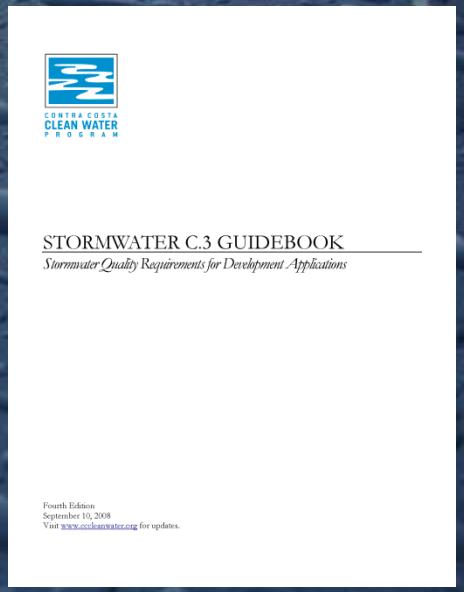
Review & Update of the *Stormwater C.3 Guidebook*



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Principal
Dan Cloak Environmental Consulting

Topics

- Review: What hasn't changed
  - LID requirements
  - Design procedure
  - Dry wells, flow-through planters, and bioretention facilities
- Update: What has changed
  - Two new IMP designs
  - IMP Sizing Calculator

Chapters 1, 2, 3 and 5

- Stormwater Control Plan required
  - Consistency and completeness
  - Delineate drainage areas on exhibits
  - Describe drainage and facilities
- Integrate with site and landscape design submittals
- Consider operation & maintenance

Soils, Plantings, and Irrigation

- Appendix B published January 2009
- Soils
  - Detailed soil specification
  - “Brand name” mixes by local suppliers
- Plantings
  - Plant list
  - Fertilization, weed control, pest control
- Irrigation
  - Smart irrigation controllers
  - Drip emitters

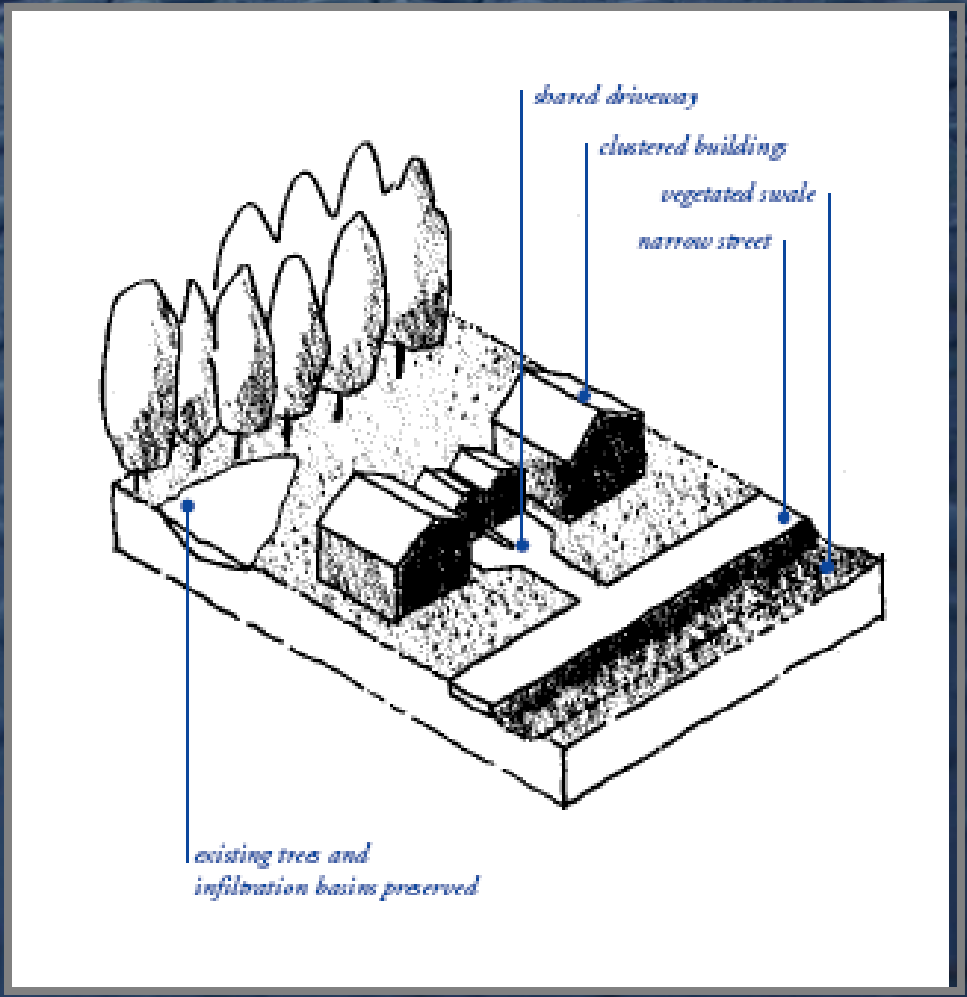
Chapter 4: LID Design Process

Analyze Your Project for LID

1. Optimize the site layout
2. Use pervious surfaces
3. Disperse runoff where possible
4. Drain remaining runoff to:
   - Bioretention Facilities
   - Flow-through Planters
   - Dry Wells
   - Cisterns + Bioretention
   - Bioretention + Vault

