C3 Annual Workshop
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Basic Training: Stormwater Controls for Development Projects

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Santa Clara Valley Urban Runoff Pollution Prevention Program

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Outline of Presentation

- Water quality impacts of urbanization
- Regulatory background
- Stormwater control measure requirements
- Low Impact Development (LID) approach
- LID measure types and applications
- Green Stormwater Infrastructure (GSI) requirements and examples

Water Quality Impacts of Urbanization

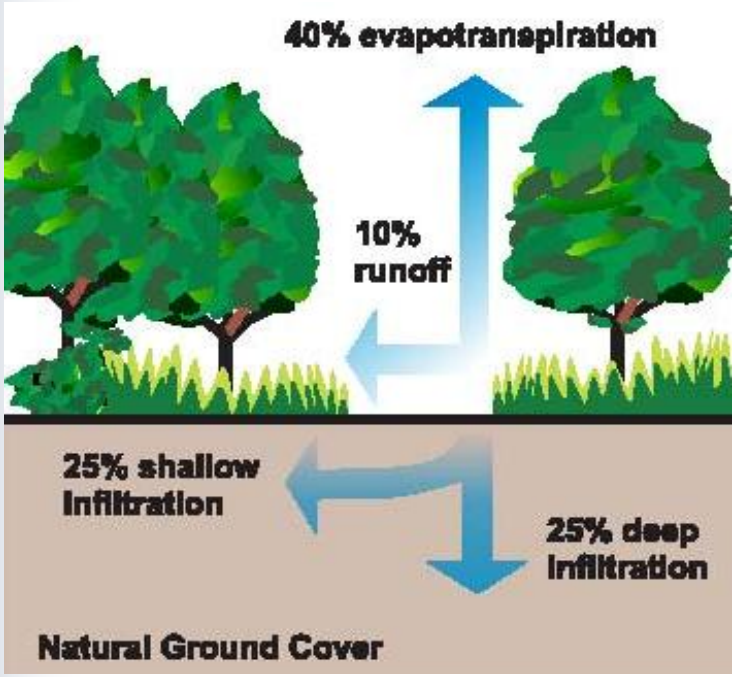
- Uses of San Francisco Bay and many local creeks are impaired by numerous pollutants
- Stormwater runoff is the largest pollutant conveyance
- Stormwater discharge regulations require pollutant and flow controls

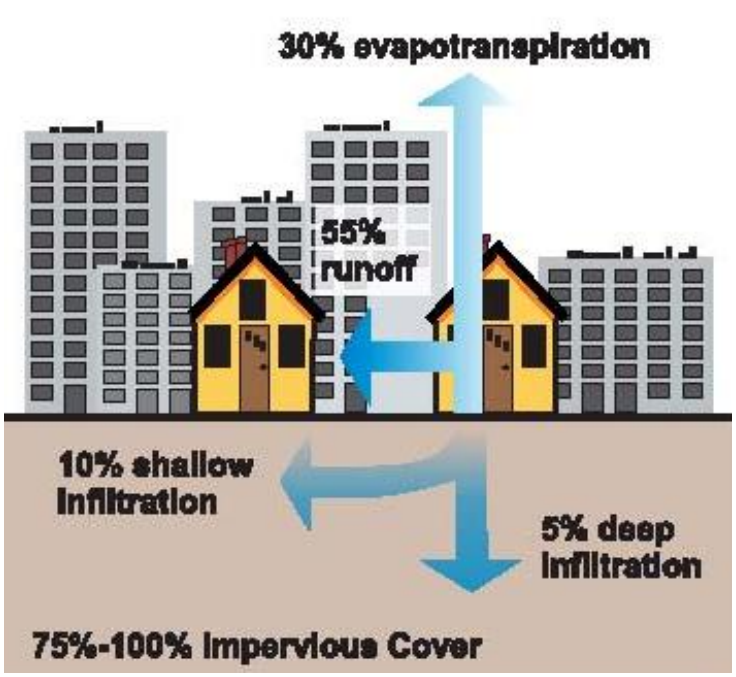
What happens during urban development?

