MONTEREY SEA
Stormwater Education Alliance
WWW.MONTEREYSEA.ORG

Post-Construction Stormwater Training

Valerie Huff, PE
August 2021

Today's Agenda

Central Coast Post-Construction Requirements

WALLACE GROUP®

Where

Who

What

How

Resources


RWQCB
Municipalities
Development Community
PCRs
Technical Guide
Design & Construct

WHERE?

Location Matters

Within MS4 Permit Boundary?

YES

Congratulations! It's time to follow the Central Coast Post-Construction Requirements! (PCRs)

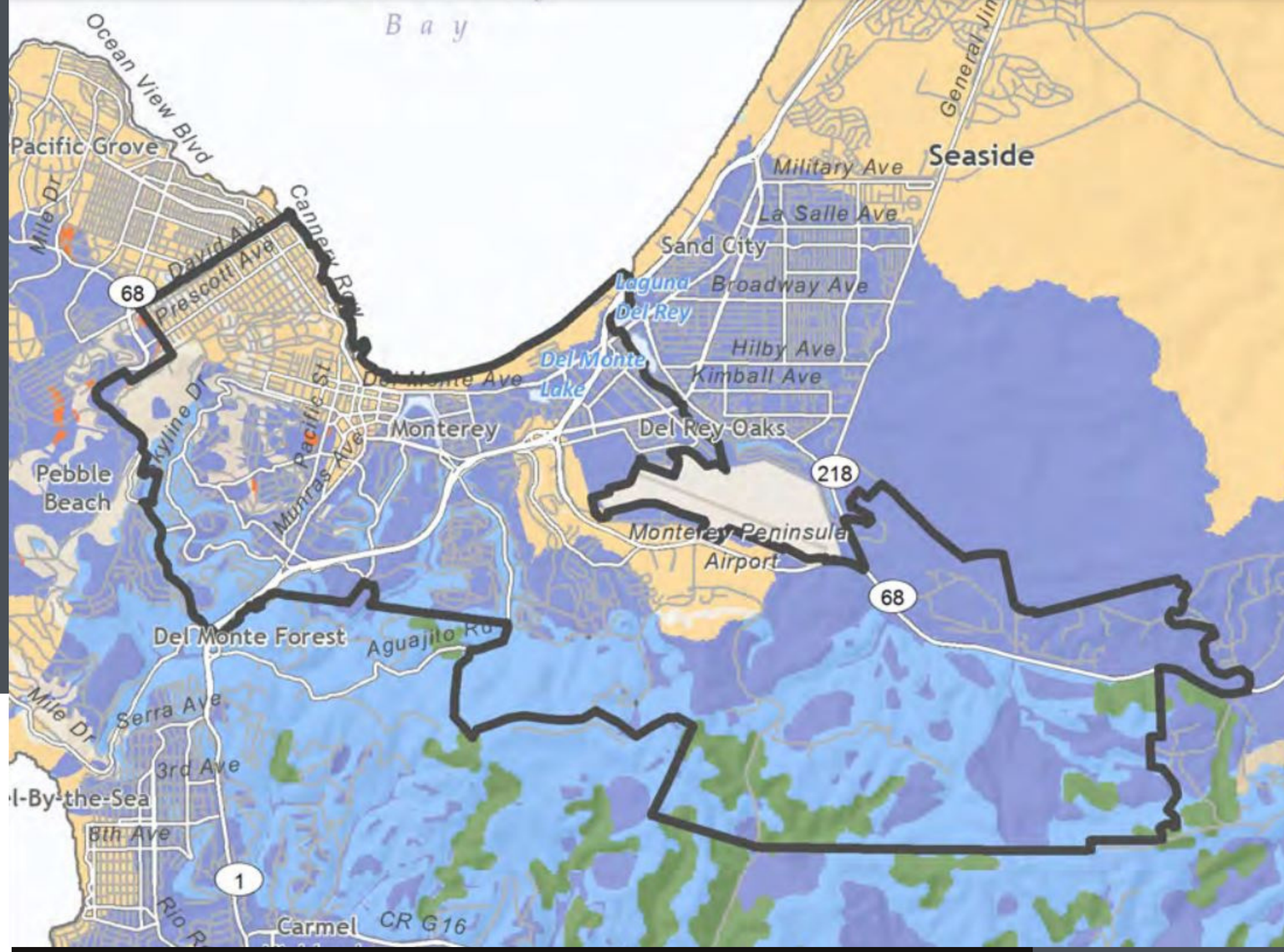
NO

- State Water Board - SWPPP
- May be other local requirements

Carmel-by-the-Sea • County of Monterey • Del Rey Oaks
Monterey • Pacific Grove • Sand City • Seaside

WHERE?

Know Your Zone



Watershed Management Zones (WMZs)

WHO?

Which types of projects must comply?

New And Replaced
Impervious Surface > 2,500 SF

See PCRs for Exemptions:

- Linear utilities
- Temporary structures
- Maintenance
- Etc

PCRS B.1.b *Regulated Projects do not include…*

WHAT?

Project Size Determines Requirements

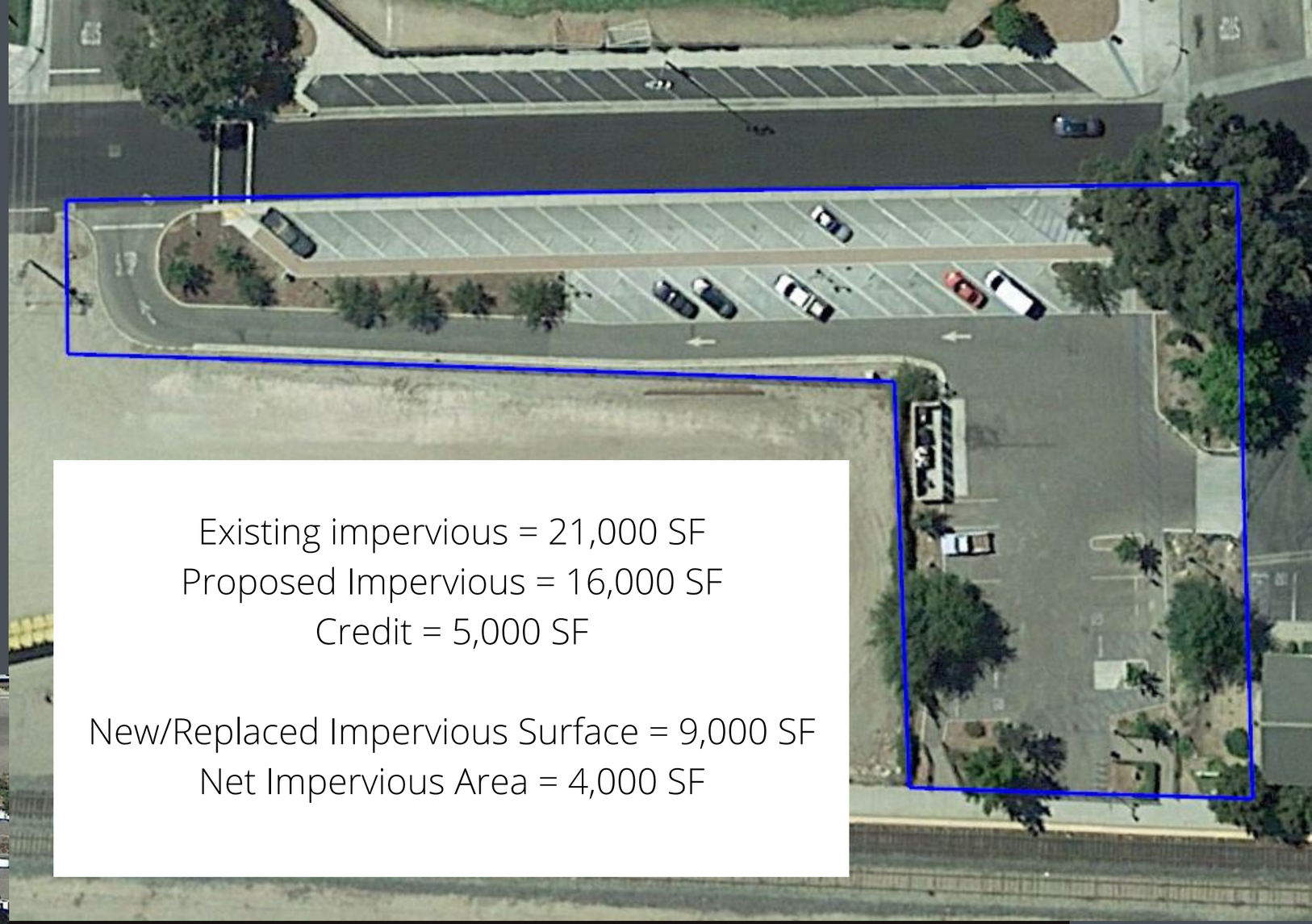
Tier	Performance Requirement	One Single Family Home	All Others
1	Site Design and Runoff Reduction	≥ 2,500 SF Impervious	≥ 2,500 SF Impervious
2	Water Quality Treatment	≥ 15,000 SF NET Impervious	≥ 5,000 SF NET Impervious
3	Retention	≥ 15,000 SF NET Impervious	≥ 15,000 SF Impervious
4	Peak Flow Management	≥ 22,500 SF Impervious	≥ 22,500 SF Impervious

Project Types for Thresholds:

- One Single Family Home
- Everything Else

NET What?

NET Impervious Area and Reduced Impervious Area Credit



Existing impervious = 21,000 SF
Proposed Impervious = 16,000 SF
Credit = 5,000 SF

New/Replaced Impervious Surface = 9,000 SF
Net Impervious Area = 4,000 SF

Credit = Existing Impervious - Proposed Impervious

Net Impervious Area = New + Replaced - Credit

WHAT?