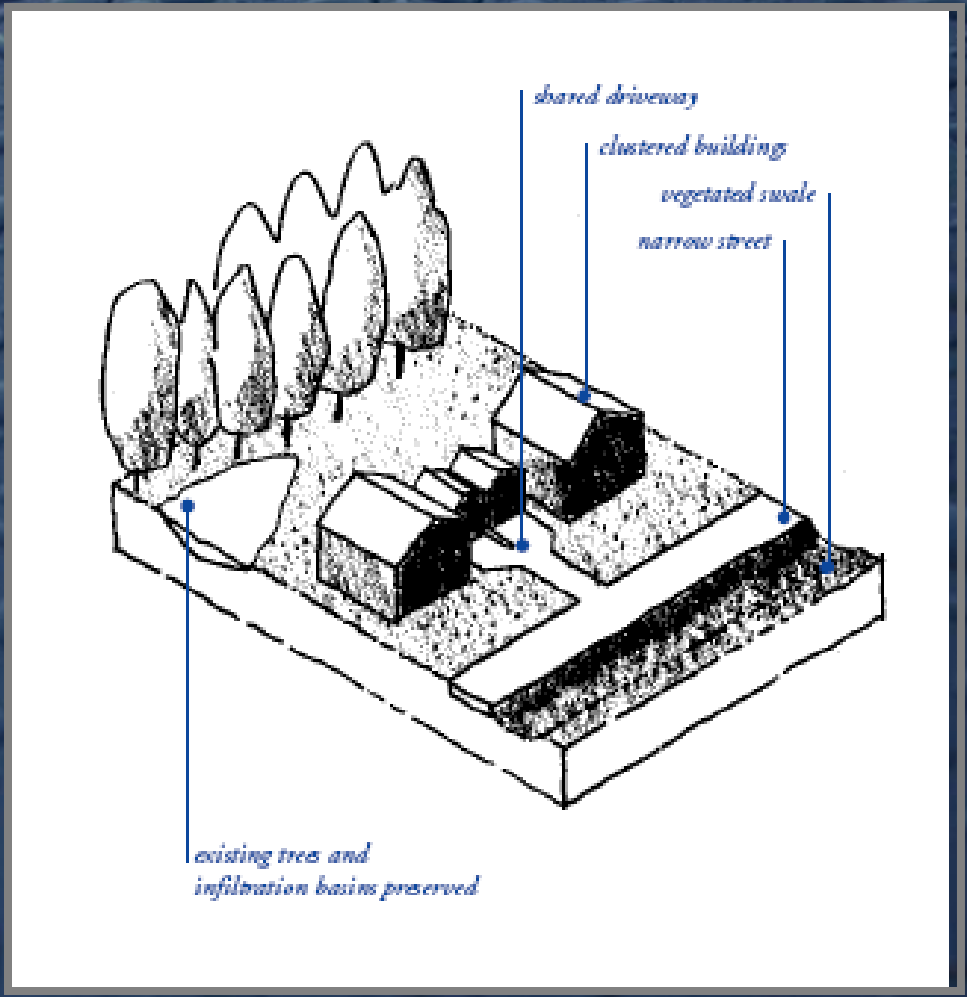
1. Optimize the Site Layout

- 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

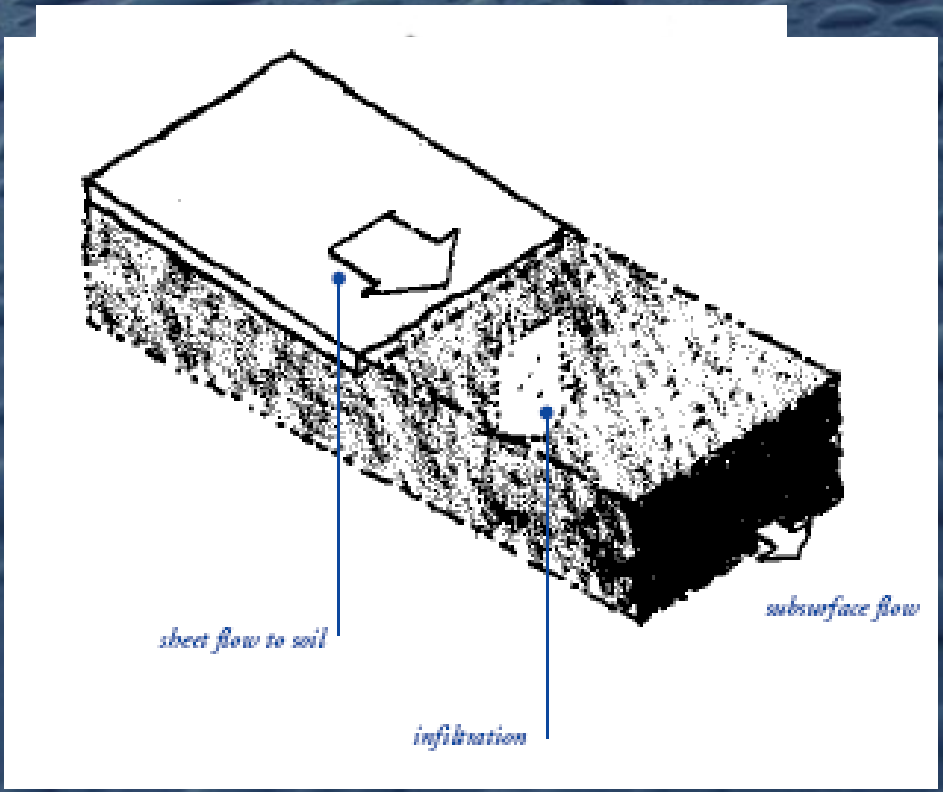


2. Use Pervious Surfaces

- Permeable pavements

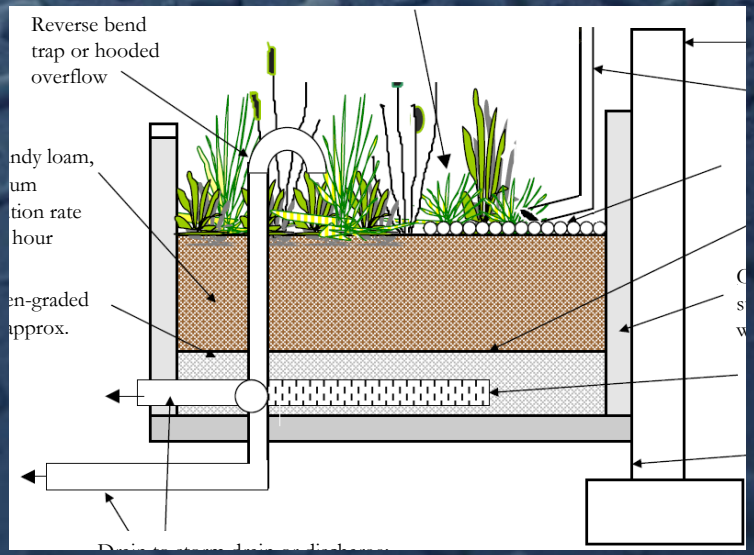
- Green roofs

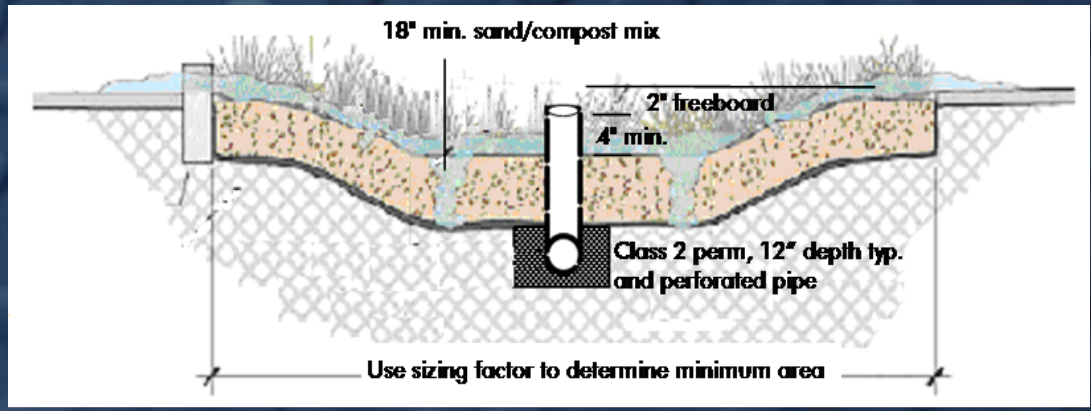
3. Disperse Runoff



4. Direct Runoff to Facilities

- Bioretention facilities
- Flow-through planters
- Dry wells
- Cisterns + Bioretention
- Bioretention + Vault





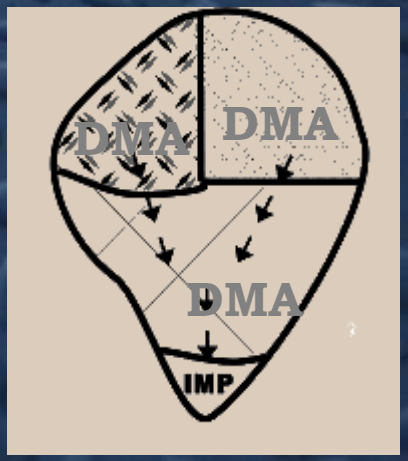
LID Design Process

Document Drainage Design

