



Phase II Post-Construction Stormwater Requirements
Workshop - February 10, 2014

Selecting Appropriate Stormwater Control Measures for Your Development Project

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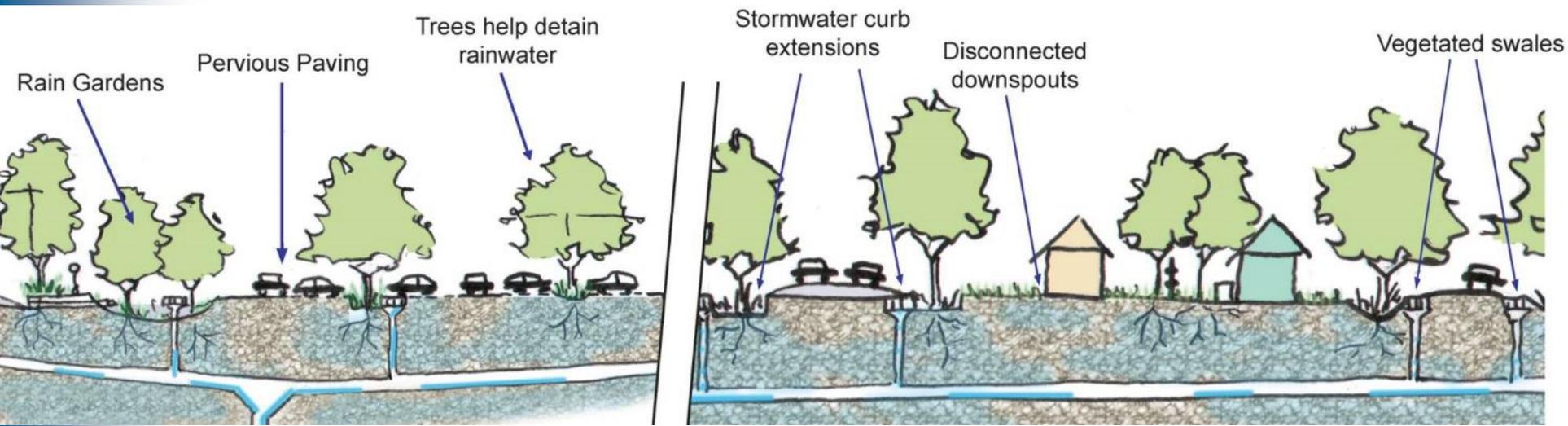
Outline of Presentation

- Strategy for Incorporating LID into Projects
- Small (Tier 1) Projects – Site Design
- Tier 2 and 3 Projects
 - Site Design to Reduce Runoff
 - Treatment Measure Options
 - Runoff Retention Approaches
 - Addressing Peak Management
- Pollutant Source Controls



Low Impact Development (LID)

- Reduce runoff and mimic a site's predevelopment hydrology:
 - Minimize disturbed areas and impervious surfaces
 - Use infiltration, evapotranspiration, or rainwater harvesting to retain and treat stormwater runoff
 - Use biotreatment where these methods are infeasible



Integrating LID into a Project

- ★ Plan & design stormwater controls integrally with the site plan and landscaping for the project ★
 - Lay out site to protect/preserve natural areas and drainage patterns
 - Delineate drainage management areas (DMAs)
 - Develop stormwater control plan to take advantage of vegetated areas for infiltration
 - Locate and size LID facilities



Small (Tier 1) Projects

- Implement site design measures
- Implement at least one runoff reduction measure:
 - Disperse runoff to landscaping
 - Use permeable pavement
 - Direct runoff to cisterns or rain barrels for reuse
- Submit project data and site design certification form



Site Design Guidance Brochures

- Brochures prepared by BASMAA for outreach to owners of small projects:
 - Landscape Designs for Stormwater Management
 - Rain Gardens
 - Rain Barrels and Cisterns
 - Pervious Paving
- Brochures available at:
www.scvurppp.org
(click on “Low Impact Development”)



LANDSCAPE DESIGNS FOR STORMWATER MANAGEMENT

Stormwater Control for Small Projects



Bay Area Stormwater Management Agencies Association



Designing landscaped areas to soak up rainfall runoff from building roofs and paved areas helps protect water quality in local creeks and waterways. These landscape designs reduce polluted runoff and help prevent creek erosion.

As the runoff flows over vegetation and soil in the landscaped area, the water percolates into the ground and pollutants are filtered out or broken down by the soil and plants.

This fact sheet shows how you can design your landscape to absorb runoff from impervious surfaces, such as roofs, patios, driveways, and sidewalks, with landscape designs that can be very attractive.

If you are interested in capturing and storing water for irrigation use, see the Rain Barrel fact sheet in this series.

Dry creek infiltrates and conveys runoff.

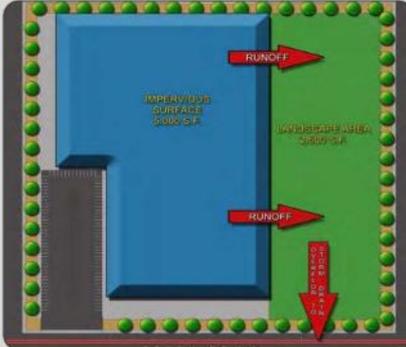
Can My Project Manage Stormwater in the Landscape?

Directing stormwater runoff to the landscape is suitable for sites with the following conditions:

- Roofs, driveways, parking areas, patios, and walkways that can drain to an existing landscape, or an area that may be converted to landscape.
- Areas of landscape with a slope of 5% or less are preferred; check with the municipality regarding requirements for steeper sites.
- Works best in well-drained soil; soil amendments may be used in areas with poor drainage.
- Landscaped areas that total at least 1/2 the size of the impervious area draining to it.
- Direct runoff away from building foundations.
- Runoff should not create ponding around trees and plants that won't tolerate wet conditions.

How Do I Size My Landscape?