Required Submittals*

PRELIMINARY SWCP

Demonstrate compliance can be accomplished

FINAL SWCP

Detailed Design

DRAFT O&M PLAN

Based on Final SWCP

CONSTRUCTION

Inspections to document SCM construction

FINAL O&M PLAN

Based on record drawings

MAINTENANCE AGREEMENT

Execute and Record with County

*Confirm required submittals with permitting jurisdiction

WHAT?

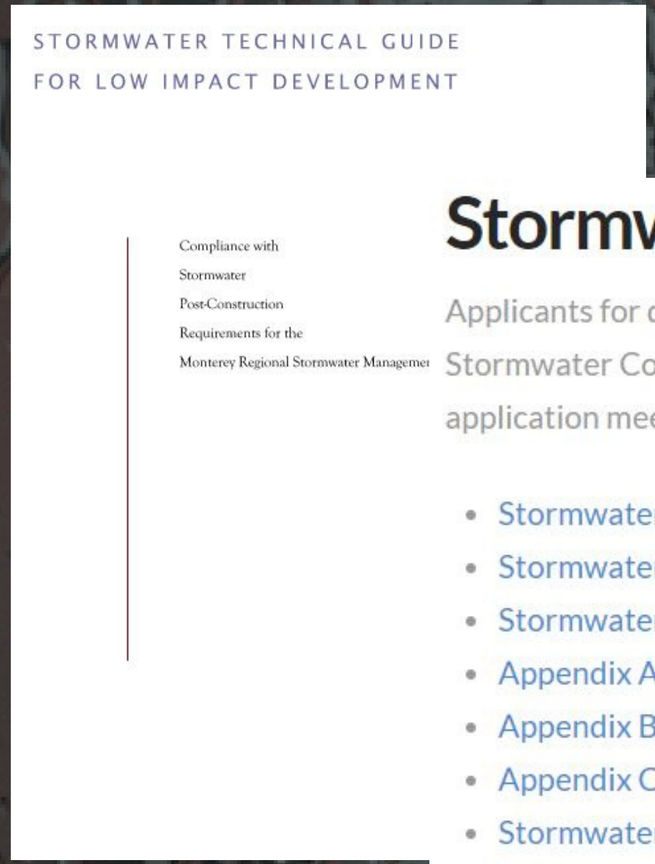
O&M Plan and Maintenance Agreement

- Record Drawings
- Certification of Construction by Engineer of Record
- Final O&M Plan
  - O&M Procedures, O&M Cost, Site Plan
- Maintenance Agreement Recorded with County Assessor/Clerk/Recorder
  - B&W, 8-1/2 x 11
- Annual certification of maintenance

The O&M Plan is a living document that will be an attachment to the Maintenance Agreement

HOW?

SCM Design and Common Challenges



Stormwater Technical Guide

Applicants for development approvals in jurisdictions within the M
Stormwater Control Plans. However, local requirements vary. Che
application meeting is recommended for all projects subject to the

- Stormwater Technical Guide
- Stormwater Control Plan Template
- Stormwater Control Plan Template – Small (Tier 1) Projects
- Appendix A: Source Control
- Appendix B: Bioretention Construction Checklist
- Appendix C: Technical Criteria for Non-LID
- Stormwater Control Measures Sizing Calculator
- Sizing Calculator Instructions
- Watershed Management Zone Maps

III.B. **Minimum Required Tier 1 Measures:**
[All regulated projects are required to minimize stormwater runoff by implementing one (1) or more of the following Site Design Measures. Explain how each measure is applicable or not applicable to the regulated project.]

III.B.1. Direct roof runoff into cisterns or rain barrels for reuse.

III.B.2. Direct roof runoff onto vegetated areas safely away from building foundations and footings, consistent with the California Building Code.

III.B.3. Direct runoff from sidewalks, walkways and/or patios onto vegetated areas safely away from building foundations and footings, consistent with the California Building Code.

III.B.4. Direct runoff from driveways and/or uncovered parking lots onto vegetated areas safely away from building foundations and footings, consistent with the California Building Code.

III.B.5. Construct bike lanes, driveways, uncovered parking lots, sidewalks, walkways and patios with permeable surfaces.

IV. Post-Construction Drainage Design (Tier 2-4)
[Provide a brief summary of the proposed drainage design. For example, "Proposed drainage improvements include a new storm drain system and low impact development features. The project site has been designed to drain to bioswales and bioretention areas which will provide treatment and retention upstream of the storm drain system."

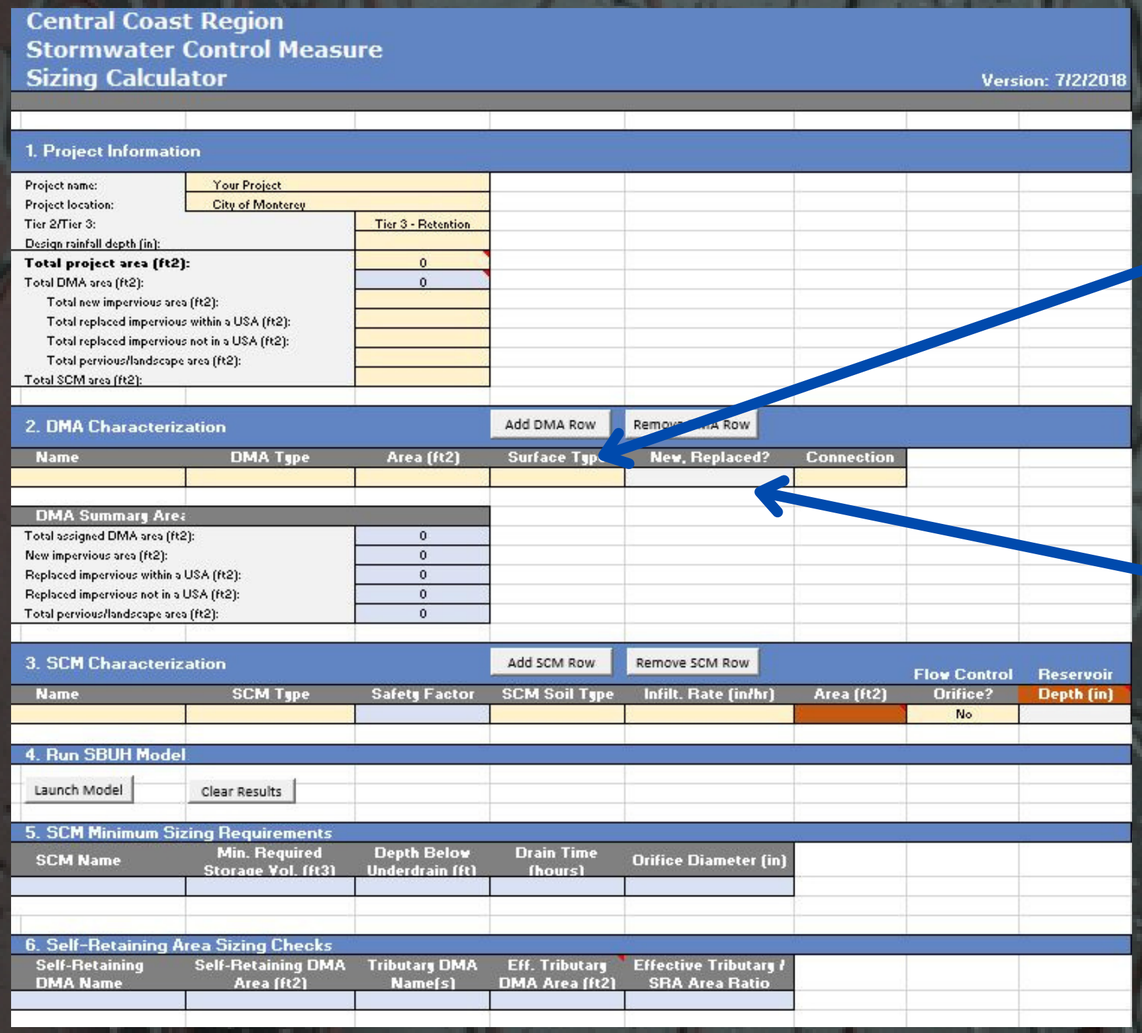
Prepare and refer to a Proposed Conditions Exhibit (11x17, color plan). Exhibit to include, at minimum: property lines, existing/proposed topography and limits of grading, all DMAs and proposed SCMs, existing/proposed buildings and other impervious surfaces, setbacks from SCMs to adjacent structures and property lines, arrows indicating direction of drainage, existing/proposed storm drain system, and other existing/proposed underground utilities.]

IV.A. Drainage Management Areas
[Briefly Describe Approach to DMA Delineation for the regulated project

For guidance on DMA delineation, refer to the JERT's Implementation Guidance Series Issue #2, "Decentralized Stormwater Management to Comply with Runoff Retention Post-Construction Stormwater Control Requirements".]