- Natural land forms changed
- Soil moved and compacted
- Vegetation removed
- Impervious surface created
- Natural drainage patterns are changed
- Land uses generate pollutants

Biggest Culprit is Impervious Surface

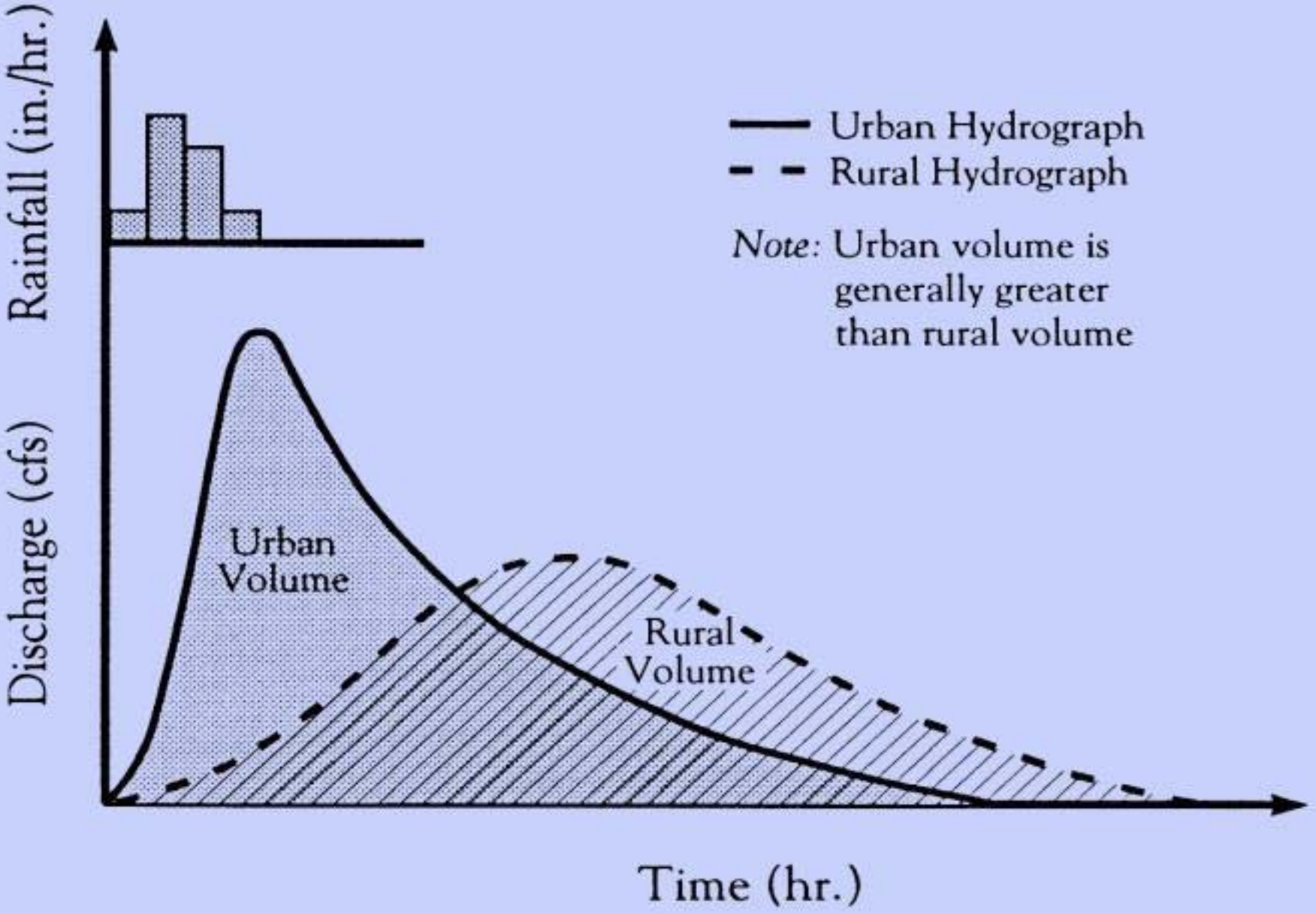
How does urban development affect the hydrologic cycle?





