

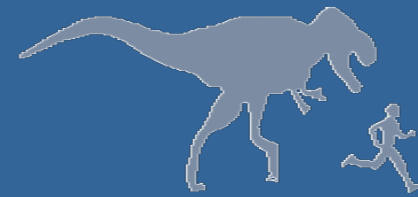
Planning, Design, and Construction of Low Impact Development Features and Facilities

Provision C.3 Stormwater Compliance for Land Development Projects

Dan Cloak, P.E.
February 11, 2020



Two Objectives



Compliance

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

Project Quality

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

Basics of C.3 and Low Impact Development

A quick review of objectives and methods

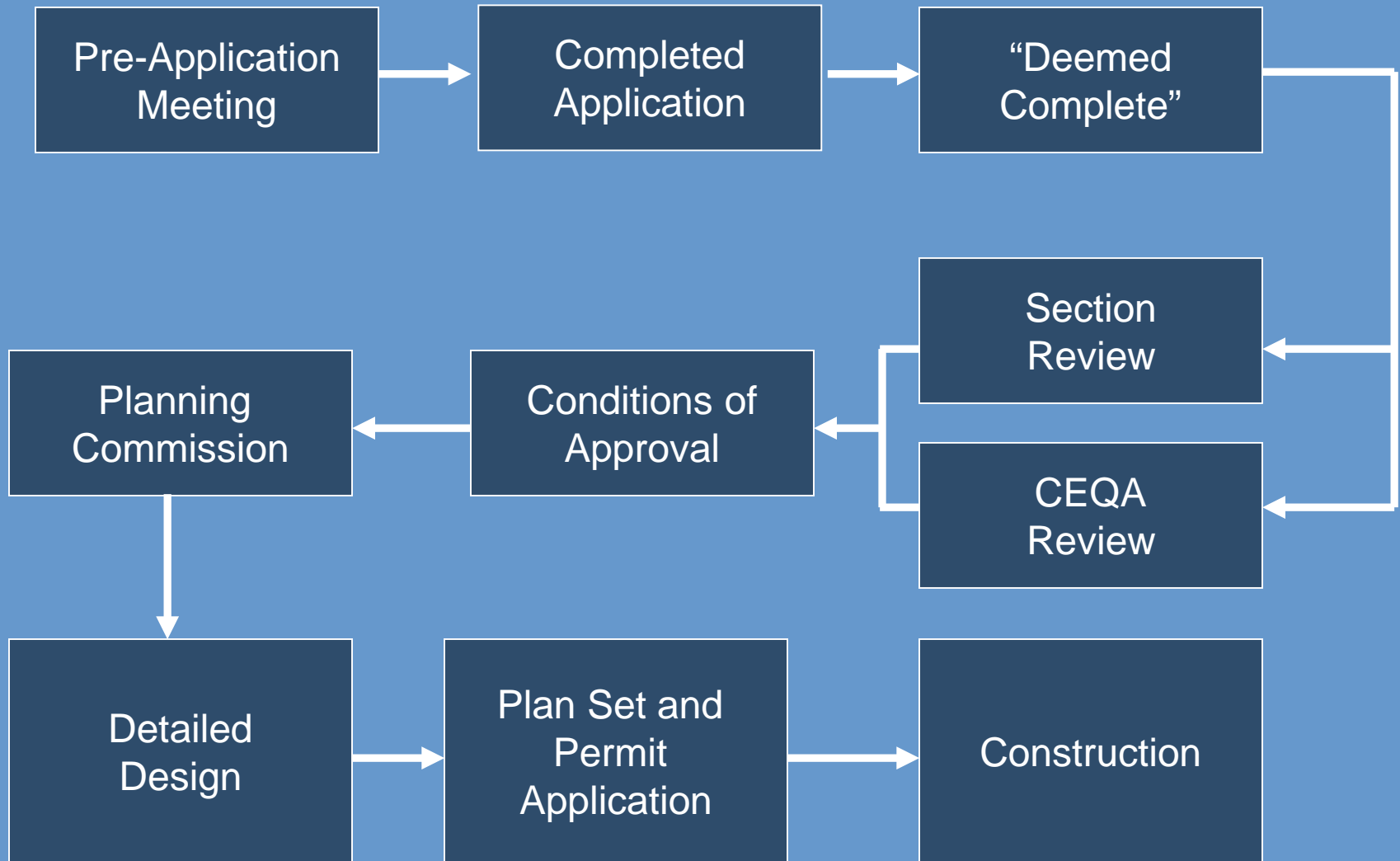
Mandate

E

- 1987 Amendments to the Clean Water Act
- Permits issued by California Water Boards
- Municipalities are required to use their land use authority to require controls on runoff from new developments
- Low Impact Development (LID) is required

Development Review Process

5

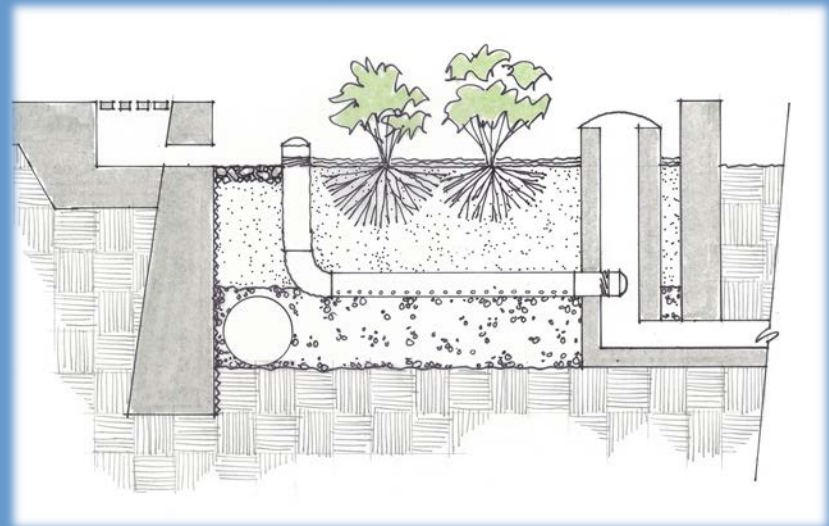


- *Stormwater C.3 Guidebook*
 - Step-by-step instructions
 - Checklist (p. 12)
 - Outline (p. 20)
- At www.cccleanwater.org
 - IMP Sizing Calculator
 - Templates
 - Stormwater Control Plan for a Small Project
 - Stormwater Control Plan for a Regulated Project
 - Examples
 - Commercial Project
 - Residential Subdivision

Low Impact Development

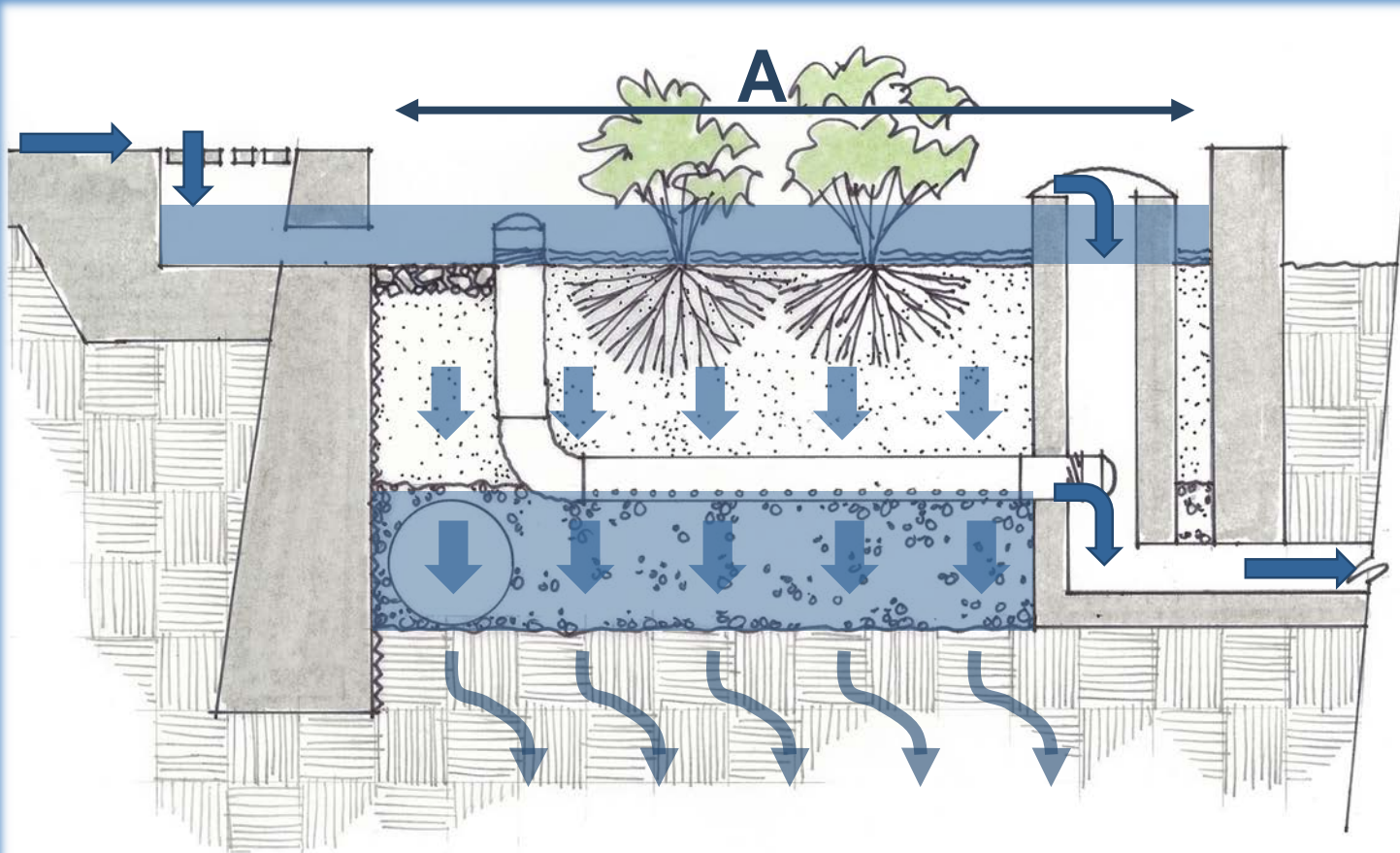
24

- Minimize imperviousness
 - Minimize roofs and paving
 - Substitute pervious paving or green roofs where possible
- Disperse runoff to landscaping
- Direct runoff to IMPs (bioretention)

