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”)
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 flow 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

4 in. thick No. 57 stone open-graded base reservoir

Typ. No. 2 stone subbase reservoir – thickness varies with design

Optional geotextile on bottom of reservoir

Typ. No. 8 aggregate in openings

Curb/edge restraint

Concrete pavers 3 1/8 in. thick

Bedding/choker course 1 1/2 to 2 in. thick (typ. No. 8 aggregate)

Cover reservoir sides with geotextile

Soil subgrade
Site Design Option: Green Roof

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

Green roof at Casa Feliz,
San Jose
Stormwater Treatment Measures

- 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

Bioretention area
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
<table>
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</tr>
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<tbody>
<tr>
<td>Rainwater cisterns</td>
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<td>Biotreatment (aka Biofiltration)</td>
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</tbody>
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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

- 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
Characteristics of Types

- Sloped Sides
  - Edge transition achieved with 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.CentralCoastLIDI.org](http://www.CentralCoastLIDI.org)
Street Bioretention Facility (sloped sided, with underdrain)
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

- 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

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*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**
Questions?

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