Follow the Guide

https://montereysea.org/post-construction-requirements/


Central Coast Region
Stormwater Control Measure
Sizing Calculator
Version: 7/2/2018

1. Project Information

Project name:	Your Project
Project location:	City of Monterey
Tier 2/Tier 3:	Tier 3 - Retention
Design rainfall depth (in):	
Total project area (ft2):	0
Total DMA area (ft2):	0
Total new impervious area (ft2):	
Total replaced impervious within a USA (ft2):	
Total replaced impervious not in a USA (ft2):	
Total pervious/landscape area (ft2):	
Total SCM area (ft2):	

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

Name	DMA Type	Area (ft2)	Surface Type	New, Replaced?	Connection

DMA Summary Area

Total assigned DMA area (ft2):	0
New impervious area (ft2):	0
Replaced impervious within a USA (ft2):	0
Replaced impervious not in a USA (ft2):	0
Total pervious/landscape area (ft2):	0

3. SCM Characterization — Add SCM Row — Remove SCM Row

Name	SCM Type	Safety Factor	SCM Soil Type	Infilt. Rate (in/hr)	Area (ft2)	Flow Control Orifice?	Reservoir Depth (in)
						No	

4. Run SBUH Model

Launch Model — Clear Results

5. SCM Minimum Sizing Requirements

SCM Name	Min. Required Storage Vol. (ft3)	Depth Below Underdrain (ft)	Drain Time (hours)	Orifice Diameter (in)

6. Self-Retaining Area Sizing Checks

Self-Retaining DMA Name	Self-Retaining DMA Area (ft2)	Tributary DMA Name(s)	Eff. Tributary DMA Area (ft2)	Effective Tributary / SRA Area Ratio

DMAs by surface type

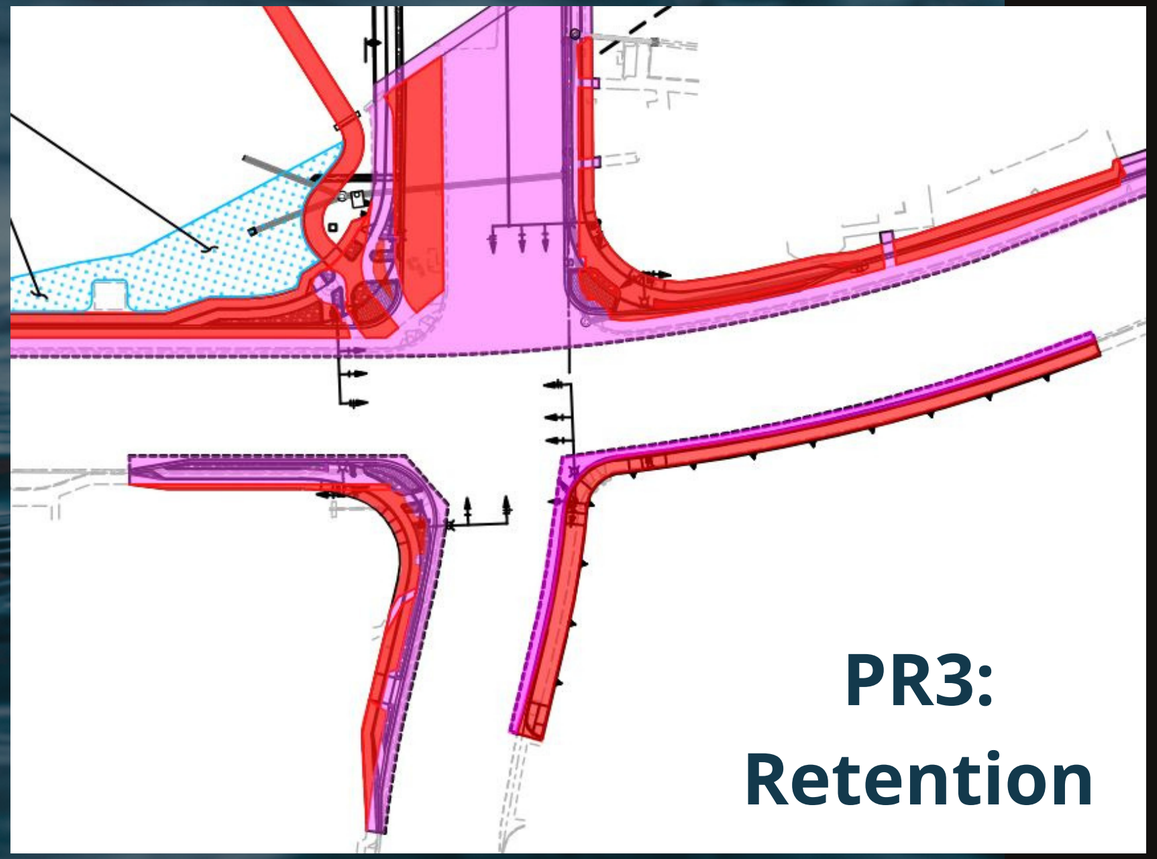
designate surfaces as new or replaced

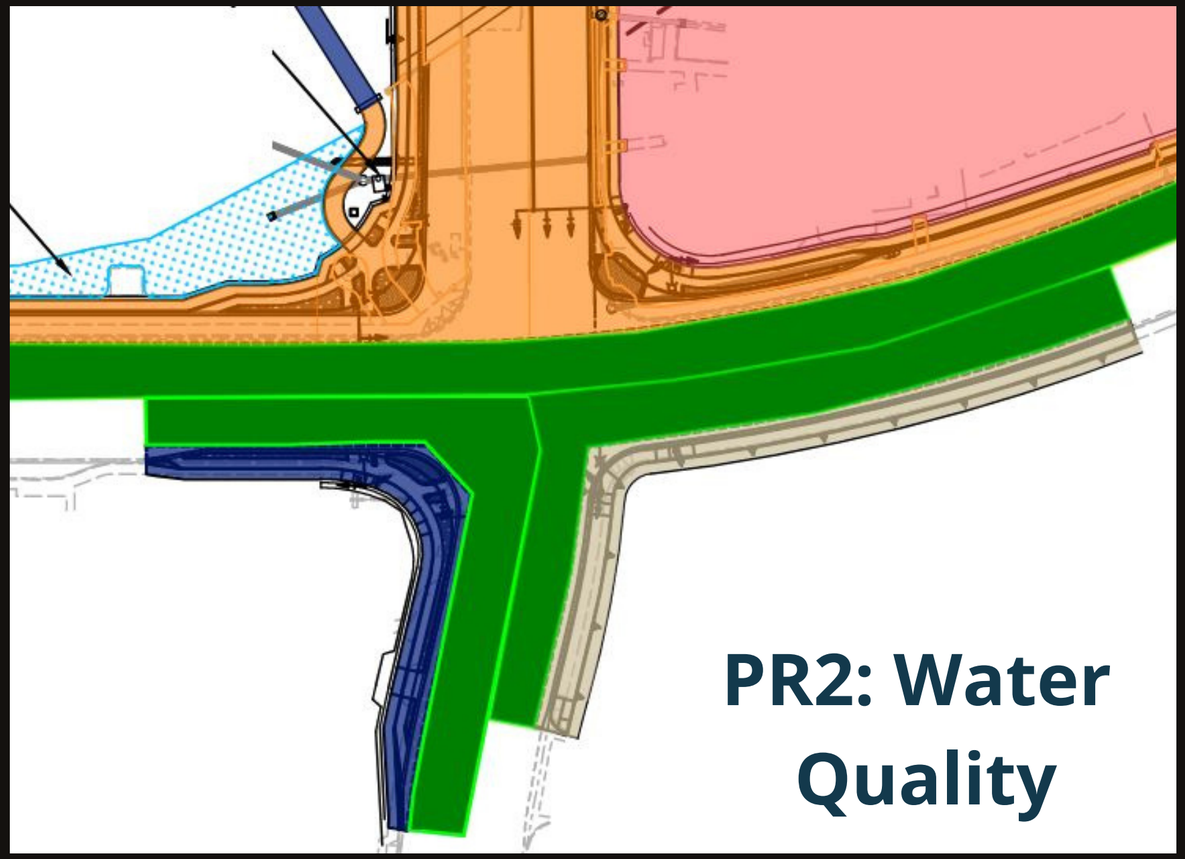
Use the Calculator

https://montereysea.org/post-construction-requirements/

PCRs Attachment D.1.b.i.
Adjustments for Redevelopment Project Retention Tributary Area

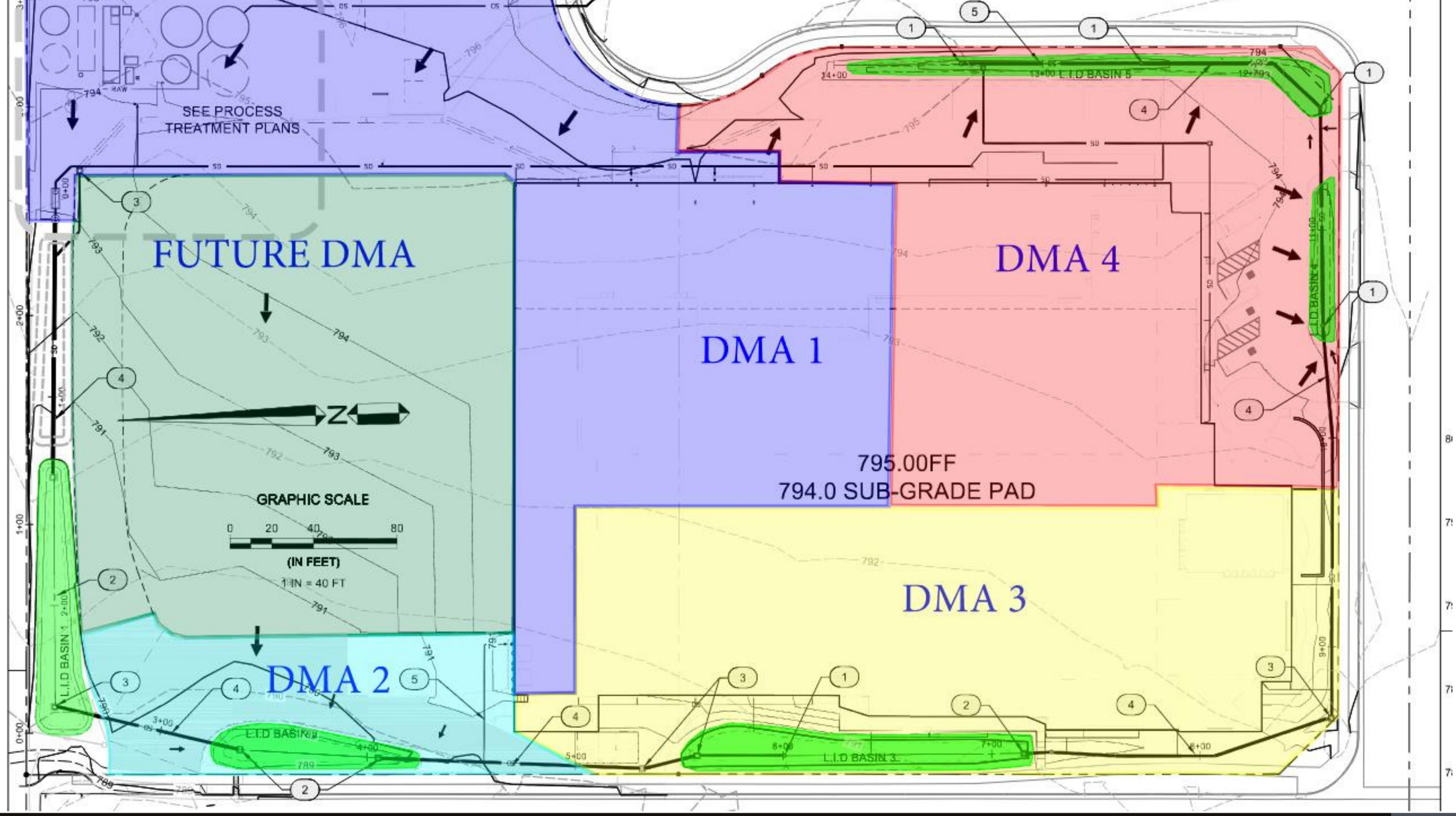
- 0.50 Multiplier
- Apply to replaced impervious surfaces to calculate "Retention Tributary Area"
- PR3 only