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

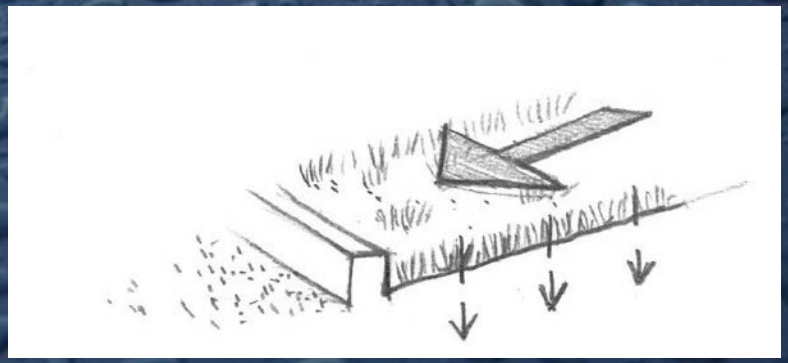
Drainage Management Areas

- 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



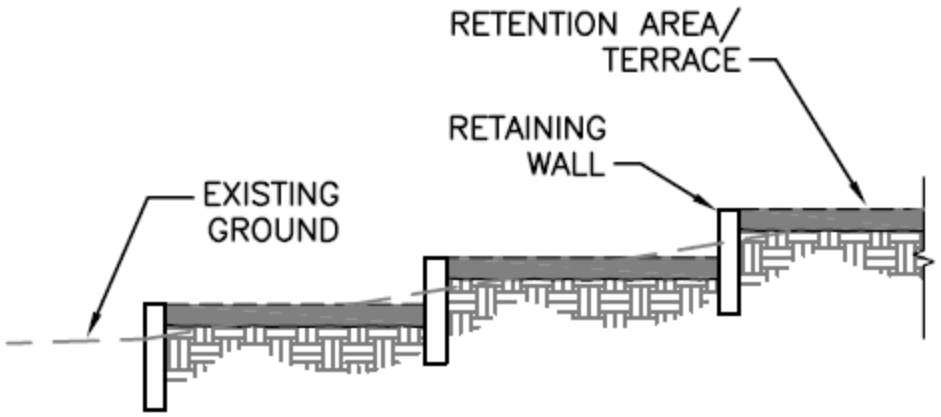
Self-treating DMAs

- 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



Self-retaining DMAs

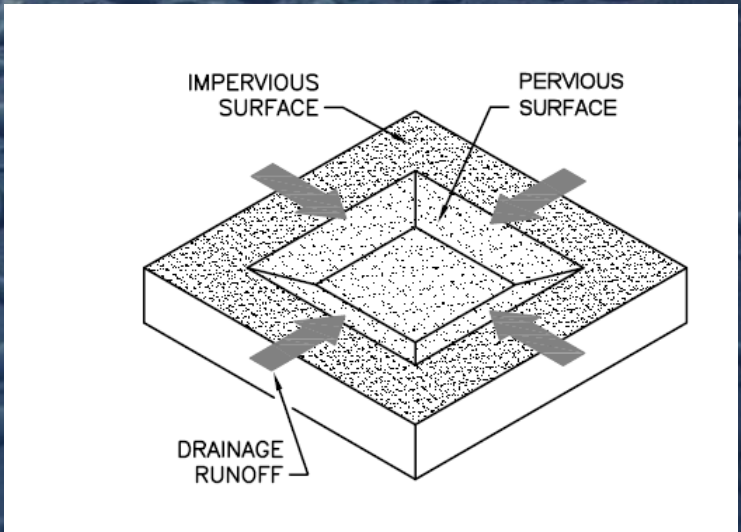
- Berm or depress grade to retain 1" rain
- Set area drain inlets above grade
- Amend soils
- Terrace mild slopes
- Have limited applicability in
  - Dense developments
  - Hillsides

