Using the LID Design Guide to Prepare and Review Project Submittals

Dan Cloak, P.E.
Dan Cloak Environmental Consulting

Low Impact Development

- Stormwater treatment *and* flow control
- Minimize imperviousness
- Disperse runoff
- Use Integrated Management Practices (IMPs)

LID Design Process

Analyze Your Project for LID

1. Optimize the site layout
2. Use pervious surfaces
3. Disperse runoff
4. Drain to Bioretention Facilities, Flow-through Planters, Dry Wells, or Cisterns with Bioretention

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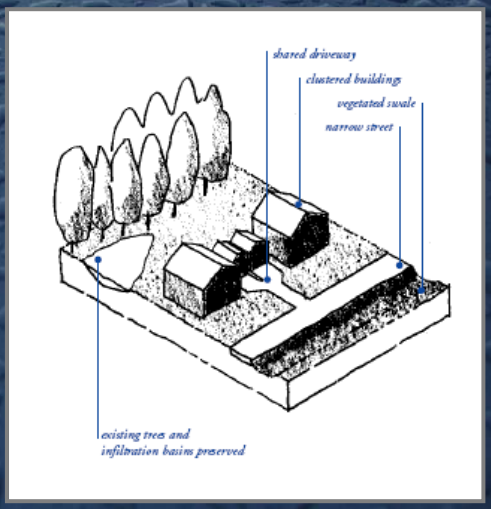
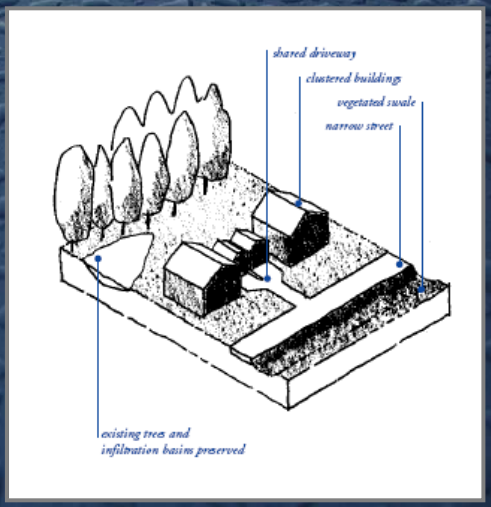
1. Optimize the Site Layout

- Define the development envelope
- Set back from creeks, wetlands, and riparian habitats
- Preserve significant trees
- Minimize grading



1. Optimize the Site Layout

- Preserve and use permeable soils
- Limit roofs and paving
- Detain and retain runoff throughout the site
- Use drainage as a design element



2. Use Pervious Surfaces

- Permeable pavements

- Green roofs

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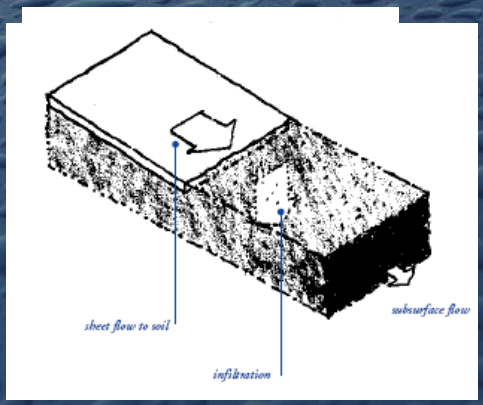
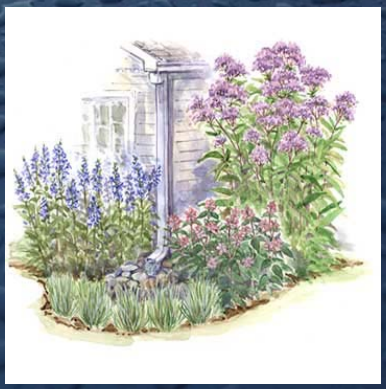
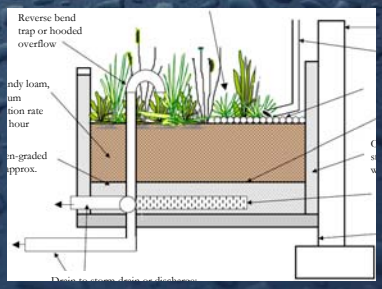
3. Disperse Runoff