The landscaped area should be 50% of the size of the contributing impervious surface. For example (see below), to manage runoff from a 5,000 square foot roof or paved surface, you should have 2,500 square feet of landscaping.



The diagram shows a blue rectangular area labeled "IMPERVIOUS SURFACE 5000 SQ. FT." with a red arrow labeled "RUNOFF" pointing to the right. This runoff enters a green rectangular area labeled "LANDSCAPED AREA 2500 SQ. FT." with another red arrow labeled "RUNOFF" pointing to the right. A third red arrow labeled "RUNOFF" points down from the landscaped area. The entire area is enclosed by a green border of small trees.

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Tier 2 and Tier 3 Projects

- Use site design approaches to reduce the amount of runoff that must be treated/retained
 - Self-Treating Areas
 - Self-Retaining Areas



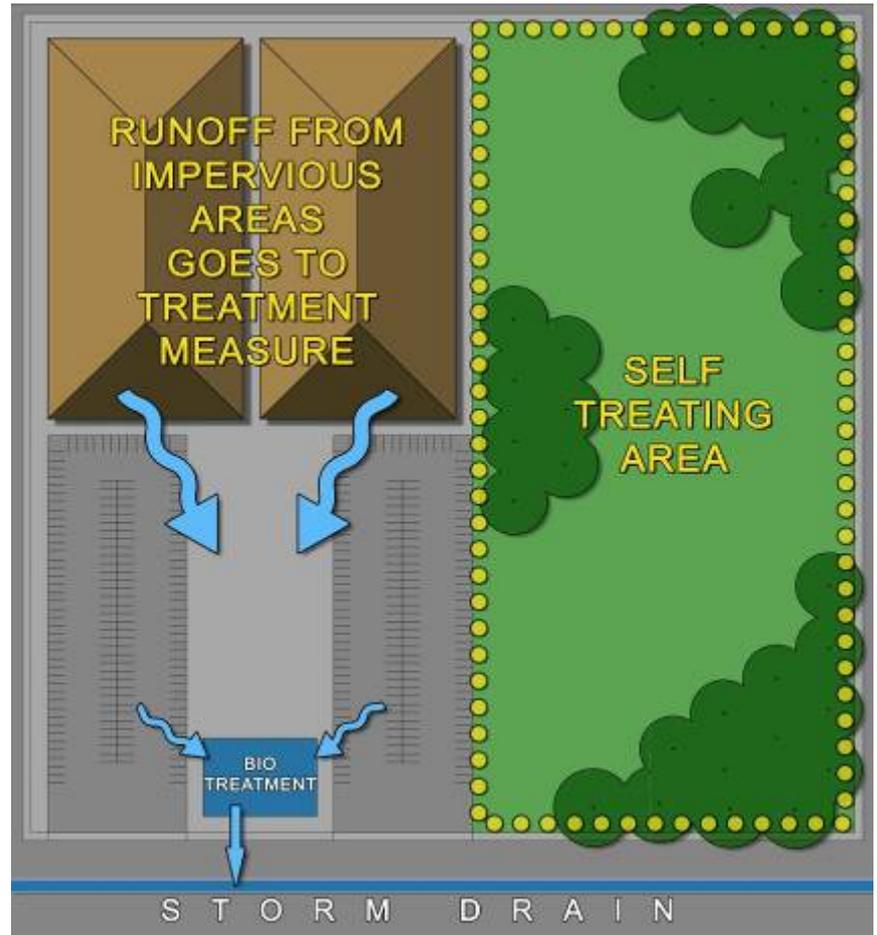
Self-Treating Areas

- Pervious area that treats rain falling on itself only, via ponding, infiltration and ET
 - Undisturbed vegetation
 - “Areas planted with native, drought tolerant, or LID appropriate vegetation”
 - Pervious paving/artificial turf
 - Green roof
- Self-treating areas must be flat or slightly concave and retain/infiltrate ~1” of rain



Self Treating Areas Reduce the Area Requiring Treatment

- **Pervious** areas of the site can infiltrate the water quality volume; additional runoff can to storm drain with no additional treatment
- Runoff from **impervious** areas flows to a smaller treatment measure



Self-Retaining Area

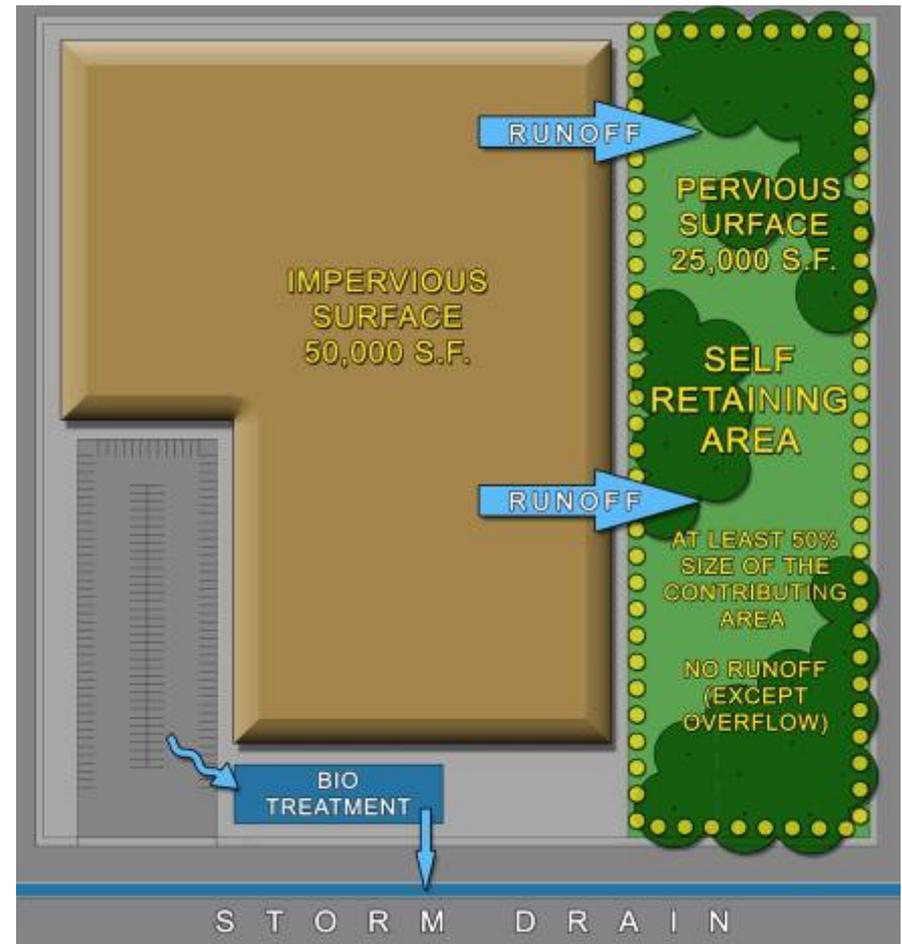
- Pervious area that retains rainfall on itself and runoff from adjacent impervious area, up to a 2:1 ratio (impervious:pervious)*
 - Roof or hardscape runoff dispersion to landscaping (3" – 4" ponding)
 - Partial green roofs
 - Pervious paving (with additional storage)
- No special soils required

