Stormwater Technical Guide

Compliance with Central Coast Stormwater Post-Construction Requirements

Dan Cloak, Principal
Dan Cloak Environmental Consulting
April 17, 2014

Introduce yourself

- **Name**
- **Organization**
- **Role in land development design or review**
- **What you want to get out of today's training**

Motivations

Regulatory Compliance

- Mandate
- Client support
- Acceptance of costs
- Structure
- Schedule
- Accountability

Project Quality

- Enthusiasm
- Interest
- Energy
- Synergies
- Opportunities
- Elegance

Objectives for Today

- Become familiar with the *Stormwater Technical Guide*
- Become familiar with the Stormwater Control Measure Sizing Calculator
- Understand how to apply Low Impact Development design to achieve compliance
- Be ready to prepare or review a Stormwater Control Plan for a development site
- Share feedback

Chapter	Time	Topic
	8:30	Introductions and setting
	8:50	About the Post-Construction Requirements and this project
1	**8:55**	Thresholds and requirements
2	**9:15**	Path to compliance
3	**9:30**	Preparing a Stormwater Control Plan
4	**10:00**	Preparing and documenting your LID design
	10:15	BREAK
4	**10:30**	Technical and regulatory issues in LID design
4	**10:45**	Using the calculator to size Stormwater Control Measures
4	**11:30**	Designing and building bioretention and other LID facilities
5	**11:50**	Landscaping, operation, and maintenance of bioretention facilities
	12:00	Adjourn

About the PCRs

- Over five years in the making
  - February 15, 2008 letter
  - Central Coast Joint Effort began 2009
  - PCRs adopted September 6, 2012
  - PCRs readopted July 12, 2013 to supersede statewide requirements
- Apply to first project approvals granted after March 6, 2014

About the *Guide*

- Santa Barbara *Guide* was model
  - Supported by SWRCB grant
  - Administered by County of Santa Barbara staff with participation by city staff
  - Issues discussed within Water Board staff's Joint Effort Review Team (JERT)
- Adapted by MRSWMP

About the *Calculator*

- Developed to support the Santa Barbara *Stormwater Technical Guide*
- May be used throughout Central Coast Region
- Storm depth is the key geographic input variable
  - 85th or 95th percentile storm
  - Charts provided by Water Board

PCRs in a nutshell

- Site Design
- Runoff Treatment
- Runoff Retention
- Peak Runoff Controls
- Facility Maintenance

Standards and Thresholds

Page 1-1

Threshold	Performance Standard
≥ 2,500 SF	Design site drainage to minimize runoff
≥ 5,000 SF net	Treat runoff
≥ 15,000 SF	Retain specified runoff volume
≥ 22,500	Manage peak flows

What does "net" mean?

Pre-Project 10,000 SF

Post-Project 7,000 SF

3,000 SF

MRSWMP Approach

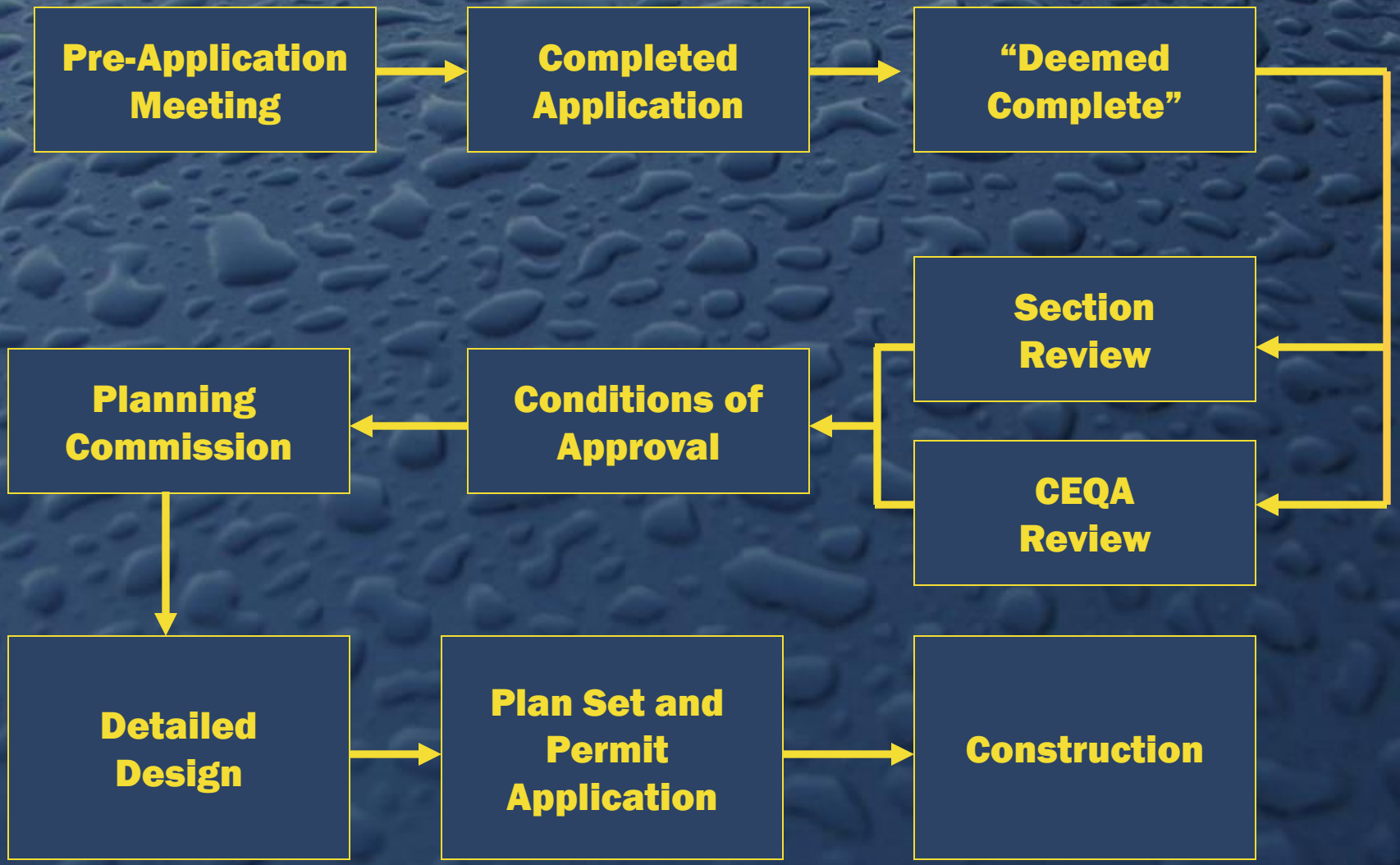
- Emphasis on on-site compliance
- Step-by-step design procedure
- Low Impact Development design
- Drainage Management Areas
  - Delineate and tabulate
  - Segregate drainage impervious/pervious
  - Bioretention for treatment and retention
- Calculator for sizing bioretention/SCMs

Path to Compliance

Page 2-1

1. Pre-application meeting
2. Follow the *Guide.*
3. Stormwater Control Plan
4. Draft O&M Plan
5. Detailed project design
6. Construction
7. Transfer maintenance responsibility

Development Review Process



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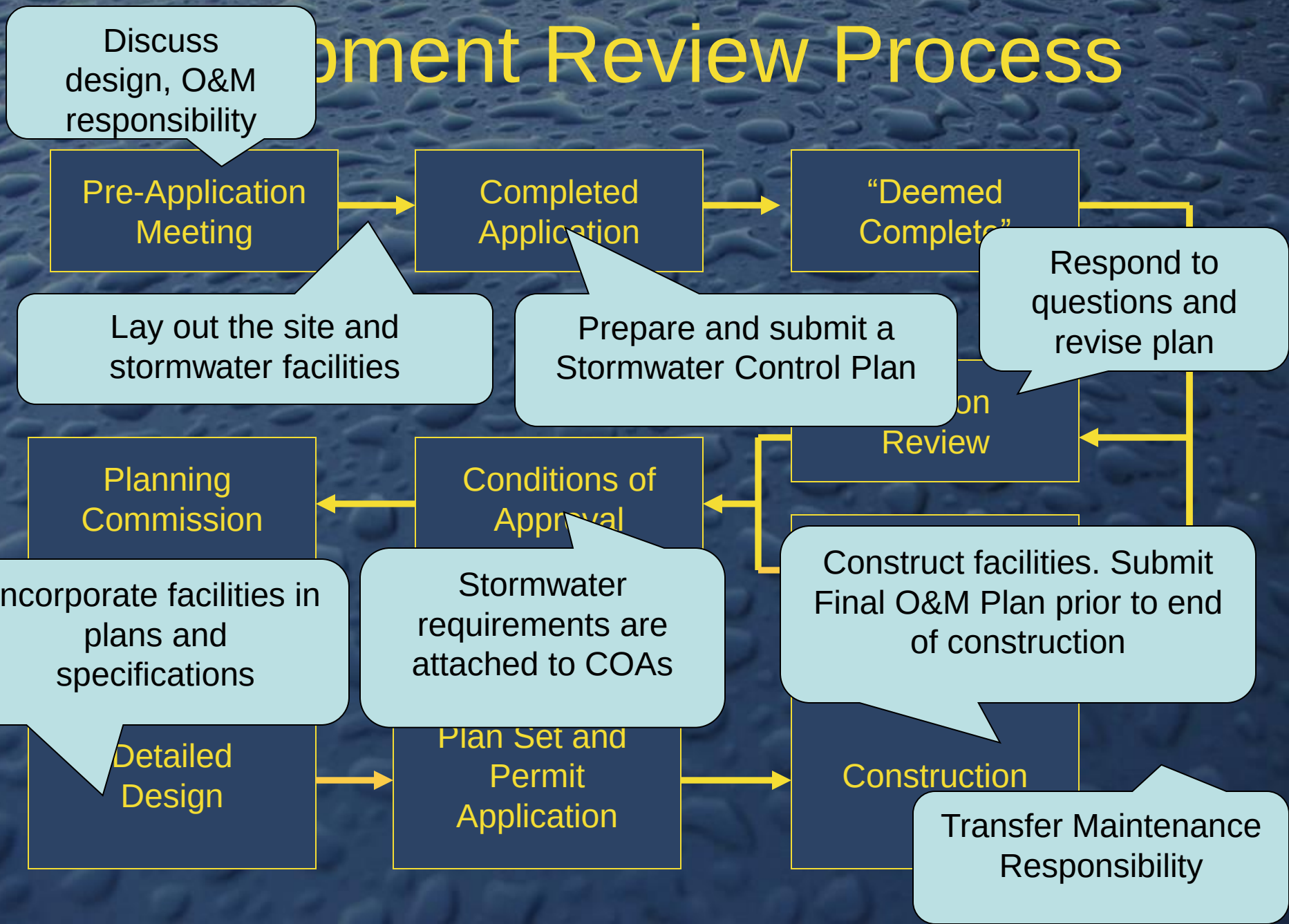


Level of Detail

Page 3-1

"Plan and design your stormwater controls integrally with the site plan and landscaping for your project."

