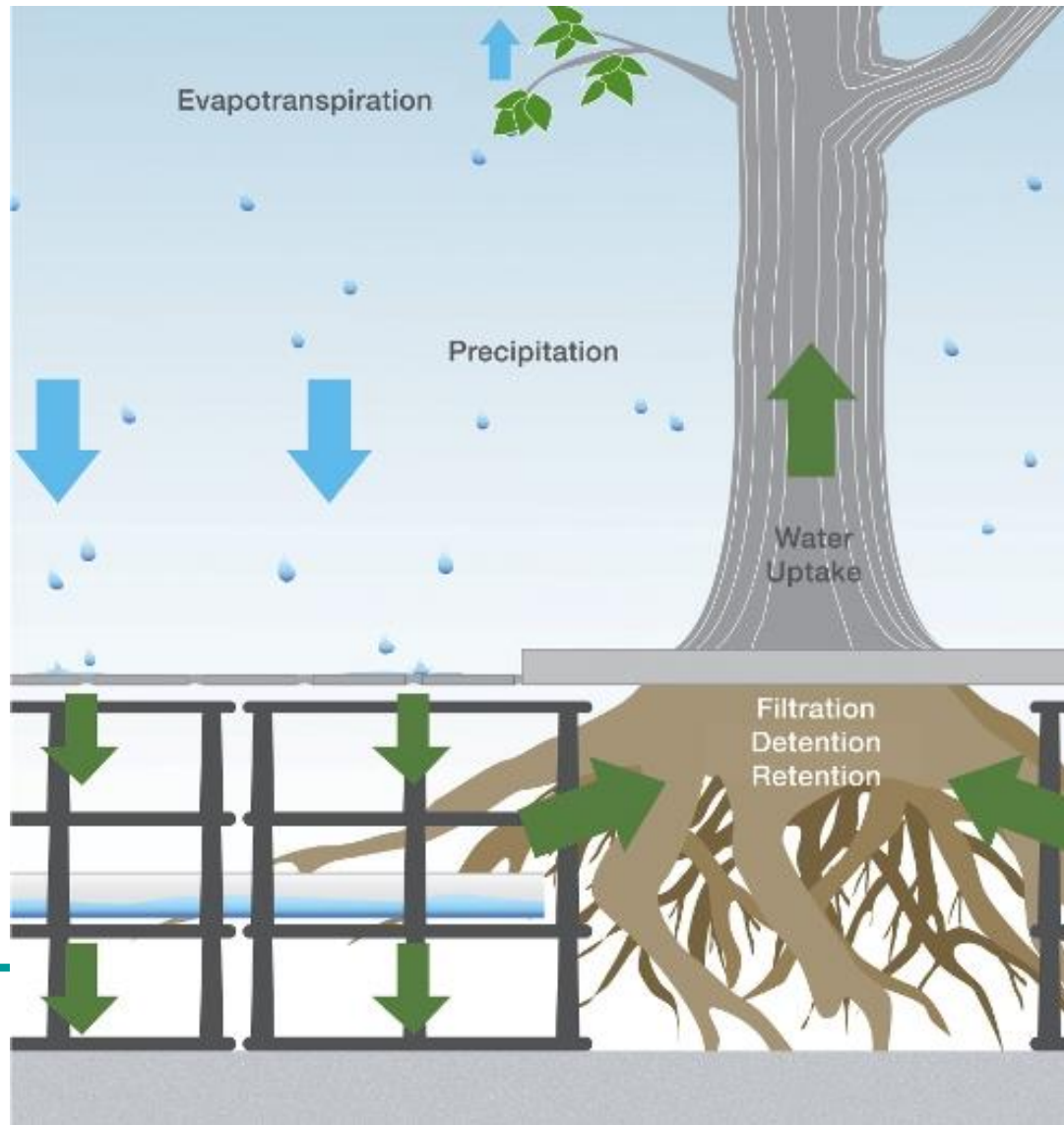


Flow-through Planter



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

Biotreatment in Tree Trench



Rainwater Harvesting and Use

- Stored stormwater used for non-potable uses, such as toilet flushing and irrigation