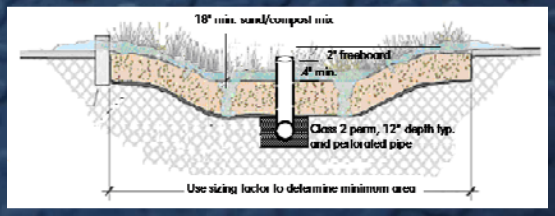




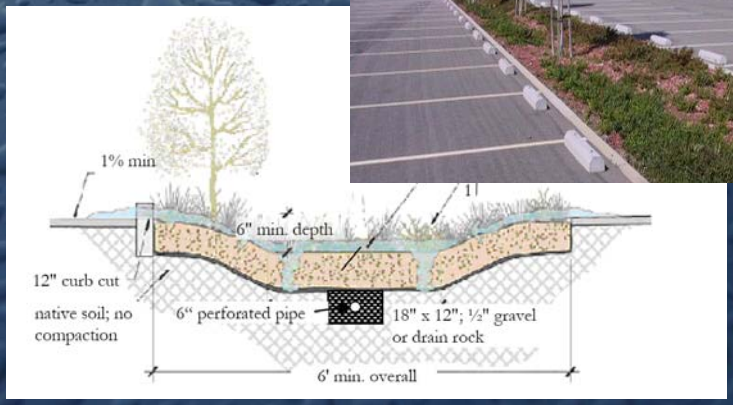
4. Direct Runoff to Facilities

- Bioretention facilities
- Flow-through planters
- Dry wells
- Cistern + bioretention