- Drainage Management Areas
  - Grading and roof areas and slopes
- Locations/sizes of stormwater facilities
- Conceptual routing of drainage

Stormwater Control Plan

Page 3-1

1. Project Information
2. Opportunities and Constraints
3. Conceptual Site Design
4. Calculations and Documentation
5. Design Details
6. Source Controls
7. Maintenance
8. Construction Checklist

Tools

- *Stormwater Technical Guide*
- Stormwater Control Plan Template
  - Small (Tier 1) projects
  - Tier 2 and Tier 3 projects
- Calculator

Small (Tier 1) Projects

Template

PCRs require:

- Implement site design strategies
- Implement at least one runoff reduction measure

Stormwater Control Plan comprises:

1. Project Data Form
2. Site Plan or Sketch
3. Design criteria checklist(s) for runoff reduction measure(s) selected

1. Project Information

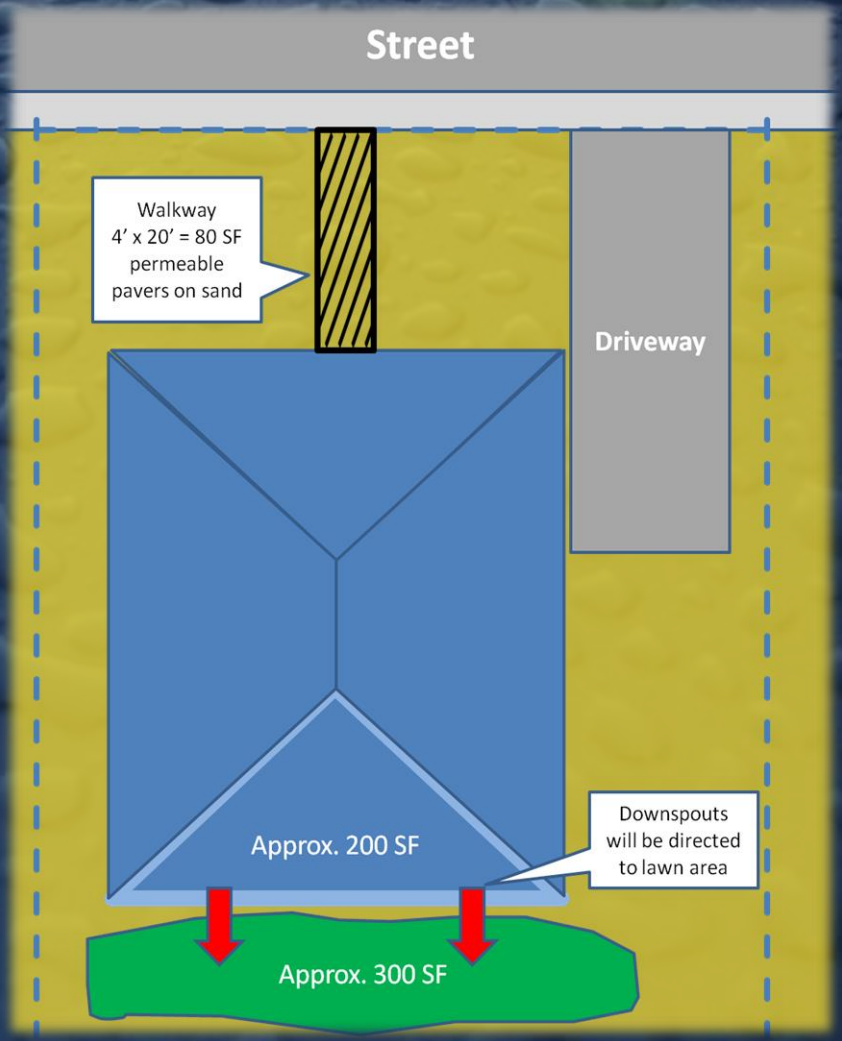
Template

- Application Submittal Date
- Project Location
- Owner/Developer
- Type and Description
- Total Site Area
- Impervious Areas
  - Total New
  - Total Replaced
  - Total Pre-Project
  - Total Post-Project
- Runoff Reduction Measures Selected

1. Disperse runoff to vegetated areas
2. Pervious pavement
3. Cisterns or rain barrels
4. Bioretention facility or planter

2. Site Plan or Sketch

Template

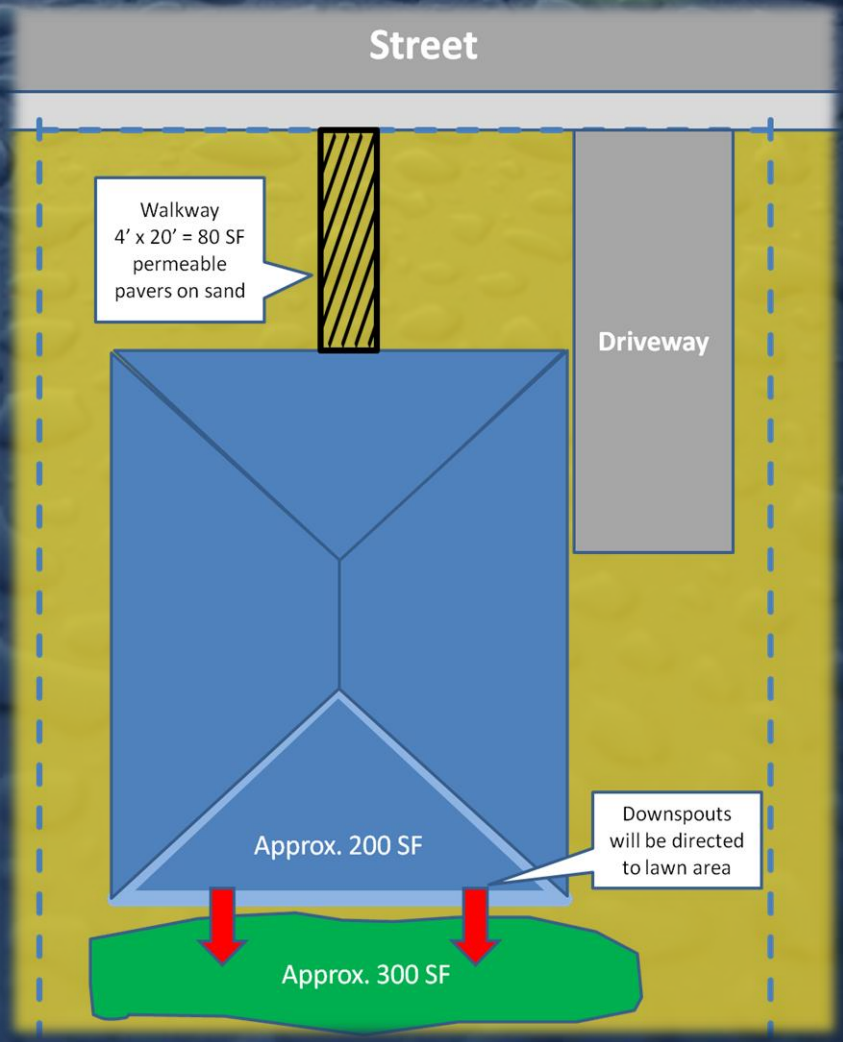


3. Design Checklist

Template

On the site plan, show:

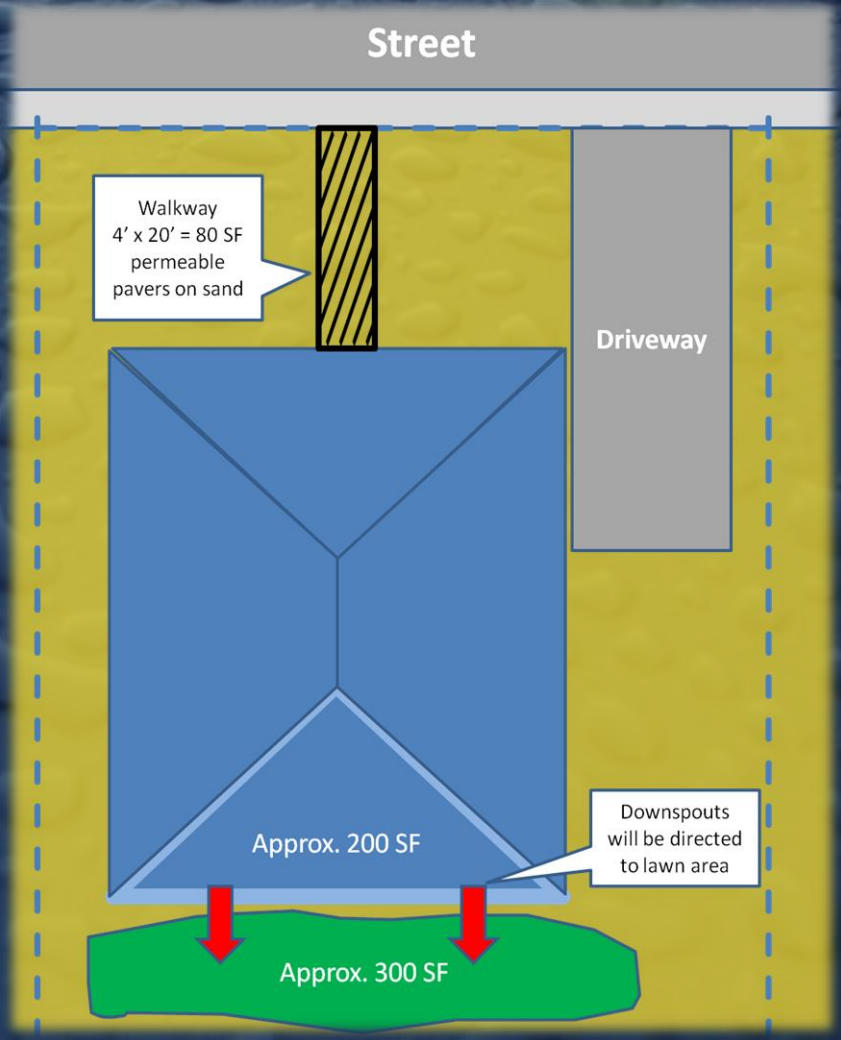
- Each impervious area from which runoff will be directed, and its square footage.
- The vegetated areas that will receive runoff, and the approximate square footage of each.
- If necessary, explain in notes on the plan how runoff will be routed from impervious surfaces to vegetated areas.



3. Design Checklist

Template

- ❑ Confirm the following standards are met:
- ❑ Tributary impervious square footage in no instance exceeds twice the square footage of the receiving pervious area. On your sketch, show rough dimensions that will confirm this criterion is met.
- ❑ Roof areas collect runoff and route it to the receiving pervious area via gutters and downspouts.
- ❑ Paved areas are sloped so drainage is routed to the receiving pervious area.
- ❑ Runoff is dispersed across the vegetated area (for example, with a splash block) to avoid erosion and promote infiltration.
- ❑ Vegetated area has amended soils, vegetation, and irrigation as required to maintain soil stability and permeability.
- ❑ Any area drains within the vegetated area have inlets at least 3 inches above surrounding grade.



Tier 2 and Tier 3 projects

Page 3-2

Guidance in 4 formats:

1. Step-by-step instructions
2. Checklist
3. Template/table of contents
4. Example Stormwater Control Plans (to come)

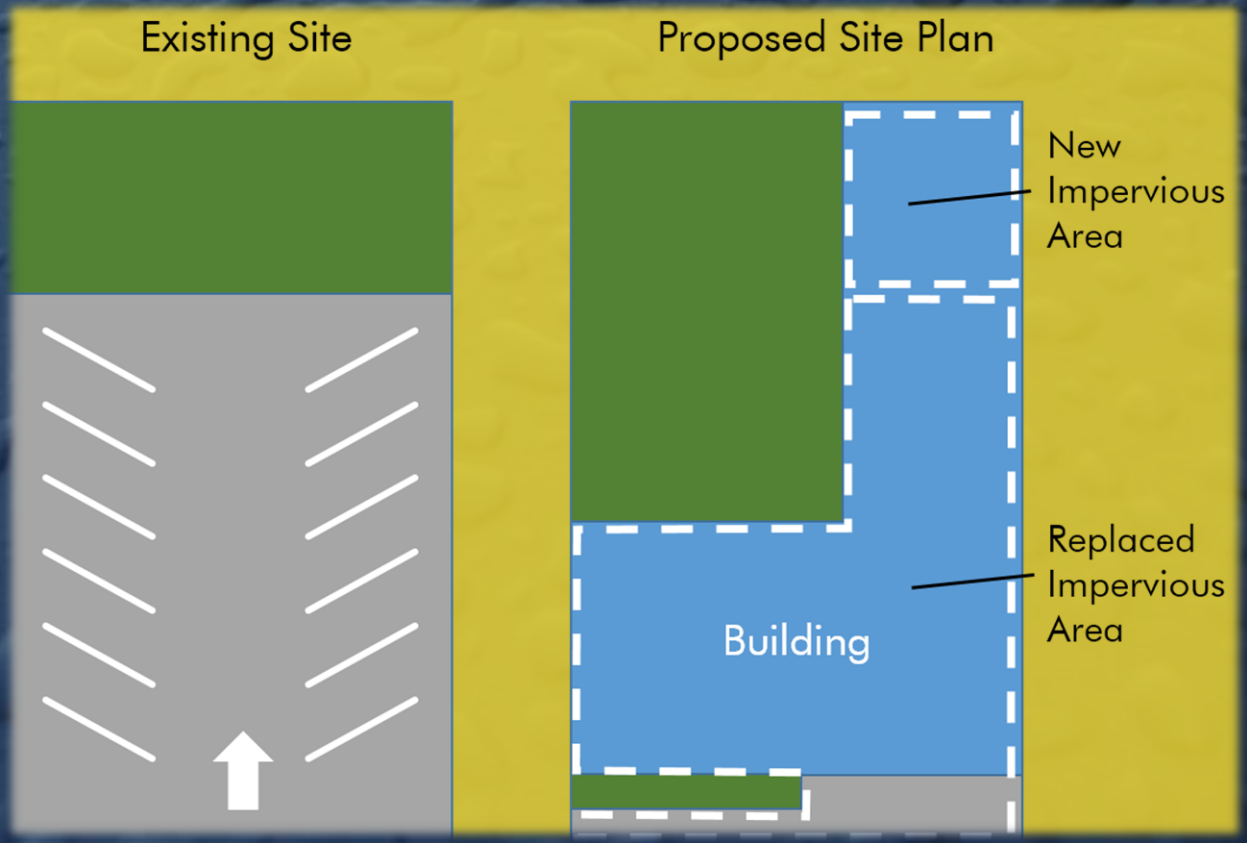
Step by Step

Template

Page 3-3

1. Project Information

- ❑ New
- ❑ Replaced
- ❑ Pre-Project
- ❑ Post-Project
- ❑ Net
  = New+ Replaced – (Pre-Post)



Step by Step

Template

Page 3-3

1. Project Information

Resolution R3-2013-0032 Adopted July 12, 2013, Approving Post-Construction Stormwater Management Requirements for Development Projects in the Central Coast

- Resolution No. R3-2013-0032
  - Resolution Attachment 1: Post Construction Requirements
  - Resolution Attachment 2: Technical Support Document for Post-Construction Requirements
    - Technical Support Document, Attachment A: Watershed Management Zone Maps (8.6 MB)
    - Technical Support Document, Attachment D: Case Study of Hydrologic Benefits of On-Site Retention in the Central Coast Region
    - Technical Support Document, Attachment E: Methods and Findings of the Joint Effort for Hydromodification Control in the Central Coast Region (2.8MB)
    - Technical Support Document, Attachment G: Stormwater Control Measure Sizing
    - Technical Support Document, Attachment H: Support for Selection of Criteria

- Watershed Management Zone(s)
- Design Storm Frequency and Depth
- Urban Sustainability Area

85th and 95th Percentile Rainfall Depths

The Central Coast Post-Construction Requirements stipulate that municipalities must require Regulated Projects to use rainfall statistics provided by the Central Coast Water Board or to calculate site-specific rainfall depths determined from local rainfall data using USEPA's methodology (see Post-Construction Requirements Provision B.4.c).