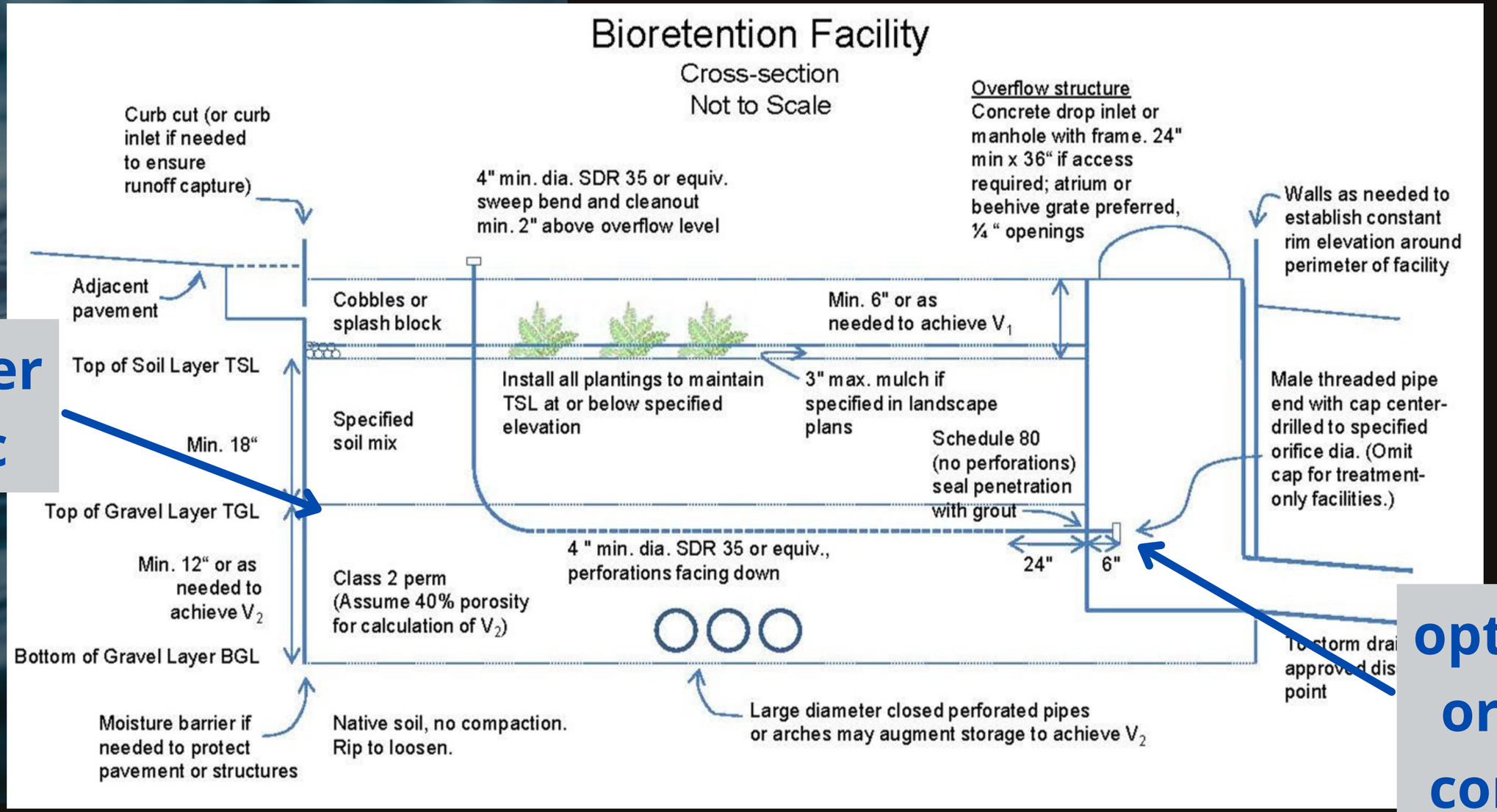


PCRs B.3.b. Water Quality Treatment Performance Requirements shall apply to the runoff from existing, new, and replaced impervious surfaces on sites where runoff from existing impervious surfaces cannot be separated from runoff from new and replaced impervious surfaces.