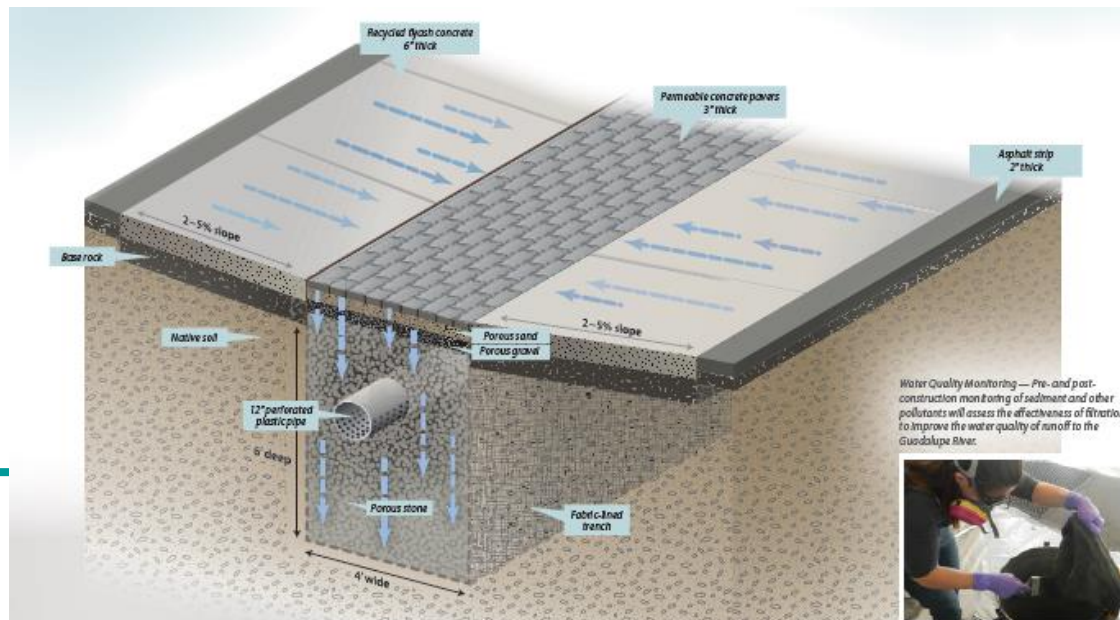
Cisterns installed underground

Rainwater Harvesting and Use



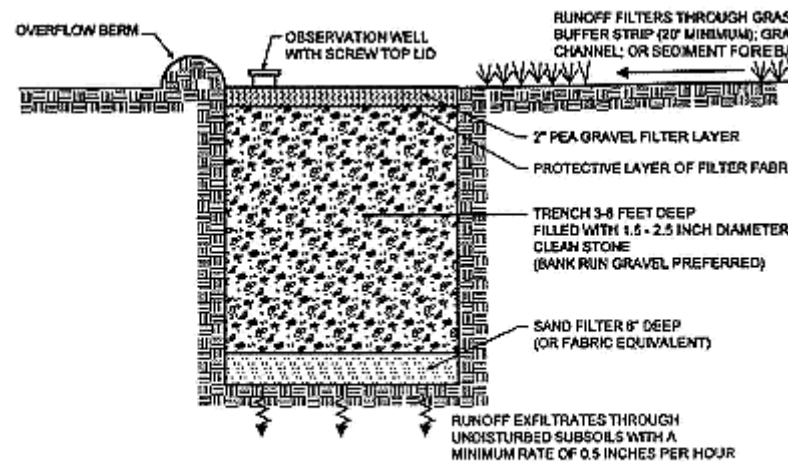
Infiltration Trench

- Store water in void space of drain rock, allowing it to infiltrate to native soils
- Requires well-draining soils (>0.5 in/hr)