Rainfall Statistics Provided by the Central Coast Water Board:

WARNING: Read instructions before downloading maps.
85th Percentile Rainfall Depth Maps (Adobe Reader, pdf)
95th Percentile Rainfall Depth Maps (Adobe Reader, pdf)

Shapefiles of 85th and 95th Percentile Rainfall Depth Maps (GIS Shape Files)

Memo Explaining Process for Developing Rainfall Depth Maps
Memo Documenting Confidence Interval Accuracy of Rainfall Depths

Directions for Using Local Rainfall Data to Develop Site-Specific Rainfall Depths:
Directions for Using Local Rainfall Data to Develop Site-Specific Rainfall Depths

Spatial Data Coverages

Google:
"Central Coast Watershed Management Zone Maps"

2. Opportunities/Constraints

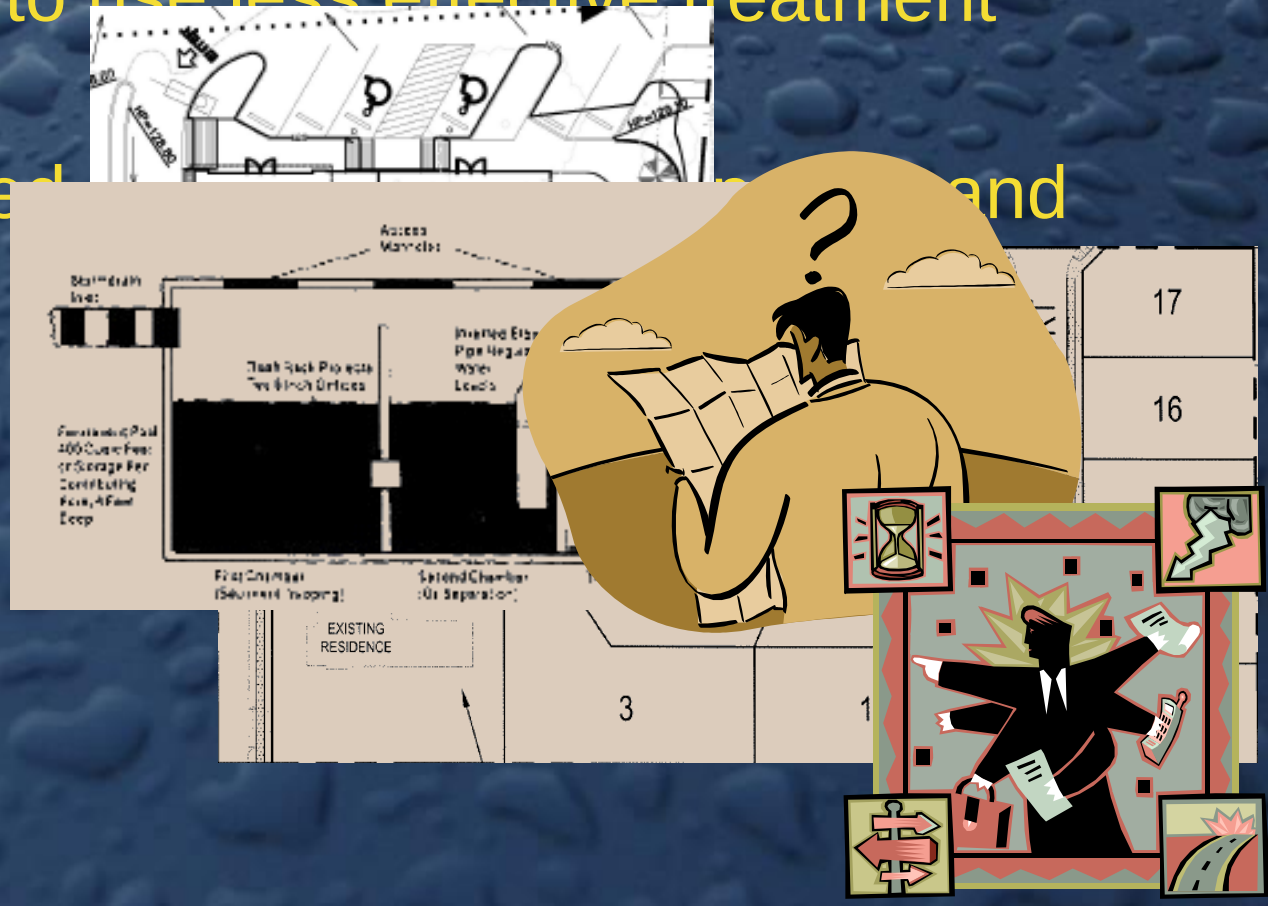
Page 3-3

- Topography
- Unbuildable Areas
  - Setbacks from street or adjacent lots
  - Setbacks from watercourses
  - Odd-shaped areas
- Factors that facilitate or prevent infiltration

3. CONCEPTUAL SITE DESIGN

3 most common mistakes

1. Didn't start early enough.
2. Planned to use less effective treatment facilities.
3. Postpone[illegible] and maintain



LID Design Process

Analyze Your Project for LID

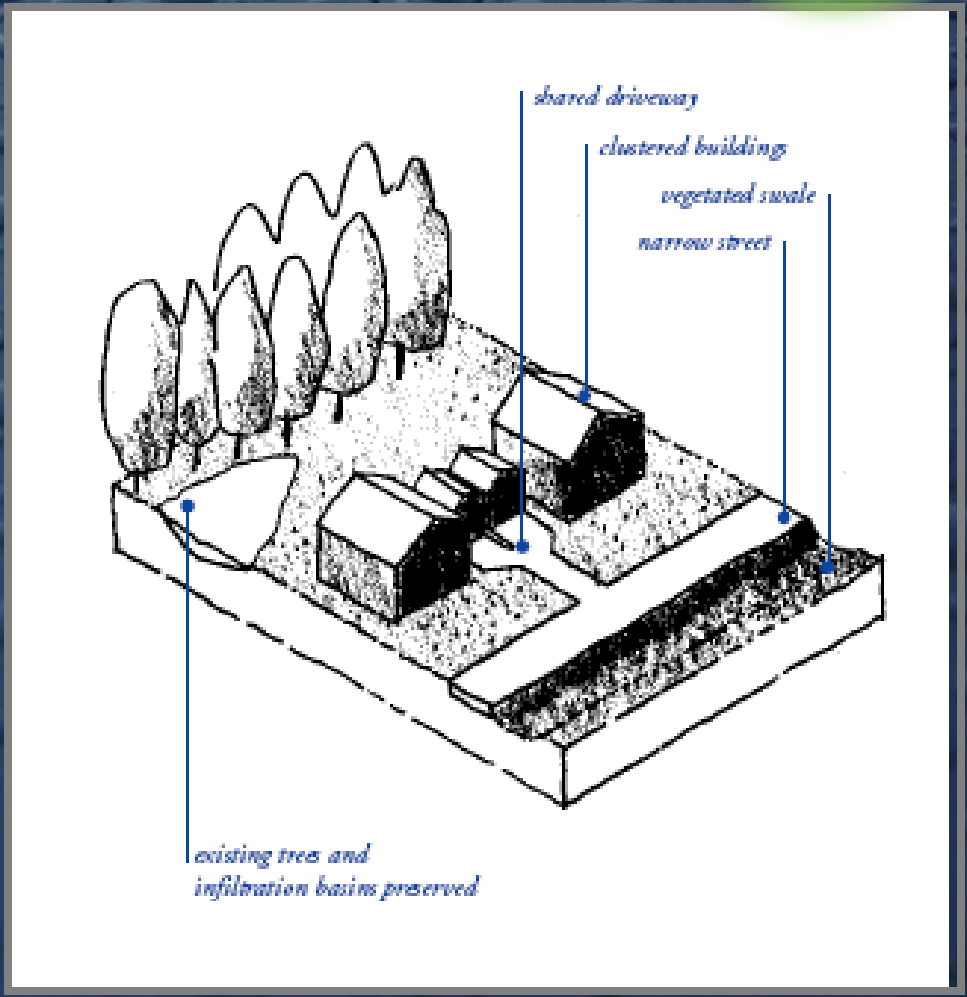
Page 3-4

- Optimize the site layout
- Limit paving and roofs
- Use pervious surfaces
- Disperse runoff
- Drain to bioretention facilities or other infiltration facilities

Optimize the Site Layout

Page 3-4

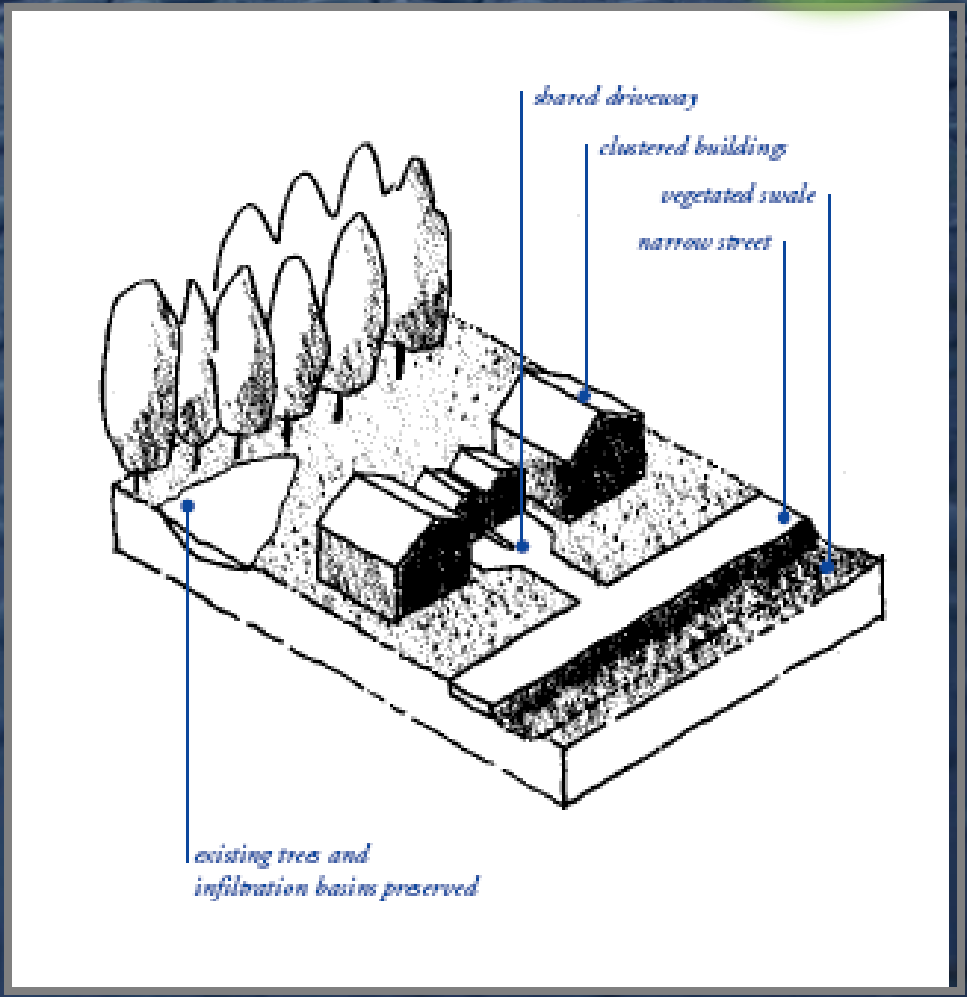
- Define the development envelope
- Minimize grading
- Set back from creeks, wetlands, and riparian areas
- Preserve significant trees