DMA Delineation



LID and Flood Control

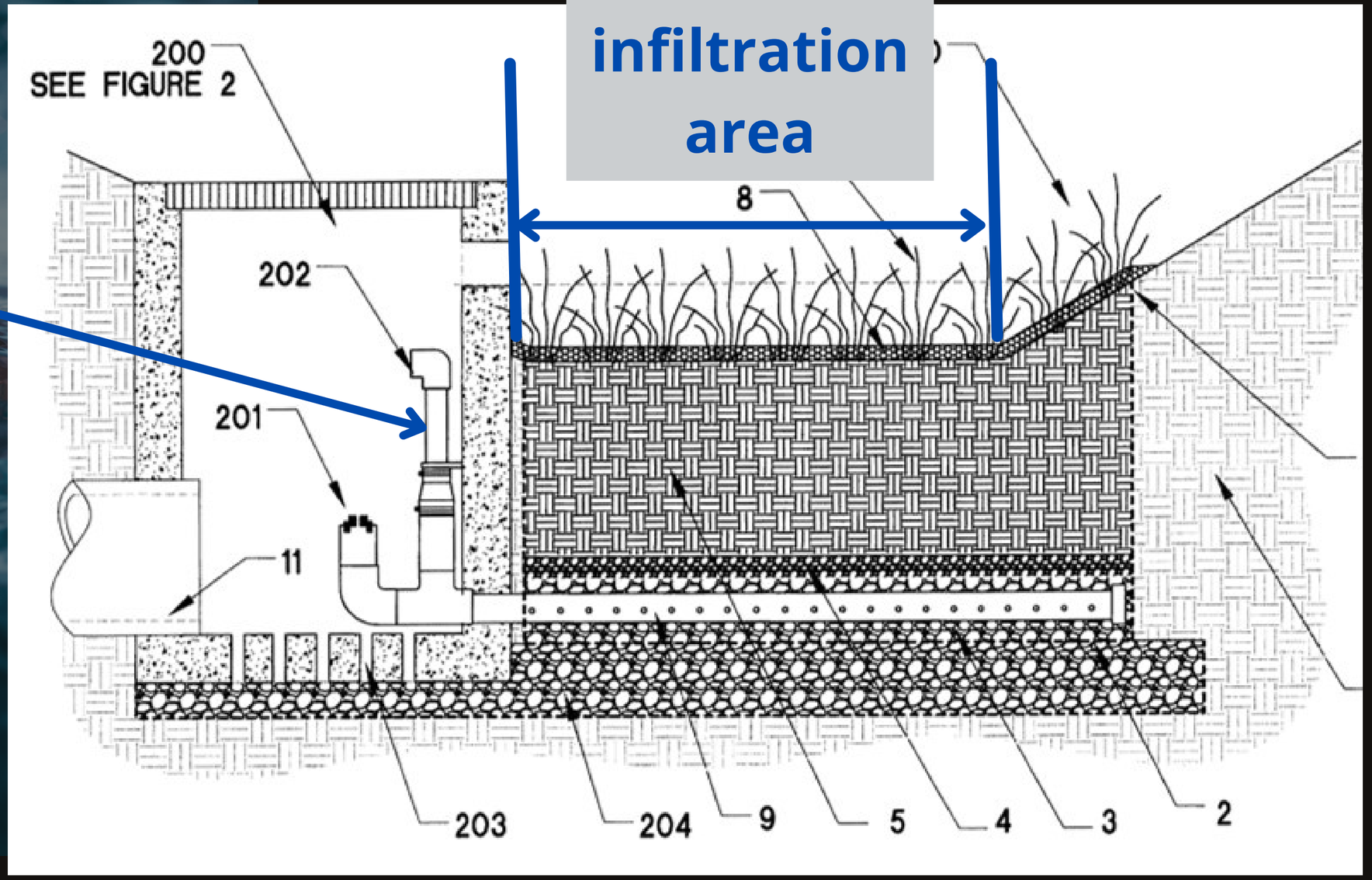


NO filter fabric

optional orifice control

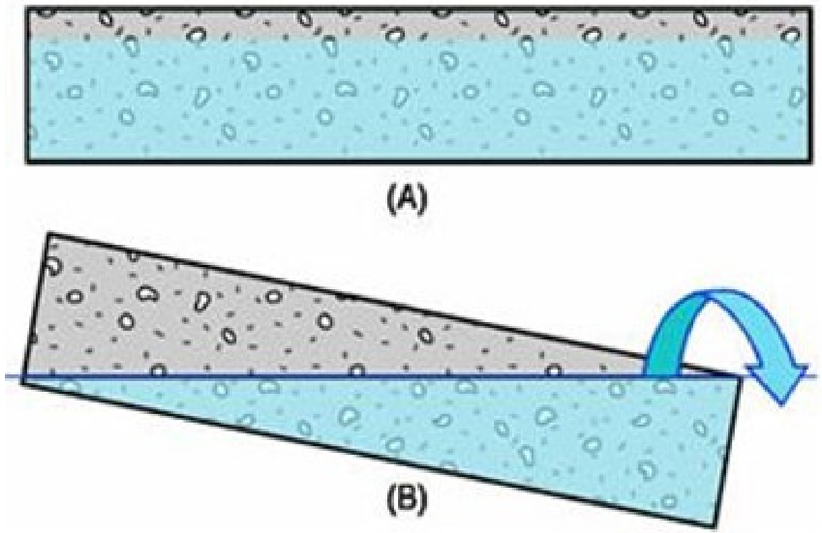
Bioretention Design

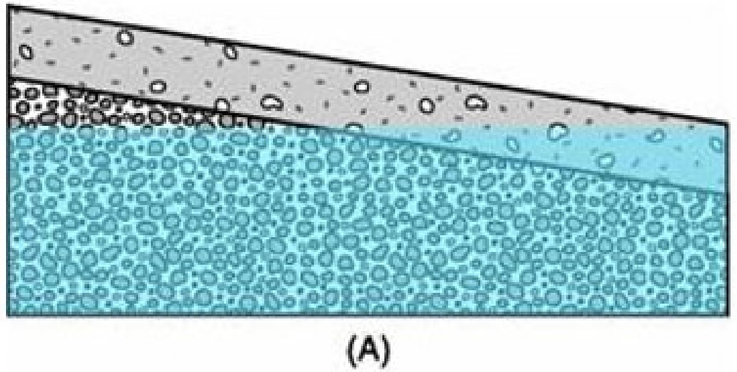
optional orifice control

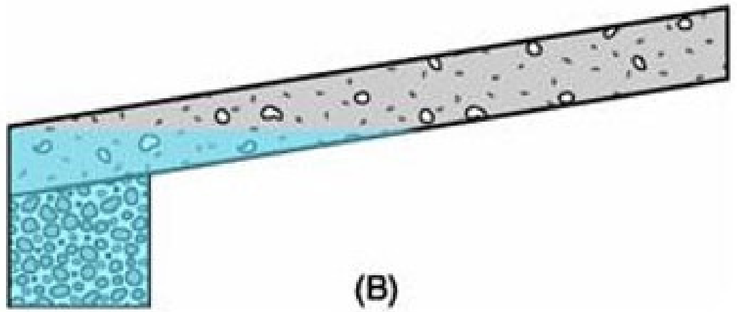


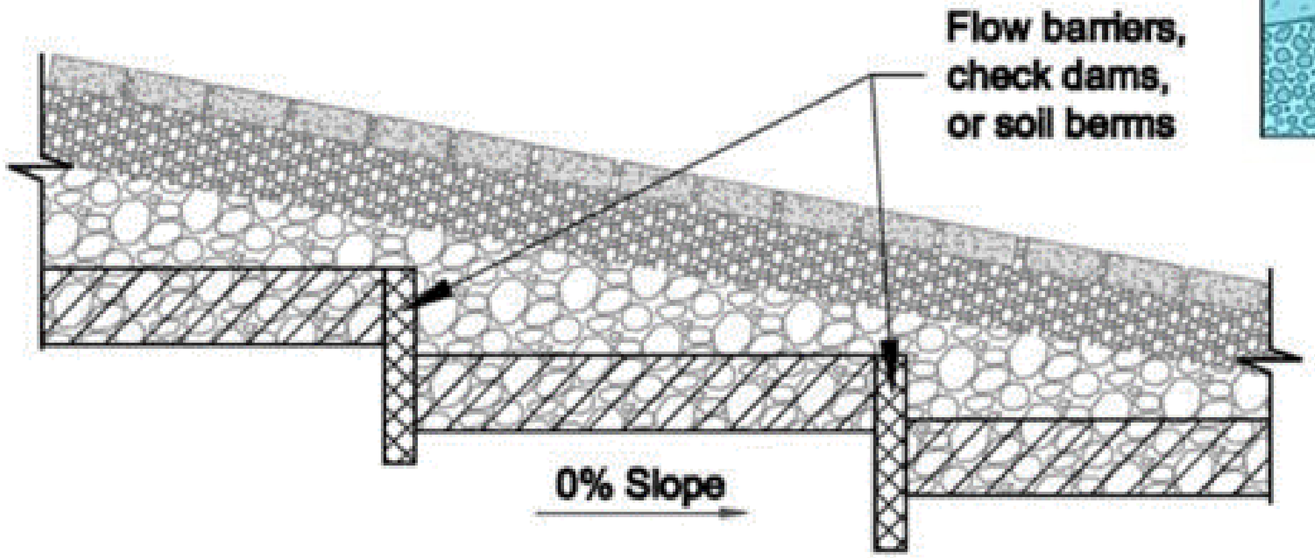
Bioretention Design

Pervious Concrete & Pavers

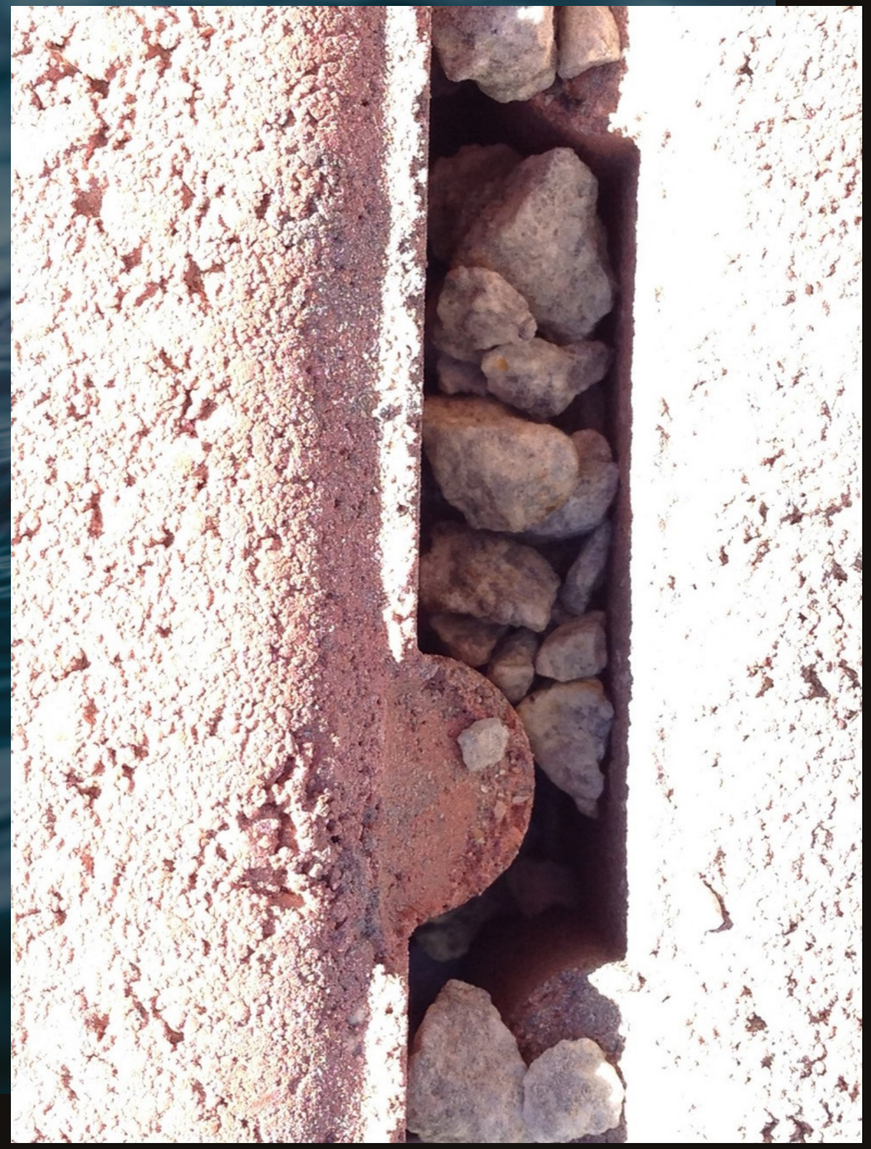








Pervious Pavements



Pervious Pavers

Permeable Pavers

Pervious Pavers

Question: What surfaces are considered pervious or impervious for threshhold calculations?

PCRs Definition of Impervious Surface:
A hard, non-vegetated surface that prevents or significantly limits the entry of water into the soil mantle, as would occur under natural conditions prior to development.