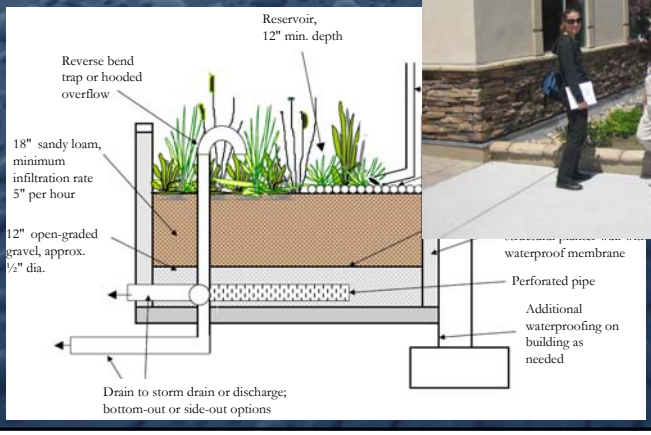




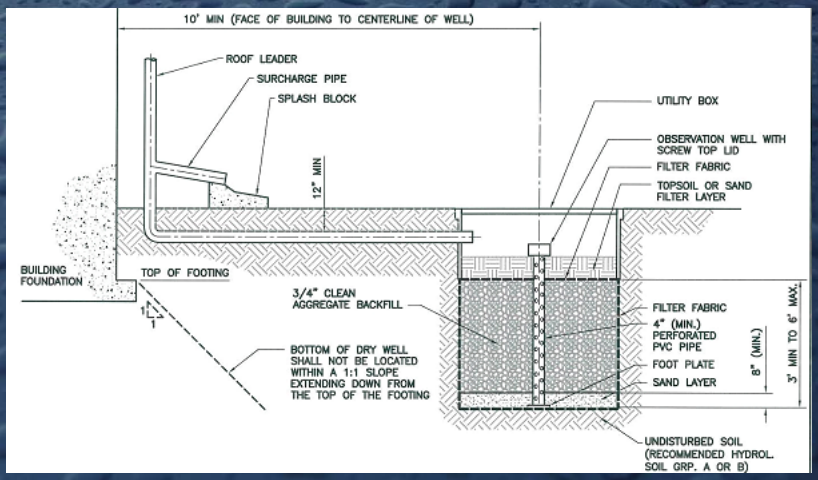
Bioretention Facility



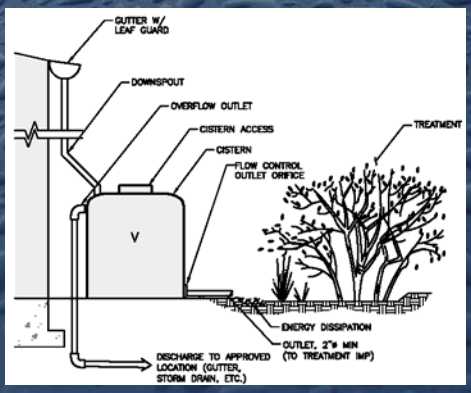
Flow-through Planter



Dry Well



Cistern with Bioretention



- Cistern volume can be in a vault or ponded on a roof

Bioretention Applications

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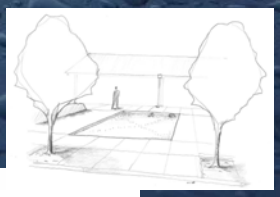
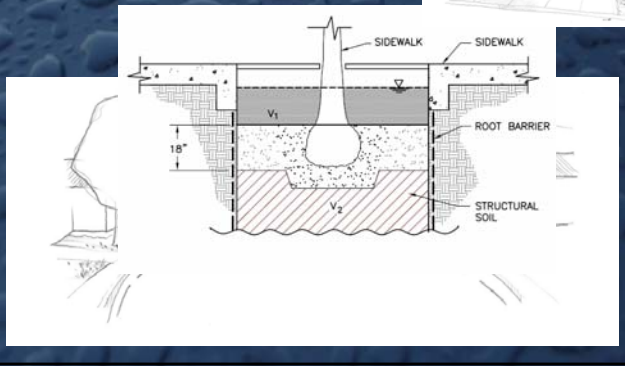
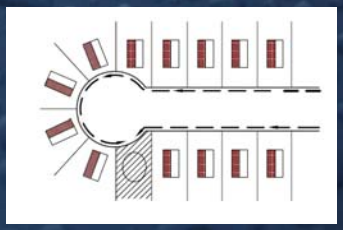
- Think multi-purpose
  - Landscape/design element
  - Conveyance of high flows
  - Trees
  - Turf





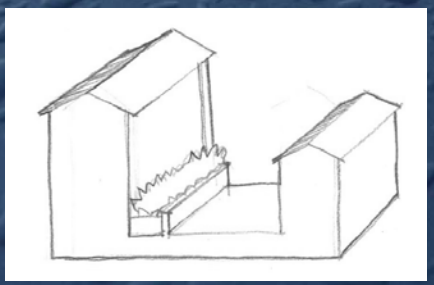
Bioretention Applications

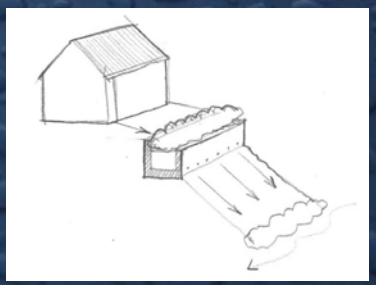
- Think ownership and maintenance
  - Whose property will this be on?
  - Where is the drainage coming from?
  - How will both the facility and its tributary drainage area be maintained?



Flow-through Planter Applications

- On or adjacent to buildings
- Other areas where infiltration is not desirable





LID Design Process

Document Drainage Design

1. Delineate drainage management areas (DMAs)
2. Classify DMAs and determine runoff factors
3. Tabulate DMAs
4. Lay out facilities

Drainage Management Areas

- Only one surface type within each area
- Many-to-one relationship between drainage areas and facilities
- Four Types of Areas
  1. Self-treating areas
  2. Self-retaining areas
  3. Areas draining to a self-retaining area
  4. Areas draining to a treatment facilities

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Self-treating DMAs

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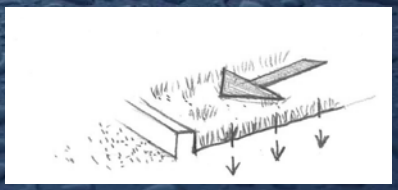
- Must be 100% pervious
- Must drain offsite
- Must not drain on to impervious areas
- Must not receive drainage from impervious areas
- Must not drain to treatment facilities
- No treatment or flow control required
- No further calculations required