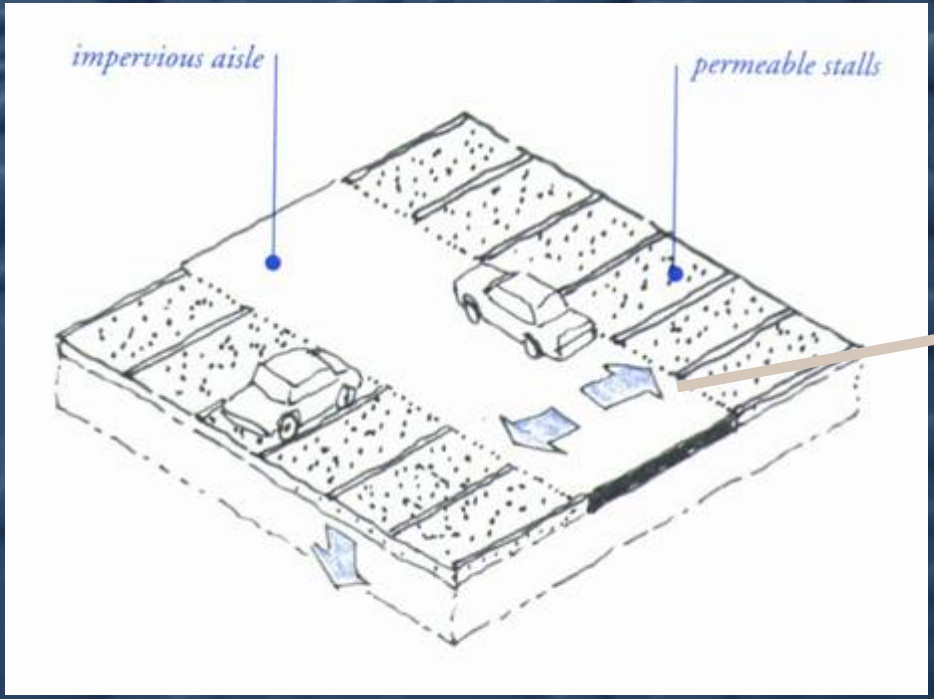


Areas draining to self-retaining areas

- 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

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 Bioretention Facilities

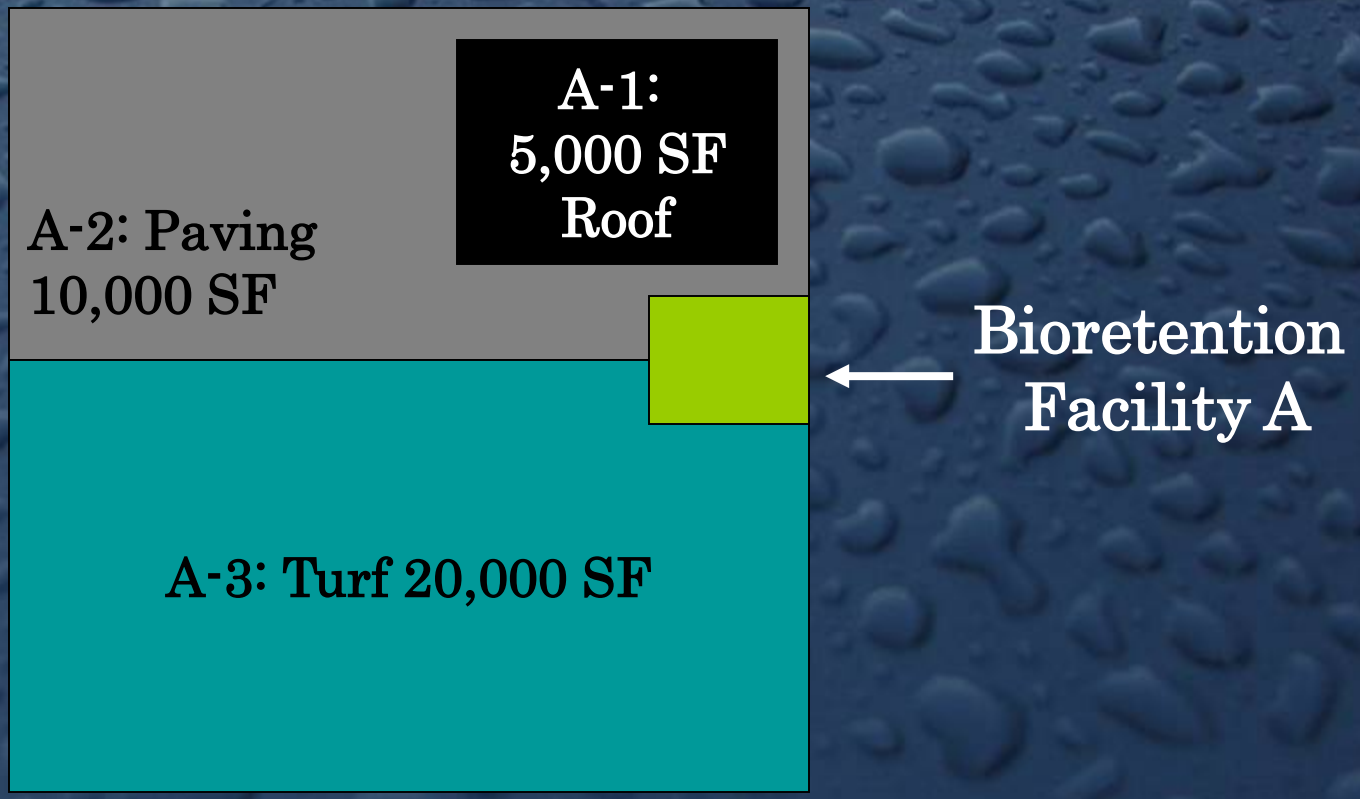
- Areas used to calculate the required size of the bioretention facility
- Where possible, drain only impervious roofs and pavement to bioretention facilities
- Delineate any pervious areas as separate Drainage Management Areas