* 2:1 ratio may not apply to 95th percentile storm – currently under investigation



Self-Retaining Areas Reduce the Area that Requires Treatment

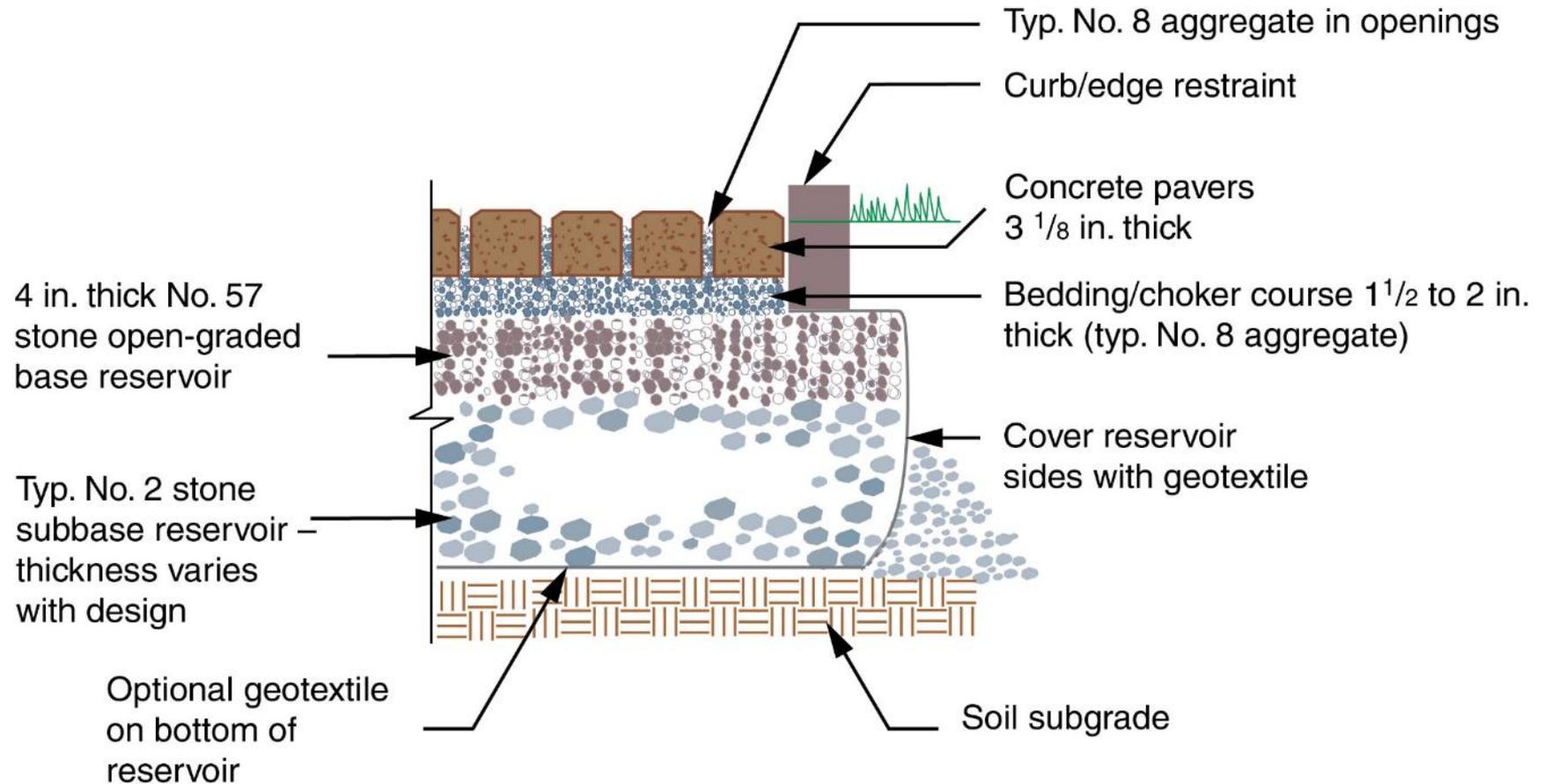
- Runoff from **impervious** portions of the project can flow directly to a **pervious** area that is at least 50% of the size of the contributing area
- Runoff from other impervious areas flows to smaller treatment measure