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Self-retaining DMAs

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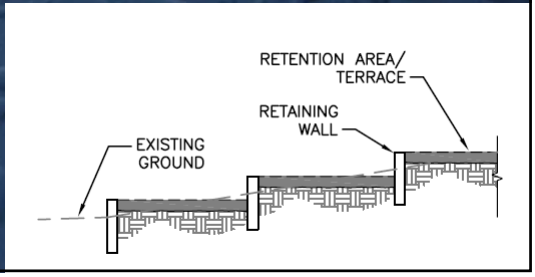
- Berm or depress grade to retain 1" rain
- Set area drain inlets above grade
- Amend soils
- Terrace mild slopes
- Have limited applicability in
  - Dense developments
  - Hillsides



Areas draining to self-retaining areas

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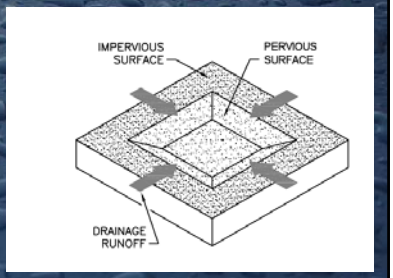
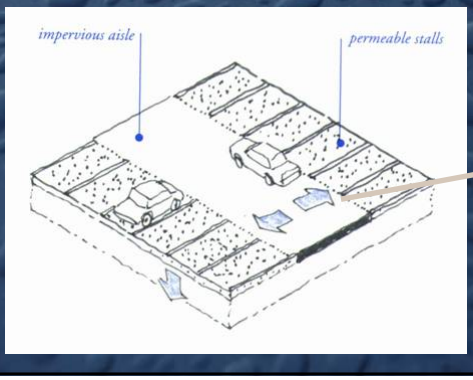
- Impervious areas can drain on to self-retaining areas
- Example: Roof leaders directed to lawn or landscape
- Maximum ratio is 2:1 for treatment; 1:1 for flow control
- No maintenance verification required

Areas draining to self-retaining DMAs





$$\frac{\text{Impervious}}{\text{Pervious}} \leq 1$$

Tabulating Areas

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Self-Treating Areas

DMA Name	Area (SF)

Self-Retaining Areas

DMA Name	Area (SF)

Areas Draining to Self-Retaining Areas

DMA Name	Area (SF)	Post-project surface type	Runoff factor	Receiving Self-retaining DMA	Receiving DMA Area (SF)	Ratio

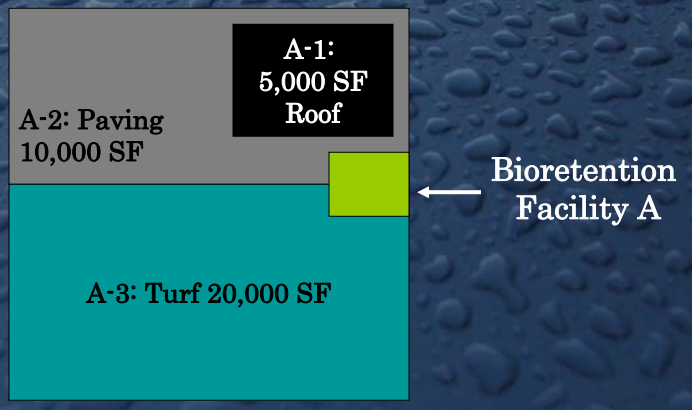
Areas draining to Treatment Facilities

- Areas used to calculate the required size of the treatment facility
- Where possible, drain only impervious roofs and pavement to treatment facilities
- Delineate any pervious areas as separate Drainage Management Areas

DMAs draining to facilities

DMA Name	*DMA Sq. Ft*	*Surface Type*	*Runoff Factor*	*Area x runoff factor*			
					Sizing Factor	*Min. Size*	*Size Planned*
Facility A-----→							

Calculating Facility Size



DMAs draining to facilities

DMA Name	*DMA Sq. Ft*	*Surface Type*	*Runoff Factor*	*Area x runoff factor*			
A-1	5000	Roof	1.0	5000			
A-2	10000	Paved	1.0	10000			
A-3	20000	Grass	0.1	2000	*Sizing Factor*	*Min. Size*	*Size Planned*
Facility A-----→				17000	0.04	680	800