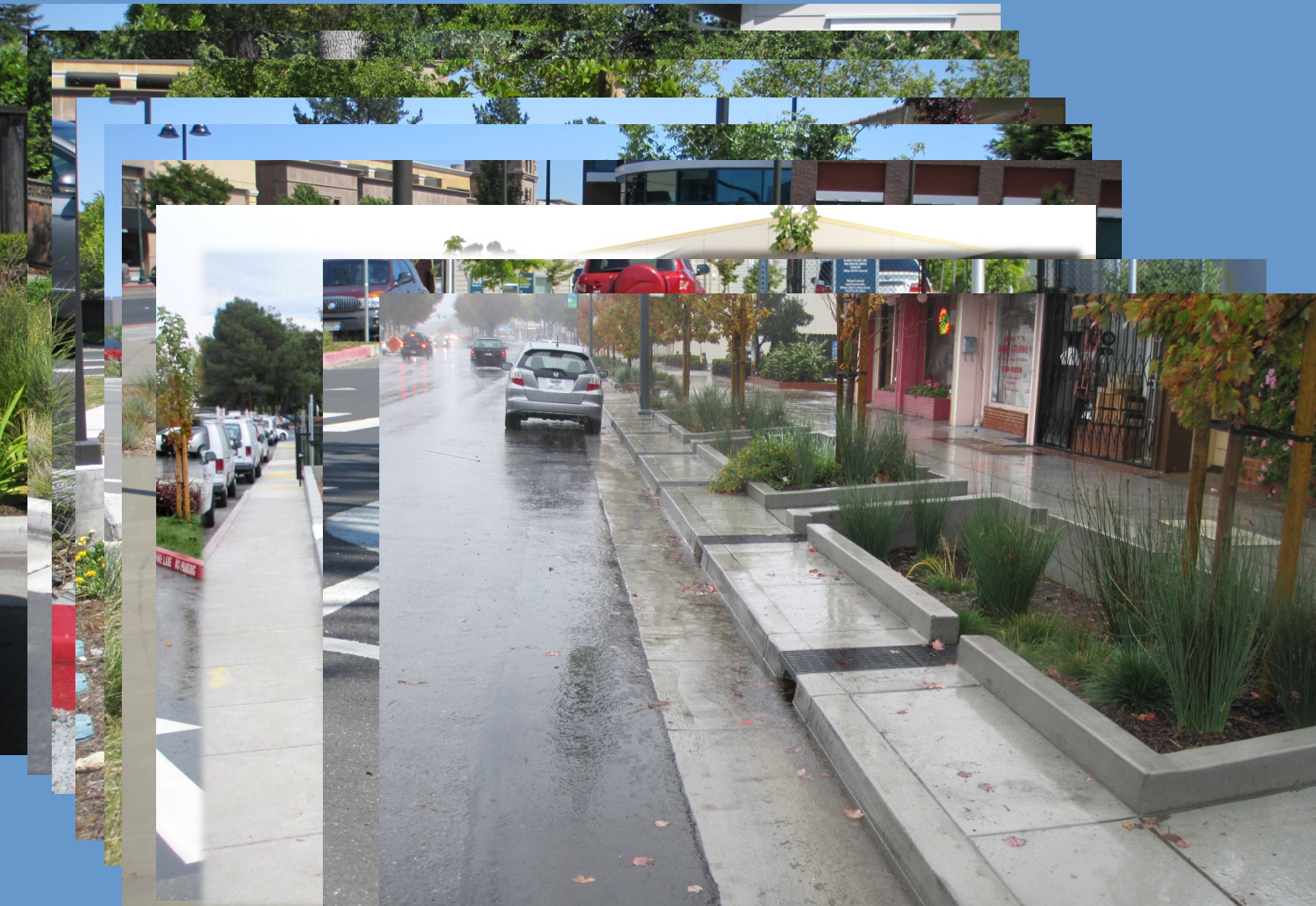


Bioretention

59



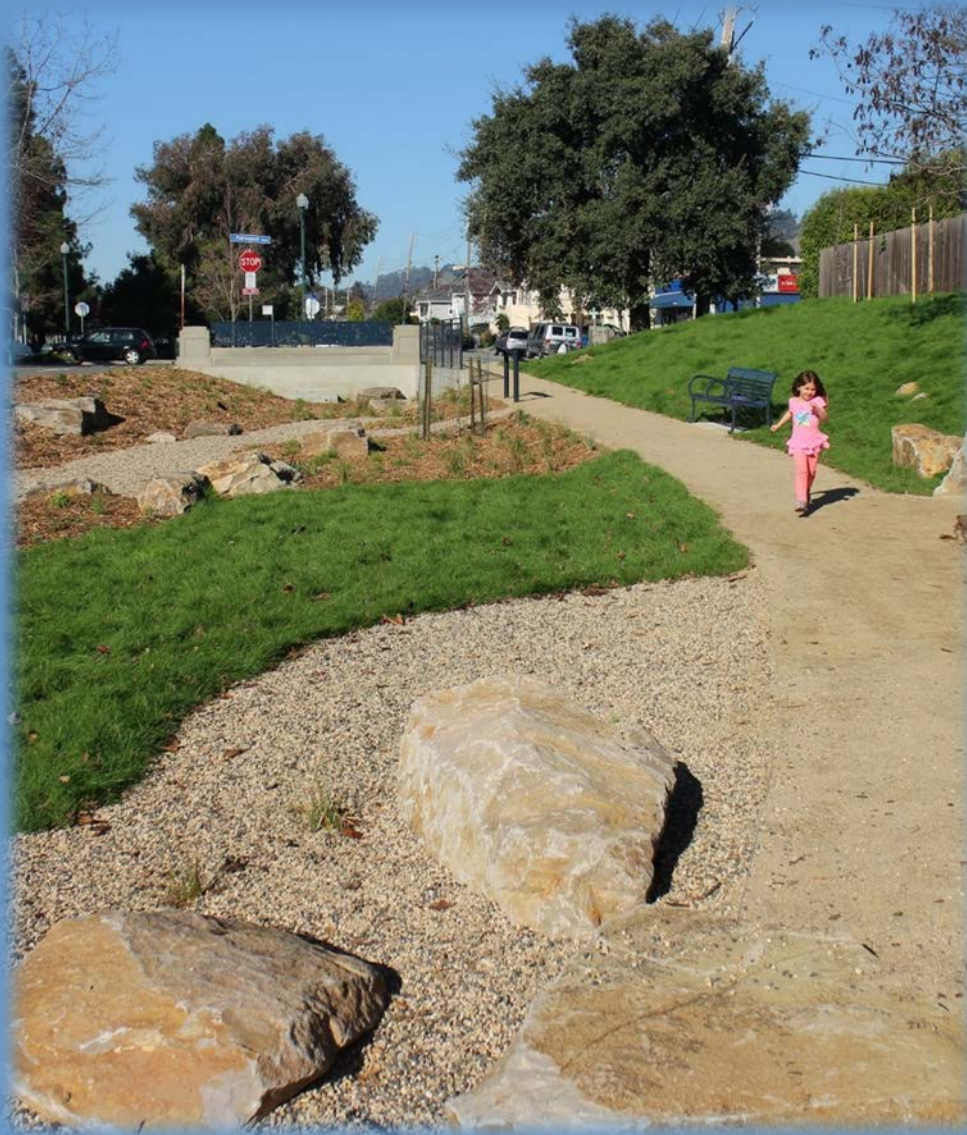
Bioretention



Aesthetic Amenity



Multiple Use

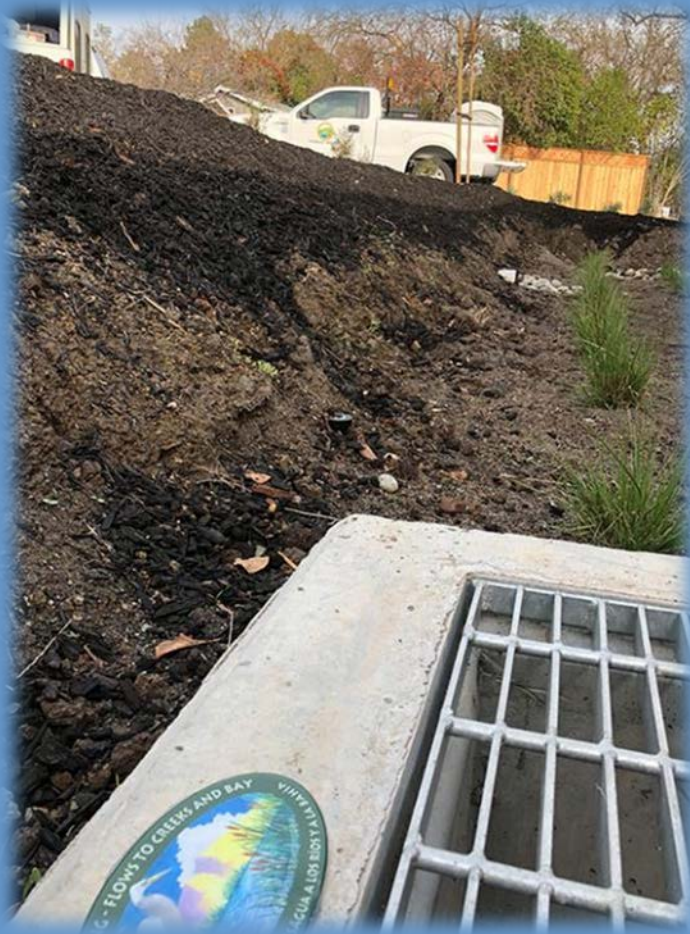


- High-visibility, well-trafficked areas
- Only impervious roofs and pavement
- Keep drainage runs short and on surface
- Integrate with site landscaping
- Level all around
- In and out by gravity flow
- Subdivisions: Common, accessible area

Keep drainage on surface

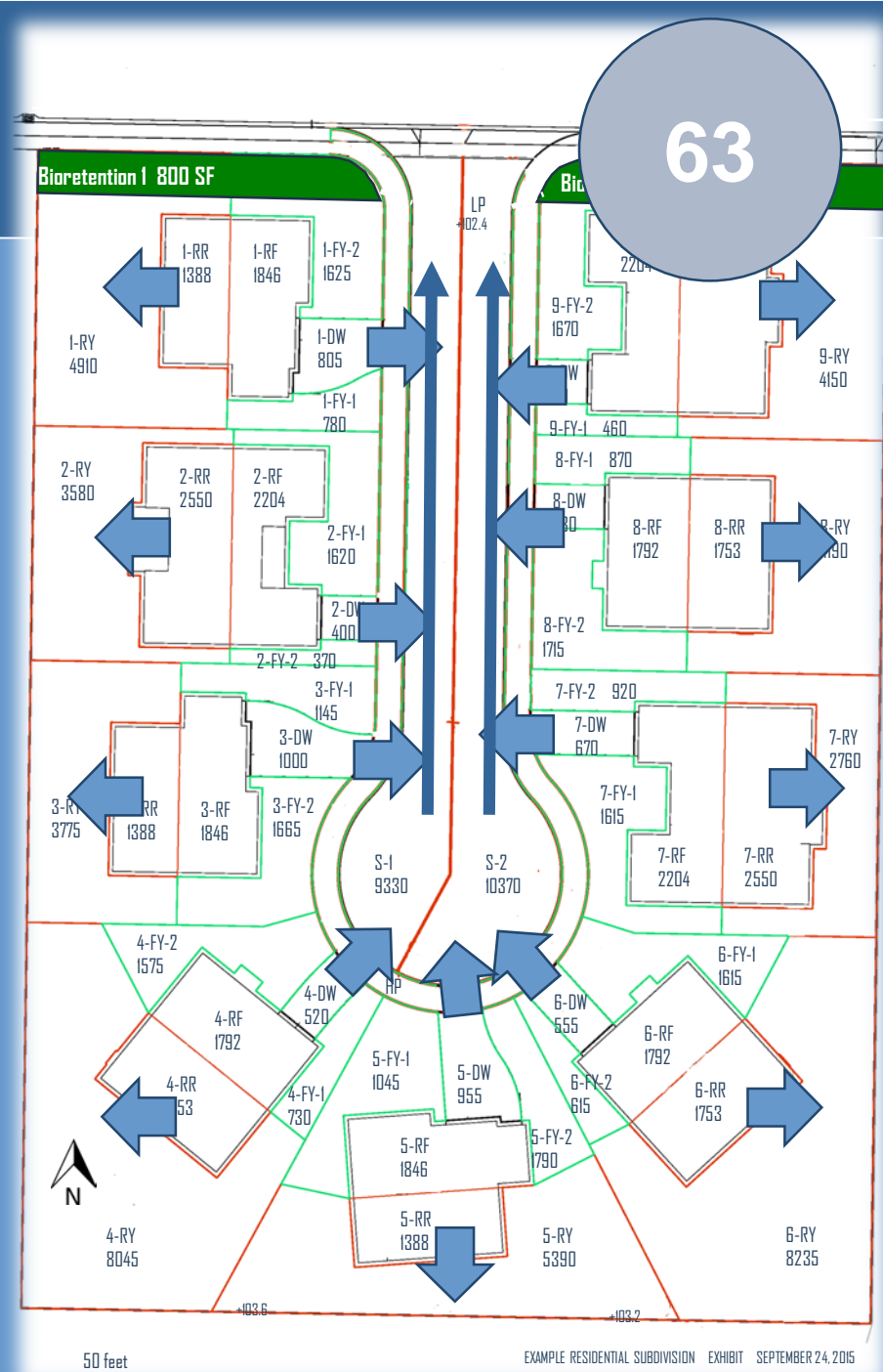


Keep drainage on surface



Subdivisions

- Drain a portion of each roof to yard
- Drain driveways to street
- Drain street to bioretention facilities on commonly owned parcels