Site Design Option: Permeable Paving



Site Design Option: Permeable Paving



Site Design Option: Green Roof



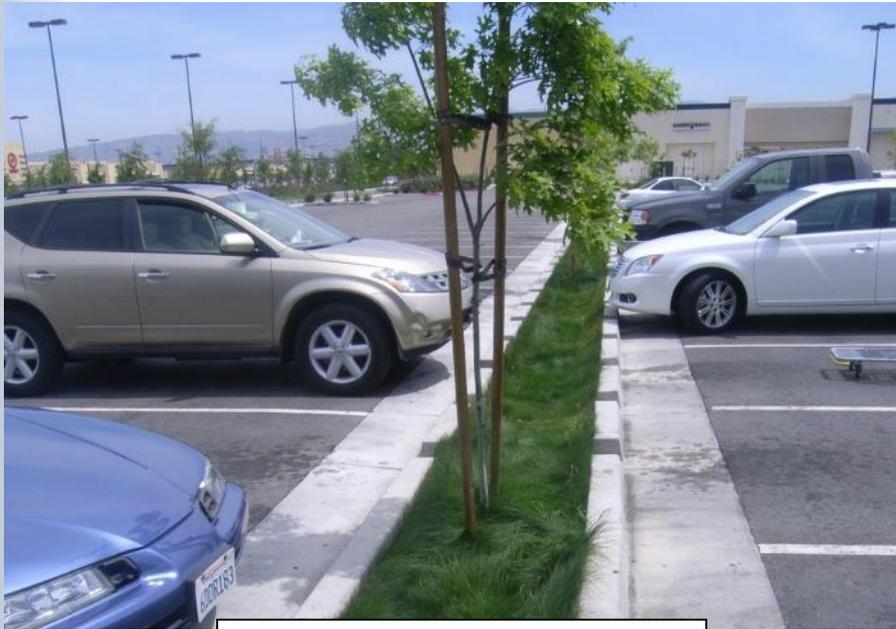
**Green roof at 1460 N 4th St.,
San Jose**



**Green roof at Casa Feliz,
San Jose**



Stormwater Treatment Measures



Bioretention area

- Engineered systems that remove pollutants from stormwater
 - Hydraulically sized to treat stormwater runoff from **frequent, small storms**
 - Permits specify the numeric sizing criteria for water quality design
 - Maintenance needed to ensure performance

LID Treatment Requirements

- LID treatment methods are the preferred option
- LID treatment defined as:
 - Rainwater harvesting/use
 - Infiltration
 - Evapotranspiration
 - Biotreatment or Biofiltration
- PCRs do not require a feasibility analysis before selection of biotreatment



Bioretention

LID Treatment Options

| LID Technique | Category |
|--|-------------------------------------|
| Rainwater cisterns | Harvest and use |
| Landscaped detention, street trees | Evapotranspiration, infiltration |
| Pervious paving | Infiltration |
| Infiltration basin | Infiltration |
| Infiltration trenches | Infiltration |
| Bioretention areas (unlined, no underdrain) | Evapotranspiration, infiltration |
| Bioretention areas (lined, with underdrain) | Biotreatment (aka Biofiltration) |
| Flow-through planters | Biotreatment |



Rainwater Harvesting and Use

- Rainwater collected and used for non-potable uses, such as:
 - Toilet flushing
 - Irrigation



Rainwater Harvesting



Barriers to Large Scale Rainwater Harvesting Systems

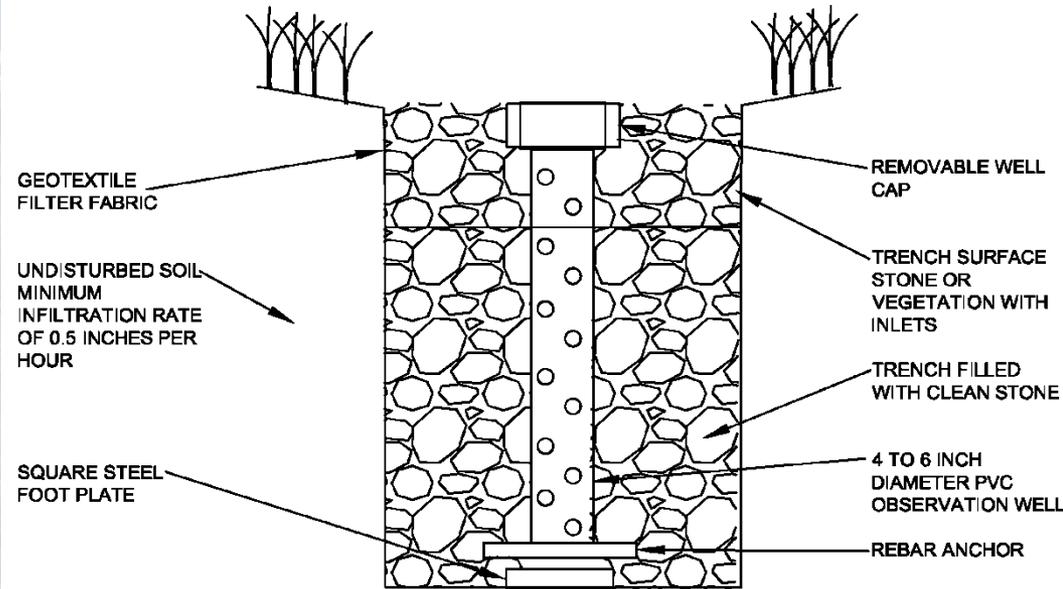
- Lack of demand to use entire water quality design volume
- Competition with recycled water use
- Complex maintenance requirements
- Capital and O&M costs