Sizing Infiltration Facilities

1. Use the 85th percentile isopluvial map to determine minimum unit volume Page 56
2. Determine a weighted runoff factor for the area tributary to the facility
3. Minimum volume = Tributary area x runoff factor x unit volume
4. Select a facility depth
5. Determine the required facility area
6. Ensure the facility can infiltrate the entire volume within 72 hours

Sizing Cistern + Bioretention

1. Minimum cistern volume = Tributary area x runoff factor x unit volume
2. Design a discharge orifice for a 24-hour drawdown
3. Determine maximum orifice discharge
4. Size bioretention facility to percolate this flow based on a surface loading rate of 5 in/hr

LID Design Process

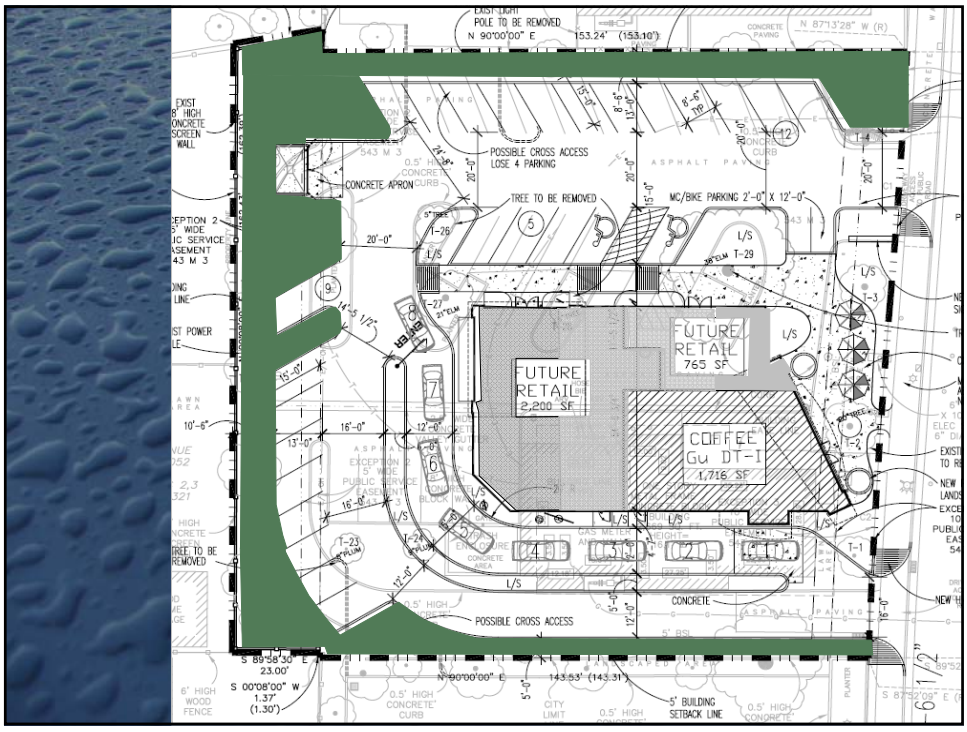
Design Sheets

Pages 63-89

- Self-Treating and Self-Retaining Areas
- Pervious Pavements
- Bioretention Facilities
- Flow-through Planter
- Dry Wells and Infiltration Basins
- Cistern with Bioretention Facility

Preliminary Design Details

- Routing of drainage to the facility
- Routing of drainage from the facility to the storm drain
- Sufficient head
- Avoid large drainage areas or long conveyance runs
- Watch out for roof slopes