DMAs draining to facilities

Treatment-only example

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

Calculating Facility Size

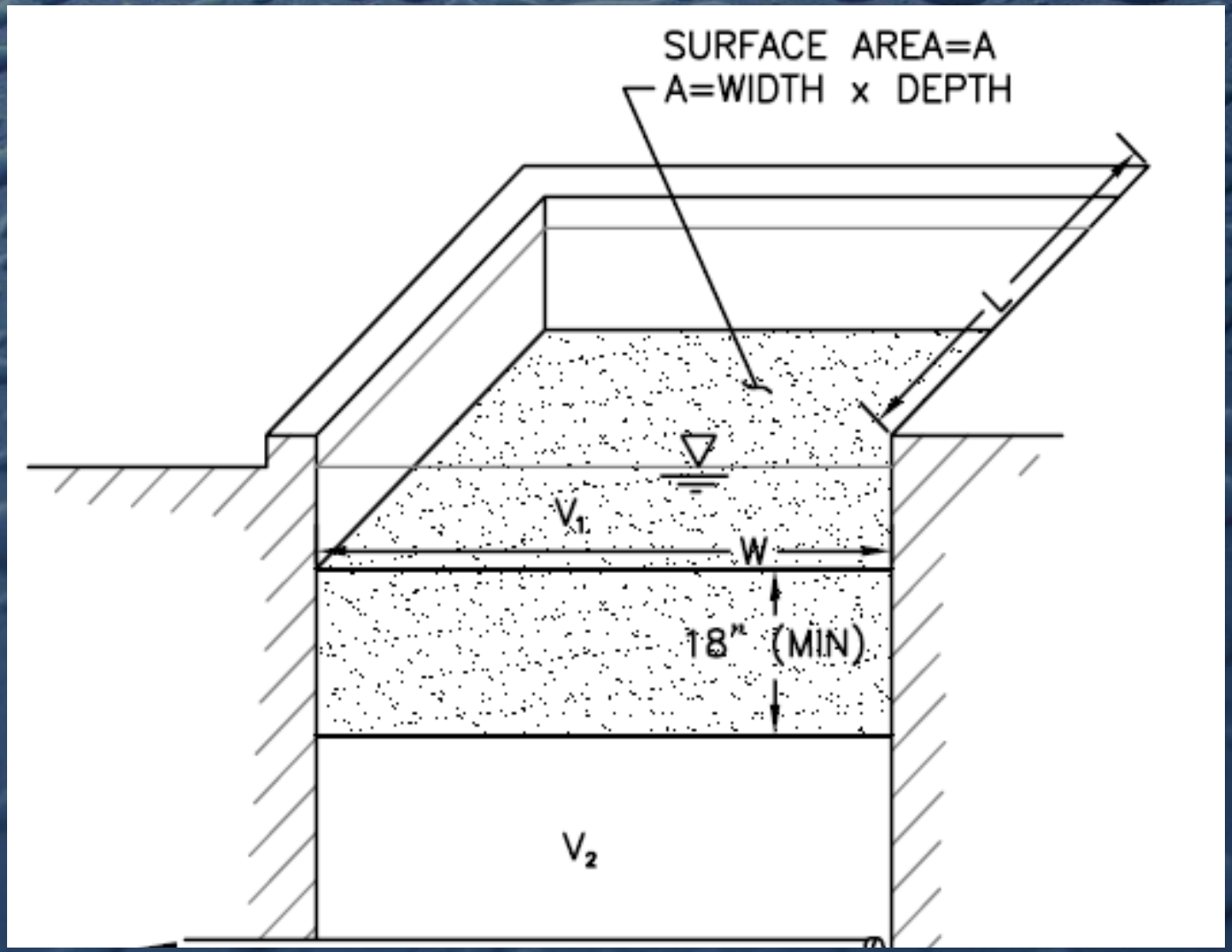


DMAs draining to facilities

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

Runoff Factors from Table 4-2 on p. 42