Infiltration Facilities

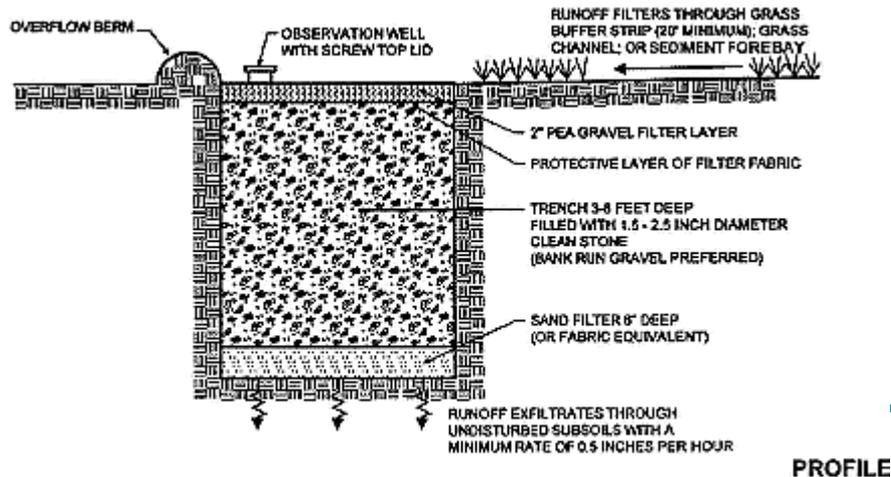


Infiltration Trench



- Store water in void space of rocks, allowing it to infiltrate to surrounding soils
- Requires reasonably infiltrative soils (max 72-hr drawdown)

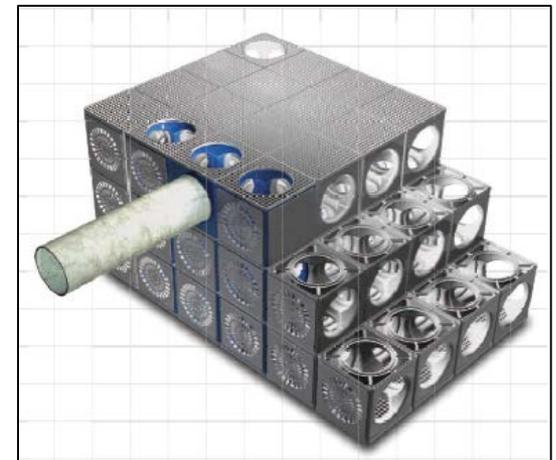
Infiltration Trenches



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

Subsurface Infiltration Systems

- Underground pipes or vaults to store and infiltrate runoff
- Provides more capacity in smaller footprint
- Can be installed under parking lots, vegetated areas, or other at-grade features
- Not recommended for poorly infiltrating soils due to potential for standing water
- Requires pre-treatment for sediment and/or other pollutants



Bioretention Measures



- Most Common
 - Bioretention areas
 - Linear bioretention areas (bioretention swales)
 - Flow-through planters (flat bottom, lined)



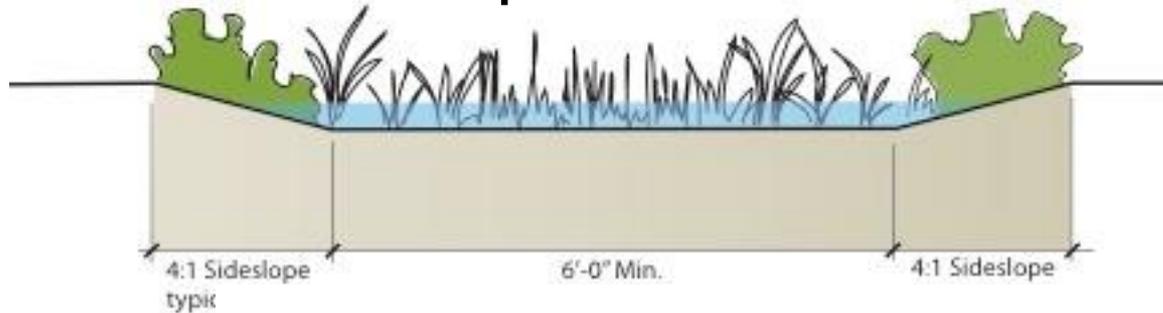
Bioretention Area



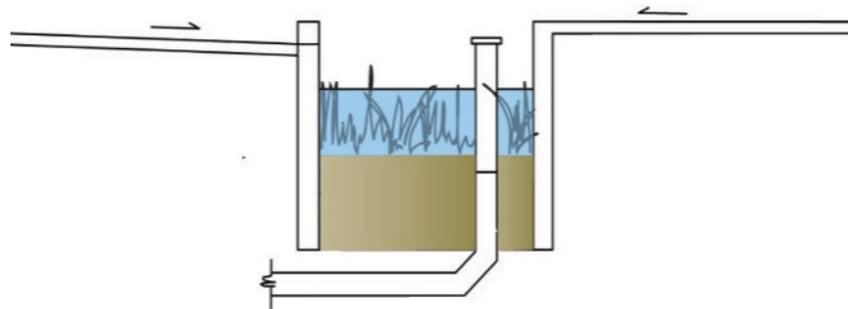
- Concave landscaped area of any shape
- Special biotreatment soil with specified infiltration rate (5-10 in/hr)
- Appropriate plants
- Underdrain required if clayey underlying soils
- Raise underdrain to maximize infiltration, if conditions allow

Basic Bioretention Types

sloped sides



flat bottom



Slide courtesy of Central Coast LIDI



Characteristics of Types

- Sloped Sides
 - Edge transition achieved w/ planting surface (shelf)
 - Landscape condition differs (ponding at bottom)
 - Landscape slope less abrupt
 - Reduced cost of structural components



Characteristics of Types

- Flat Bottom (planter)
 - Fits in constrained areas
 - OK along face of building (with waterproofing)
 - Typically no infiltration
 - Requires more structure at edges (walls)
 - Edge considerations for pedestrian interface (curb)
 - One landscape condition (ponding across surface)