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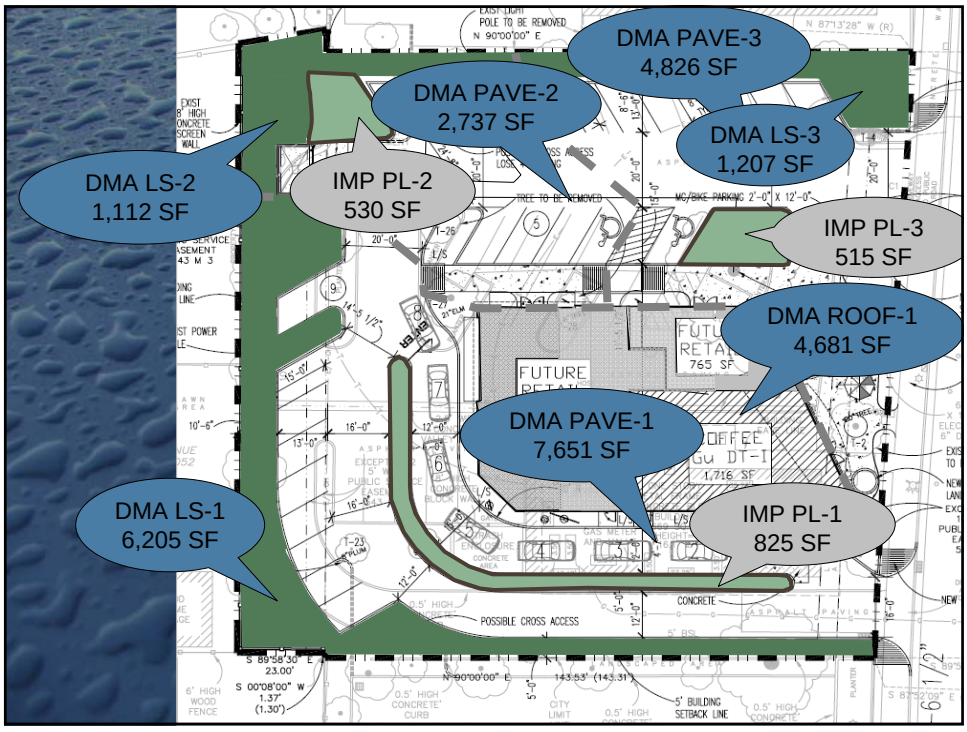
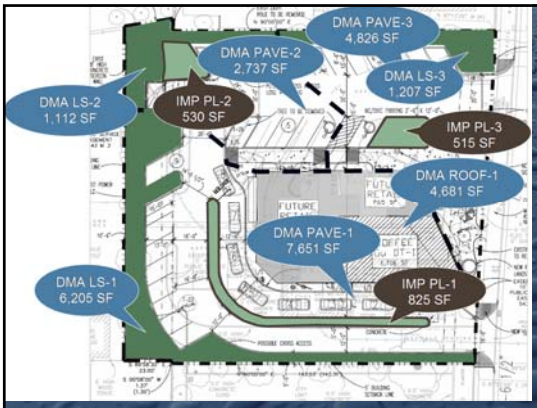

DMA PAVE-3
4,826 SF
DMA PAVE-2
2,737 SF
DMA LS-3
1,207 SF
DMA LS-2
1,112 SF
IMP PL-2
530 SF
IMP PL-3
515 SF
DMA ROOF-1
4,681 SF
DMA PAVE-1
7,651 SF
DMA LS-1
6,205 SF
IMP PL-1
825 SF
FUTURE
765 SF
1,716 SF
POSSIBLE CROSS ACCESS
5' BUILDING SETBACK LINE



DMA Name	*DMA Sq. Ft*	*Surface Type*	*Runoff Factor*	*Area x runoff factor*			
LS-1	6,205	Land-scape	0.1	*621*			
Roof-1	4,681	Roof	1.0	*4,681*			
Pave-1	7,651	Asphalt	1.0	7,651	*Sizing Factor*	*Min. Size*	*Size Planned*
Bioretention Area PL-1----→				12,953	0.04	518	825

Alternatives to LID Design

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- Consult with municipal staff first
- Prepare a complete Project Submittal
- Apply the policy of selection of treatment facilities (p. 21)
- Meet criteria for:
  - LID
  - Treatment
  - Flow-control – Provision D.1.d.(10)

Alternative Facilities

- Sand Filters
  - Design flow produced by 0.2 in/hr rainfall intensity
  - Surface loading rate of 5 in/hr
- Dry detention basins
  - Use 85th percentile isopluvial map
  - Design details in California BMP Handbook
- Wet Detention Ponds
  - Consult with mosquito control agency
- Vegetated Swales
  - Use linear bioretention areas instead