Sizing Factors for Flow Control



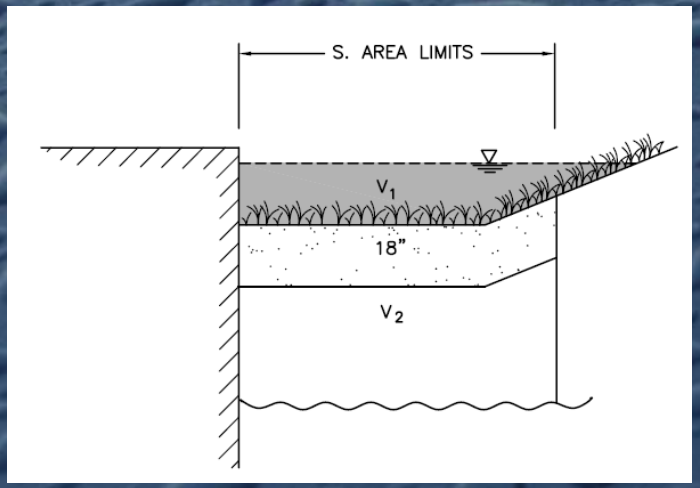
Surface Storage, V_1

Area of soil flooded before overflow, A

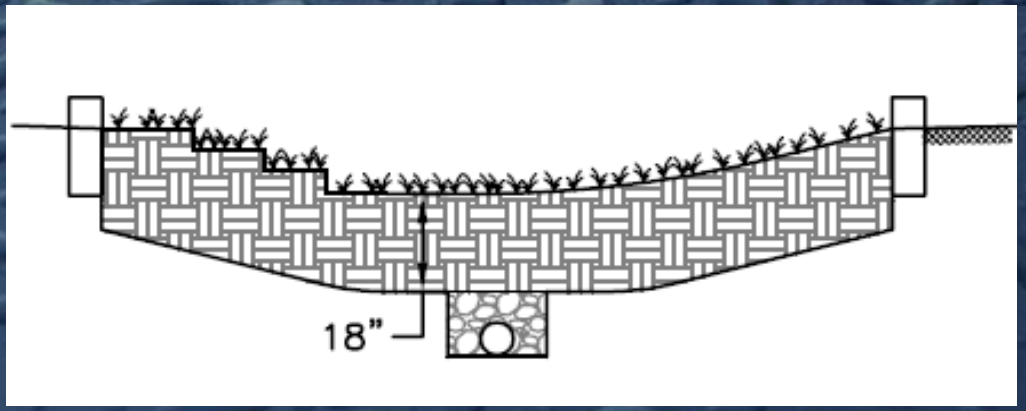
Subsurface Storage, V_2

Bioretention Design Options

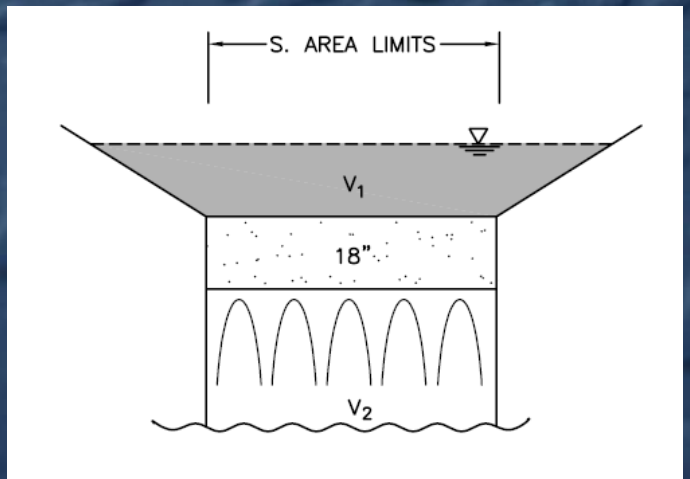
Edge Treatments