Bioretention Design Parameters

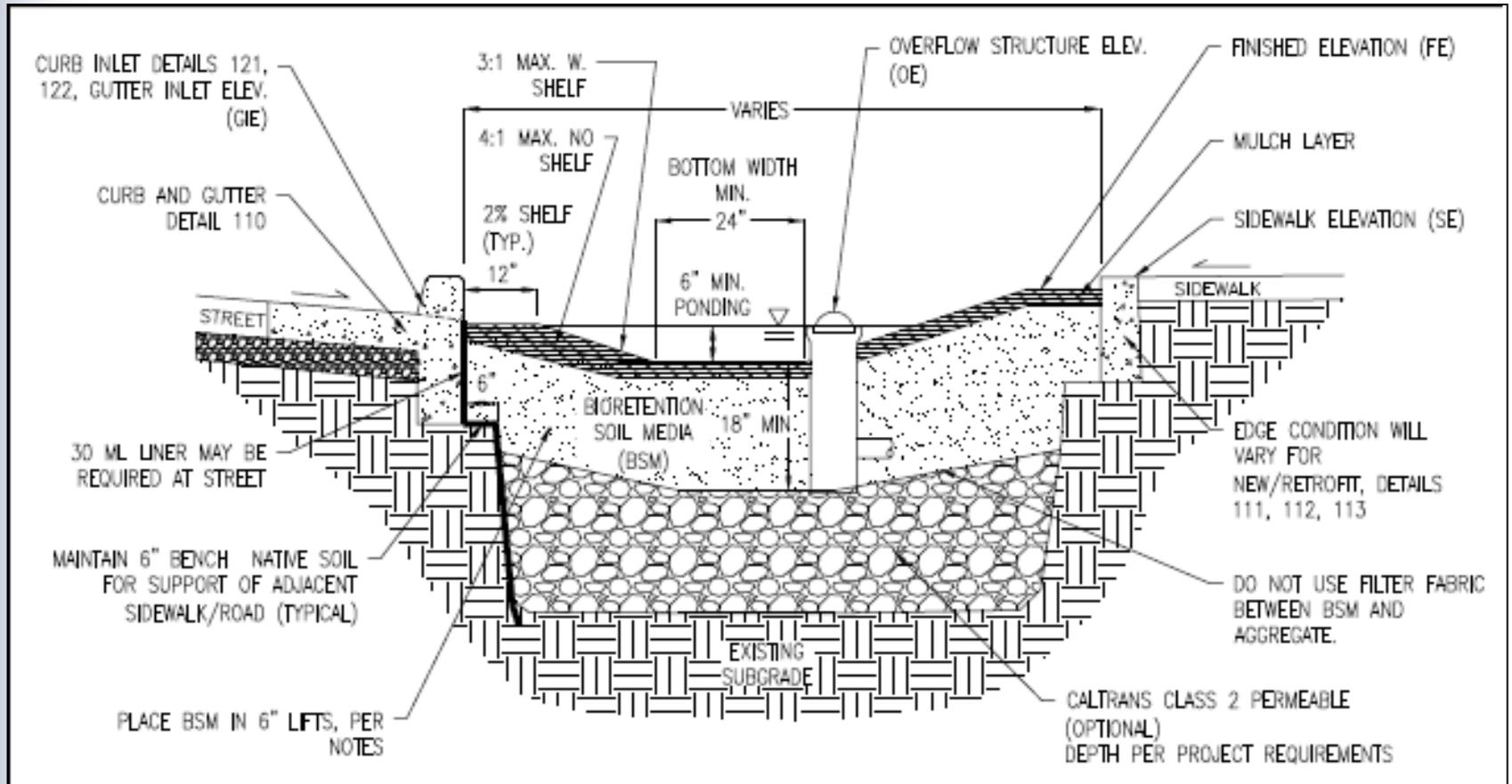
- Maximum surface loading of 5 in/hr
- Minimum surface ponding depth of 6 inches
- Biotreatment soil consisting of 60-70% sand and 30-40% compost (use BASMAA spec*)
- Minimum biotreatment soil depth:
 - 18 inches if no underdrain
 - 24 inches if underdrain (place near top of drain rock)
- Minimum drain rock depth of 12 inches
- No liner/barrier unless lateral infiltration not technically feasible