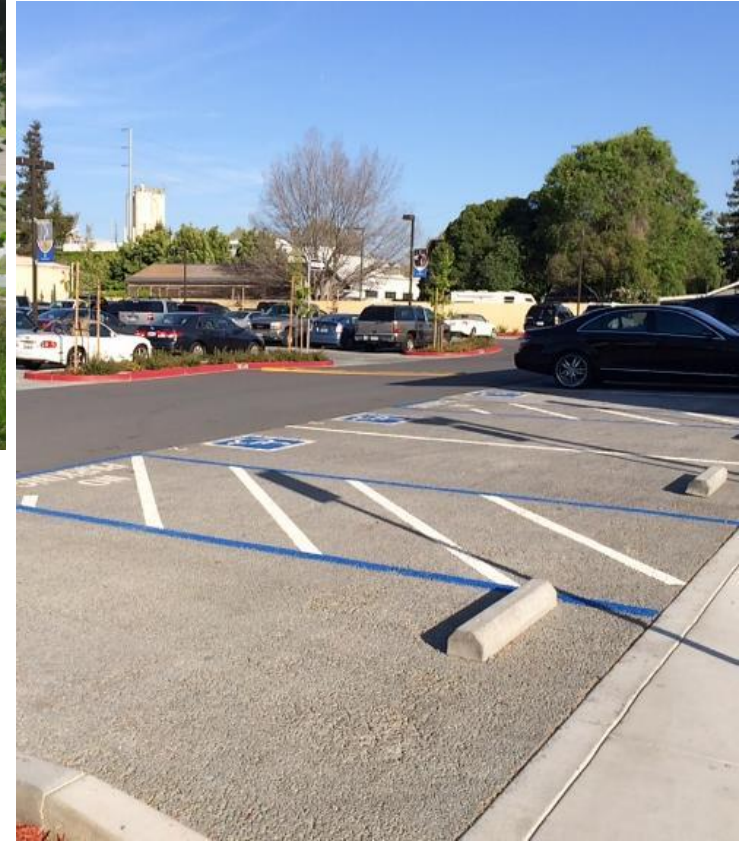
Martha Gardens Green
Alleys Project,
City of San José

Infiltration Trenches



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

Pervious Pavement



Green Roofs

- Green roofs are considered 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 professional



Green Roofs



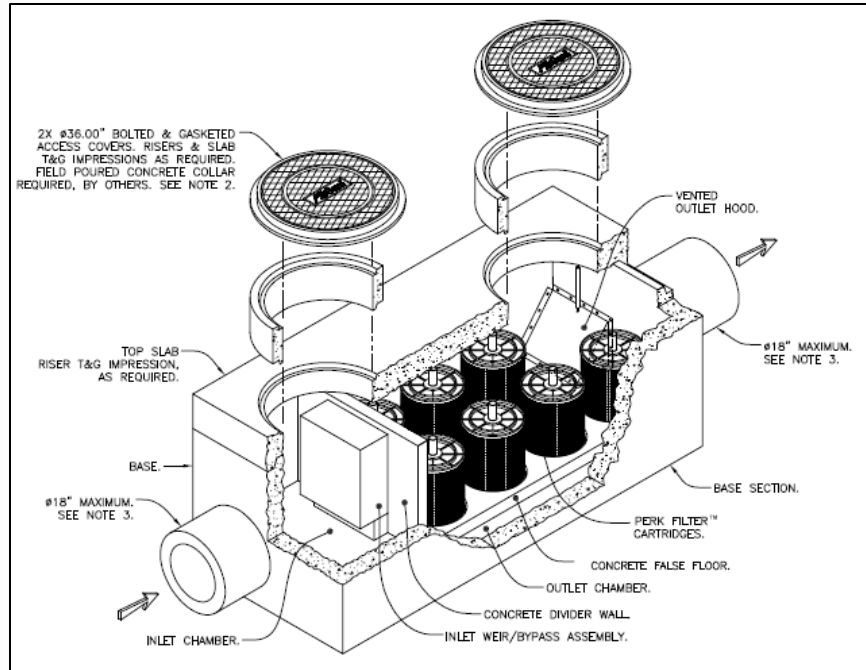
“Special Projects”

- Under MRP 2.0, 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. In MRP 3.0 Affordable Housing is being added.
- Amount of credit is based on size of project, lot coverage, location, density, and amount of surface parking, and now, affordable housing criteria.
- Non-LID measures are currently limited to tree box filters and media filters



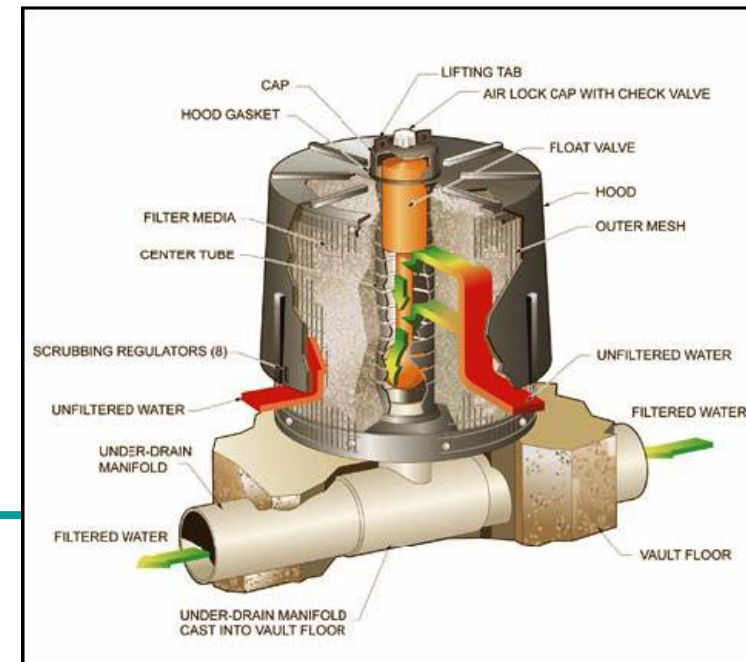
Non-LID: Media Filters

(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 (see example cartridge at right)



