Bioretention Measure Operation and Maintenance

C.3 Workshop
June 22, 2022

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San Mateo Countywide
Water Pollution Prevention Program

Presentation Outline

- Useful Bioretention O&M Resources
- Introduction to Bioretention Measures
- 10 Commonly Found Plants in Bioretention Measures
- Operation and Maintenance Defined
- Bioretention Operational Issues
- Bioretention Maintenance Issues
- Mulch and O&M Issues
- IPM and Avoiding Pesticides in Bioretention Areas
- Example Maintenance Project

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Useful Bioretention O&M Resources

SMCWPPP Green Infrastructure Design Guide (2020)

- https://www.flowstobay.org/data-resources/resources/green-infrastructure-design-guide/

San Jose GSI Maintenance Field Guide (2019)

- www.sanjoseca.gov/home/showdocument?id=40709

San Francisco GI Maintenance Guide Book (2018)

- https://sfpuc.sharefile.com/share/view/sb83923c24cb4298a

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Overview of Bioretention Measures

- **Examples**
- **Cross-section detail**
- **Three types:**
  - Flow through planter
  - Basic bioretention area or Rain garden
  - Tree well filter

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Bioretention Area Examples

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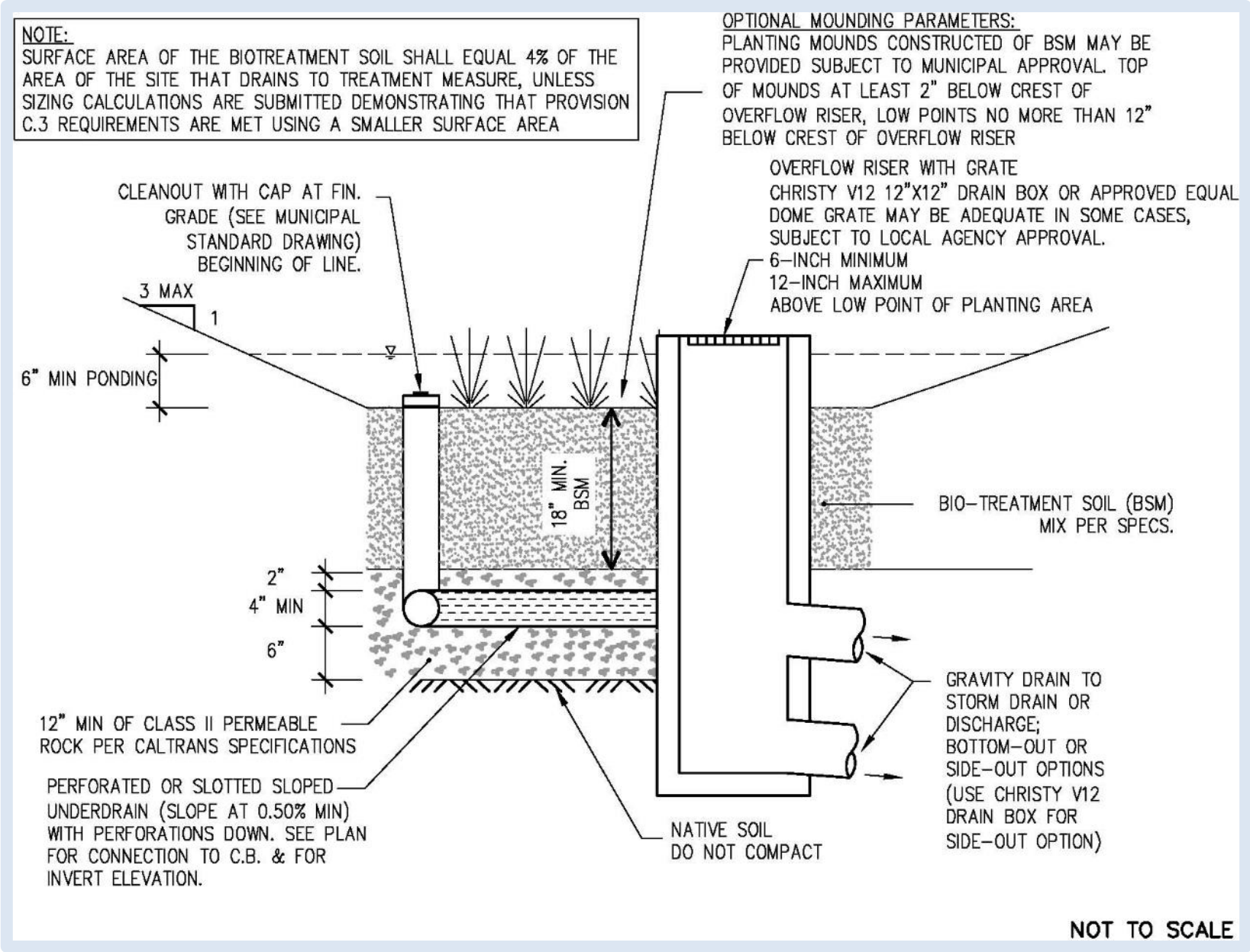
Typical Bioretention Area Cross-section Detail