Little runoff before development

Lots of runoff after development



Urbanization Increase Peak Flow in Creeks

Mount, 1995

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)

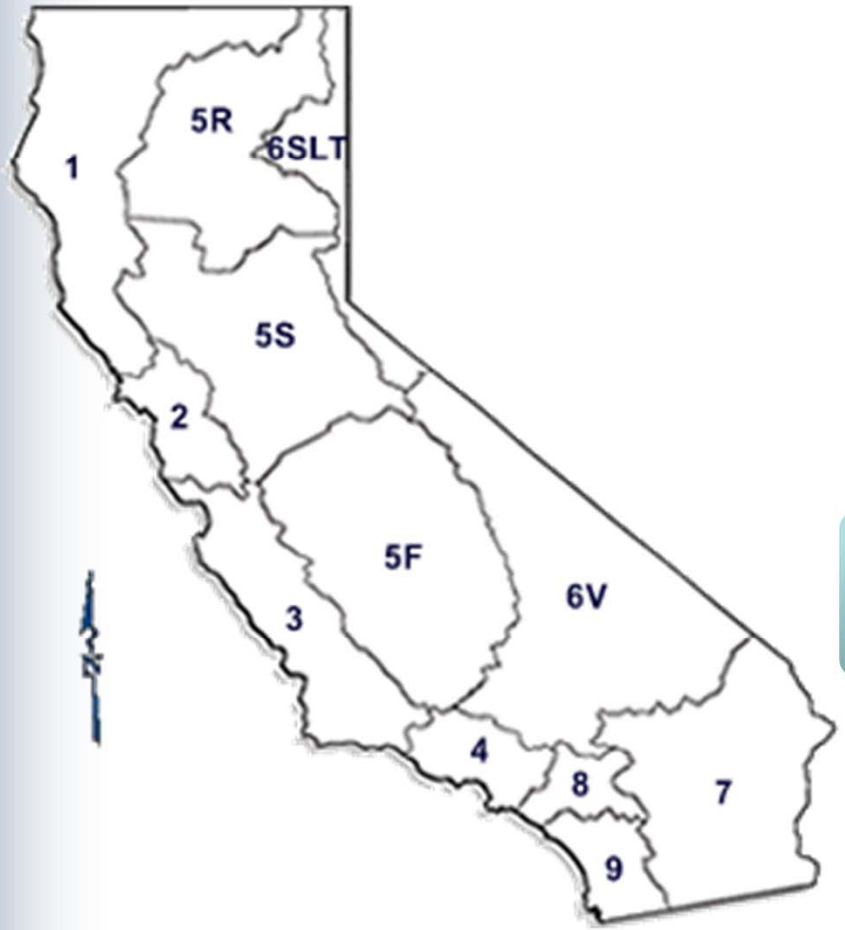
Lower Silver Creek
(Erosion undermining outfall protection structure on left bank)

Concrete Lined Channel 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
- EPA has also established construction and industrial discharge standards

NPDES Permitting Authority



U.S. EPA

State Water Resources Control Board

Regional Water Quality Control Board (9 regions)

MS4s

MS4 = Municipal separate storm sewer system

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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

Bay Area Municipal Regional Permit (MRP)

- One regional permit for urbanized areas (total of 76 permittees):
  - San Mateo, Santa Clara, Alameda, and Contra Costa Counties, Fairfield-Suisun, and Vallejo
- Current MRP effective 1/1/16 - 12/31/20
- Key requirements:
  - Low Impact Development (LID); Green Infrastructure
  - Monitoring and control measures for pollutants of concern: Trash, Mercury, PCBs, Pesticides

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

Provision C.3 Requirements

- Regulated Projects
  - Public and private projects that create and/or replace > 10,000 sq.ft. of impervious surface
  - 5,000 sq.ft. threshold for certain land uses (parking lots, gas stations/automotive, restaurants)
- Non-regulated Projects
  - Retrofit projects done on a “voluntary” basis; i.e., “green stormwater infrastructure” (GSI) projects on public property and in public rights-of-way

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

NOT C.3 Regulated Projects

- 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 made of permeable paving;
- Interior remodels;
- Routine maintenance and repair;
- Pavement resurfacing within existing footprint.