Non-LID Tree Well Filters

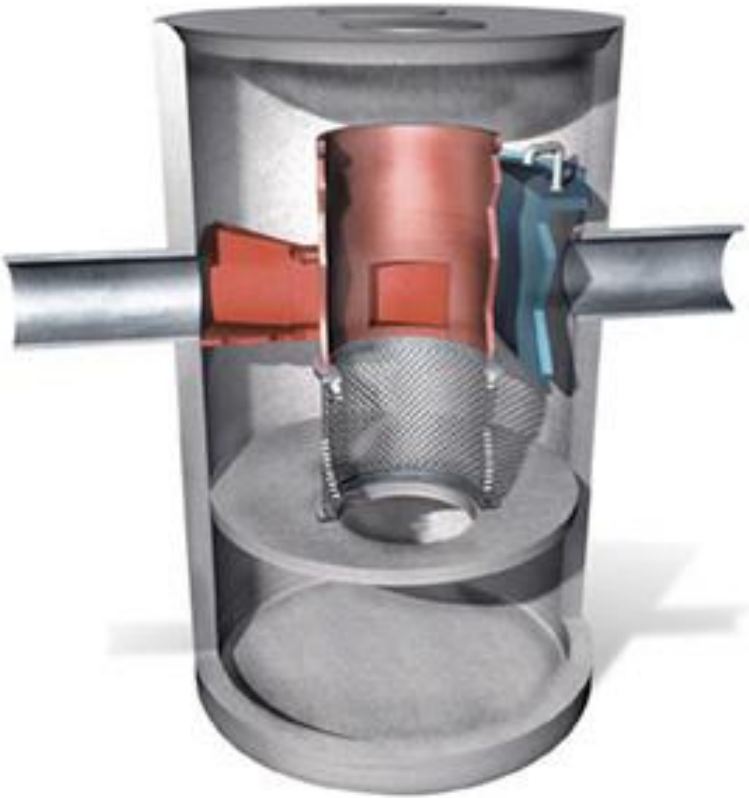
(Limited use ONLY in “Special Projects”)



- 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).