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Regenerative Landscaping in Bioretention Measures

ReScape California

ReScape California's holistic and regenerative landscaping principles include:

- Using climate-appropriate vegetation and minimizing planting of intensive-resource landscapes such as turfgrass
- Using compost and mulch enhances fertility, soil structure, and improves nutrient and water retention; they inoculate the soil with beneficial organisms, and provide other benefits
- More information at: www.rescapeca.org

Regenerative Bioretention Measure Maintenance

- **Know your plants**
  - Identify the plant or at least know how its maintained
  - Right plant in the right place reduces pruning and waste
  - Know your weeds and what they are telling you
- **Avoid pesticides and synthetic fertilizers**
  - Can kill beneficial insects and soil life
  - Can impact water quality discharges
- **Use compost and wood mulch**
  - Improve soils, reduce water consumption and weeds
  - Inoculate soil and improve plant health

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New Approach to Plant Identification

- **Focus on the most common plants**
- **Three maintenance groups: Rushes, Grasses and Flowers**
  - Rushes stems are round (solid or hollow)
  - Rushes do not respond well to pruning – the whole plant can die
  - Grasses leaves are flat (edges) and have evolved with grazing and regrowth
  - Grasses can have shorter life spans and some can turn brown in summer without irrigation
  - Flowers are broadleaved and have bigger colorful flowers
  - Flowers may need to have blooms removed (aka, deadheaded) after they wilt

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Plant Identification

Rushes

Grasses

Flowers

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Common GI Plants and Care - Rushes

Juncus patens

CA Gray Rush

California Native

Evergreen perennial

Height & Width: 2’ and spreading

Care: Remove dead stems only by way of dethatching by hand with rubber gloves. If live growth needs pruning, remove only tips (top 4-6 inches) in Spring (will be slow to recover). If plant is too big, lift plant, divide root ball, and plant (may be slow to recover).

Pinterest

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If possible – don’t prune at all!

Common GI Plants and Care - Rushes

Chondropetalum tectorum

Cape Reed/Rush

Non-native from South Africa

Evergreen perennial

Height & Width: 3’ to 4’ H. & spread

Care: Remove dead stems only. If live growth needs pruning, remove only tips (top 4-6 inches) in Spring (will be slow to recover). If plant is too big, lift plant, divide root ball, and plant (may be slow to recover).

If possible – don’t prune at all!

Village Nurseries

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Common GI Plants and Care - Grasses

Carex tumulicola or Carex divulsa

Berkeley Sedge*

(tumulicola is a California native, divulsa is from Europe)

Perennial, evergreen grass

Height & Width: 2’ x 3’

Care: Dethatch with rubber gloves; divide larger plants in fall; will be greener with more water – can turn brown in summer without irrigation.