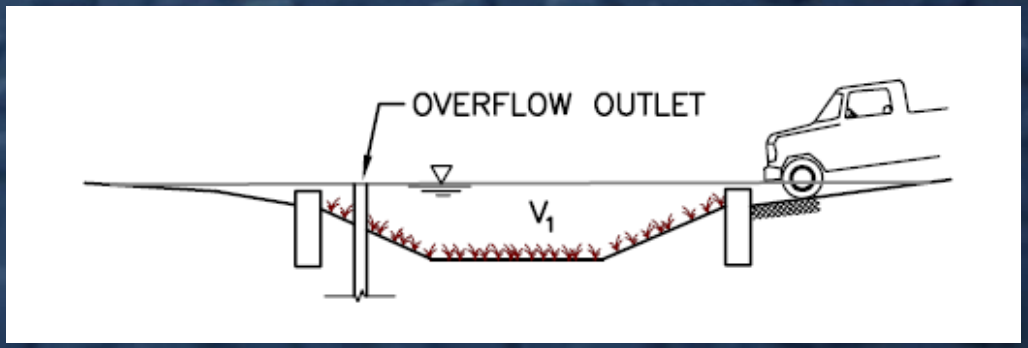
Stepped-back side slope



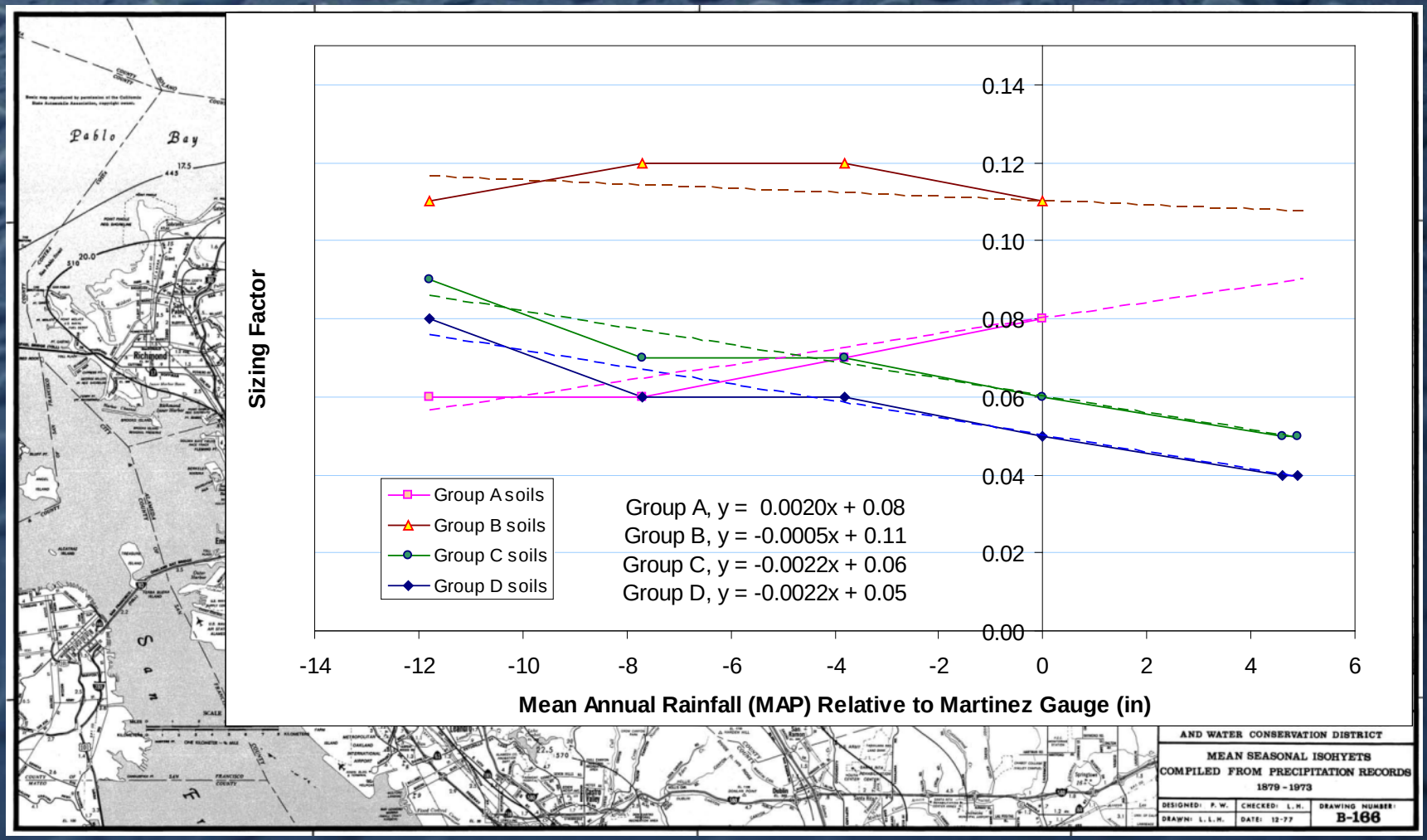
Subsurface Storage Options



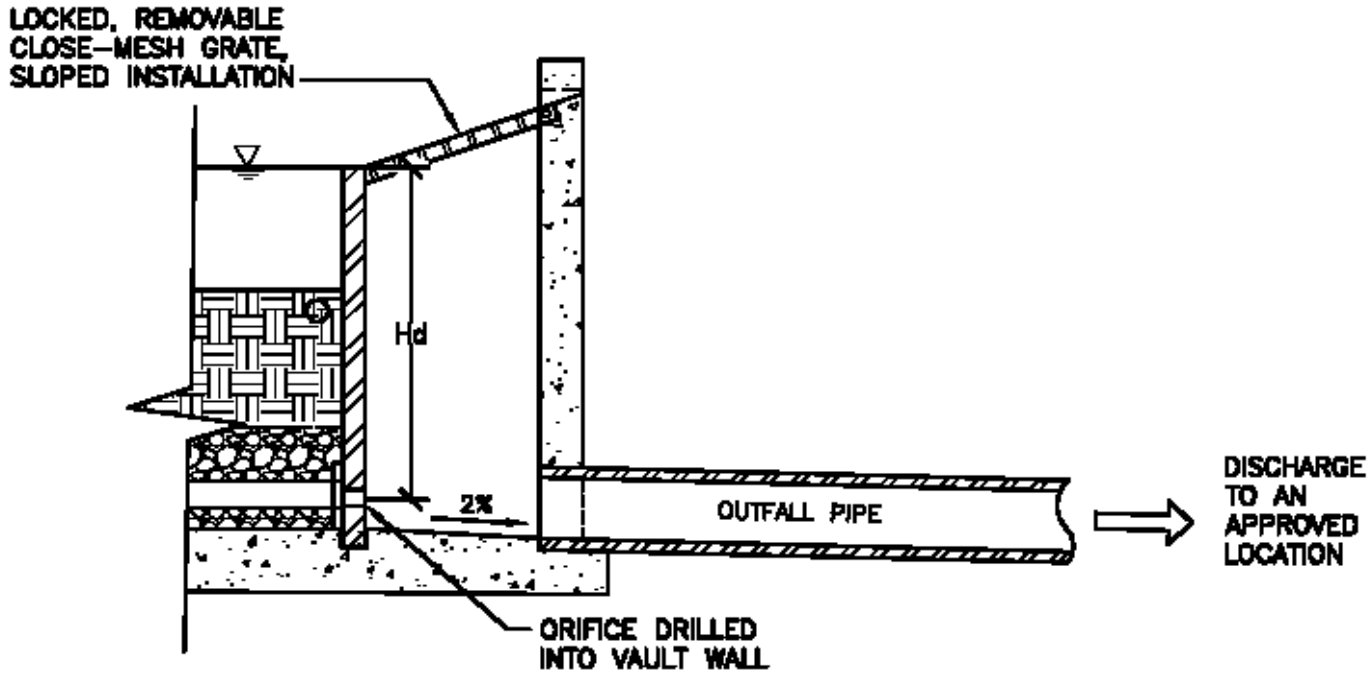
Using Shallow Flooding for Storage



Adjustment for Rainfall



Orifice Sizing for Flow Control



SECTION

N.T.S.