Small Projects and Single Family Home Requirements

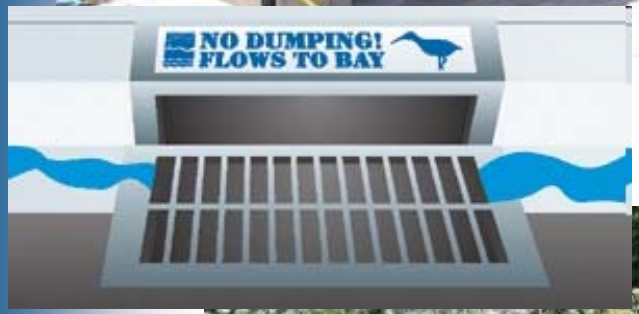
- Single family homes (>2,500 sq. ft. of impervious area) and small projects (between 2,500 and 10,000 sq. ft. of impervious area) must implement one of six site design measures:
  - Direct roof runoff into cisterns or rain barrels
  - Direct roof runoff onto vegetated areas
  - Direct sidewalk and patio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

Source Control Measures

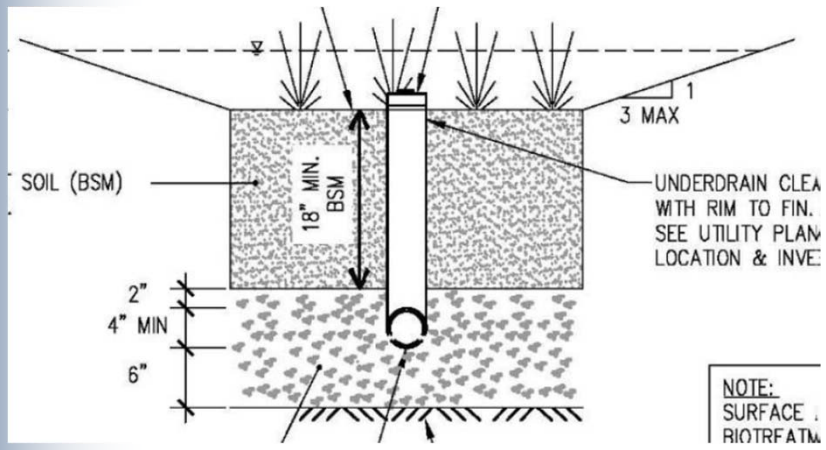


- **Structural Source Controls** are permanent design features that reduce pollutant sources
  - Covered trash enclosures
  - Storm drain labeling
  - Drought-tolerant native plants
- **Operational Source Controls** are practices to be conducted on an ongoing basis after construction is completed
  -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

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



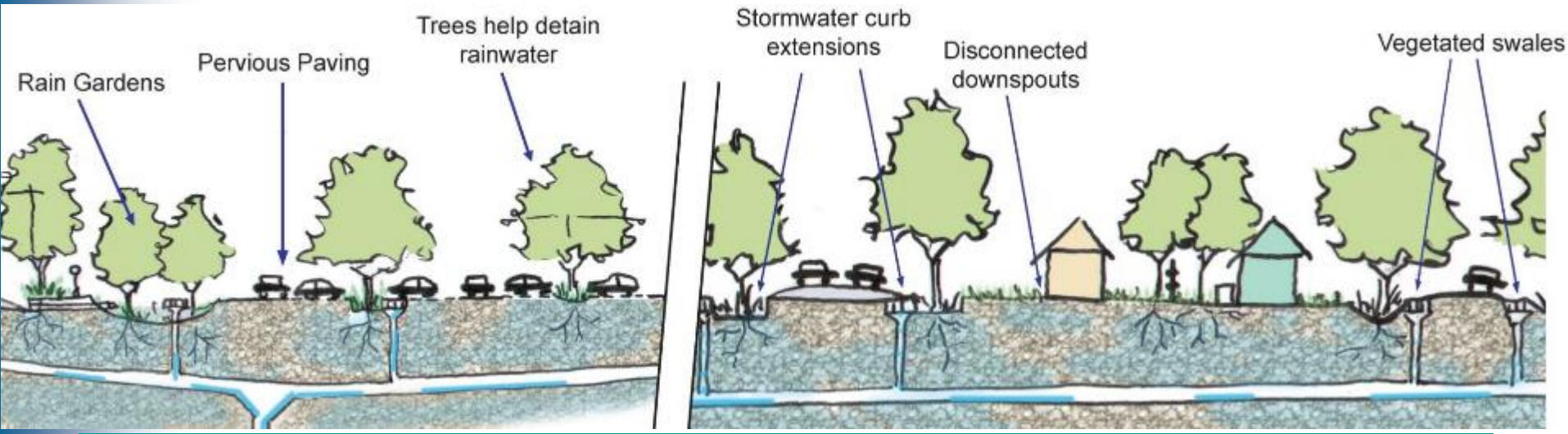
- Engineered systems that remove pollutants from stormwater
- Sized to treat stormwater runoff from **frequent, small storm events**
- Provision C.3.d of the MRP specifies numeric sizing criteria for water quality design
- Operations & Maintenance (O&M) agreement (or other mechanism) required

How Much Runoff Must Be Treated?