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*Nurseries may misidentify these two plants: they may call them both Berkeley Sedge or may refer to them as Foothill Sedge (tumulicola) or European Gray Sedge (divulsa)

Common GI Plants and Care - Grasses

Muhlenbergia rigens

Deer grass

California Native

Perennial, evergreen grass

Height & Width: 5’ x 4’

Care: Deadhead spent flowers; dethatch with rubber gloves; divide larger plants in fall; greener with more water.

WUCOLS

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Common GI Plants and Care - Grasses

Muhlenbergia capillaris

Hairy Awn Muhly

Some Muhlys are CA Natives

Perennial, evergreen grass

Height & Width: 4’ x 3’

Care: Deadhead spent flowers; dethatch with rubber gloves; divide larger plants in fall; greener with more water. White flowered variety is native.

Shown: Pink Muhly – not native to CA

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Common GI Plants and Care - Grasses

Festuca idahoensis* or *F. glauca
Blue Fescue

From Europe

Perennial, evergreen grass

Height & Width: 2’ x 2’

Care: Deadhead spent flowers; dethatch with rubber gloves; divide larger plants in fall; greener with more water

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*These plants look very similar in the field and nurseries may misidentify them. Typically, Blue Fescue is F. glauca and Idaho Fescue is F. idahoensis. Only the Idaho Fescue is native.

Common GI Plants and Care - Grasses

***Lomandra hystrix* 'Katie Belles'**

Lomandra/Creek Mat Rush

From Australia

Evergreen perennial

Height & Width: 4' to 6' and spreading (other cultivars are smaller)

Care: Remove old/dead leaves. If plant is too big, lift plant, divide root ball, and plant (recovers well from pruning)

PlantRight

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Common GI Plants and Care - Flowers

Achillea millefolium

Yarrow

Some are California natives

Evergreen perennial

Height & Width: 3’ x 2’ when in bloom & spreading

Care: Deadhead spent flowers, divide clumps as necessary. White flower variety (Common Yarrow) is CA native.

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Common GI Plants and Care - Flowers

Penstemon heterophyllus

Foothill Penstemon

California native

Perennial herbaceous flower

Height & Width: 3’ x 2’

Care: Deadhead spent flowers; remove dead growth

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Common GI Plants and Care - Flowers

Epilobium canum

California Fuchsia

California native

Perennial herbaceous flower
Height & Width: 3’ x 2’

Care: Deadhead spent flowers; remove dead growth

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Typical O&M Issues

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Remove Debris Blocking Inlets and Flow

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Blocked Inlets continued…

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Remove Trash/Leaves

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Repair Eroded Areas – Add Splash Block