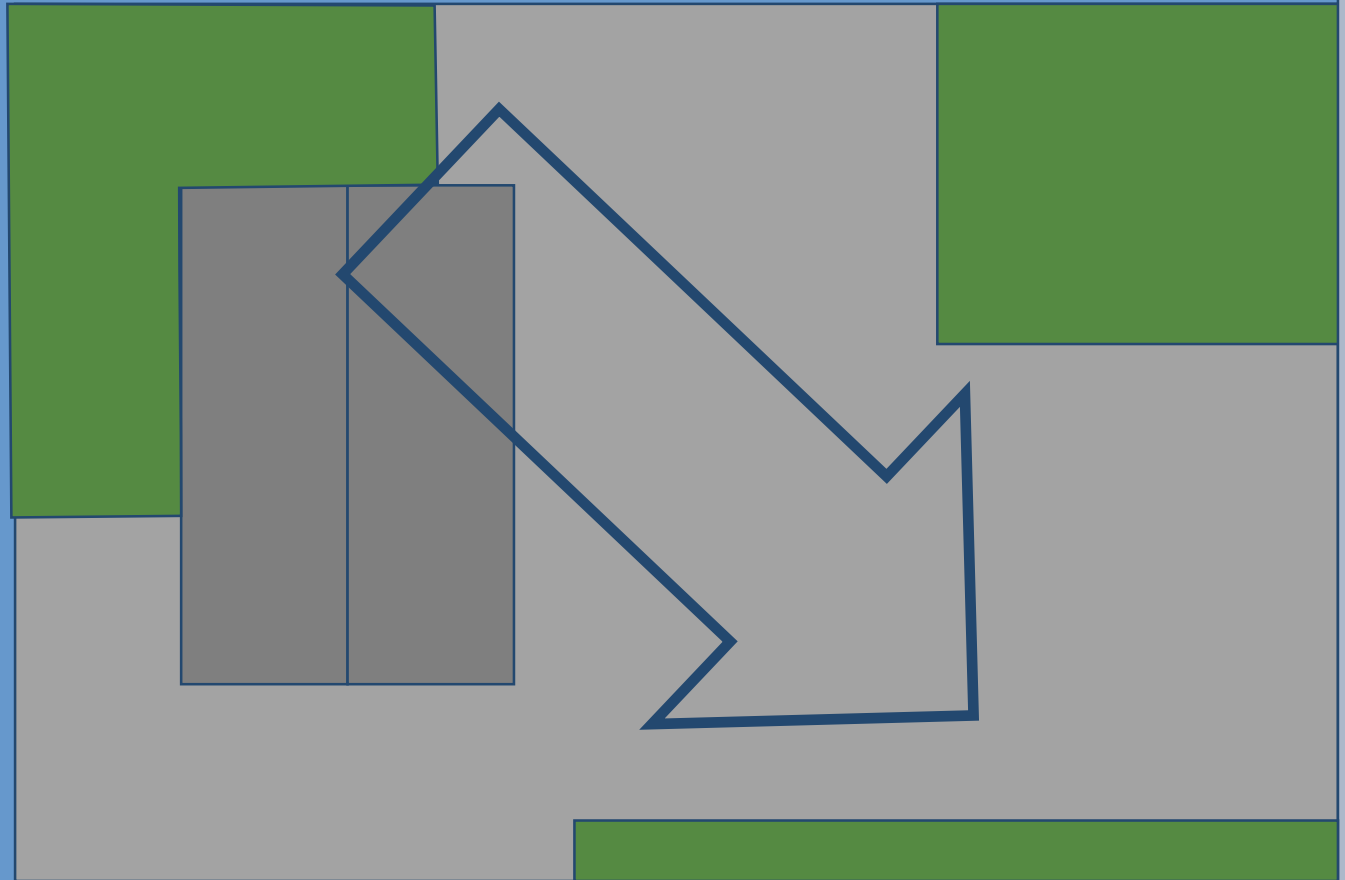


Documenting Compliance

Drainage Management Areas

29

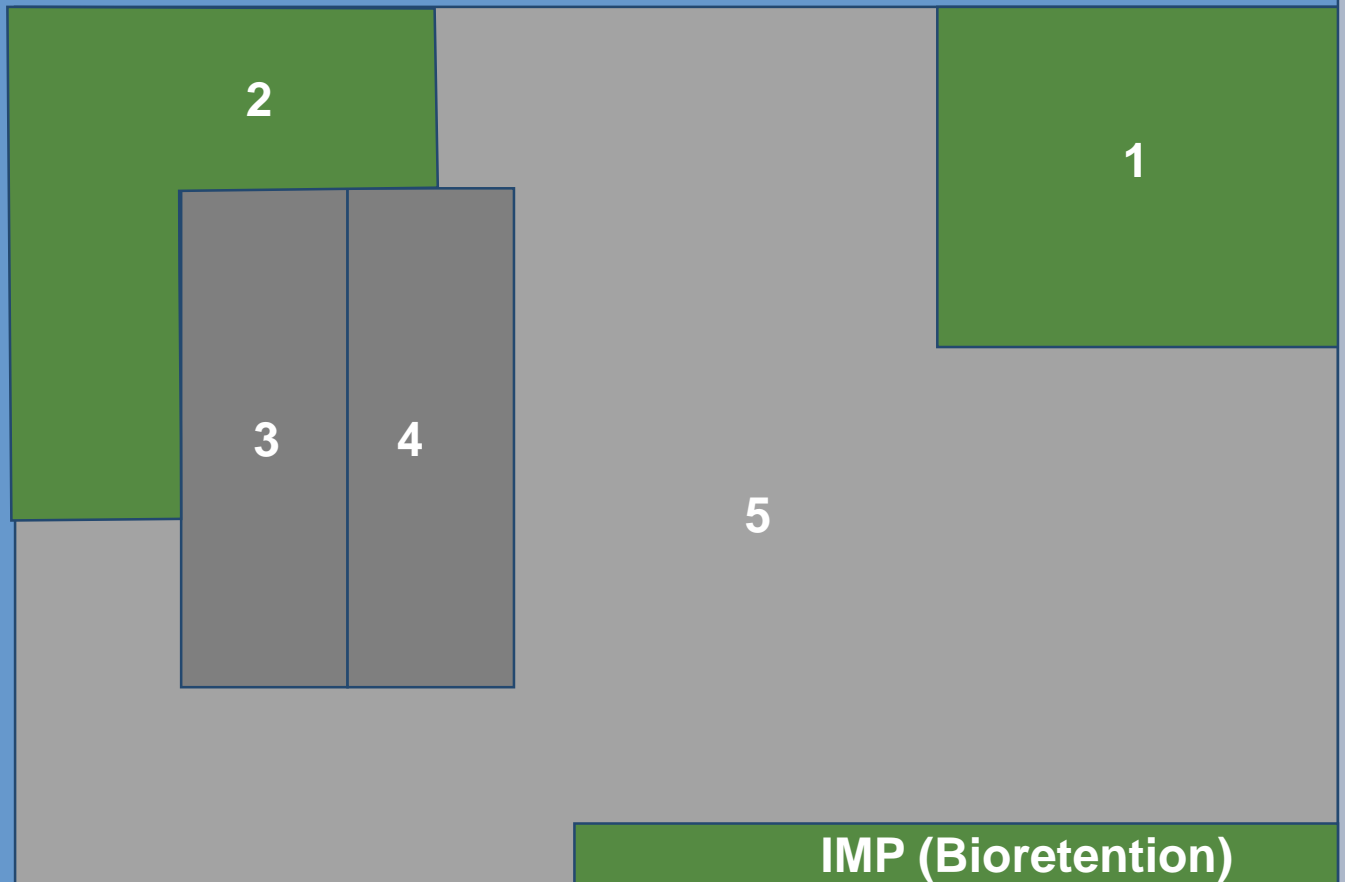
- **Delineate**
- **Identify**
- **Classify**
- **Tabulate**
- **Describe**
- **Calculate**



Drainage Management Areas

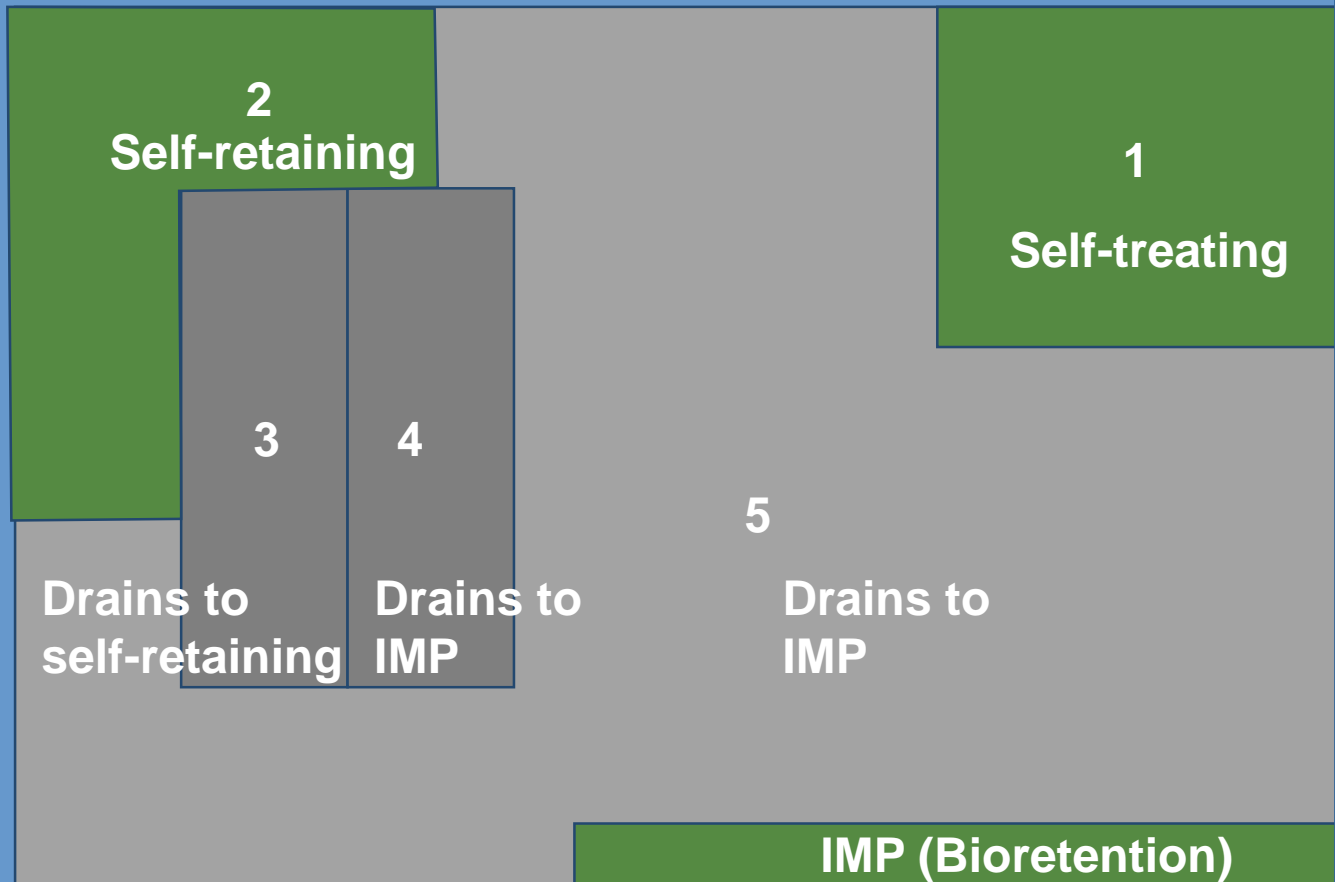
29

- Delineate
- Identify
- Classify
- Tabulate
- Describe
- Calculate



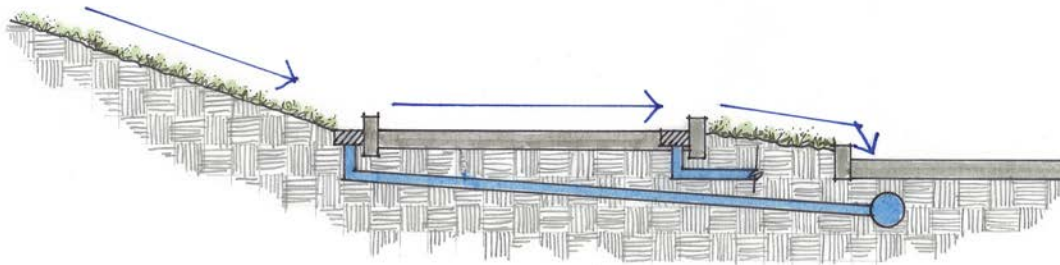
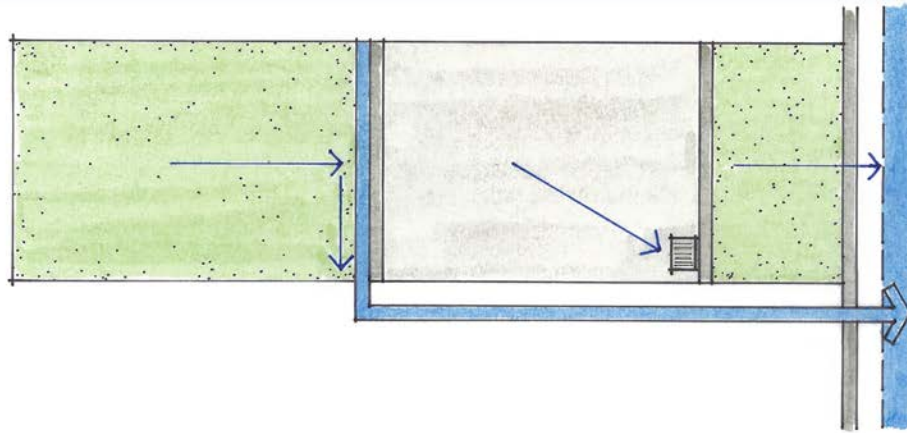
Drainage Management Areas