Optimize the Site Layout

Page 3-4

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



Use Pervious Surfaces

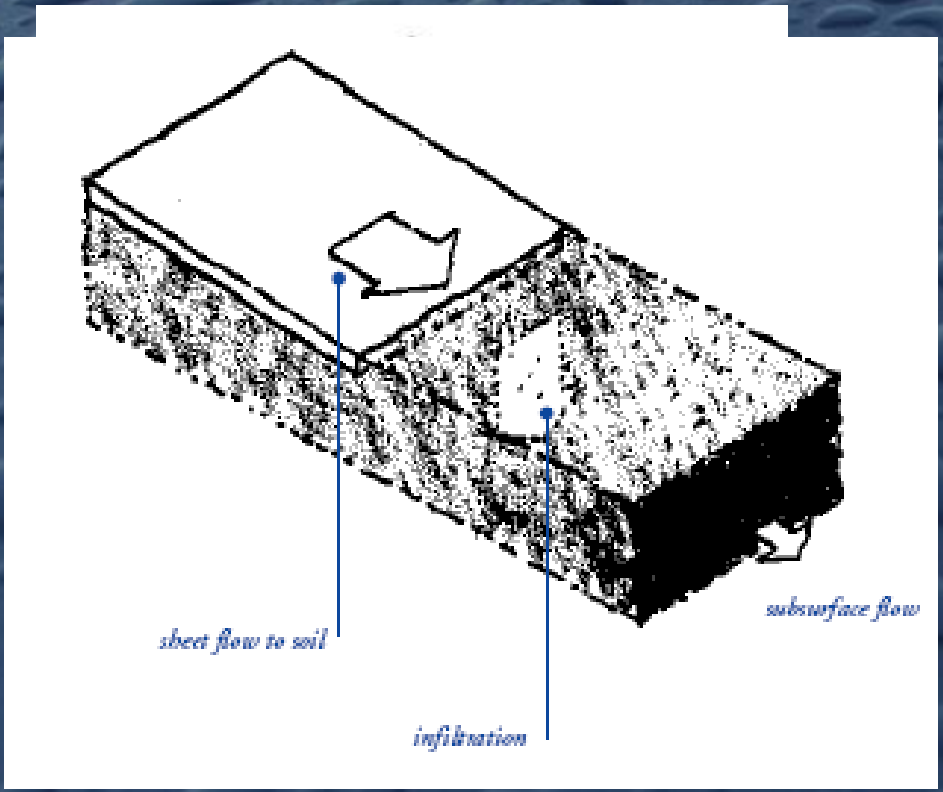
Page 3-4

- Permeable pavements

- Green roofs

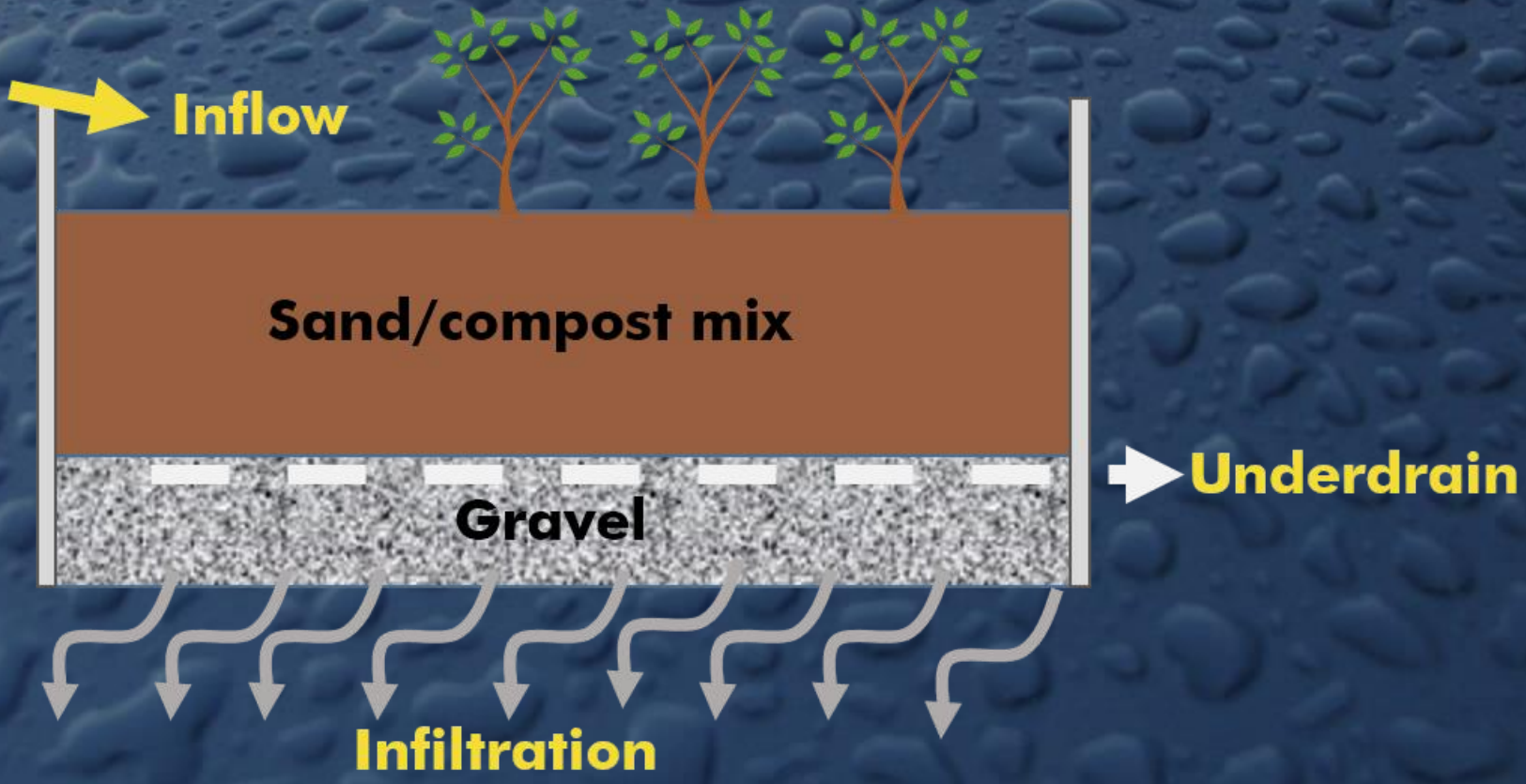
Disperse Runoff

Page 3-4



Direct Runoff to Facilities

Page 3-4



Landscape Treatments

Tips for Siting Facilities

Page 3-5

- Require 4% - 10% of tributary area
- Flat sites
  - Limit drainage runs
  - Small facilities distributed throughout site
- Sloped sites
  - May work to collect runoff and pipe down hill
  - Use the head from roof downspouts
- Consider future ownership and access

4. Calcs and Documentation

Page 3-6

5. Design of LID Facilities

Page 3-6

6. Source Controls

Page 3-6

- Identify sources from checklist in Appendix A
- Complete table in format of Table 3-1
- Narrative to explain special features, materials, or methods of construction

Potential Source of Runoff Pollutants	Permanent/Structural Source Control BMPs	Operational/Pollution Prevention BMPs

7. Maintenance of Facilities

Page 3-6

- Operation and maintenance plan required (Chapter 5)
- O&M Plan is referenced in an agreement that "runs with the land"
- Stormwater Control Plan must:
  - Acknowledge and summarize maintenance requirements
  - Include a statement accepting maintenance responsibility
- Most significant for subdivisions

8. Construction Checklist

Page 3-7

- Device to alert plan checker to stormwater requirements and to facilitate review

Stormwater Control Plan Page #	BMP Description	See Plan Sheet #s

9. Certification

Page 3-8

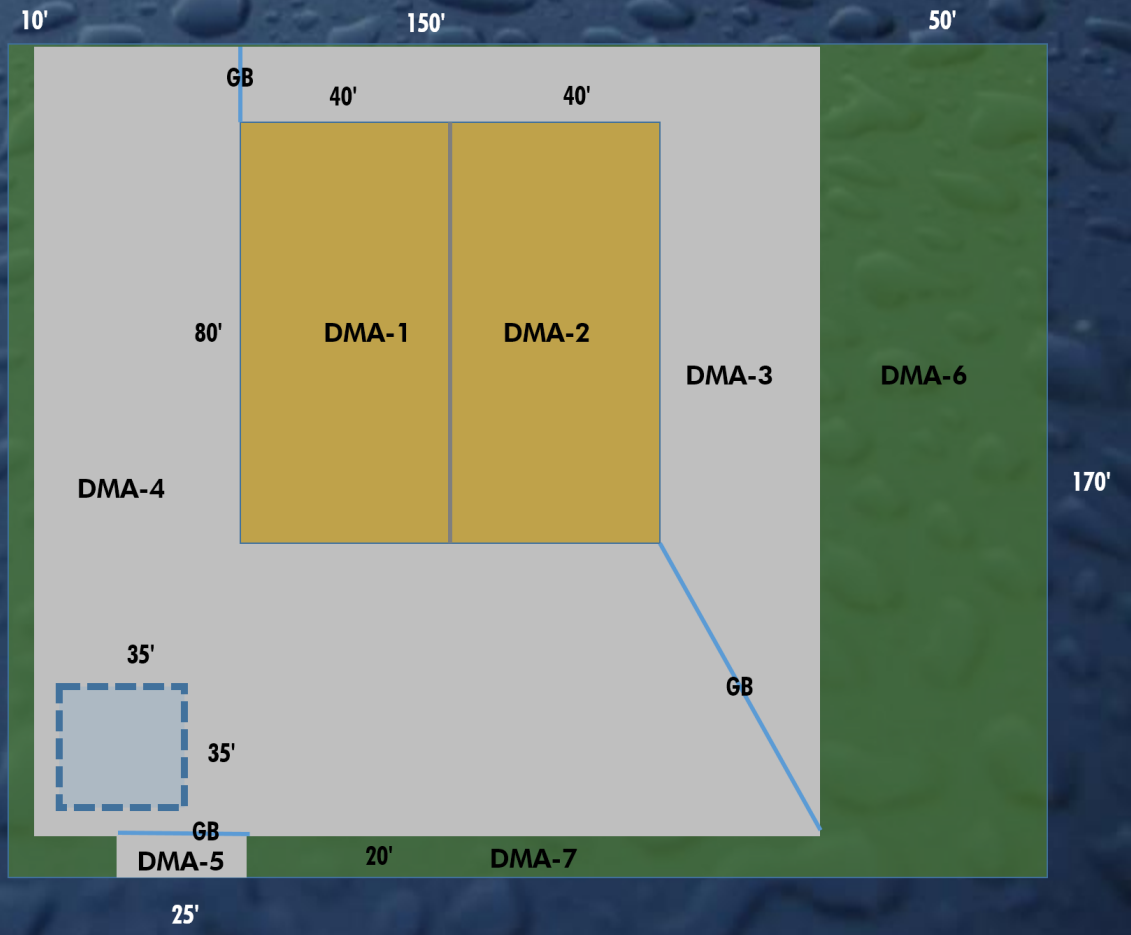
"The preliminary design of stormwater treatment facilities and other stormwater pollution control measures in this plan are in accordance with the current edition of the Monterey Regional Stormwater Management Program's *Stormwater Technical Guide.*"