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

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

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

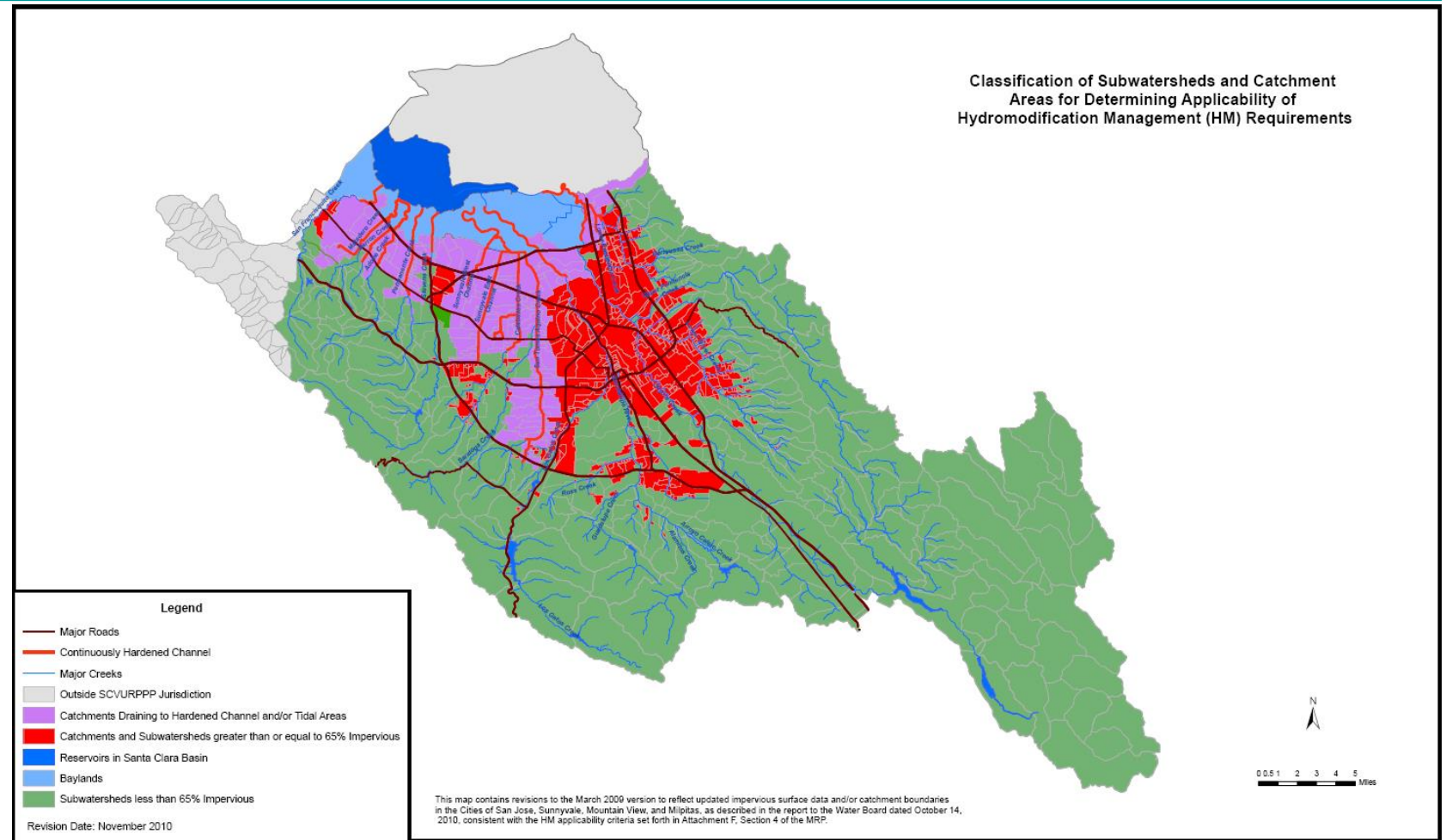
Hydromodification Management

- 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 of more of impervious area
 - Increase impervious area over pre-project condition, AND
 - Drain to creeks susceptible to erosion



HM Applicability Map for Santa Clara Valley

- Applicable areas (with creeks susceptible to erosion) shown in green
- See SCVURPPP website for county-wide and permittee-specific maps



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



What is Green Stormwater Infrastructure?

- Systems that use vegetation, soils, and natural processes to manage stormwater, integrated into urban streetscapes, parking lots and other urban areas



Green Stormwater Infrastructure (GSI)

- Over the long term, municipalities are required to retrofit existing public streets, roofs, and parking lots to divert runoff to:
 - Vegetated areas
 - Pervious pavement
 - Biotreatment and infiltration facilities
- These measures supplement current requirements for LID on regulated projects



Green Stormwater Infrastructure Benefits

- GSI projects can achieve multiple benefits:
 - Flow reduction
 - Pollutant reduction
 - Urban greening
 - Traffic calming
 - Improved bike and pedestrian safety
 - Climate benefits
 - Flood resiliency
- Promoting benefits helps get public support



Overview of GSI Requirements

- Implement new C.3.j requirements that took effect on 7/1/2022
 - Construct required amount of GSI (“greened acres”) by end of permit term
- Continue to implement the GSI Plan (completed in 2019)
 - Prioritize and map planned and potential projects
 - Update related municipal plans
 - Evaluate funding options
 - Track progress
- Continue to conduct GSI education and outreach
- Continue to avoid GSI “missed opportunities”
 - Construct previously indicated “planned and funded” projects with GSI
 - Review new public projects and assess opportunities for incorporating GSI

For More Information:

- SCVURPPP New and Redevelopment Resources Webpage
<https://scvurppp.org/newdev/>
- SCVURPPP C.3 Stormwater Handbook
<https://scvurppp.org/2016/06/20/c-3-stormwater-handbook-june-2016/>
- SCVURPPP GSI Handbook
<https://scvurppp.org/swrp/gsi/>
- SCVURPPP Stormwater Treatment Measure Data Portal
<https://scvurppp.org/gsi/>
- Municipal Regional Stormwater Permit (MRP 3.0)
www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/stormwater/MRP/mrp5-22/R2-2022-0018.pdf

Questions?

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