- Delineate
- Identify
- **Classify**
- Tabulate
- Describe
- Calculate



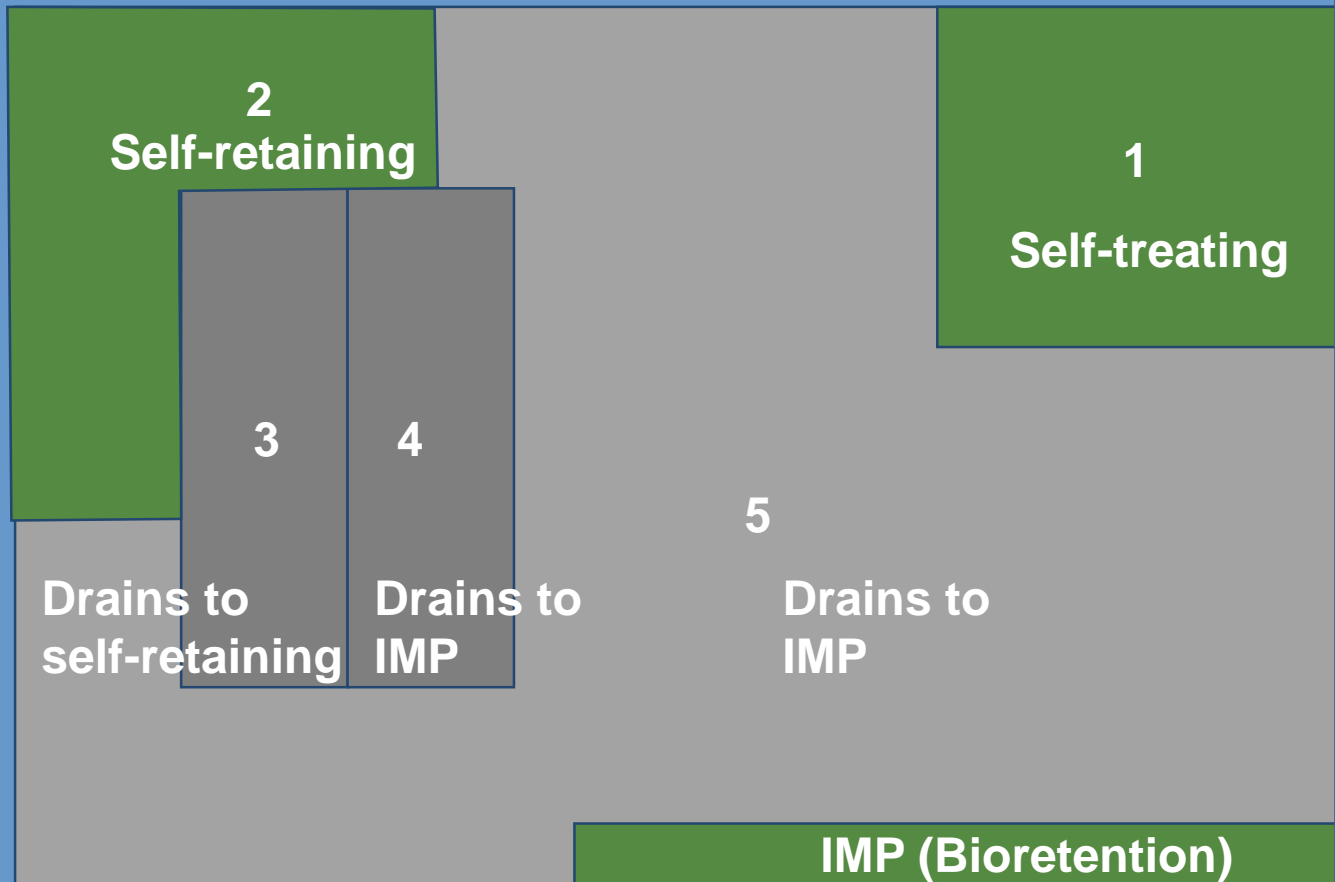
Self-treating DMAs

31



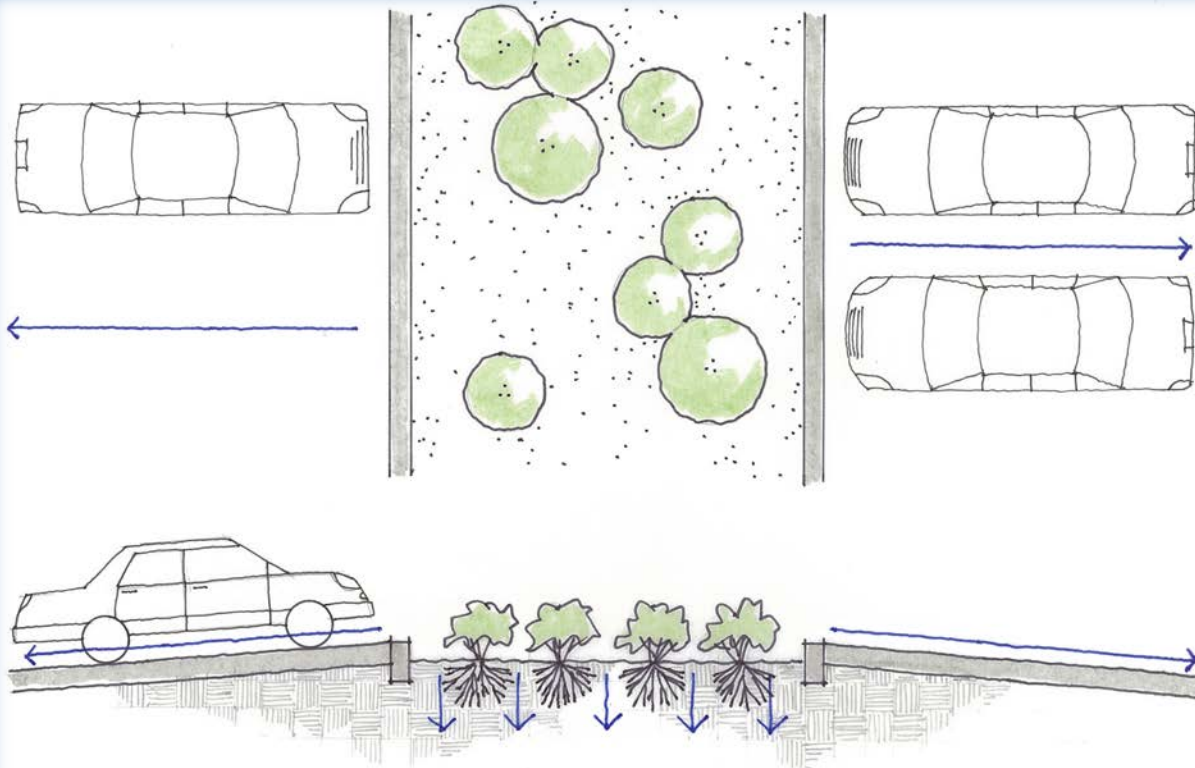
Drainage Management Areas

- Delineate
- Identify
- **Classify**
- Tabulate
- Describe
- Calculate



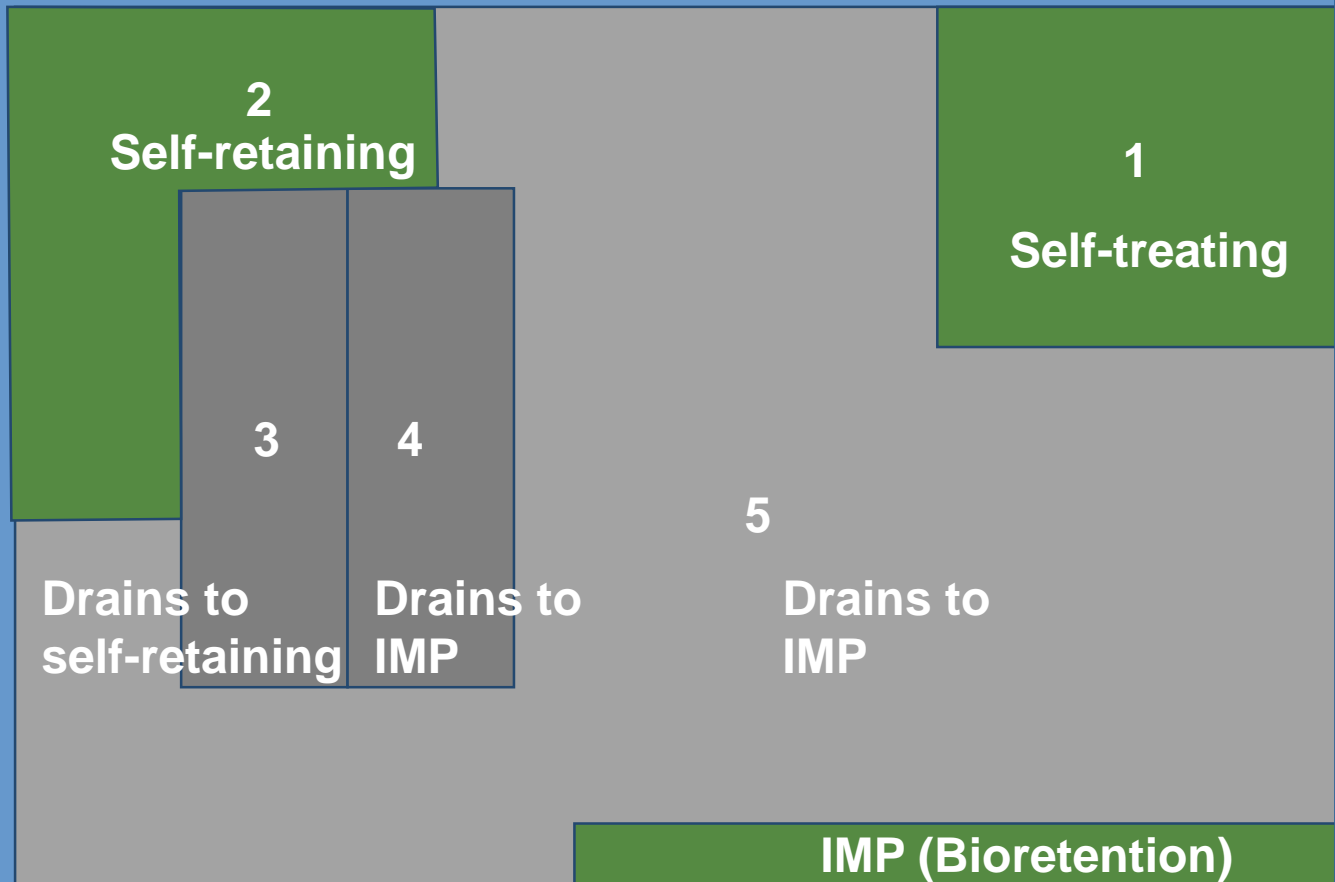
Self-retaining DMAs

32



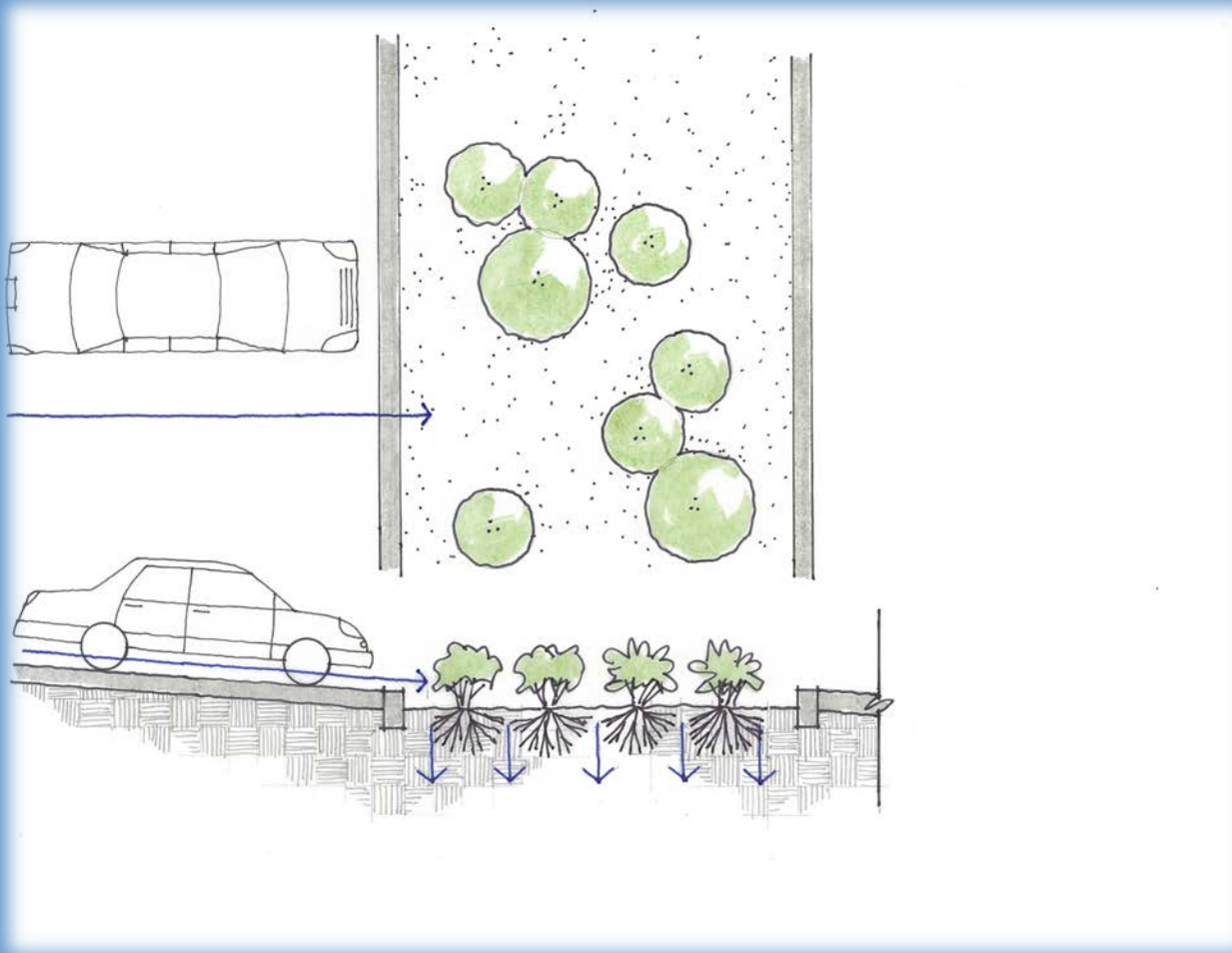
Drainage Management Areas

- Delineate
- Identify
- **Classify**
- Tabulate
- Describe
- Calculate



Areas draining to self-retaining

33

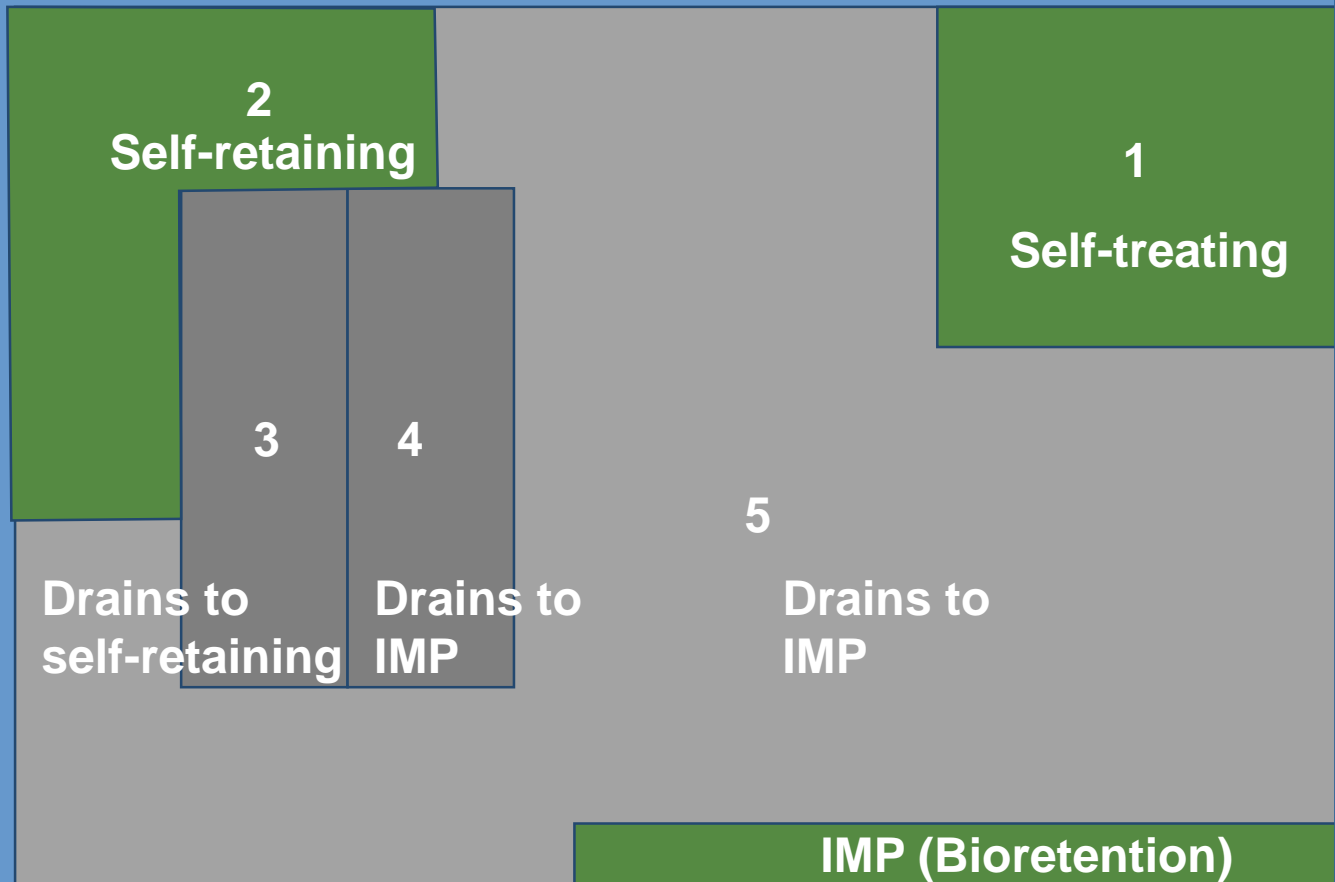


Max. ratio is
2 impervious to
1 pervious
(treatment only)

Or 1:1
(treatment +
flow control)

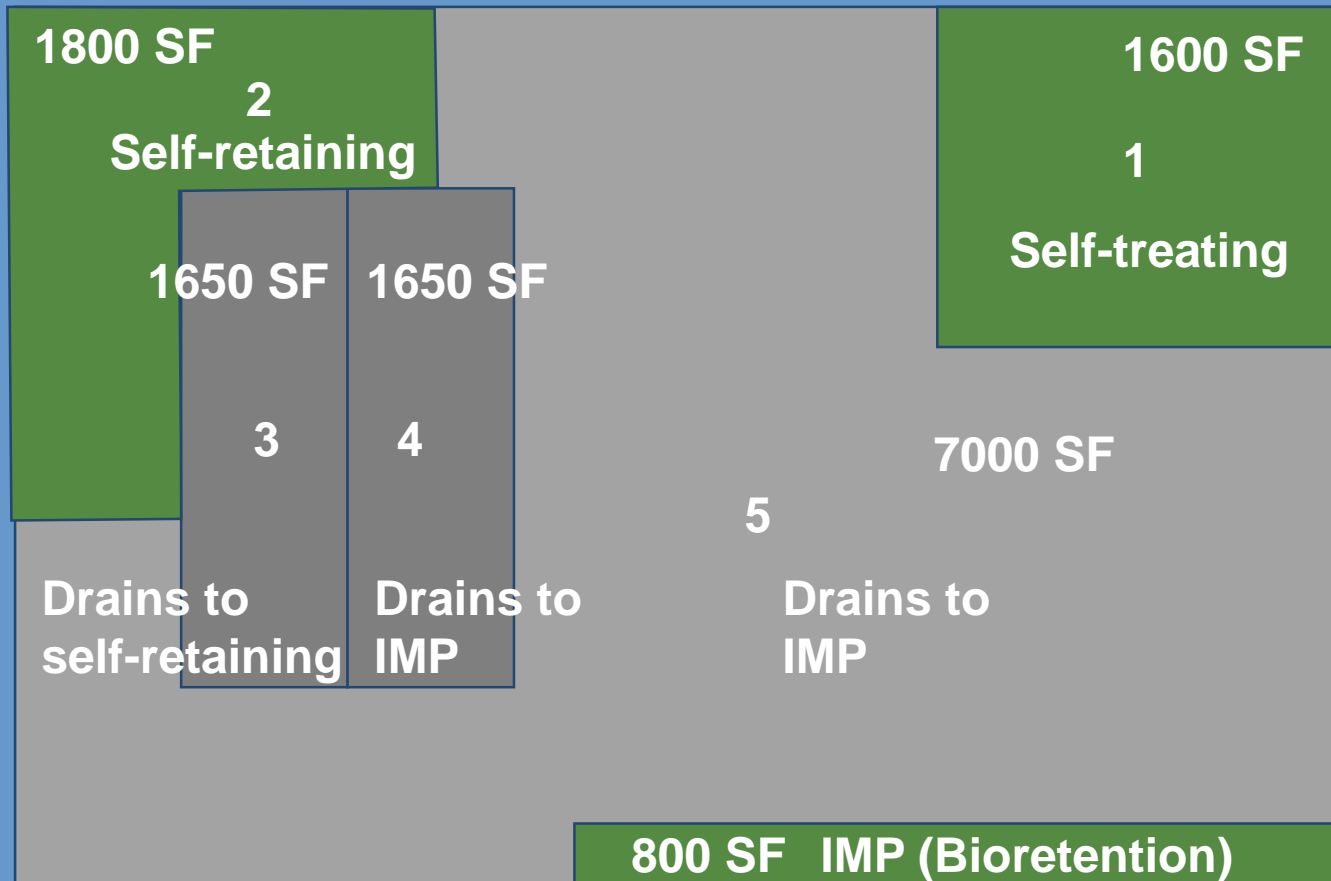
Drainage Management Areas

- Delineate
- Identify
- **Classify**
- Tabulate
- Describe
- Calculate



Drainage Management Areas

- Delineate
- Identify
- Classify
- Tabulate
- Describe
- Calculate



IV. DOCUMENTATION OF DRAINAGE DESIGN

IV.A. Descriptions of each Drainage Management Area

IV.A.1. Table of Drainage Management Areas

Table x. Drainage Management Areas

<i>DMA Name</i>	<i>Area (SF)</i>	<i>Surface Type/Description</i>	<i>DMA Type/Drains to</i>

IV.A.2. Drainage Management Area Descriptions

DMA [name], totaling x,xxx square feet, drains [description of area]. DMA [name] drains to [Self-Retaining DMA name or IMP name]. [Describe notable or exceptional characteristics or conditions.]

DMA [name], totaling x,xxx square feet, drains [description of area]. DMA [name] drains to [Self-Retaining DMA name or IMP name]. [Describe notable or exceptional characteristics or conditions.]

DMA [name], totaling x,xxx square feet, drains [description of area]. DMA [name] drains to [Self-Retaining DMA name or IMP name]. [Describe notable or exceptional characteristics or conditions.]