- Must treat 100% of project 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 (flow-based treatment measure)

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



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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

“Special Projects”

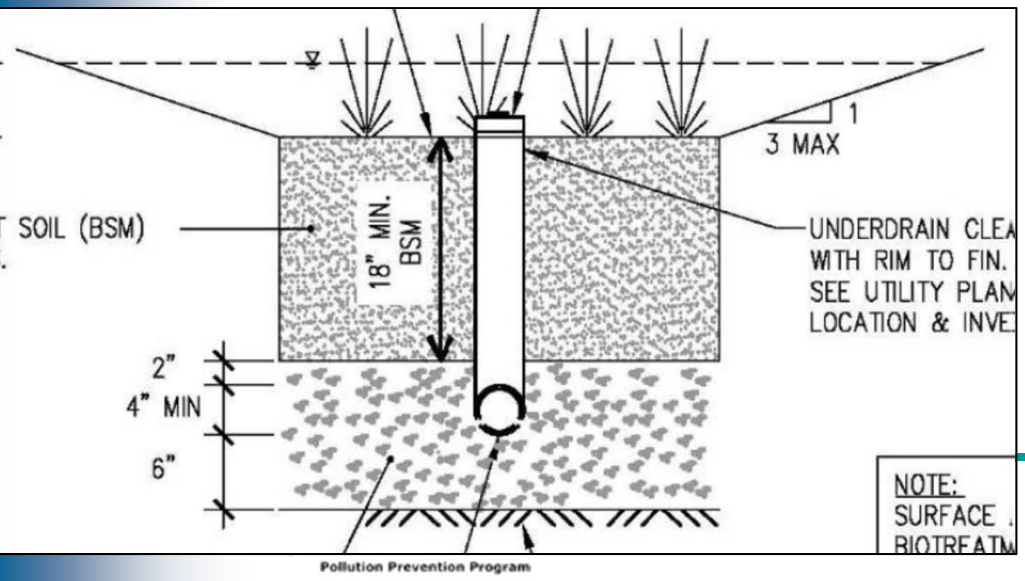
- Special Projects are high density and transit oriented development projects that may receive LID treatment reduction credit, i.e., allowed limited use of “non-LID” treatment measures
- Amount of credit based on size of project, lot coverage, location, density, and amount of surface parking
- Non-LID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

Biotreatment Measures

Flow-through planter

- Most common type of LID treatment
  - Bioretention areas/ rain gardens
  - Linear bioretention areas ("bioswales")
  - Flow-through planters