Calculation Format with Flow Control

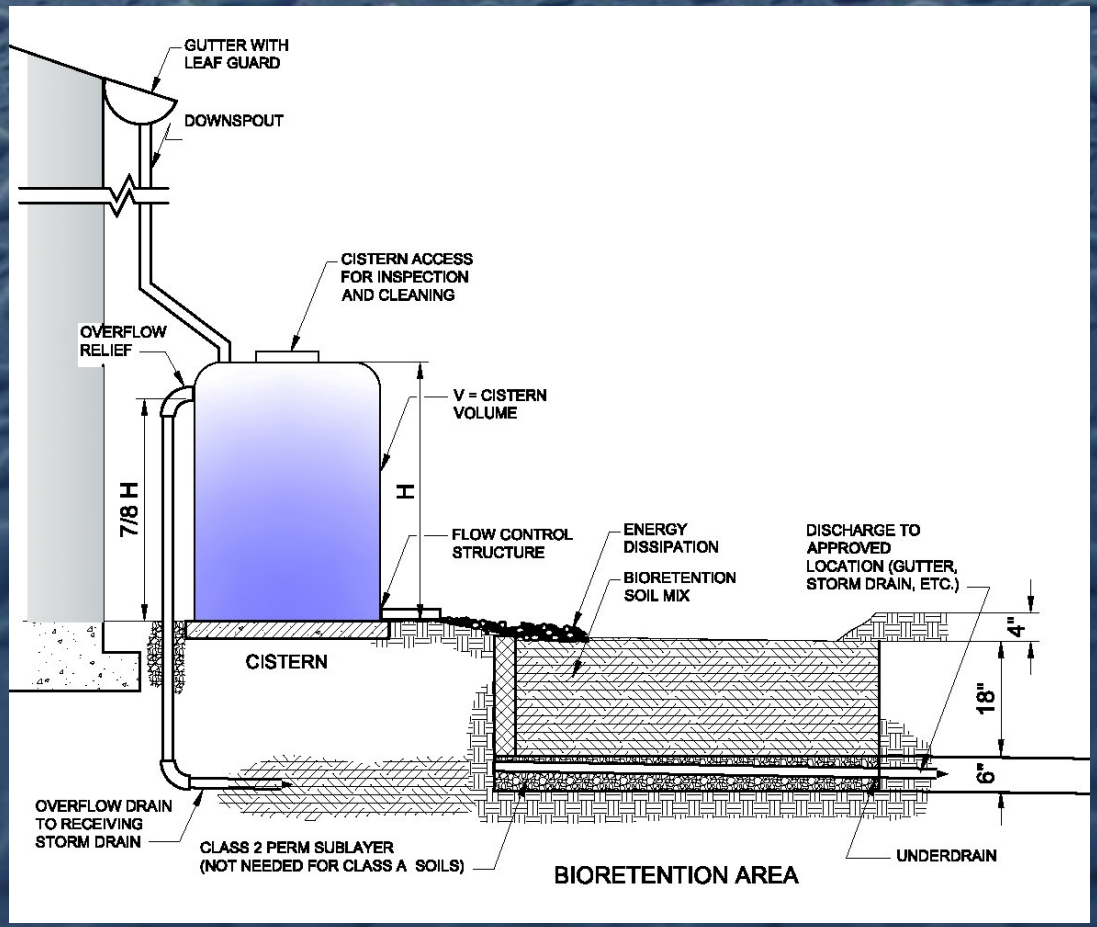
DMA Name	*DMA Area (square feet)*	*Post-project surface type*	*DMA Runoff factor*	*DMA Area × runoff factor*
			Total	

Soil Type:	*IMP Name*			
IMP Sizing factor	*Rain Adjustment Factor*	*Minimum Area or Volume*	*Proposed Area or Volume*	
				IMP Area
				V or V1
				V2
			Orifice Size:	

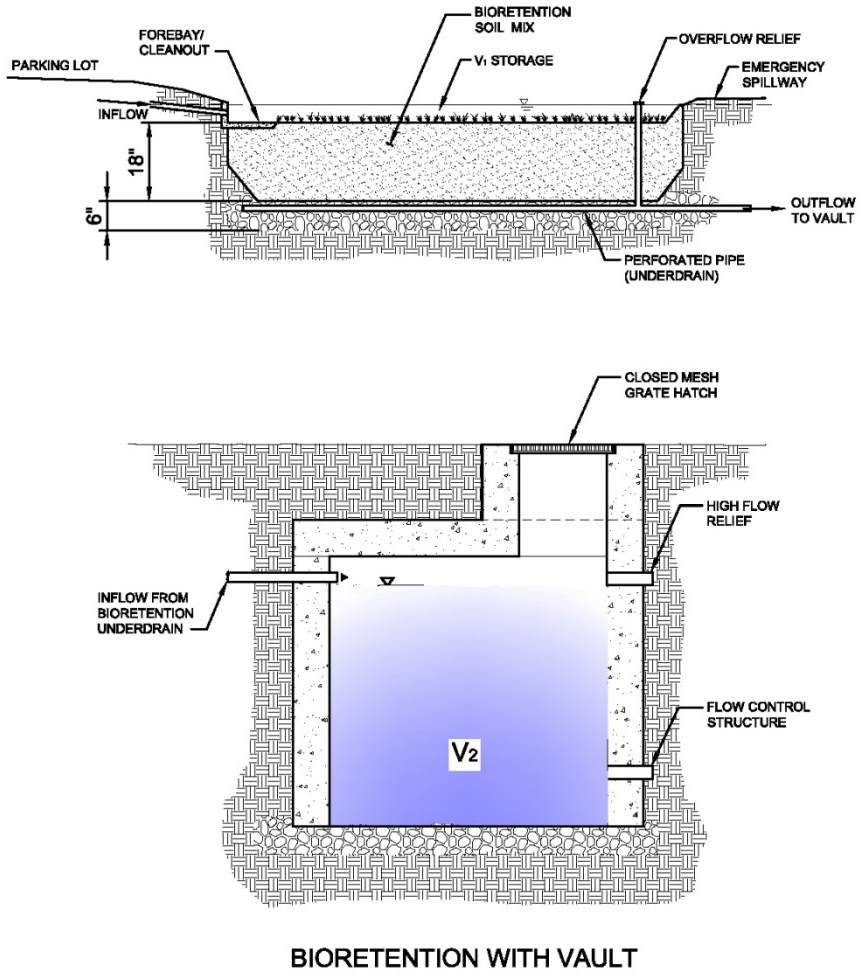
Update

- Two new IMPs
- Sizing Calculator

Cistern + Bioretention



Bioretention + Vault



BIORETENTION WITH VAULT

Sizing Calculator