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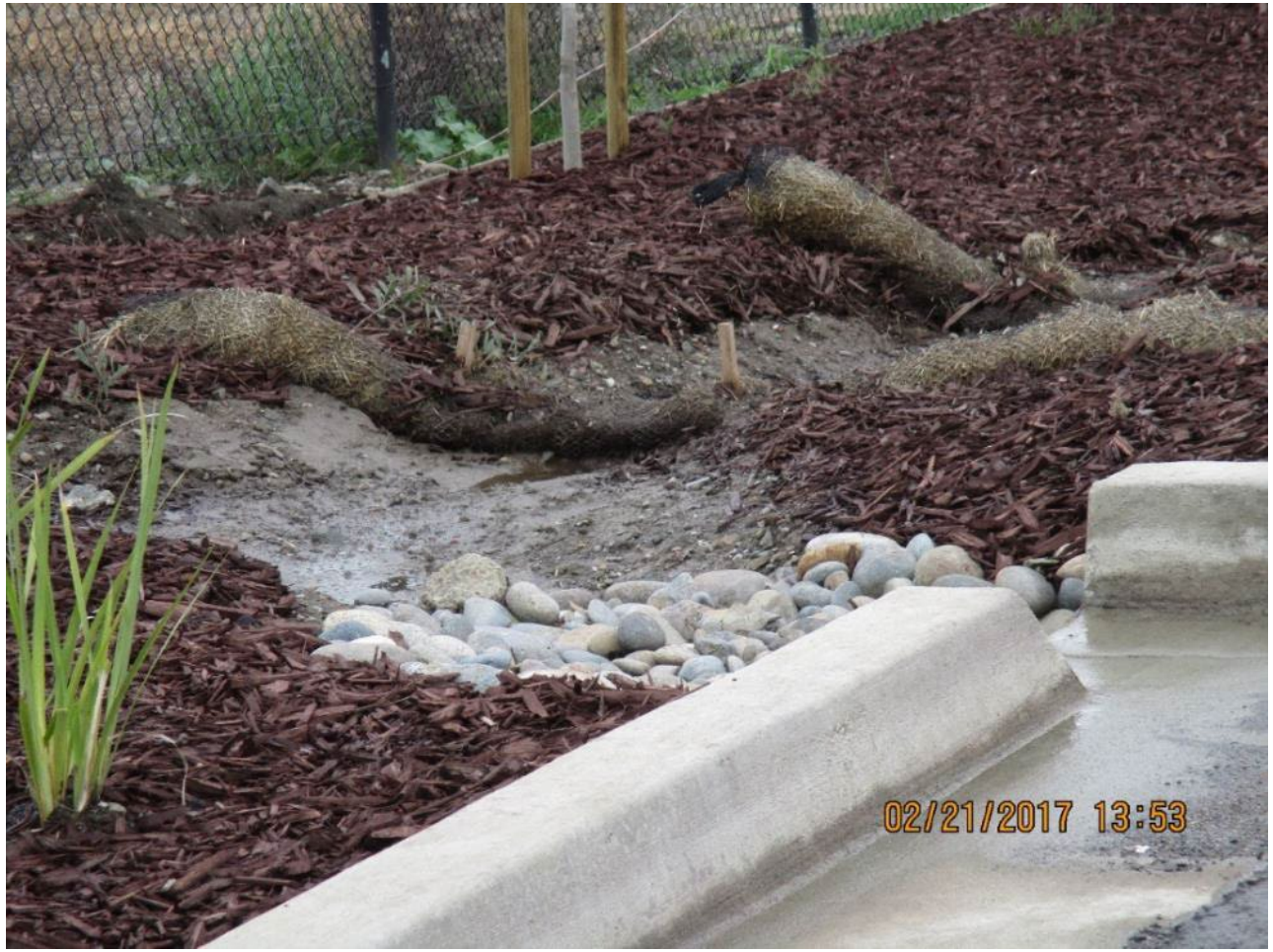
Repair Eroded Areas & Add Biotreatment Wood Mulch



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Add BWM – Clear Blocked Outlet/Overflow- Add Plants

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If More Biotreatment Soil Media (BSM) is Needed:

- BSM = 60-70% sand + 30-40% compost
- BASMAA BSM Spec. (adopted and revised 2016)
- BSM Supplier List on Flowstobay website:

https://www.flowstobay.org/preventing-stormwater-pollution/with-new-redevelopment/c-3-regulated-projects/

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Plant Maintenance Tips/Questions

- Know your plant - learn the top 10!
- Are more plants needed? 70% minimum coverage
- Is it a “weed” or a desired plant?
- What time of year is best to prune?
- Does it really need to be pruned?
- Are plants too close together?
- Should it be divided and replanted?
- How long does it live?
- Is it dormant or dead?

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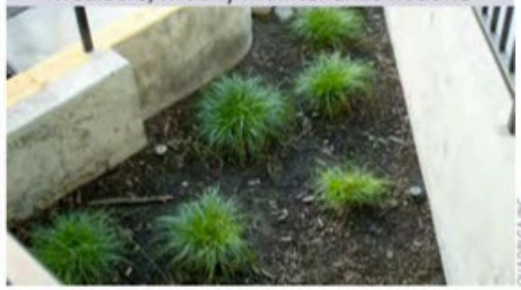
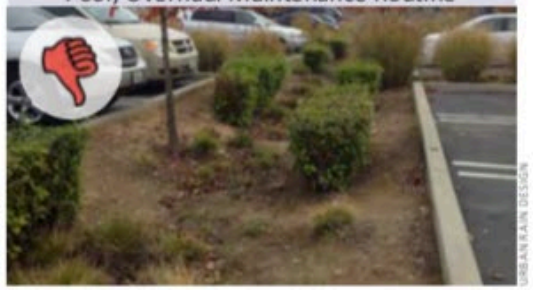
GIDG