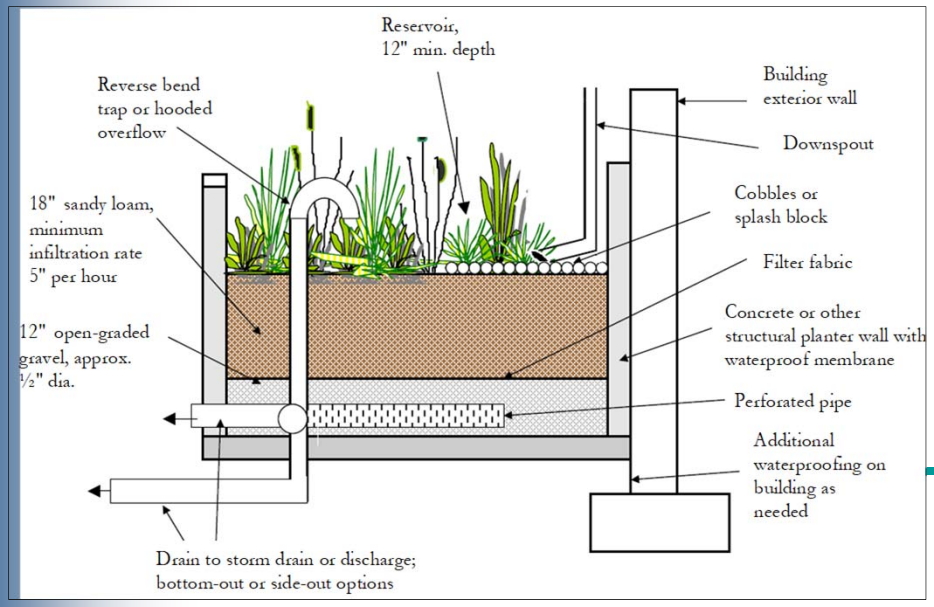
Bioretention / Rain Garden



- 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

Bioretention Areas

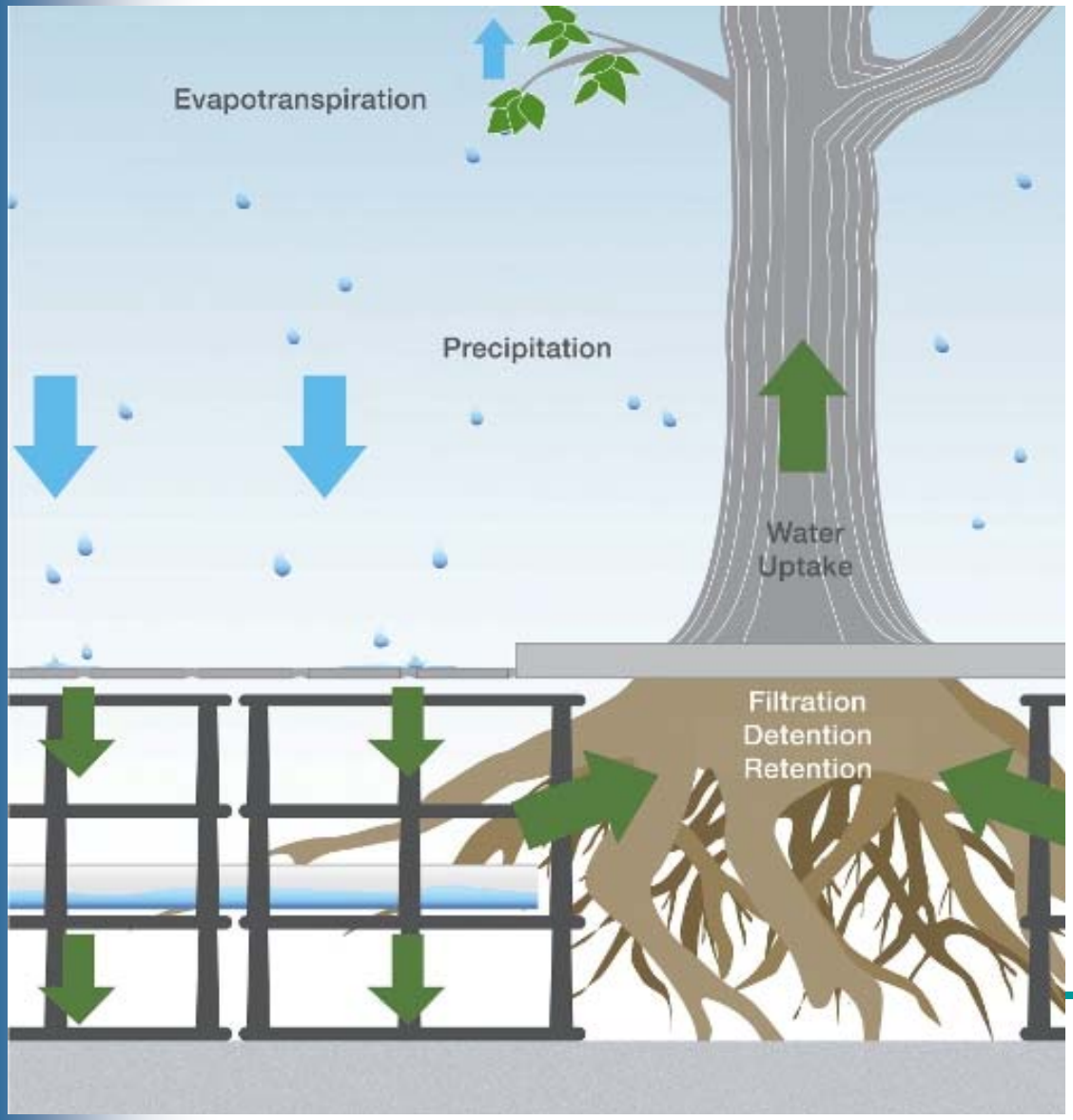
Flow-through Planter



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

Source: Dan Cloak Environmental Consulting, 2010, with modifications

Biotreatment in Tree Trench



Rainwater Harvesting and Use

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