Pervious Pavements

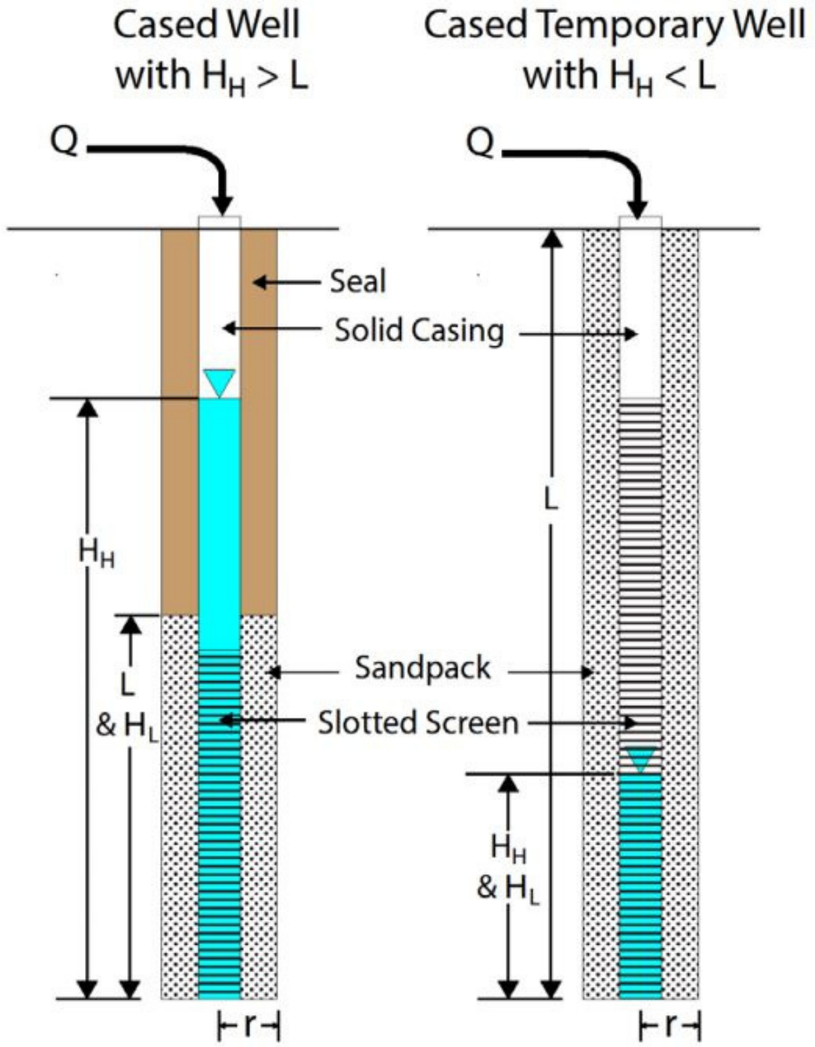
Question: What surfaces are considered pervious or impervious for threshhold calculations?

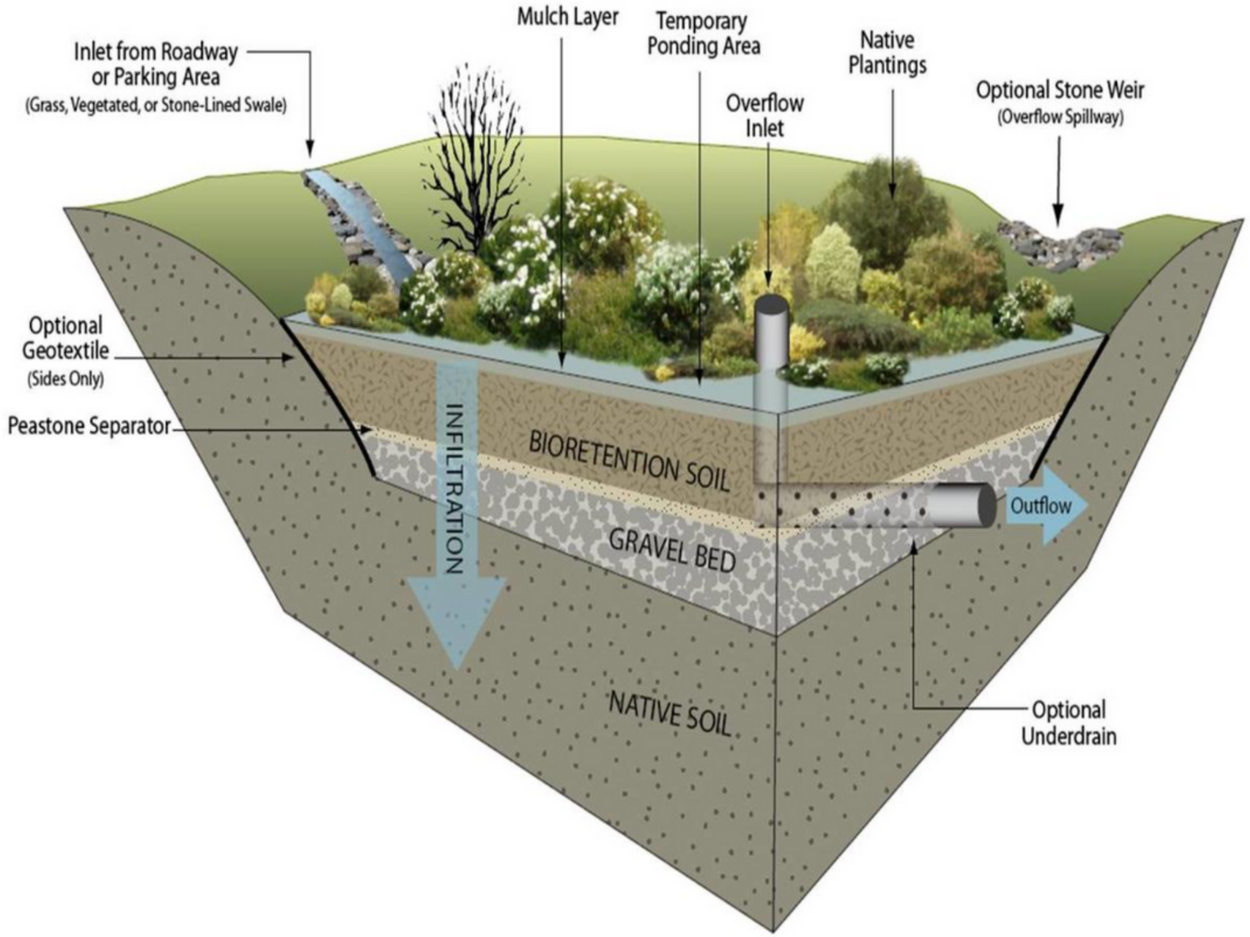
Pervious Pavements

Question: Please provide guidance on percolation testing

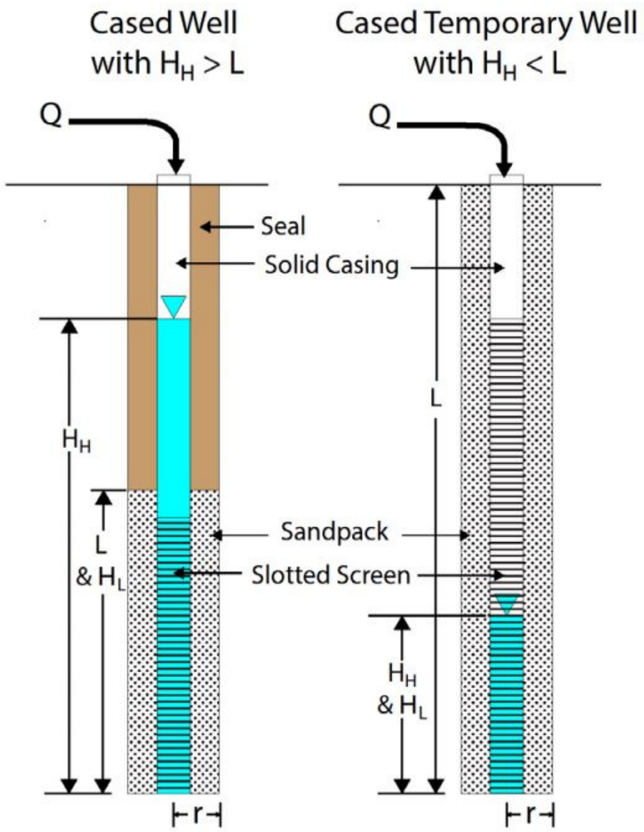
- **Surface SCMs vs. Subsurface SCMs**
- **Interpreting test results**
- **Factors of safety**
- **Multiple tested infiltration rates**
- **Resources when onsite testing not performed**