Use the Calculator

Integrated Management Practice Calculator [Feb 2020 Example.xml]

File Tools Help

Project Information

All of the project information is required. Please fill in all of the information before editing the DMAs and IMPs.

Project Name

Location

APN

Total Area sq ft Mean Annual Precip in

Design Goal

Treatment Plus Flow Control

Treatment Only

Drainage Management Areas (DMAs) Integrated Management Practices (IMPs) Calculation Warnings(0) Summary Report

DMA1 DMA2 DMA3 DMA4 DMA5

DMA Type IMP NOTE: The DMA can drain only to IMPs with the same soil type.

Drainage Area (sq. ft.) Drains to DMA

NRCS Soil Group

Post-project Surface Type

Add New DMA Remove Current DMA Rename Current DMA

Use the Calculator

Integrated Management Practice Calculator [Feb 2020 Example.xml]

File Tools Help

Project Information

All of the project information is required. Please fill in all of the information before editing the DMAs and IMPs.

Project Name: February 2020 Example

Location: Anytown, USA

APN: 5555-5555

Total Area: 14500 sq ft Mean Annual Precip: 20 in

Design Goal

Treatment Plus Flow Control

Treatment Only

Drainage Management Areas (DMAs) Integrated Management Practices (IMPs) Calculation Warnings(0) Summary Report

IMP1

NRCS Soil Group: D

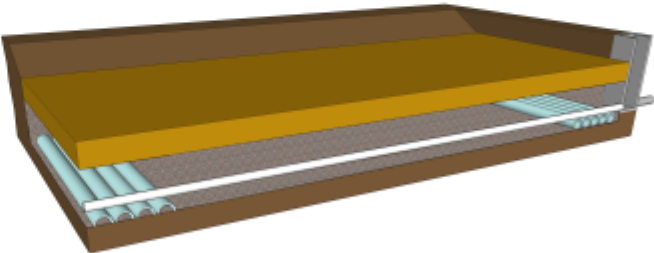
IMP Type: Bioretention Facility

Parameter	Minimum	Proposed
Area (sq ft)	346	800

Connected

DMA4 DMA5

Connect IMP Disconnect Selected IMP



Use the Calculator

Project Name: February 2020 Example
 Project Type: Treatment Only
 APN: 5555-5555
 Drainage Area: 14,500
 Mean Annual Precipitation: 20.0

Self-Treating DMAs

DMA Name	Area (sq ft)
DMA1	1,600.0

II. Self-Retaining Areas

Self-Retaining DMA	
DMA Name	Area (sq ft)
DMA2	1,800

III. Areas Draining to Self-Retaining Areas

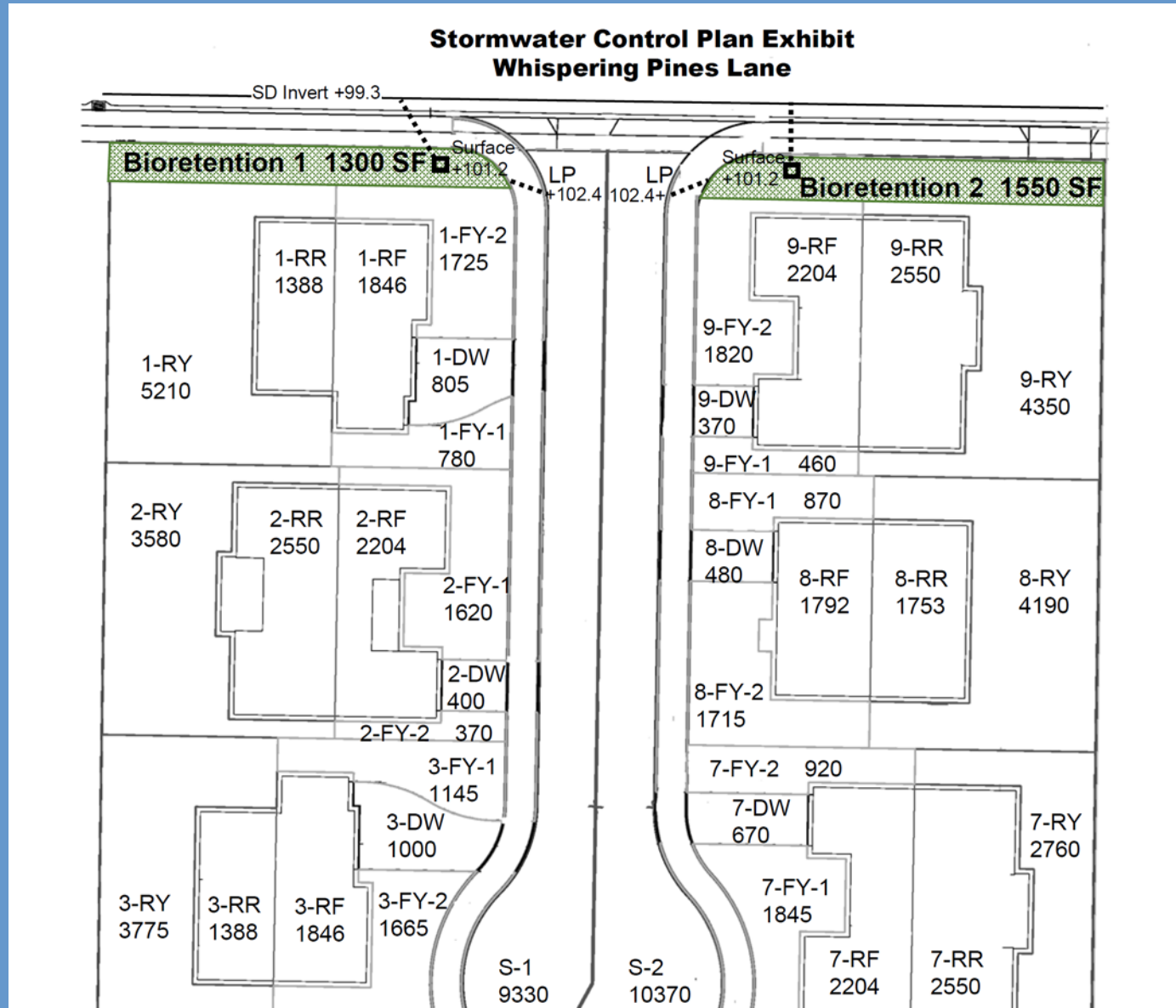
DMA Name	Area (sq ft)	Surface Type	Runoff Factor	Product (Area x Runoff Factor) [A]	Receiving Self Retaining DMA	Receiving Self-Retaining DMA Area (sq ft) [B]	Ratio [A]/[B]
DMA3	1650	Conventional Roof	1.0	1,650.0	DMA2	1,800	0.92

IV. Areas Draining to IMPs

IMP Name: IMP1
 IMP Type: Bioretention Facility
 Soil Group: IMP1

DMA Name	Area (sq ft)	Post Project Surface Type	DMA Runoff Factor	DMA Area x Runoff Factor	IMP Sizing			
					IMP Sizing Factor	Rain Adjustment Factor	Minimum Area or Volume	Proposed Area or Volume
DMA4	1,650	Conventional Roof	1.00	1,650				
DMA5	7,000	Concrete or Asphalt	1.00	7,000				
Total				8,650				
Area					0.040	1.000	346	800

Example Residential Subdivision

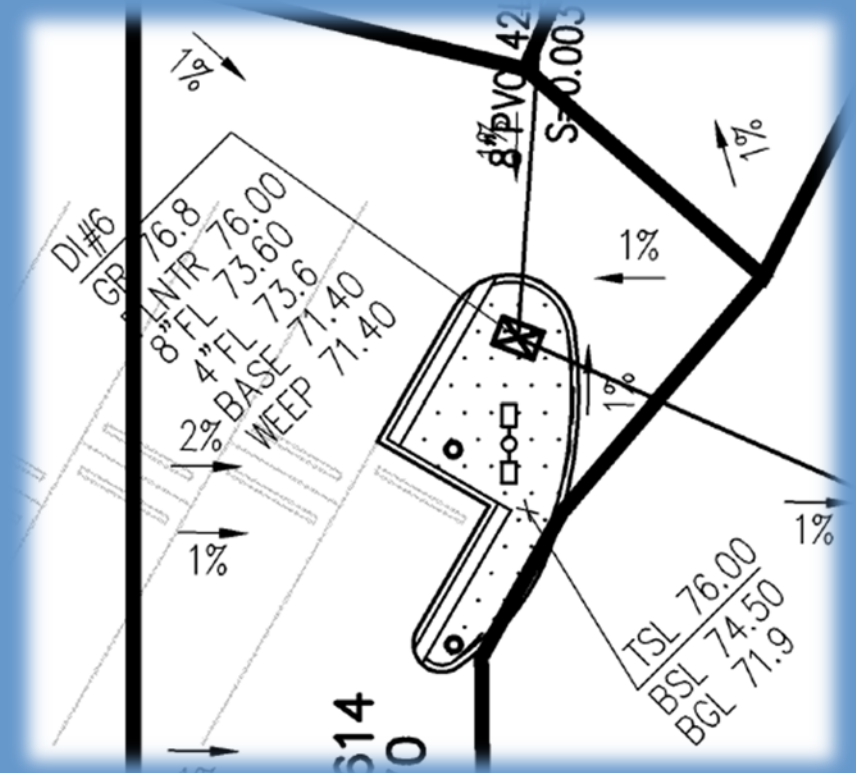


Design and Construction

Construction Documents

48

- Show DMAs and IMPs
 - On the Grading and Drainage Plan, or
 - a separate Stormwater Control Plan
- Show key elevations for bioretention facilities

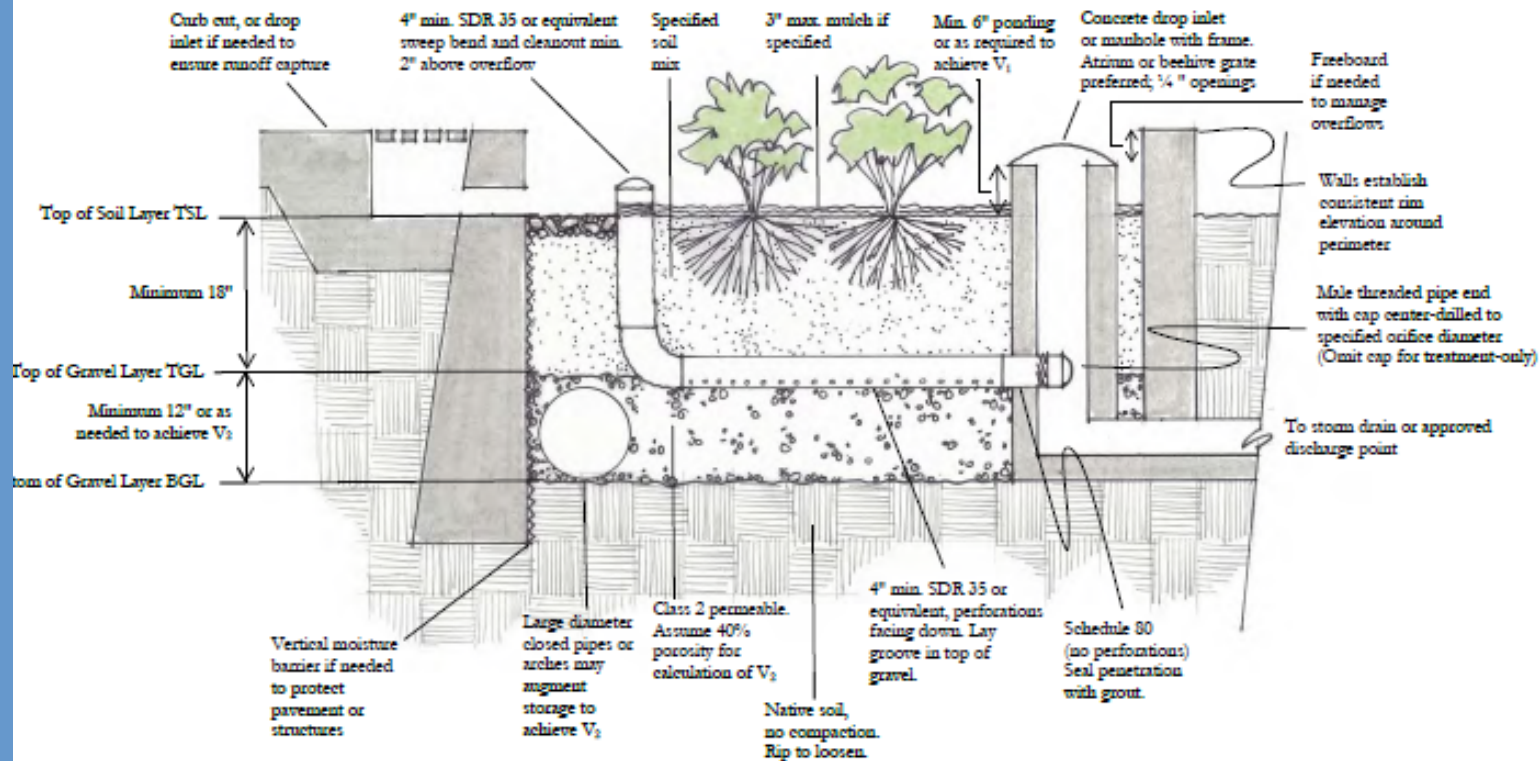


Include Criteria in Plan Set

67

Bioretention Facility

Cross-section
Not to Scale



Notes:

- No liner, no filter fabric, no landscape cloth.
- Maintain EGL, TGL, TSL throughout facility area at elevations to be specified on drawing.
- Class 2 perm layer may extend below and underneath drop inlet.
- Elevation of perforated pipe underdrain is atop gravel layer.
- See Appendix B for soil mix specification, planting and irrigation guidance.
- See Chapter 3 for factors and equations used to calculate V_1 , V_2 and orifice diameter.