DOCUMENTING YOUR LID DESIGN

Drainage Management Areas

Page 4-2

- Follow roof ridges and grade breaks
- Different DMA for each surface type



DMA Types

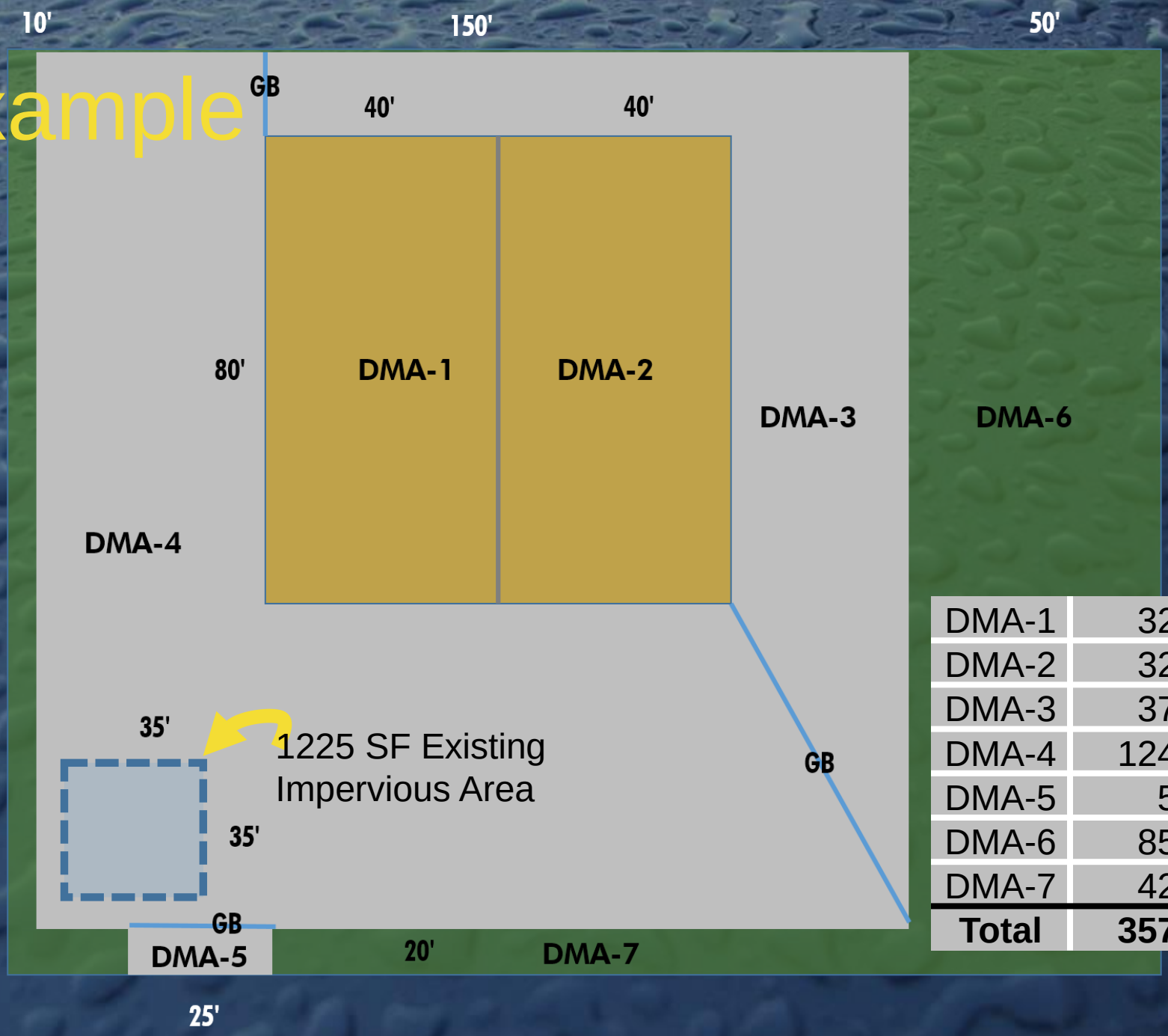
Page 4-2

- Pervious DMAs
  - Self-treating
  - Self-retaining
- Impervious DMAs
  - Drains to self-retaining
    - Max 2:1 ratio impervious:pervious
  - Drains to LID facility

Use a curb to avoid run-on from self-treating areas

Grade self-retaining areas to drain inward. Set any area drains to pond 3"-4"

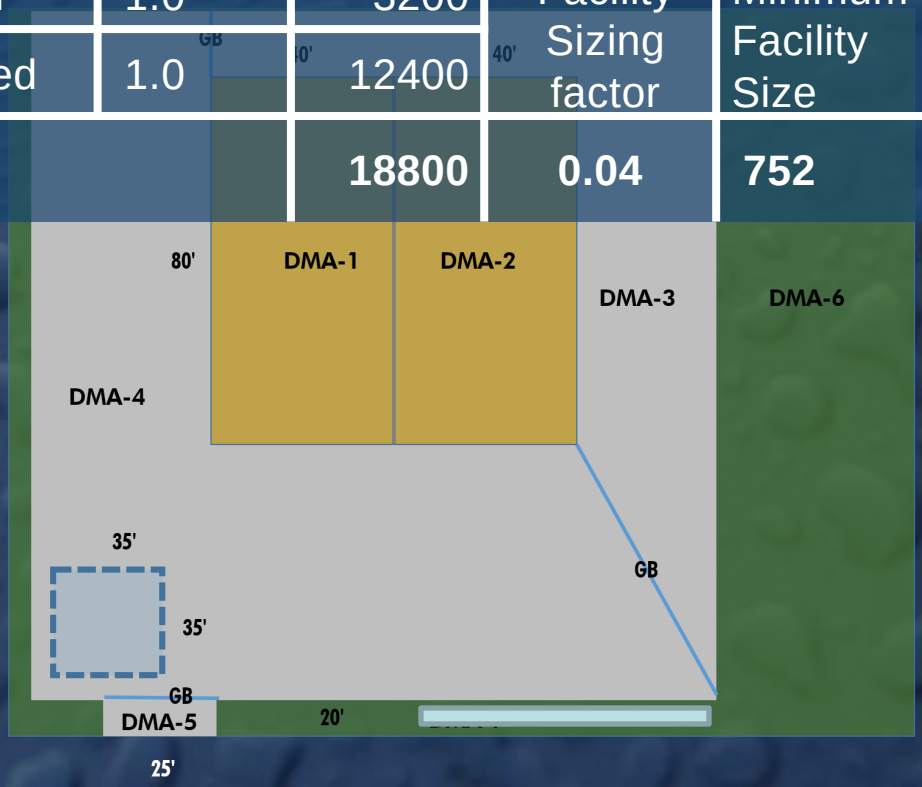
Example



DMA-1	3200
DMA-2	3200
DMA-3	3700
DMA-4	12400
DMA-5	500
DMA-6	8500
DMA-7	4200
Total	**35700**

Sizing – Treatment Only

DMA Name	DMA Area (SF)	Post-project surface type	DMA Runoff factor	DMA Area × runoff factor	Facility Name		
DMA-1	3200	Roof	1.0	3200			
DMA-2	3200	Roof	1.0	3200	Facility Sizing factor	Minimum Facility Size	Proposed Facility Size
DMA-4	12400	Paved	1.0	12400			
Total>				18800	0.04	752	900



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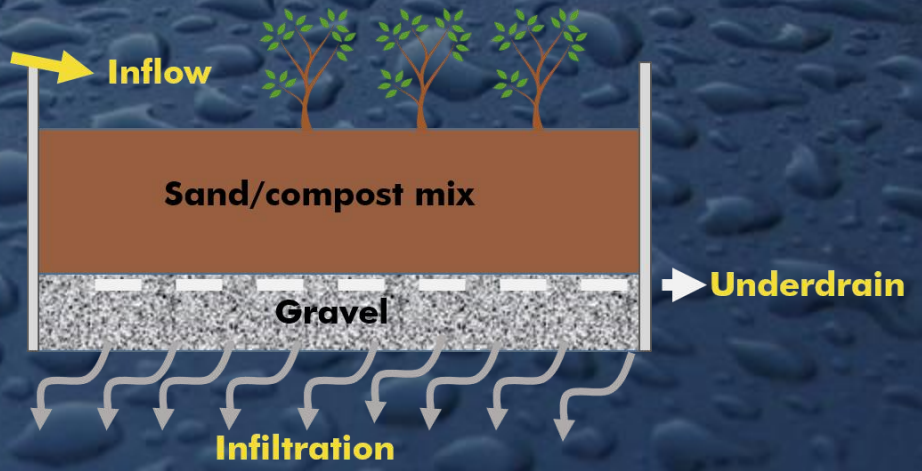
DMA-3	3700
DMA-4	12400
DMA-5	500
DMA-6	8500
DMA-7	4200
Total	**35700**

BREAK

Technical & Regulatory Issues

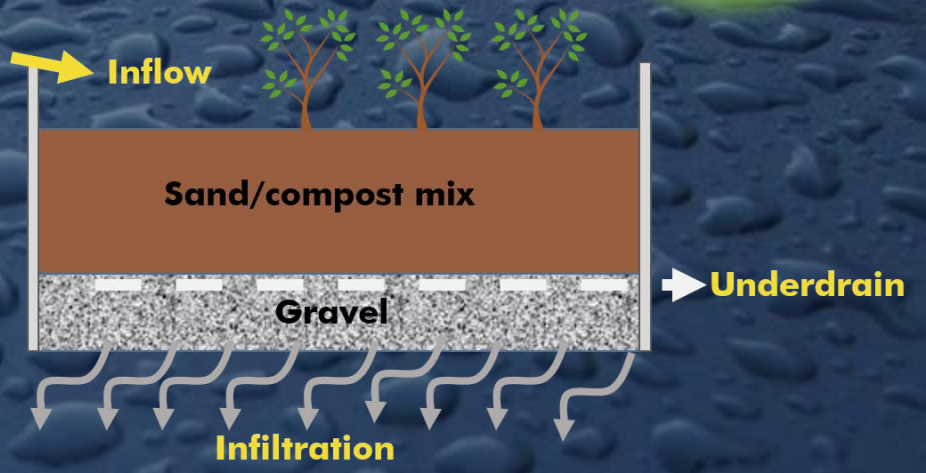
- Rationale for bioretention
  - LID principles and ancillary benefits
  - Simplicity and low costs
  - Advantages/ disadvantages of underdrains



Technical & Regulatory Issues

Page 4-5

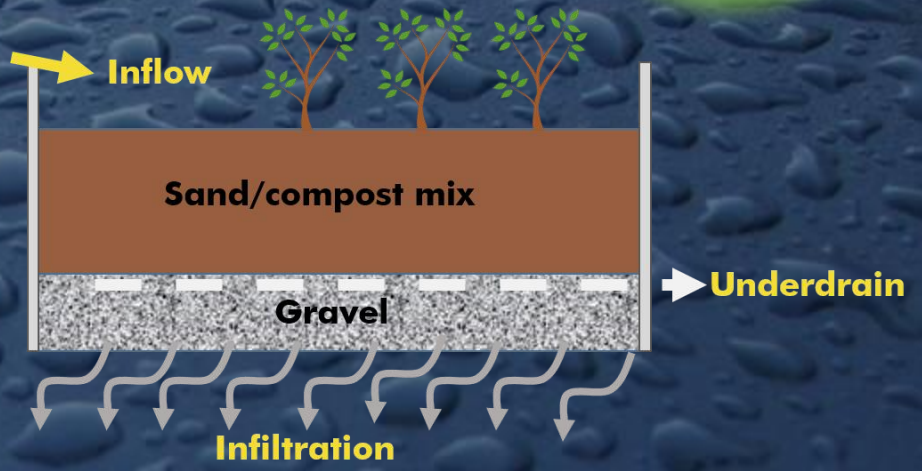
- Sizing approaches
  - Flow
    - Treatment
    - Rates and durations
  - Design
  - Volume
- Calculating facility volume
  - Simple method
  - Routing method
    - Santa Barbara Unit Hydrograph



Technical & Regulatory Issues

Page 4-6

- Estimating infiltration rates and sizing factors
  - In infiltrative soils
    - Safety factor for direct infiltration
  - In clayey soils



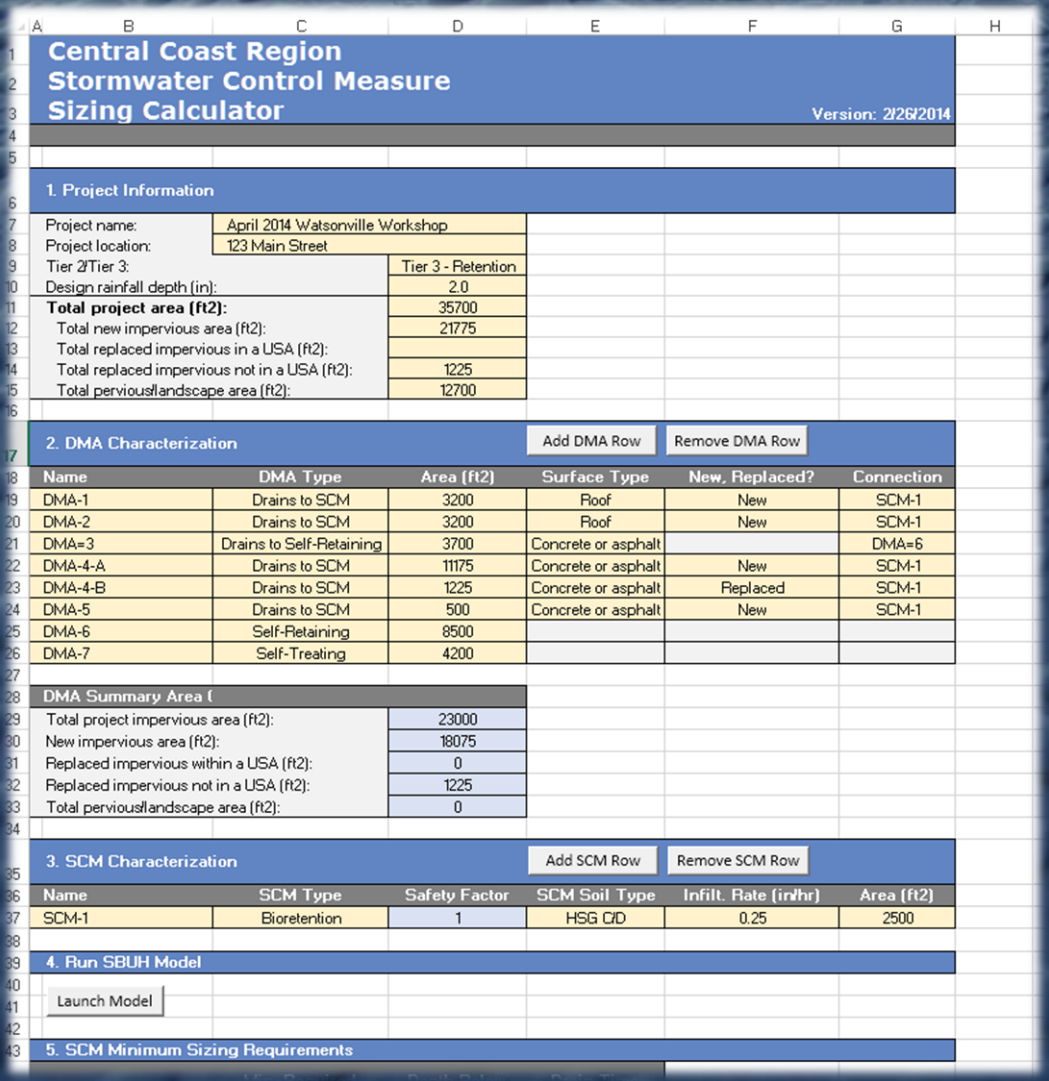
Non-LID Facilities

Page 3-5

- Issue for treatment only (Tier 2)
- PCRs state only an order of preference
- *Stormwater Technical Guide* adopts language from statewide permit
- Facilities:
  - Tree-box-type biofilters
  - Vault-based media filters
- Site Criteria
- Design criteria for facilities are in Appendix C