Cisterns installed underground

Rainwater Harvesting

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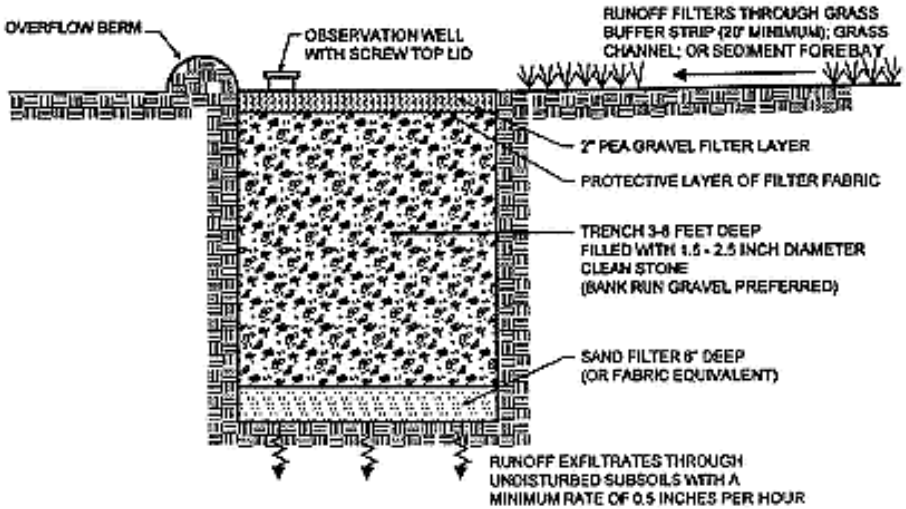
Infiltration Trench

- 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 Jose

Infiltration Trenches



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

Pervious Pavement

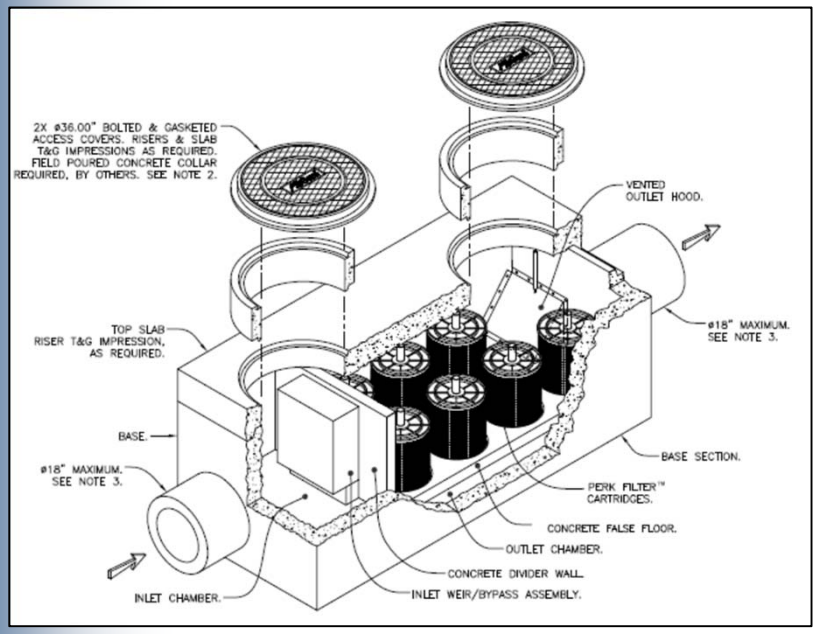
Permeable Pavers

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 landscape architect or other professional