- Locations of bioretention facilities
- Bioretention delineated from other landscaping
- Soil specification
- Separate irrigation zone
- Drip emitters
- Smart controllers
- Plant palette



B

Use Construction Checklist

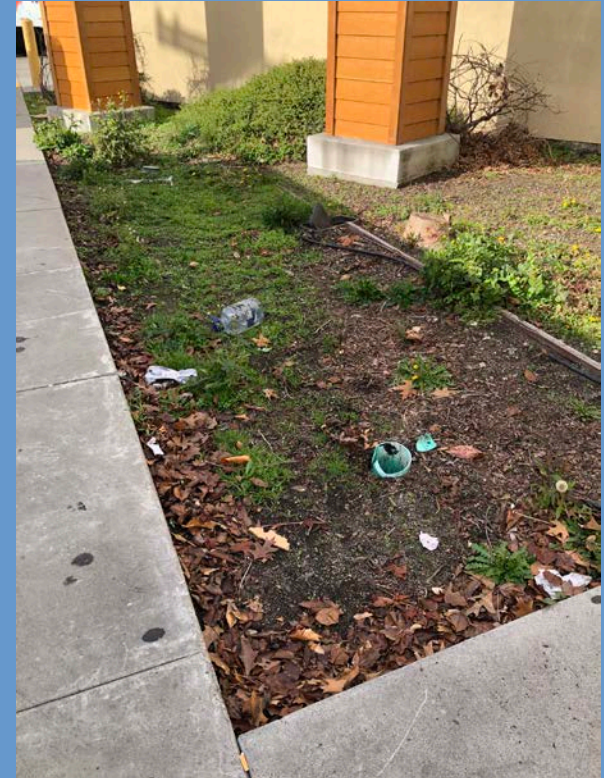
82



Operation and Maintenance

- Stormwater Facilities Operation and Maintenance Agreement
 - Runs with the land
 - Provides for maintenance in perpetuity
- Stormwater Facilities Operation and Maintenance Plan
 - Responsible parties
 - Maintenance requirements and schedule
- Inspections

Operation and Maintenance



Operation and Maintenance

- Most O&M issues relate to problems with original design and construction
- Lack of clear lines of responsibility between owner, operator, and contractors
 - O&M Plan not on site at time of inspection
 - Landscape crews aren't aware of key instructions—no amendments, no fertilizers, no pesticides
 - Sparse or no vegetation

Operation and Maintenance



Summary

Do

- Integrate LID into the project concept
 - Keep drainage at the surface
 - Distribute facilities throughout the site
 - Seek multiple uses and multiple benefits
- Follow the *Guidebook*

Don't

- Plan on using non-LID (proprietary) systems
- Plan on using pervious pavement
- Mix and match with flood control hydrology

Green Infrastructure: Plans, Mandates, and Alternative Compliance

What is “Green Infrastructure”?

- Retrofit existing street drainage with Low Impact Development drainage design
- Also encompasses LID for development and redevelopment



Multiple Benefits

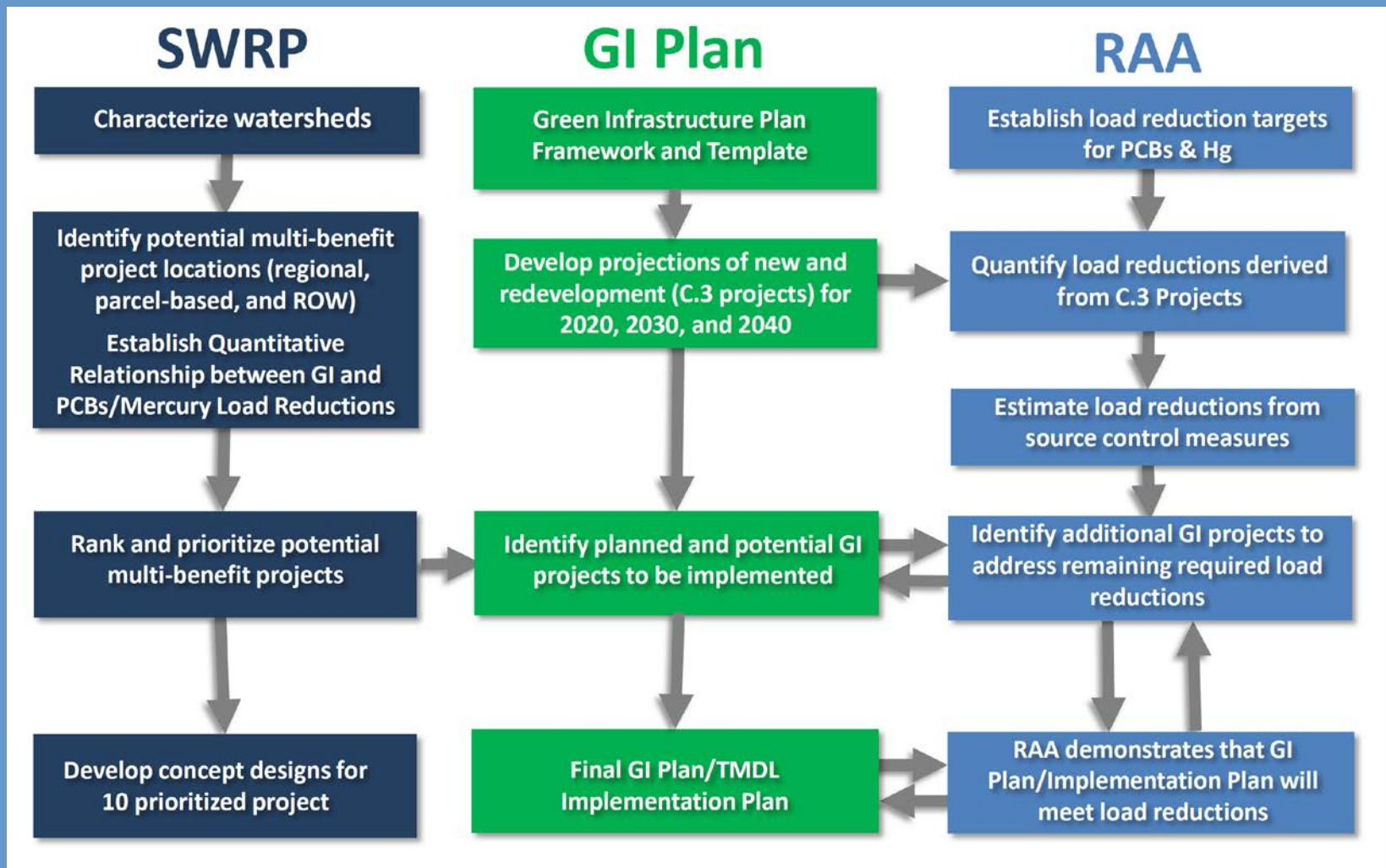
- Stop spills, dumping, and “urban slobber”
- Sustainable, low-maintenance treatment
- Synergies
 - Multi-modal transport, “complete streets”
 - Urban greening and air quality
 - Heat island mitigation
 - Active and passive recreation

Political & Regulatory Momentum

- Solution to combined sewer overflows
- Big-city scale commitments
 - Philadelphia, Washington, San Francisco
- Political momentum
 - Climate change
 - Public health
 - Triple bottom line
- Perceived solution to stormwater-related non-attainment

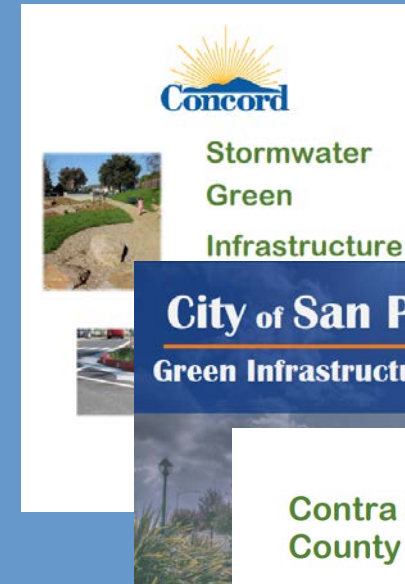


Related Countywide Planning



In the Green Infrastructure Plans

- Projections/targets
- Project lists and maps
- Design Guidelines/
Standard Details
- Funding strategies
- Policies
- Outreach and education

The cover of the City of San Pablo Green Infrastructure Plan has a dark blue background. The title "City of San Pablo" is written in white, with "Green Infrastructure Plan" in white below it. A small photograph of a street scene is visible on the left side of the cover.

City of San Pablo Green Infrastructure Plan

The cover of the Contra Costa County Infrastructure Plan features the Contra Costa County logo on the right, which is a circular seal. The text "Contra Costa County" is written in green on the left. Below the title, the words "Infrastructure Plan" are written in green. The cover includes a photograph of a street with a lamp post and some greenery.

Contra Costa County

Infrastructure Plan



City of Pleasant Hill

Green Infrastructure Plan

AUGUST 30, 2019



July 2019

Status of GI Plans and Mandate

- Plans were submitted September 30, 2019
 - Under review by Water Board staff
- MRP 3.0 Negotiations
 - **Decouple** Green Infrastructure mandate from requirement to reduce PCB stormwater loads
 - Identify substitute driver, such as mandating a number of “**greened acres**” during permit term
 - Permittees use **indicators** to show progress
 - “**No missed opportunities**” will continue

“No missed opportunities” (C.3.j.ii.)

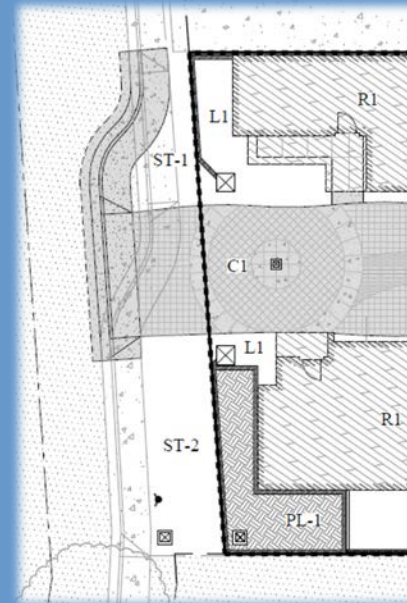
- Ongoing: Screen capital improvement projects for potential to include Green Infrastructure
- Report capital projects reviewed and GI projects planned/constructed
- Regional guidance for reviewing and reporting was distributed in May 2016 (and on website)

So where is this going?