Using the Calculator

Page 4-5



Central Coast Region Stormwater Control Measure Sizing Calculator

Version: 2/26/2014

1. Project Information

Project name:	April 2014 Watsonville Workshop
Project location:	123 Main Street
Tier 2/Tier 3:	Tier 3 - Retention
Design rainfall depth (in):	2.0
Total project area (ft2):	35700
Total new impervious area (ft2):	21775
Total replaced impervious in a USA (ft2):	
Total replaced impervious not in a USA (ft2):	1225
Total pervious/landscape area (ft2):	12700

2. DMA Characterization — Add DMA Row | Remove DMA Row

Name	DMA Type	Area (ft2)	Surface Type	New, Replaced?	Connection
DMA-1	Drains to SCM	3200	Roof	New	SCM-1
DMA-2	Drains to SCM	3200	Roof	New	SCM-1
DMA=3	Drains to Self-Retaining	3700	Concrete or asphalt		DMA=6
DMA-4-A	Drains to SCM	11175	Concrete or asphalt	New	SCM-1
DMA-4-B	Drains to SCM	1225	Concrete or asphalt	Replaced	SCM-1
DMA-5	Drains to SCM	500	Concrete or asphalt	New	SCM-1
DMA-6	Self-Retaining	8500			
DMA-7	Self-Treating	4200			

DMA Summary Area (

Total project impervious area (ft2):	23000
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3. SCM Characterization — Add SCM Row | Remove SCM Row

Name	SCM Type	Safety Factor	SCM Soil Type	Infilt. Rate (in/hr)	Area (ft2)
SCM-1	Bioretention	1	HSG C/D	0.25	2500

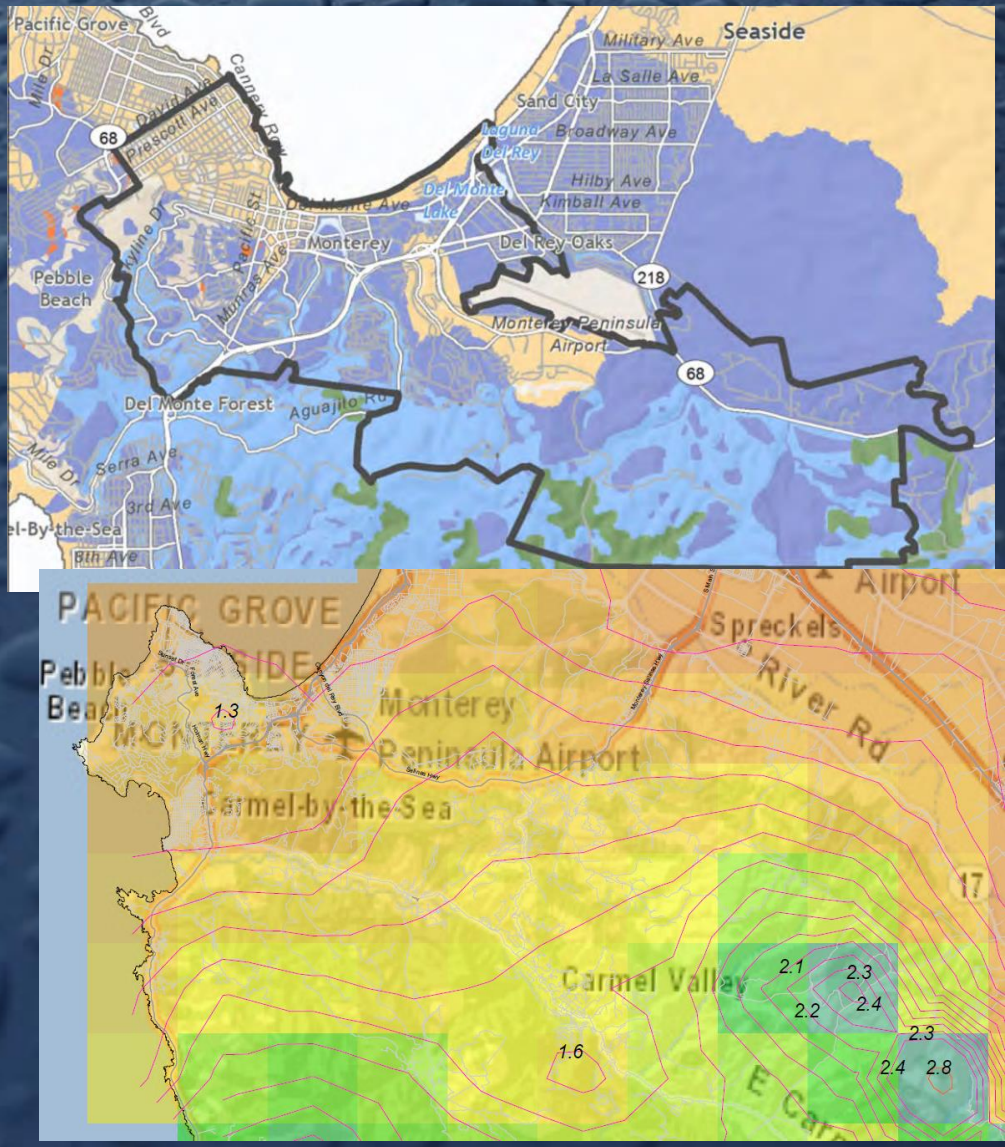
4. Run SBUH Model

Launch Model

5. SCM Minimum Sizing Requirements

Rainfall Depths

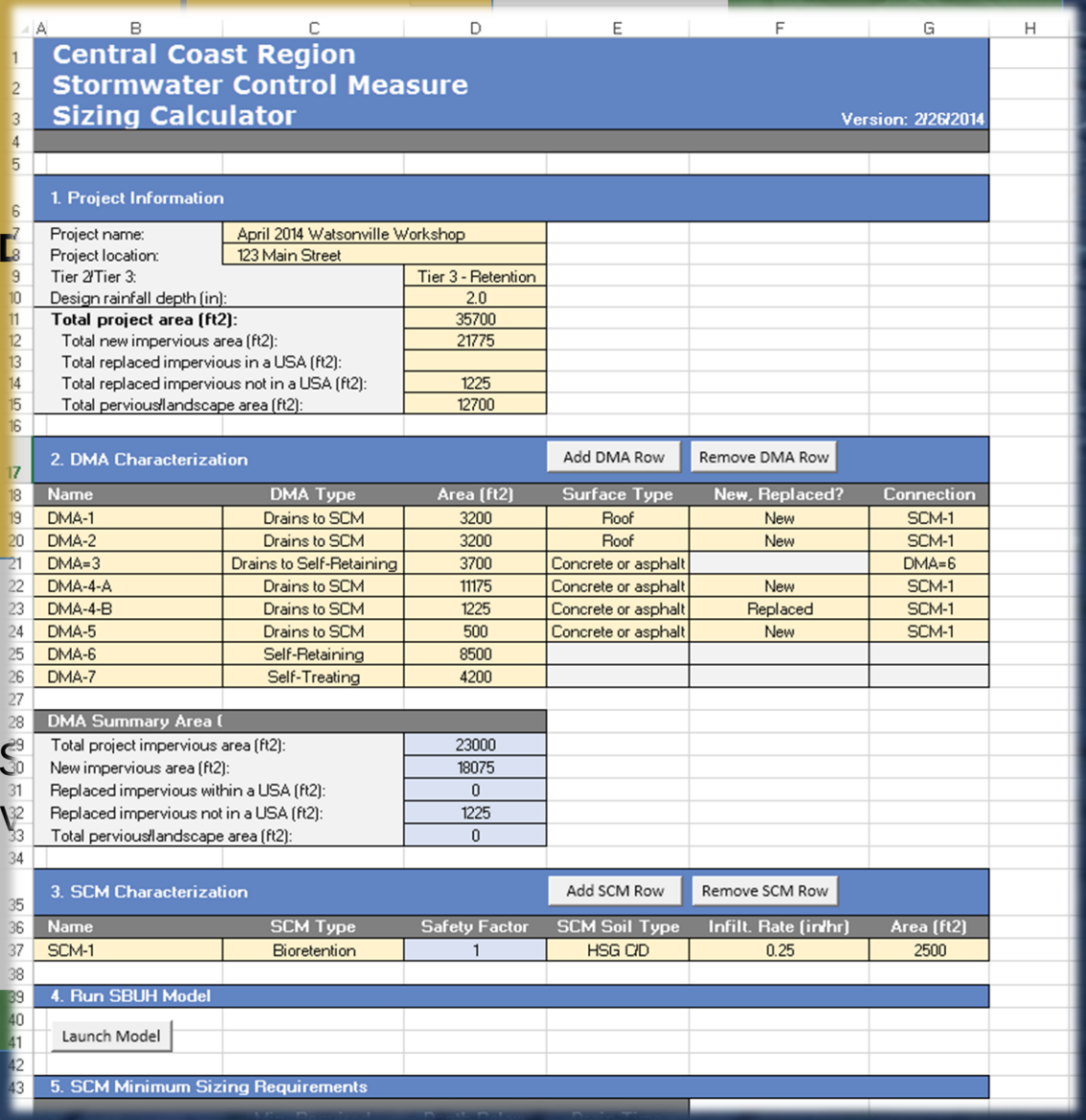
- **Identify Watershed Management Zone**
- **Designated Groundwater Basins (Zones 4, 7, and 10)**
- **85th or 95th percentile**
- **Use isohyets to determine rainfall depth**



Calculator Exercises

After each step, launch the model and note the difference in depth required and drain time.