*See SF Bay Municipal Regional Permit, Attachment L



Bioretention Design Detail



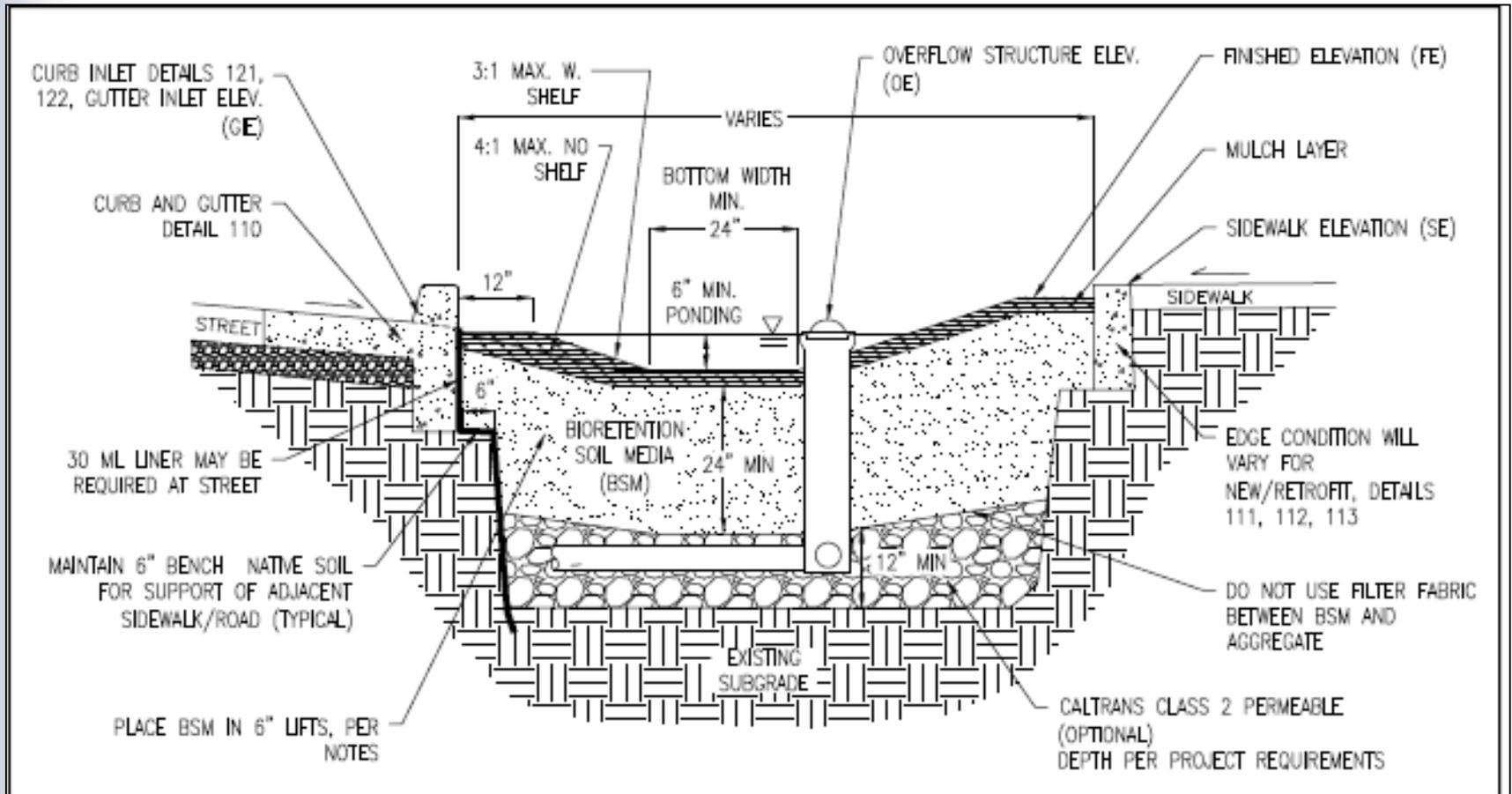
Street Bioretention Facility (sloped sided, without underdrain)



Detail #102 available at www.CentralCoastLID1.org



Bioretention Design Detail



Street Bioretention Facility (sloped sided, with underdrain)

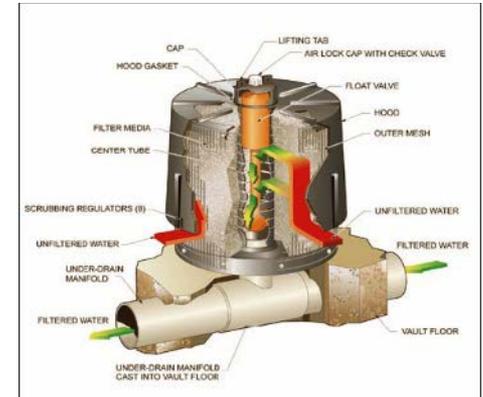


Detail #202 available at www.CentralCoastLID1.org



Non-LID Treatment Measures

- Manufactured devices
 - Media filters
 - High-rate tree box filters
- Vegetated swales and detention basins (unless designed to infiltrate or filter stormwater through biotreatment soil)
- Do not provide any runoff retention

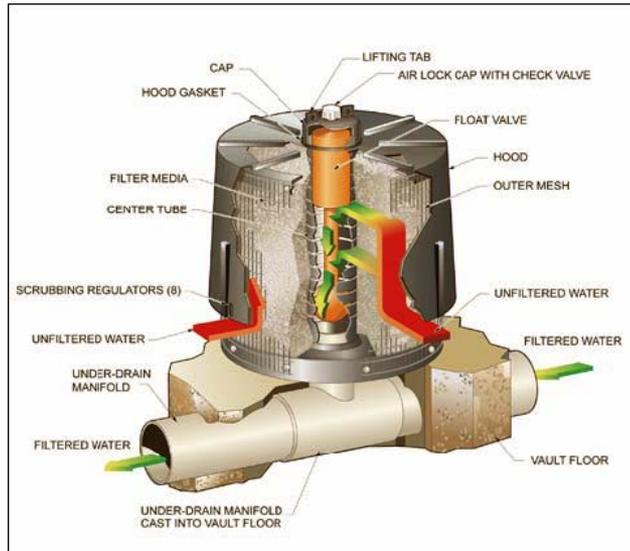


Non-LID Treatment Measures

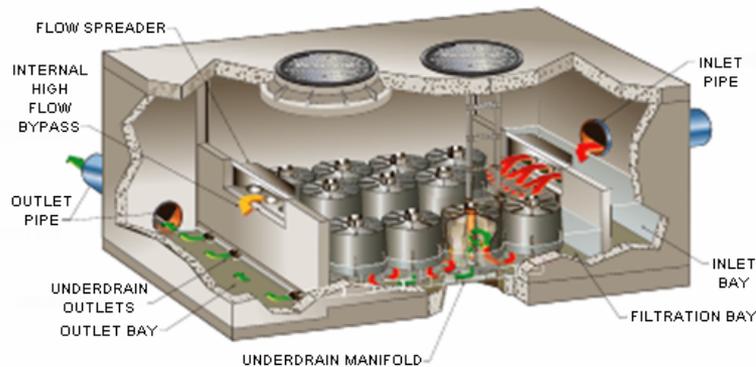
- PCRs state that Non-Retention Based Treatment is the least preferred option but no specific conditions for use
- Phase II permit (and Santa Barbara Technical Guide) allows use only when:
 - Projects that create/replace ≤ 1 acre impervious surface in pedestrian oriented commercial district with 85% lot coverage by permanent structures
 - Facilities receiving runoff solely from existing (pre-project) impervious areas
 - Historic sites that cannot alter original configuration