Infiltration Testing

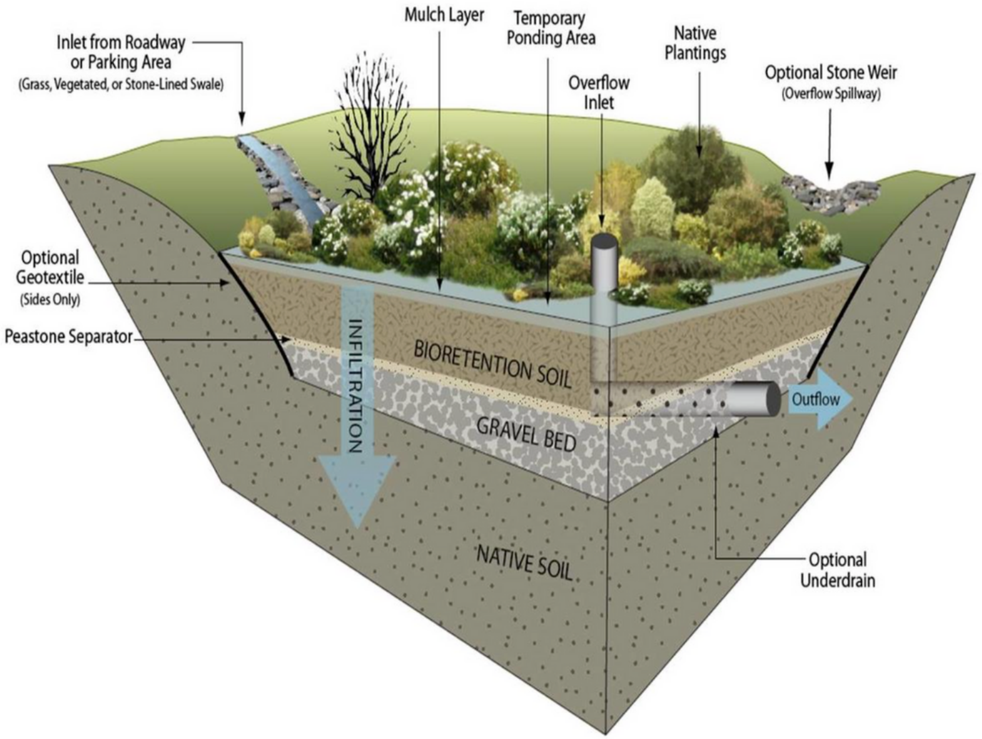




Infiltration Testing

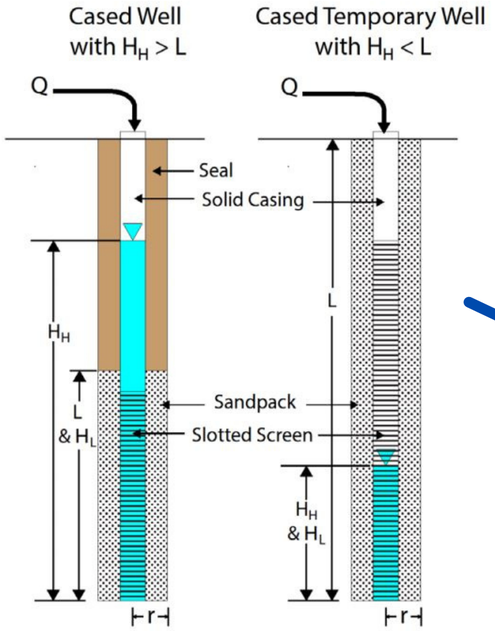


6" diameter
3' water depth
sidewall/base ratio = 24

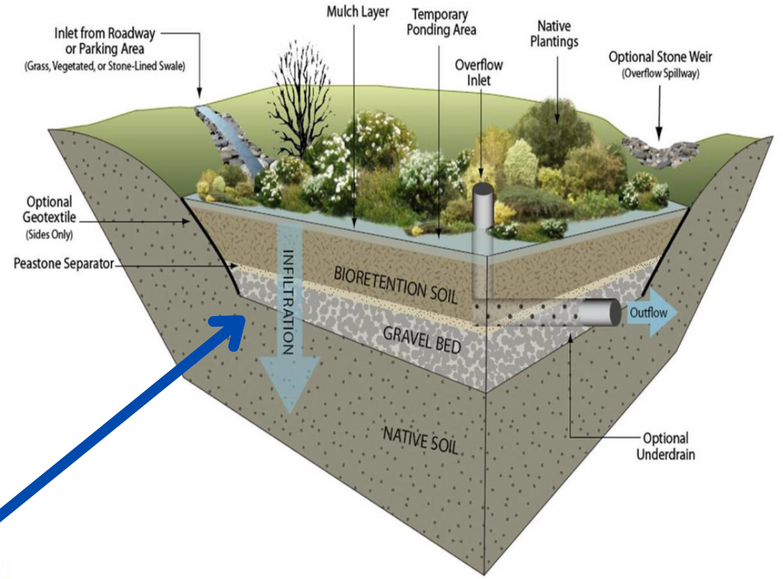


4' wide
6' long
2' gravel depth
sidewall/base ratio = 1.67

"Small-scale SCMs are generally those for which the sidewall of the SCM provides a significant component of infiltration relative to the bottom of the SCM."



$$I_t = \frac{\Delta H\ \pi r^2\ 60}{\Delta t(\pi r^2 + 2\pi r H_{avg})} = \frac{\Delta H\ 60\ r}{\Delta t(r + 2H_{avg})}$$

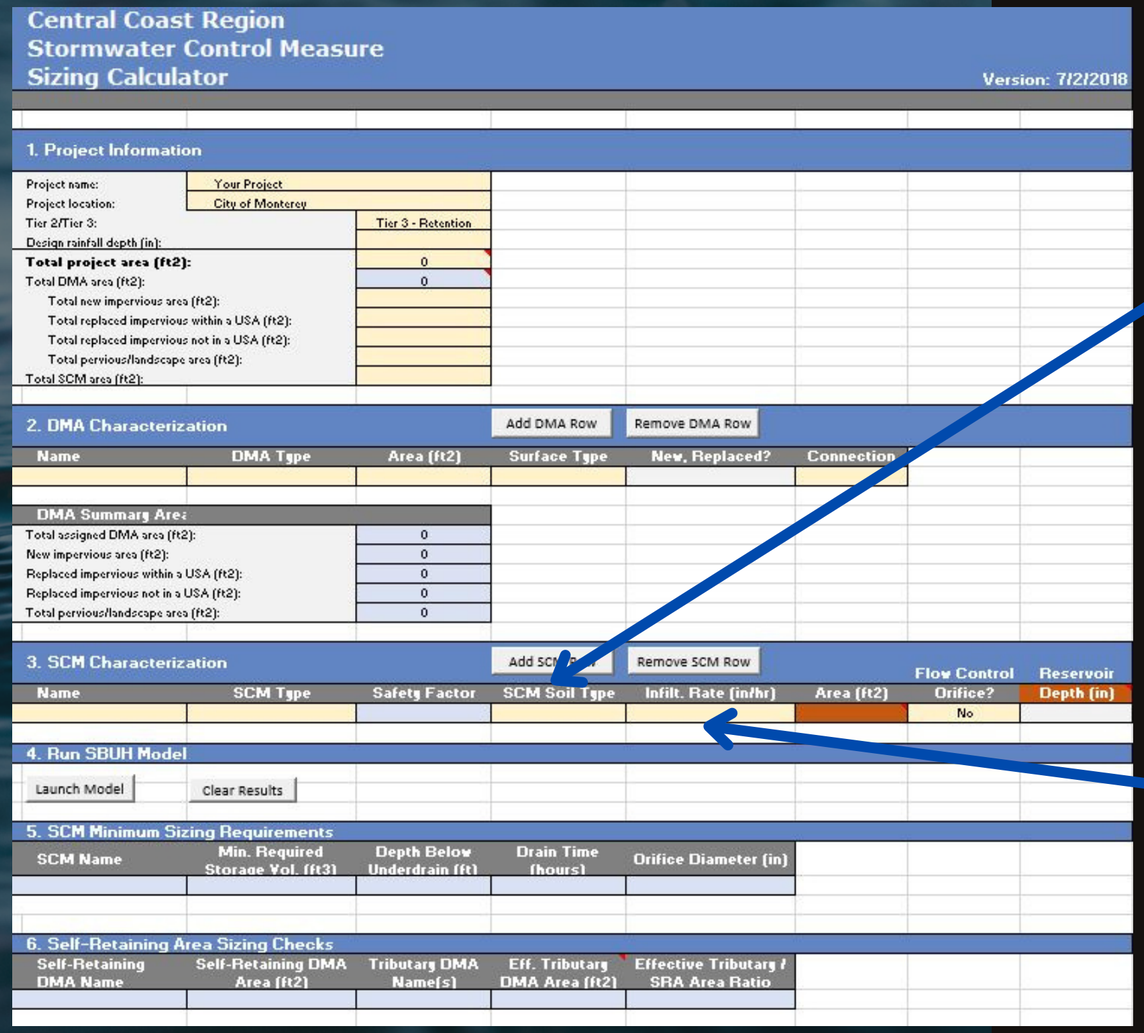


Where:

I_t = tested infiltration rate, inches/hour
ΔH = change in head over the time interval, inches
Δt = time interval, minutes
*r = effective radius of test hole
H_{avg} = average head over the time interval, inches

Solution? The Porchet Method

Infiltration Testing



Central Coast Region
Stormwater Control Measure
Sizing Calculator

Version: 7/2/2018

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Total SCM area (ft2):	

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

Name	DMA Type	Area (ft2)	Surface Type	New, Replaced?	Connection

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Replaced impervious not in a USA (ft2):	0
Total pervious/landscape area (ft2):	0

3. SCM Characterization — Add SCM Row — Remove SCM Row

Name	SCM Type	Safety Factor	SCM Soil Type	Infilt. Rate (in/hr)	Area (ft2)	Flow Control Orifice?	Reservoir Depth (in)
						No	

4. Run SBUH Model

Launch Model — Clear Results

5. SCM Minimum Sizing Requirements

SCM Name	Min. Required Storage Vol. (ft3)	Depth Below Underdrain (ft)	Drain Time (hours)	Orifice Diameter (in)