- Change soil type to C/D
- Increase the area of SCM-1 to take up more of the available area
- Make DMA-4B new instead of impervious
- Connect DMA-3 to SCM-1
- Connect DMA-1 to SCM-1
- Create SCM-2 in the left setback and



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DMA-6	Self-Retaining	8500			
DMA-7	Self-Treating	4200			

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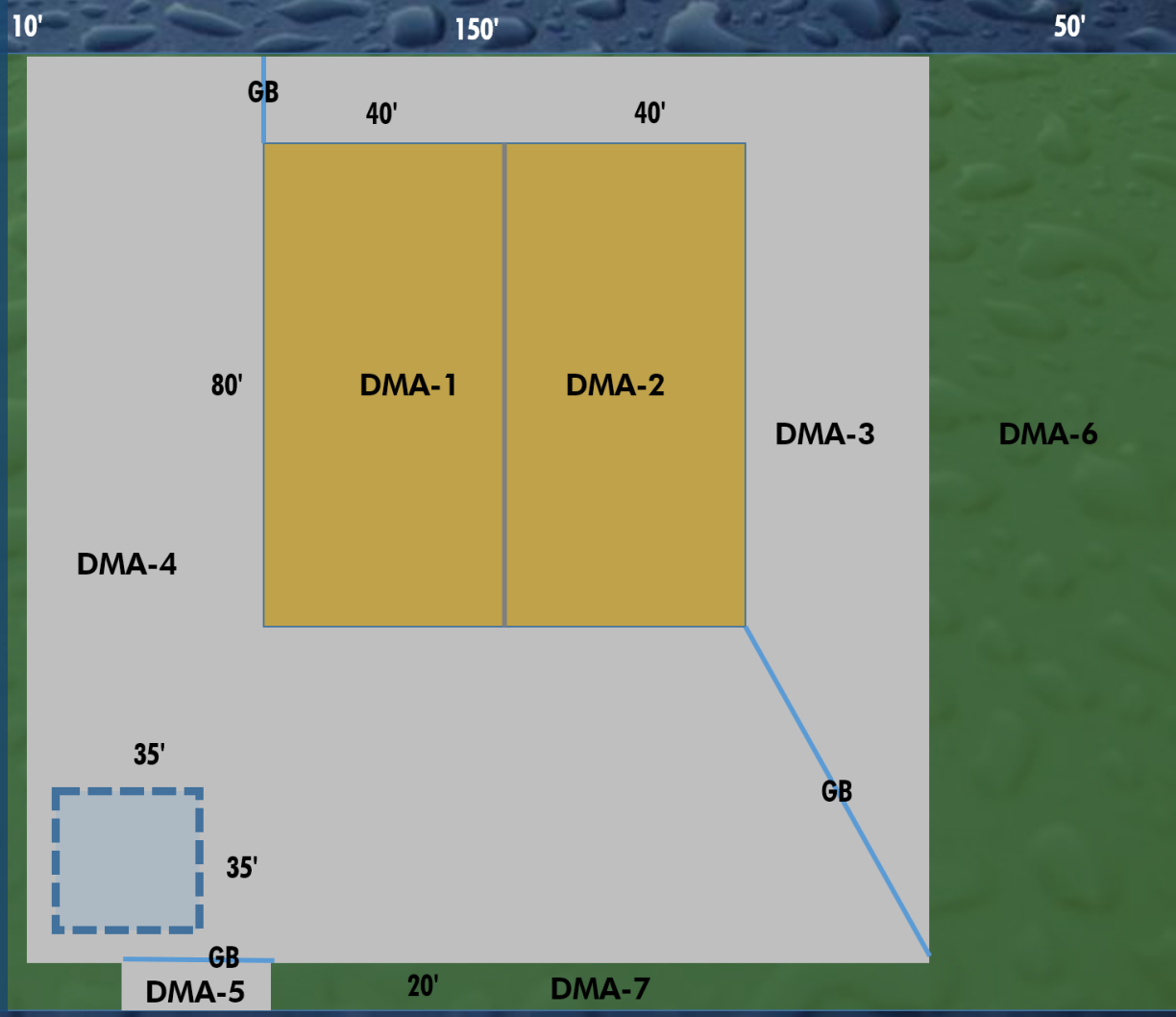
Launch Model

5. SCM Minimum Sizing Requirements

Calculator Exercises

After each step, launch the model and note the difference in depth required and drain time.

- **Change soil type to C/D**
- **Increase the area of SCM-1 to take up more of the available area**
- **Make DMA-4B new instead of impervious**
- **Connect DMA-3 to SCM-1**
- **Connect DMA-1 to SCM-1**
- **Create SCM-2 in the left setback and direct some drainage there.**



Ten Percent Adjustment

Page 4-8

- Dedicate a minimum 10% of site's "Equivalent Impervious Surface Area" to Stormwater Control Measures
- PCRs specify method of calculating EISA
  - Use "correction factors" in Table 4-6
- Requires demonstration of infeasibility

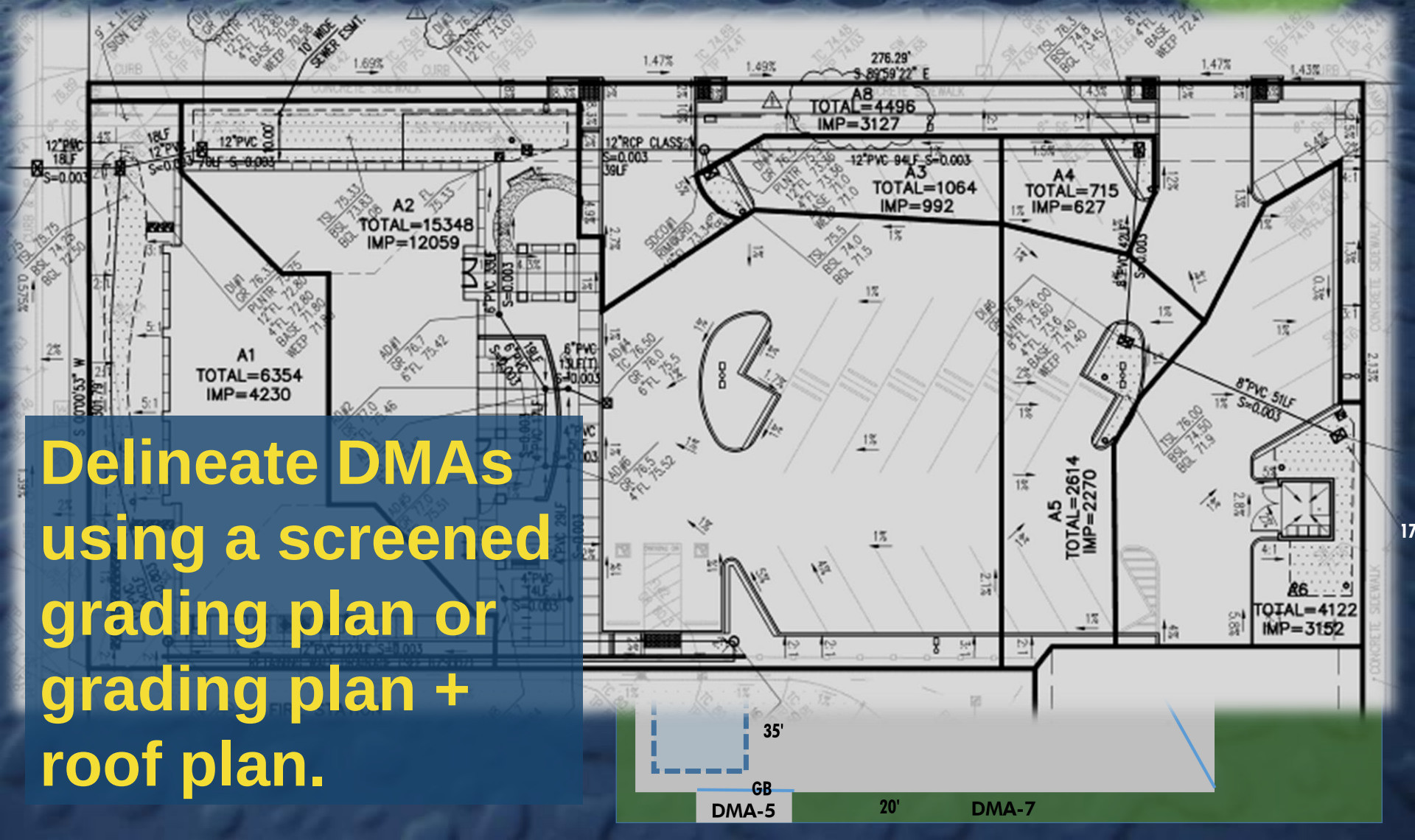
Off-Site Compliance

Page 3-8

BIORETENTION DESIGN

DMAs are as intended

Page 4-2

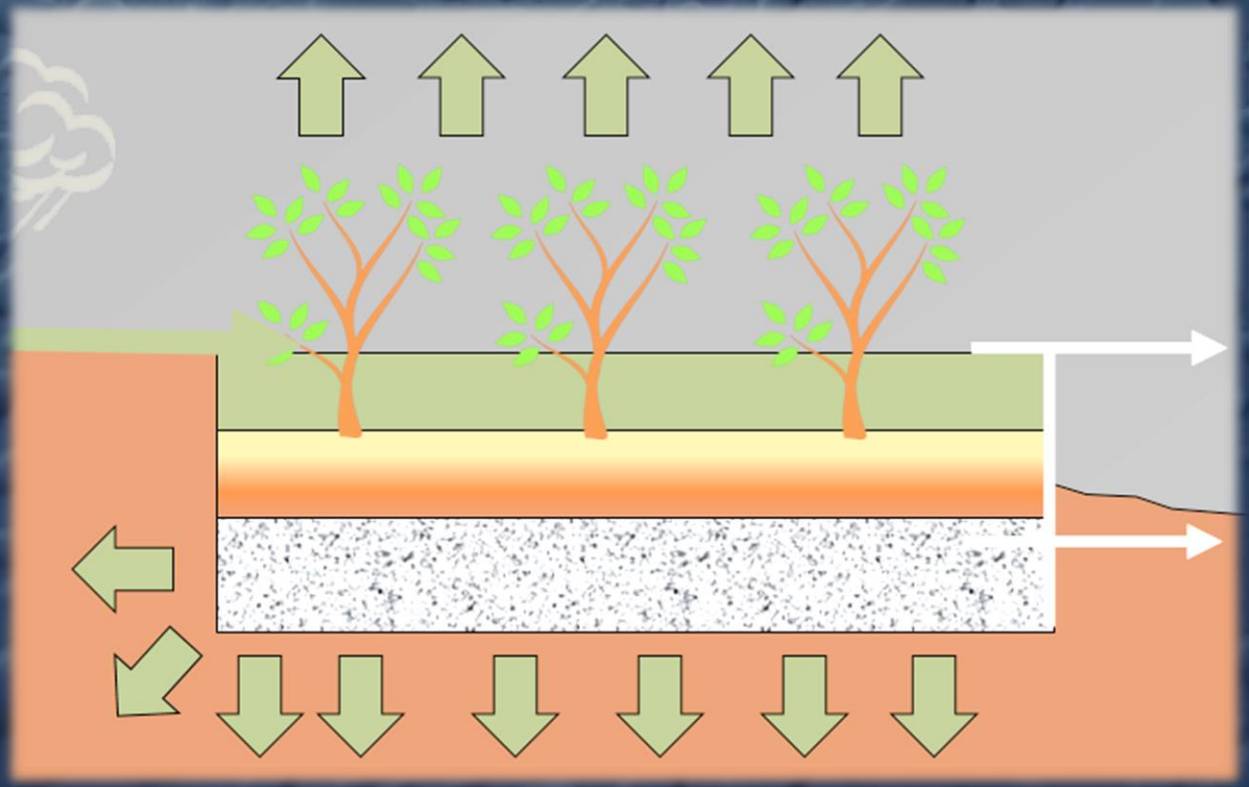


Delineate DMAs using a screened grading plan or grading plan + roof plan.

Make This Happen

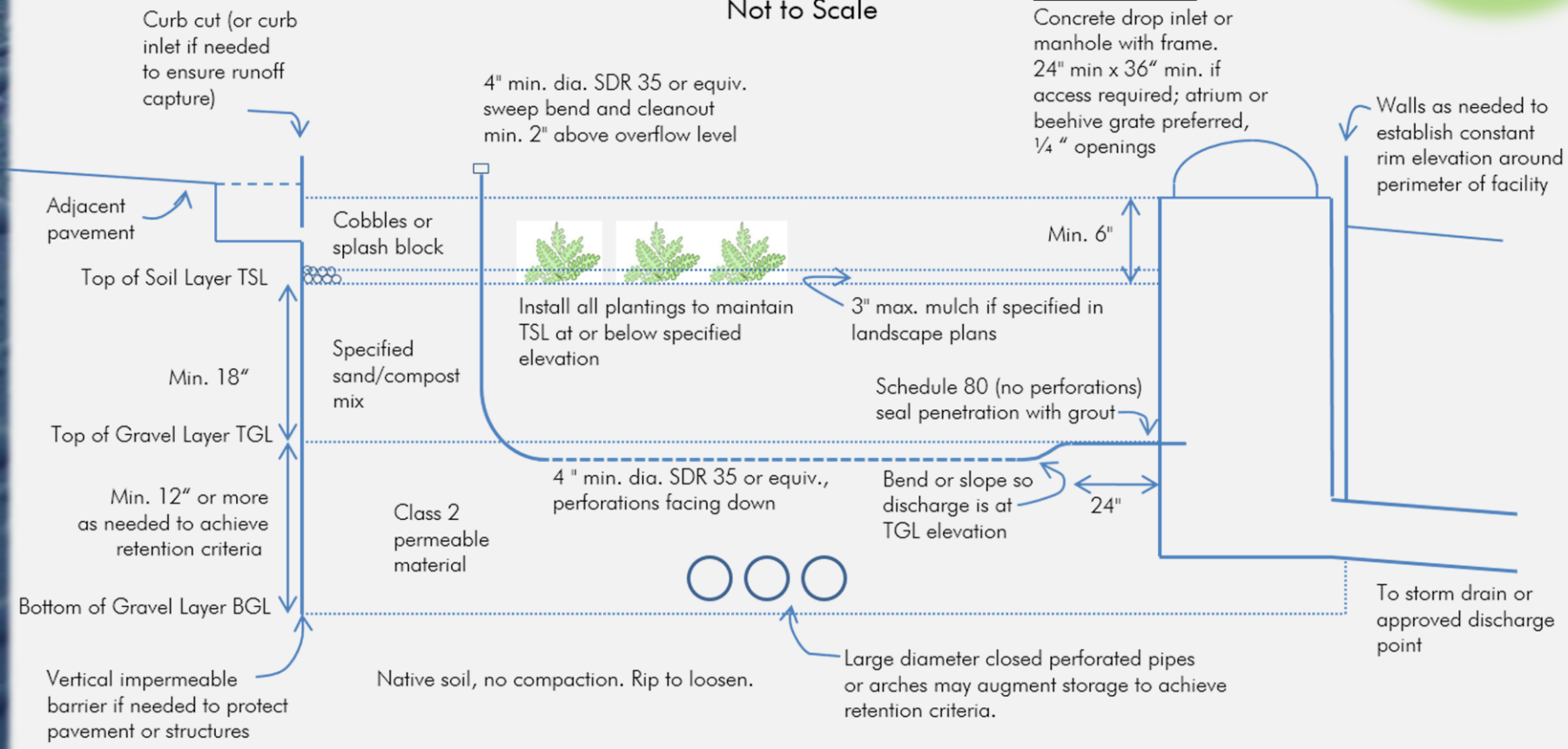
Page 4-7

- Bioretention facilities are level so they "fill up like a bathtub."