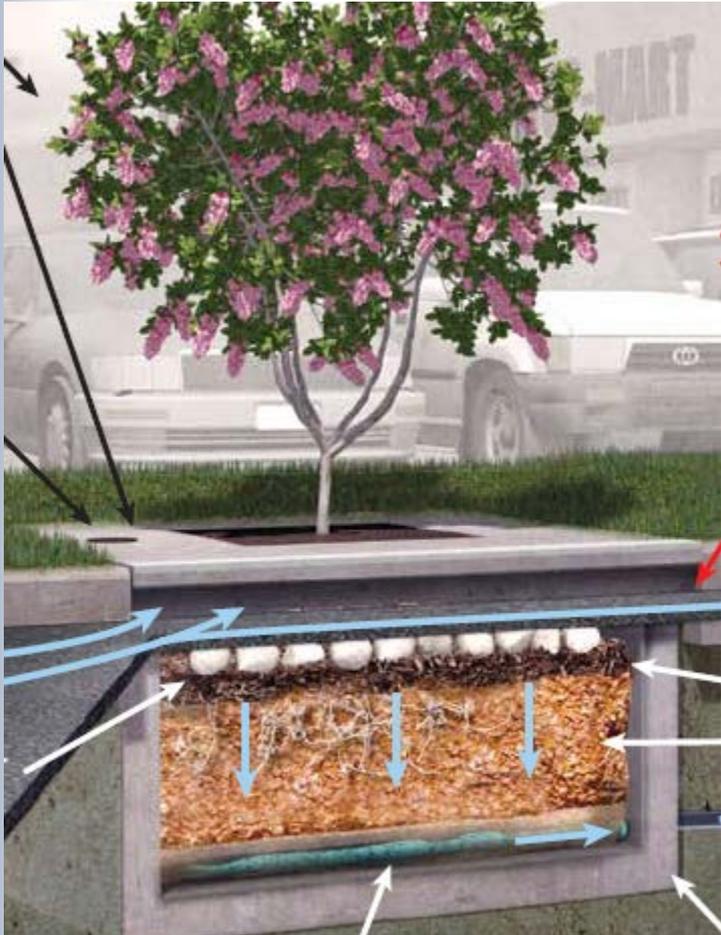
Media Filters



- Fine particles are filtered by filter media (see example cartridge)
- Multiple cartridges may be arrayed in a vault structure
- Vault should have an underdrain to prevent standing water
- Design for accepted media loading rate



Manufactured Tree Well Filters



Example of a Manufactured Tree Well Filter

- Tree well filter with proprietary planting media and underdrain
- Planting media has extremely high infiltration rate.
- Now available with biotreatment soil to meet LID requirements (but treats smaller area).

Vegetated Swale

(NOT a stand-alone treatment measure unless stormwater filtered through bioretention soils)



- Linear, shallow, vegetated channel
- Used to be allowed to filter stormwater through dense vegetation
- OK if allows stormwater to infiltrate downward through biotreatment soil

Extended Detention Basin

(NOT a stand-alone treatment measure unless designed as an infiltration basin)



- Basin with specially designed outlet to detain stormwater for at least 48 hours
- Used to be allowed to treat stormwater by settling
- Ok if used for storage upstream of LID measure or peak flow management

Runoff Retention Requirements

- Site Assessment
 - Review/document opportunities & constraints
- Site Design Measures
- Runoff Reduction Measures
 - Self-treating and self-retaining areas
- Structural Stormwater Control Measures
 - Retain remaining runoff



Runoff Retention SCMs

| LID Technique* | Category |
|--|-------------------------------------|
| Rainwater cisterns | Harvest and use |
| Landscaped detention, street trees, green roofs | Evapotranspiration, infiltration |
| Pervious paving | Infiltration |
| Infiltration basin | Infiltration |
| Infiltration trenches | Infiltration |
| Bioretention areas (unlined, no underdrain) | Evapotranspiration, infiltration |

*Size for Tier 3 requirement (95th percentile storm)



Runoff Retention SCMs

- Can combine with LID treatment facilities
- Will typically need to provide additional storage to retain more runoff from 95th percentile storm
 - Larger surface area of facility
 - More storage below facility (e.g., deeper drain rock layer or subsurface infiltration structures)
 - Increased surface storage in basin
- If can't meet on-site (after 10% adjustment):
 - Reduce impervious surface on site
 - Consider mitigation off-site



Peak Management Options

- Additional storage may be needed to match 2-10-year pre-project peak flows, depending on:
 - Pre-project imperviousness
 - Site soil type
 - Amount of runoff retention
- Study being conducted to determine under what conditions meeting Tier 3 also meets Tier 4
- Can combine 2- to 10-year peak control with required flood control facilities



Peak Management

- Runoff retention SCMs help reduce peaks
- Additional storage and flow controls if needed
 - Pond, detention basin, tank or vault
 - Specialized outlet to control rate of flow to pre-project conditions



Source Control Measures

- Phase II permit requires Regulated Projects with pollutant generating activities and sources to implement source control measures as applicable.
- Examples of pollutant sources include:
 - Pools, spas, and fountains
 - Restaurant operations
 - Vehicle and equipment cleaning areas
 - Outdoor storage of equipment, materials or wastes
 - Non-stormwater discharges
 - Pesticide/fertilizer use on landscaping
- Applicants should document pollutant sources and control measures in Stormwater Control Plan



Source Control Measures



- **Structural Source Controls** are permanent design features that reduce pollutant sources.
- Examples include:
 - Covered trash enclosures
 - Labels on storm drain inlets
 - Non-stormwater discharges drain to landscaping or to sanitary sewer
 - Beneficial landscaping (native or drought-tolerant plants)
- Required for Regulated projects as appropriate



Source Control Measures



- **Operational Source Controls** are practices to be conducted on an ongoing basis after construction is completed
- **Examples:**
 - Integrated pest management for landscaping
 - Street or parking lot sweeping
- Required for Regulated projects as appropriate



Choose less toxic products for your home and garden. Look for this symbol before you buy.



Questions?



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