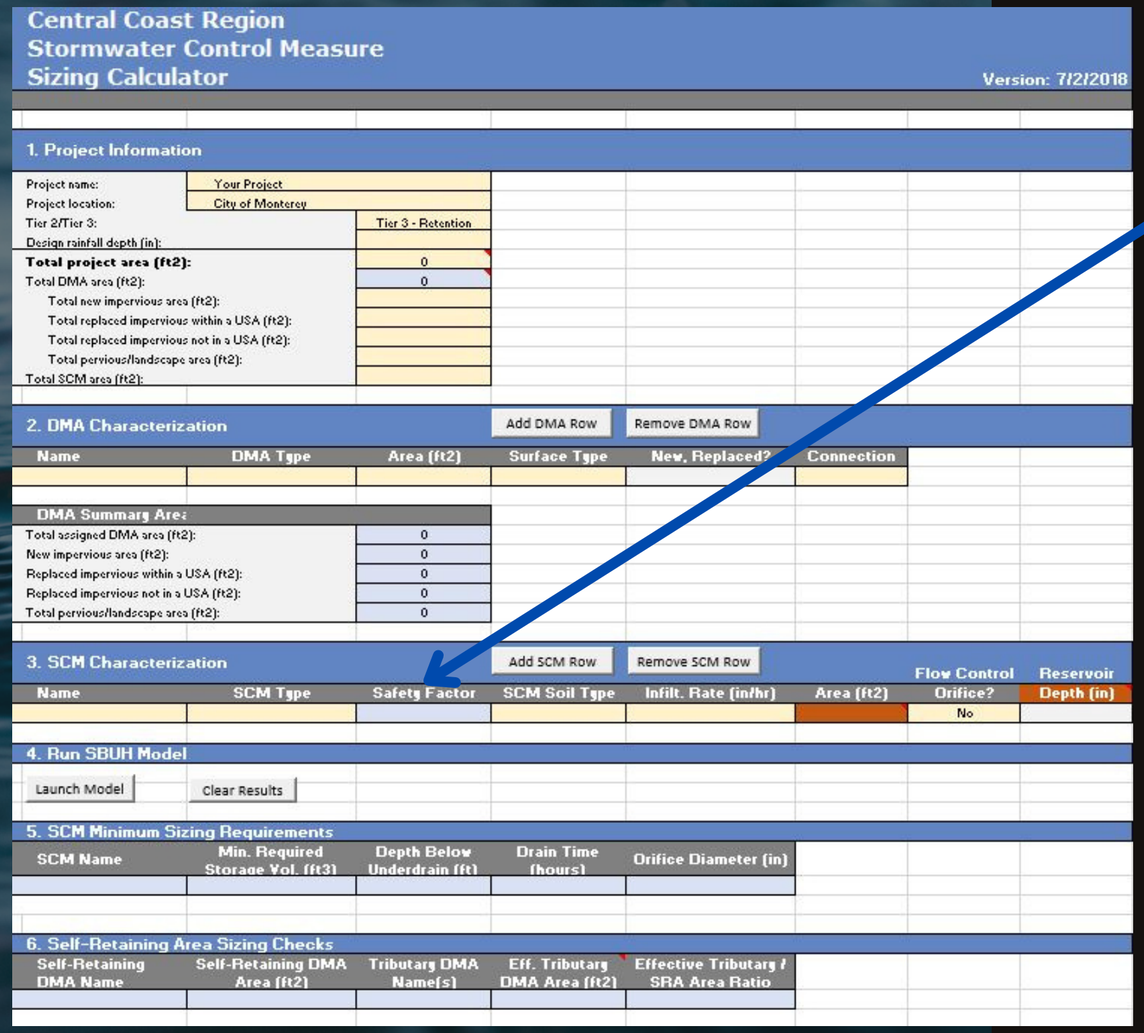
6. Self-Retaining Area Sizing Checks

Self-Retaining DMA Name	Self-Retaining DMA Area (ft2)	Tributary DMA Name(s)	Eff. Tributary DMA Area (ft2)	Effective Tributary / SRA Area Ratio

Hydrologic Soil Group (HSG)

HSG A/B = 0.75 inch/hr
HSG C/D = 0.25 inch/hr

Infiltration Testing



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SCM Name	Min. Required Storage Vol. (ft3)	Depth Below Underdrain (ft)	Drain Time (hours)	Orifice Diameter (in)

6. Self-Retaining Area Sizing Checks

Self-Retaining DMA Name	Self-Retaining DMA Area (ft2)	Tributary DMA Name(s)	Eff. Tributary DMA Area (ft2)	Effective Tributary / SRA Area Ratio

SF = 1.0 for Bioretention

SF = 2.0 for "Direct Infiltration"

Infiltration Testing

Question: If a site has high groundwater (less than 10 feet) and very poor infiltration rates, how does the engineer address PR3 (retention)?

PCRs C.1.
Technical Infeasibility

c) Technical infeasibility may be caused by site conditions, including:
   i) Depth to seasonal high groundwater limits infiltration and/or prevents construction of subgrade stormwater control measures[6]
   ii) Depth to an impervious layer such as bedrock limits infiltration
   iii) Sites where soil types significantly limit infiltration
   iv) Sites where pollutant mobilization in the soil or groundwater is a documented concern
   v) Space constraints (e.g., infill projects, some redevelopment projects, high density development)
   vi) Geotechnical hazards
   vii) Stormwater Control Measures located within 100 feet of a groundwater well used for drinking water
   viii) Incompatibility with surrounding drainage system (e.g., project drains to an existing stormwater collection system whose elevation or location precludes connection to a properly functioning treatment or flow control facility)

Technical Infeasibility

Question: If a site has high groundwater (less than 10 feet) and very poor infiltration rates, how does the engineer address PR3 (retention)?

Dedicate 10% of the site's "Equivalent Impervious Surface Area" (EISA) to retention based SCMs.

PCRs B.4.e. *Ten Percent Adjustment for Sites with Technical Infeasibility* and Attachment E *Ten Percent Adjusment to Retention Requirement*

TABLE 1: Correction Factors[15] for Use in Calculating Equivalent Impervious Surface Area

Pervious Surface	Correction Factor
Disturbed Soils/Managed Turf (dependent on original Hydrologic Soil Group)	A: 0.15 B: 0.20 C: 0.22 D: 0.25
Pervious Concrete	0.60
Cobbles	0.60
Pervious Asphalt	0.55
Natural Stone (without grout)	0.25
Turf Block	0.15
Brick (without grout)	0.13
Unit Pavers on Sand	0.10
Crushed Aggregate	0.10
Grass	0.10

Question: What happens when 10% EISA cannot be achieved?

PCRs C. *Alternative Compliance (Off-Site Compliance)*

- Offsite Compliance
- Watershed or Regional Plan
- Urban Sustainability Areas (USA)

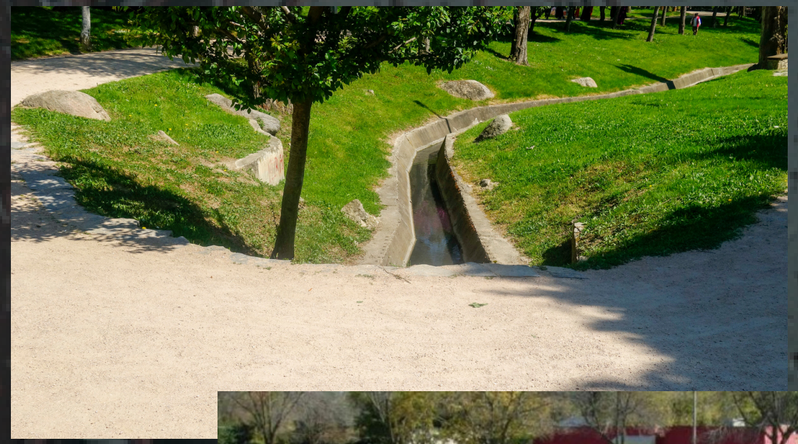
Technical Infeasibility

Question: What happens when 10% EISA (technical infeasibility) AND offsite compliance cannot be achieved?

PCRs C.4 *Other situations as approved by the Central Coast Water Board Executive Officer*

Technical Infeasibility

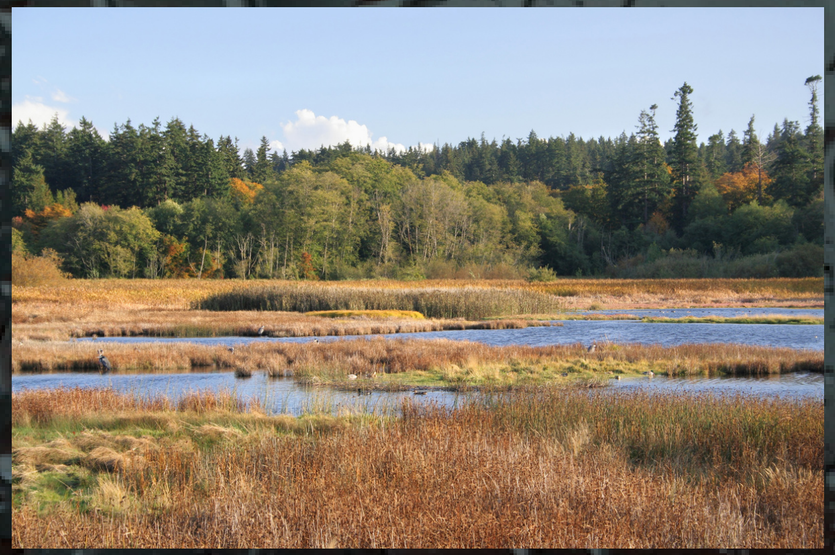
Question: Please discuss PR5



PCRs B.6.

Performance Requirement No. 5: Special Circumstances

- Highly Altered Channel
- Intermediate Flow Control
- Historic Lake and Wetland



"Special Circumstances"

Question: If underground chambers are used for PR3, can they also be used for PR2?
Is pretreatment required for PR2?

Technical Guide Appendix C:
Technical Criteria for Non-LID Treatment Facilities

5. Facilites with subsurface storage require permanent structural pre-treatment of stormwater, except in the instance of a one (1) single family dwelling (SFD) project.

Underground Retention

MRSWMP - Technical Guide & Attachments, Infiltration Resources
https://montereysea.org/post-construction-requirements/

Santa Barbara County - O&M Plans and Agreements, PCR Workshops
https://countyofsb.org/pwd/sbpcw/development/new-and-redevelopment.sbc

Central Coast Low Impact Development Initiative - Design and Construction Guidance
https://www.centralcoastlidi.org/resources.php

Central Coast Low Impact Development Initiative - Training Video Library
https://www.centralcoastlidi.org/online-training.php

Caltrans Pervious Pavement Design Guidance
https://www.uni-groupusa.org/PDF/Caltrans%20DG-Pervious-Pvm_102913.pdf

Caltrans Bioswale Design Guidance
https://dot.ca.gov/-/media/dot-media/programs/design/documents/dg-biofiltration-swale-092712-a11y.pdf

Central Coast RWQCB - PCRs, WMZ mapping, rainfall depths
https://www.waterboards.ca.gov/centralcoast/water_issues/programs/stormwater/docs/lid/lid_hydromod_charette_index.html

Resources

Thank you!

QUESTIONS?

WALLACE GROUP®

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805.544.4011

MONTEREY SEA
Stormwater Education Alliance
WWW.MONTEREYSEA.ORG