Bioretention Facility

Cross-section
Not to Scale



Notes:

- No liner, no filter fabric, no landscape cloth.
- Maintain BGL. TGL, TSL throughout facility area at elevations to be specified in plan.
- Class 2 permeable material layer may extend below and underneath drop inlet.
- Elevation of underdrain discharge is at top of gravel layer.
- See Chapter 4 for instructions on facility sizing and additional specifications.

Call out elevations

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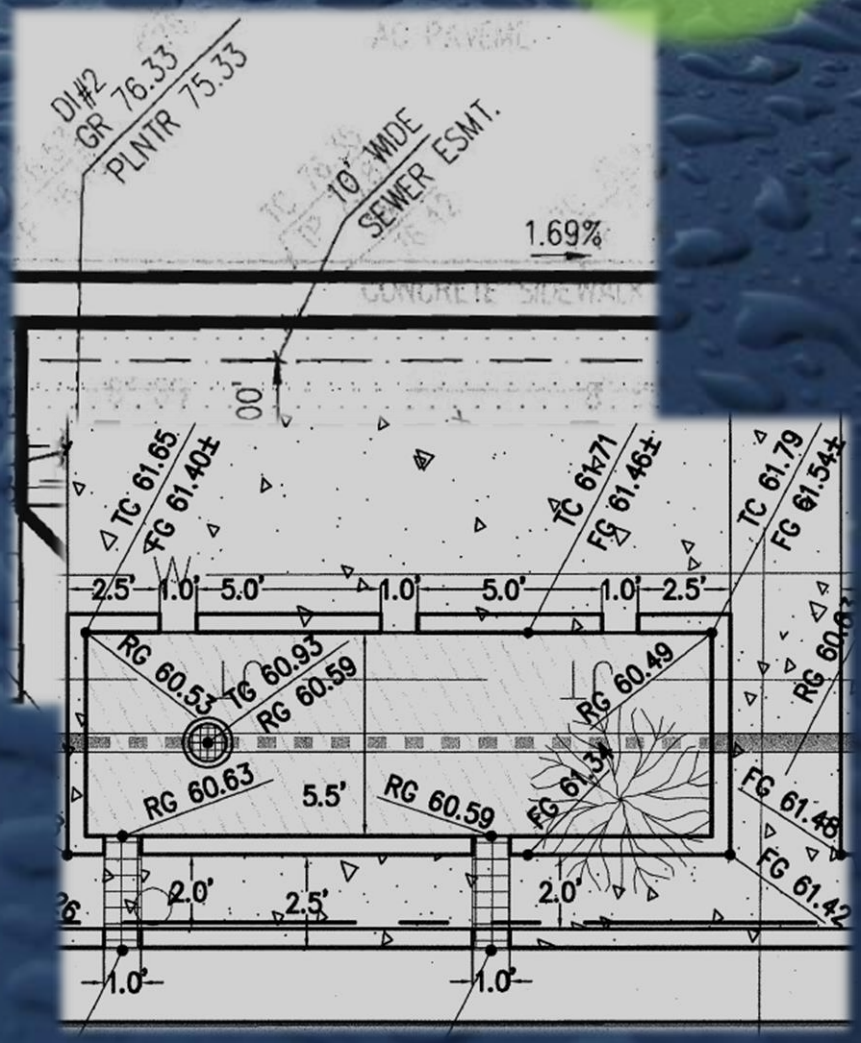
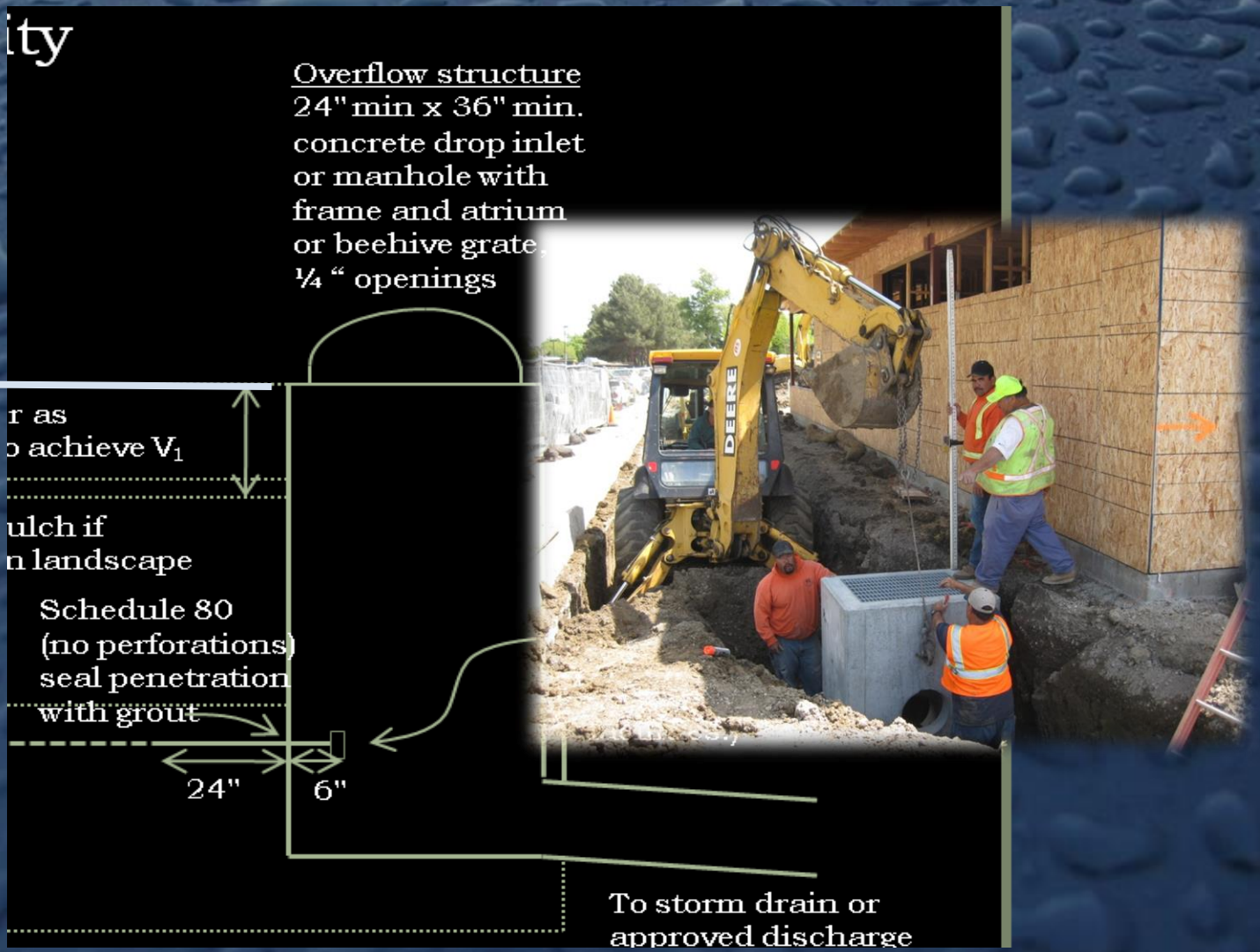
- Outlet structure
  - Top of overflow grate
  - Underdrain connection
- Inlet
  - Flow line at inlet
  - Top of curb
  - Top of adjacent paving
- Soil layers
  - Top of soil layer
  - Bottom of gravel layer
  - Bottom of soil layer



Outlets

Overflow elevation



Bioretention Edges

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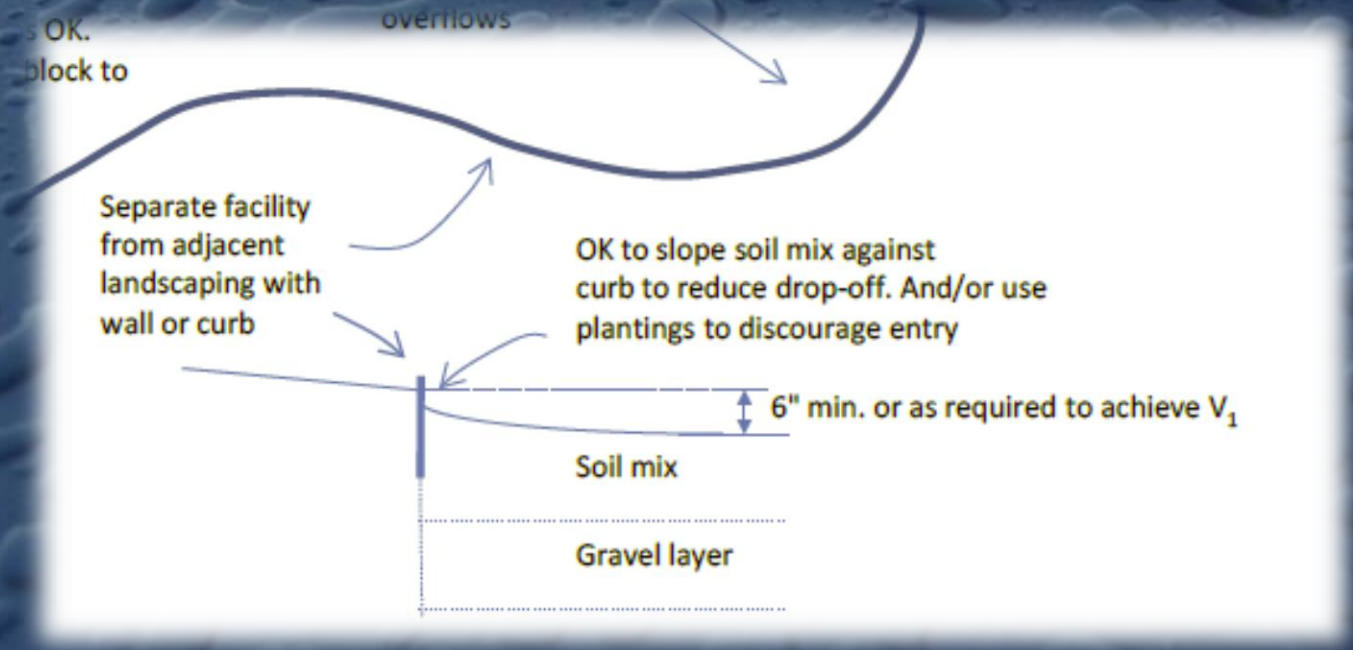

Gravel and Underdrain

Page 4-7

- Class 2 permeable
  - Caltrans spec 68-2.02(F)(3)
- No filter fabric
- Underdrain
  - Discharge elevation at top of gravel layer
  - PVC SDR 35 or equivalent; holes facing down
  - Solid pipe for 2' closest to outlet structure
  - Cleanout

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Planting Soil

- 60-70% Sand
  - ASTM C33 for fine aggregate
- 30-40% Compost
  - Certified through US Composting Council Seal of Testing Assurance Program
- Install in 8"-12" lifts
- Do not compact
- Do not overfill
- Leave room for mulch

Landscaping

Page 4-7

- Select plants for fast-draining soils
- Select for facility location
- Avoid problem conditions
  - Overly dense plantings
  - Aggressive roots
  - Invasive weeds
  - Need for irrigation or fertilization

Landscaping—O&M issues

Page 5-2

- No fertilizer
- No pesticides
- Clean up as needed and annually
- Add mulch if needed annually
  - Compost mulch (aged mulch) recommended
- Avoid filling in or regrading

Avoid design conflicts

Page 4-8

- Elevations consistent with grading and architectural plans
- Facilities do not interfere with parking or pedestrian circulation
- Utilities are located elsewhere
- Protection of adjacent paving and structures has been considered

Construction Checklist

Apx. B

- Layout
- Excavation
- Overflow/connection to storm drain
- Underdrain
- Gravel layer
- Soil mix
- Irrigation
- Planting
- Final inspection

DISCUSSION