CHAPTER 6

6.4 Operations and Maintenance

Maintenance Quality Observation Levels

MULCH APPLICATION

Good, Continue Maintenance Routine	Mediocre, Modify Maintenance Routine	Poor, Overhaul Maintenance Routine
		
Condition: A 3-inch layer of mulch is maintained and kept at proper distances from shrub and tree plantings.	*Condition:* The mulch layer is depleted. Mulch has been knocked or washed out of the landscape	*Condition:* Mulch layer is absent.
Continued Actions: Twice yearly observation for adequate mulch coverage.	*Immediate Actions:* Add or redistribute bark mulch where it has been reduced to less than 3 inches deep. Place mulch that has been knocked or washed out of planters back into place.	*Immediate Actions:* Add a 3-inch layer of mulch. If mulch was once present, determine if a new type of mulch is needed to ensure longevity.

HAND WEEDING

Good, Continue Maintenance Routine	Mediocre, Modify Maintenance Routine	Poor, Overhaul Maintenance Routine
		
Condition: Little to no weeds visible within the planting area, sidewalks, gutters and pavement.	*Condition:* Several weeds can be found throughout the site.	*Condition:* Landscape is overrun with weeds.
Continued Action: Quarterly hand weeding, or as necessary.	*Immediate Actions:* Remove all visible weeds located in planted areas, sidewalks, gutters and pavement. Remove as much of the root system as possible. Dispose of weeds off-site.	*Immediate Actions:* Remove all visible weeds by hand, if possible. Herbicides should be used only as a last resort. Use only the least toxic herbicides. Develop a plan with the Owner before use.

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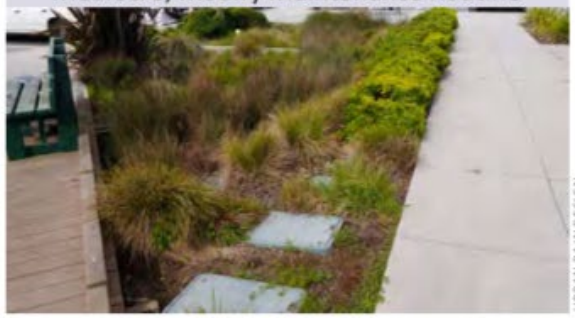
PLANT COVERAGE

Good, Continue Maintenace Routine

Condition: Landscape achieves 100% plant coverage.

Continued Action: Monthly observation for proper coverage. Twice yearly plant addition in April and October, as necessary.

Mediocre, Modify Maintenance Routine



Condition: Landscape has about 70% plant coverage, achieving the minimum requirement for functionality.

Immediate Actions: If, by visual assessment, the planter is determined to have inadequate plant coverage, schedule the installation of additional plants. Refer to as-built drawings for plant species and size.

Poor, Overhaul Maintenance Routine

Condition: Landscape has less than 70% plant coverage.

Immediate Actions: Schedule the installation of additional plants. Refer to as-built drawings for plant species and size. Replace ill-adapted plants with a species better adapted to permanently altered environmental conditions.

PLANT HEALTH

Good, Continue Maintenance Routine

Condition: All plants are healthy, disease-free and suited to the environmental conditions.

Continued Action: Monthly site inspection for any plants that are dead, damaged, diseased, stressed or missing.

Mediocre, Modify Maintenance Routine

Condition: Few plants show signs of struggle, disease, pest-infestation or are broken.

Immediate Action: Analyze struggling plants for cause of struggle and correct. Remove struggling plants unlikely to recover or plants likely to infect surrounding plants. Replace with a healthy plant.

Poor, Overhaul Maintenance Routine

Condition: Plants are unhealthy, damaged, missing or dead.