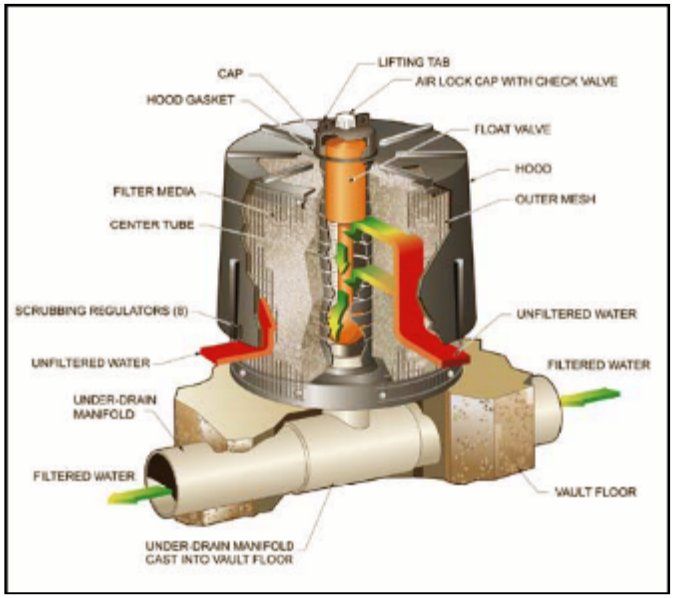
Green Roofs

Non-LID: Media Filters



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

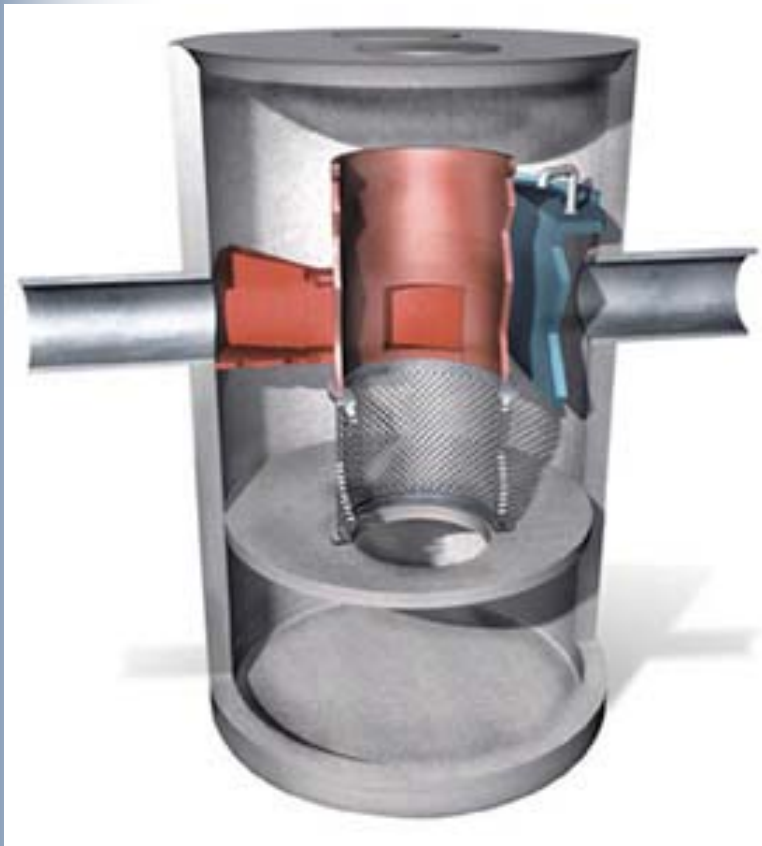
- Fine particles are filtered by filter media (see example cartridge at right)



Non-LID Tree Well Filters

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

Non-LID: Hydrodynamic Separators



- 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

- 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

- 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 flow control

What is Green Infrastructure?
(or 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 pavements
  - Biotreatment and infiltration facilities
- These measures supplement current requirements for LID on regulated projects

GSI 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

- Develop a GI Plan (by September 2019)
  - Prioritize and map planned and potential projects
  - Update related municipal plans
  - Evaluate funding options
  - Track progress
- Conduct education and outreach
- Conduct “early implementation”
  - Construct planned and funded projects
  - Review public project lists and assess opportunity for incorporating GI elements

Examples of GSI

Bioretention Area in a Curb Bulb-out, Rosita Park Neighborhood, Los Altos

Pervious Pavers, Commodore Park, San Jose

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Hacienda Ave, Campbell (Before)

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Santa Clara Valley Urban Runoff Pollution Prevention Program

Hacienda Ave, Campbell (After)

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Examples of GI

Hacienda Ave, Campbell

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For More Information:

- SCVURPPP C.3 Stormwater Handbook
- SCVURPPP GSI Handbook Part 1

www.scvurppp.org

- 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”)

Questions?

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