- Green Infrastructure is not going away
- There is no big, comprehensive funding source
- The next 5-10 years are an opportunity to learn and get better at implementation
- Federal and state grants will support some substantial (larger scale) projects
- GI will be incorporated in some “Complete Streets” and other transportation projects
 - Contingent on aligning funding streams

GI in Land Development Approvals

- Municipalities may require:
 - Construct and maintain GI in street frontage
 - Pay new fees
- Municipalities may allow:
 - GI in frontage to offset on-site treatment
 - Fee in lieu of on-site LID that pays for GI elsewhere (alternative compliance)



GI Engineering Considerations

- Flat areas near catch basins
- Surrounding ROW that is or could be landscaped
- Minimize height of curbs or walls



MRP 3.0: Potential Changes to Provision C.3

Other than Green Infrastructure

Timeline

Date	Permit	Guidebook
2003	C.3 added	
2005		1 st Edition
2005		2 nd Edition
2006	HMP Accepted	3 rd Edition & calculator
2009		4 th Edition; current calculator
2009	MRP 1.0	5 th Edition
2011	Amendment (LID)	Addendum
2012		6 th Edition
2015	MRP 2.0	Addendum
2017		7 th Edition
2021	MRP 3.0	

MRP 3.0 Negotiations

Issue	MRP 2.0	Water Board Proposes
Threshold for Regulated Projects	10,000 SF; 5,000 SF for some land uses	5,000 SF for all land uses
Single-Family Homes	“Small Project”	Remove exemption
LID Exemption	Special Projects	Eliminate non-LID
Alternative Compliance	Broad; vague	Expand
O&M	O&M Plans and Agreements; Inspections	“Asset Management”

Hydromodification Management

- MRP 2.0 (2015) aimed to make requirements regionally consistent
- Contra Costa municipalities submitted in September 2017:
 - Applicability map
 - Updated facility sizing criteria
- Water Board staff agreed Contra Costa municipalities will continue current practices pending their response to submittals
- Aiming to resolve sizing and add language to MRP 3.0

Stormwater C.3 Guidebook, 8th Ed.

- Compliance for higher-density development, which may include
 - New sizing criteria for treatment only
 - Further guidance on off-site compliance
- Updated HM criteria and maps
- Updated IMP Sizing Calculator
- Ongoing improvements and clarifications

Break

LID Topics

Implementing Low Impact Development
Drainage Design in
Land Development Projects

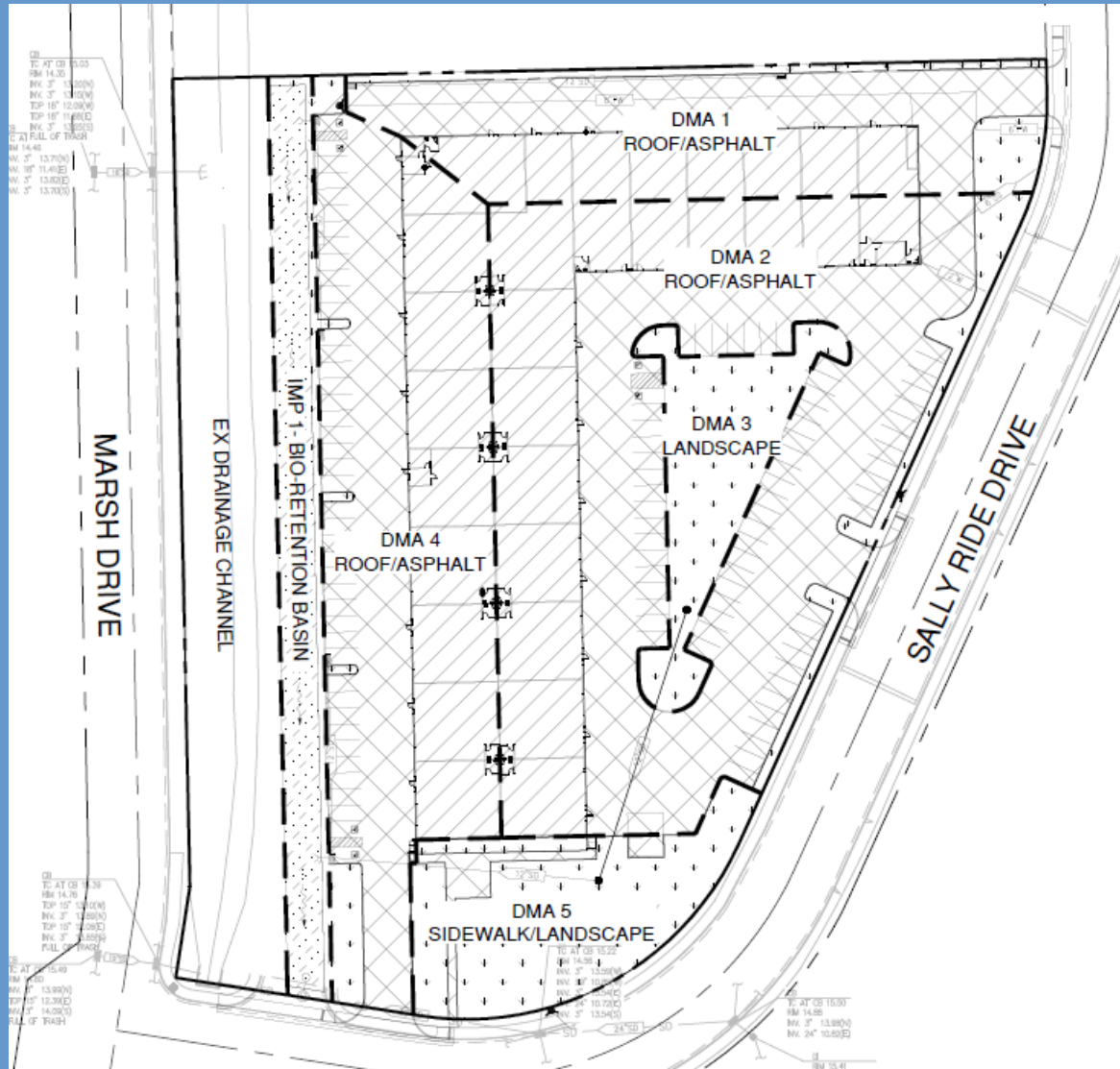
Topic List (see agenda)

1. Making C.3/LID Review Part of Design Review
2. 100% LID in Higher-Density Projects
3. Alternative Compliance for Regulated Projects
4. LID and Flood Management:
Bioretention and Basins
5. Getting LID Features and Facilities Built Right
6. Operation, Maintenance, and Inspections

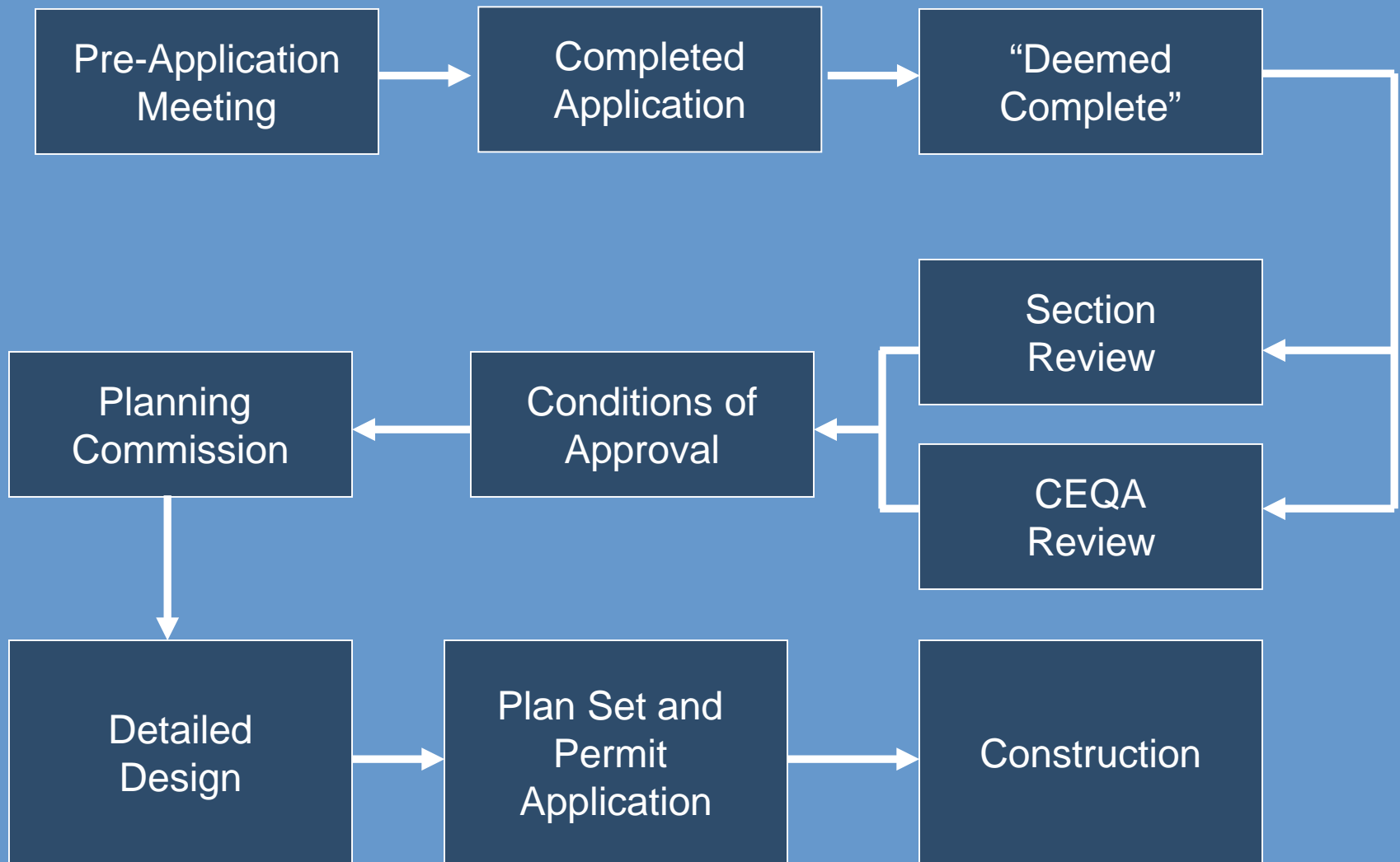
Topic 1: LID and Design Review

- Problem:
 - Initial project concepts, site layouts, and renderings often either:
 - Omit LID features and facilities entirely
 - Incorporate conventional drainage piped to LID
 - The project is later characterized as being difficult to incorporate LID
 - This can lead to ineffective and expensive designs and project delays

Illustration



Development Review Process



LID/Design Review: Questions

1. On the applicant's side: How can we ensure LID is incorporated in the original project concept?
2. Would it help to boost Design Review Boards' attention to LID?
3. What could the countywide program (CCCWP) do to help?

Topic 2: 100% LID in High-Density



100% LID: Questions

- How can we get the minimal landscaped spaces in high-density projects (often in frontage) to be used for LID?
- Would it help if bioretention facilities could be sized smaller? Why, and how much?
- What will be the outcomes if non-LID treatment is disallowed entirely?

Topic 3: Alternative Compliance

- Observation: Alternative compliance has been available since the beginning of C.3 (2005) but has seldom been used.
- Water Board staff sees alternative compliance as a substitute for allowing non-LID treatment

Example of Alternative Compliance



Alternative Compliance: Questions

- Who has attempted to use alternative (offsite) compliance? Successful or unsuccessful?
- Is there really a need for an in-lieu program? At what cost to applicants?
 - And how much of that need could be addressed by better anticipating the need to implement LID on-site?

Topic 4: LID & Flood Management

- Problems:
 - Designers want to use Flood Control facilities (basins) to meet C.3 requirements (for example, by incorporating bioretention into the basin footprint)
 - Designers want to use C.3 facilities to meet flood control requirements (for example using bioretention/hydromodification-management facilities to control 10-year peak flows)
 - Designers focused on C.3 (for example, retention in backyards) may neglect to provide emergency overflow pathways

LID and Flood Control

- How can we help applicants' engineers better understand the relationship between flood control requirements and C.3 requirements?

- Problems:
 - Plans and details shown on application submittals and on construction drawings do not incorporate all criteria in the *Guidebook*
 - Filter fabric
 - Impermeable liners where not needed
 - Soil mix and gravel doesn't cover entire area "A"
 - Side slopes, inadequate structural support
 - Construction inspection doesn't follow all phases (see checklist)

Getting LID Built Right: Questions

- How can we encourage applicants' engineers to follow the criteria in the *Guidebook*?
- Are municipalities using the construction inspection checklist? Do we need other tools?

Topic 6: Operation & Maintenance

- Problems
 - Smaller municipalities are still “ramping up” their inspection programs.
 - Many operational problems stem from shortcomings in design
 - Hard to do something right that is done infrequently
- Question:
 - How can these problems be addressed?

Workshop Summary

Please complete and hand in the request for feedback on the back of your agenda