Immediate Action: Analyze struggling plants for cause of struggle and correct, if possible. Remove struggling plants unlikely to recover or plants likely to infect surrounding plants. Replace with a healthy plant.

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Tree Well Filter Maintenance

- Choose tree species appropriate for the space available and site.
- Regular/seasonal pruning should be scheduled.
- Disease/damaged trees, and those with poor structure, should be removed and replaced.
- Check irrigation system/needs during dry season.
- Remove stakes after two years.

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Maintenance: 1 x Monthly

- Low traffic area
- Low pedestrian activity
- Single species
- Blends with natural area
- Plants & spray irrigation set back from concrete
- Easy cleanup & plant care
- Irrigation checked monthly
- After 6 years, plants dug up, divided, & replanted: 60% survival of replant

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Maintenance: 2 x Monthly

- **Low traffic (cul-de-sac)**
- **Low pedestrian volumes**
- **High long-term parking**
- **Five plant species**
- **Plants quickly crowded each other, causing greater maintenance**
- **Drip irrigation set on surface (under mulch)**
- **Challenging location**
  - Adjacent properties are poorly maintained
  - Abandoned vehicles
  - Homelessness
- **Maintenance should be weekly**

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A bit about plant spacing…

Crowding = Frequent pruning

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Maintenance Examples from the Field

- Design with a simple palette limited to no more than 3 plant species per treatment area
- Align plants in rows for ease of maintenance
- Select plants with limited need for trimming or pruning

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A simple plant palette (3 or less species)

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Dormant plants in Summer

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Greened up in Winter

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Plant Pruning Example

A newly installed bioretention measure with two types of rushes

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Improper Pruning of Rushes

One year later, improper and unnecessary pruning of rushes leads to poor plant health issues

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Results of Improper Rush Pruning

Two years later, repeated pruning has led to almost complete plant failure

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Standing Water in Landscape

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Standing Water on Impervious Surfaces

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Vector Control District Coordination

- If you see standing water in bioretention areas, you may want to contact the San Mateo County Mosquito & Vector Control District for mosquito control: www.smcmvcd.org
- The District has a list of installed stormwater treatment systems for each jurisdiction

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Mulch and O&M

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Mulch Topics

- **Purpose of mulch**
  - Reduces weed growth
  - Conserves water by minimizing soil dehydration
  - Keeps soil cool
  - Reduces soil erosion
- **Depth of mulch**
  - 3 inches is required in California for water-efficient landscaping and conservation
- **Mulch considerations**
  - Depends on site and design
  - Wood mulch
    - Improves soil
    - Holds moisture
    - Needs periodic replacement
- **Rock mulch**
  - Prevents erosion
  - Can heat up soil
  - Doesn’t improve soil
  - Can make weeding difficult
  - Potential vandalism (cobble)

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Mulch Types

- **Wood Mulch (recommended):**
  - Uncomposted Wood Mulch
  - Composted Wood Mulch
- **Rock Mulch (only when really needed):**
  - Gravel (small)
  - Medium-sized rock
  - Cobble (large)
- **Combination (option):**
  - Rock mulch can be used in the flow line with wood mulch on the sloped sides
  - Jute netting can also be used to temporarily hold the mulch in place until plants are established

The Bioretention Measure Design Affects the Mulch Choice

Off-line design with trench drains & wood mulch

In-line design with Splash Apron and Cobbles

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Composted Wood Mulch Benefits

The composting process provides benefits:

- Inoculates mulch and soil media with beneficial organisms
- Holds more water
- Floats less (heavier and less resinous)
- Less flammable
- Reduces pathogens that might be in the mulch like Sudden Oak Death (Phytopthora ramorum)

The Biotreatment Wood Mulch (BWM) Specification can be downloaded from the SMCWPPP website:

https://www.flowstobay.org/preventing-stormwater-pollution/with-new-redevelopment/c-3-regulated-projects/

Uncomposted Arbor Mulch

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Composted Arbor Mulch

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Gravel Rock Mulch (Small)

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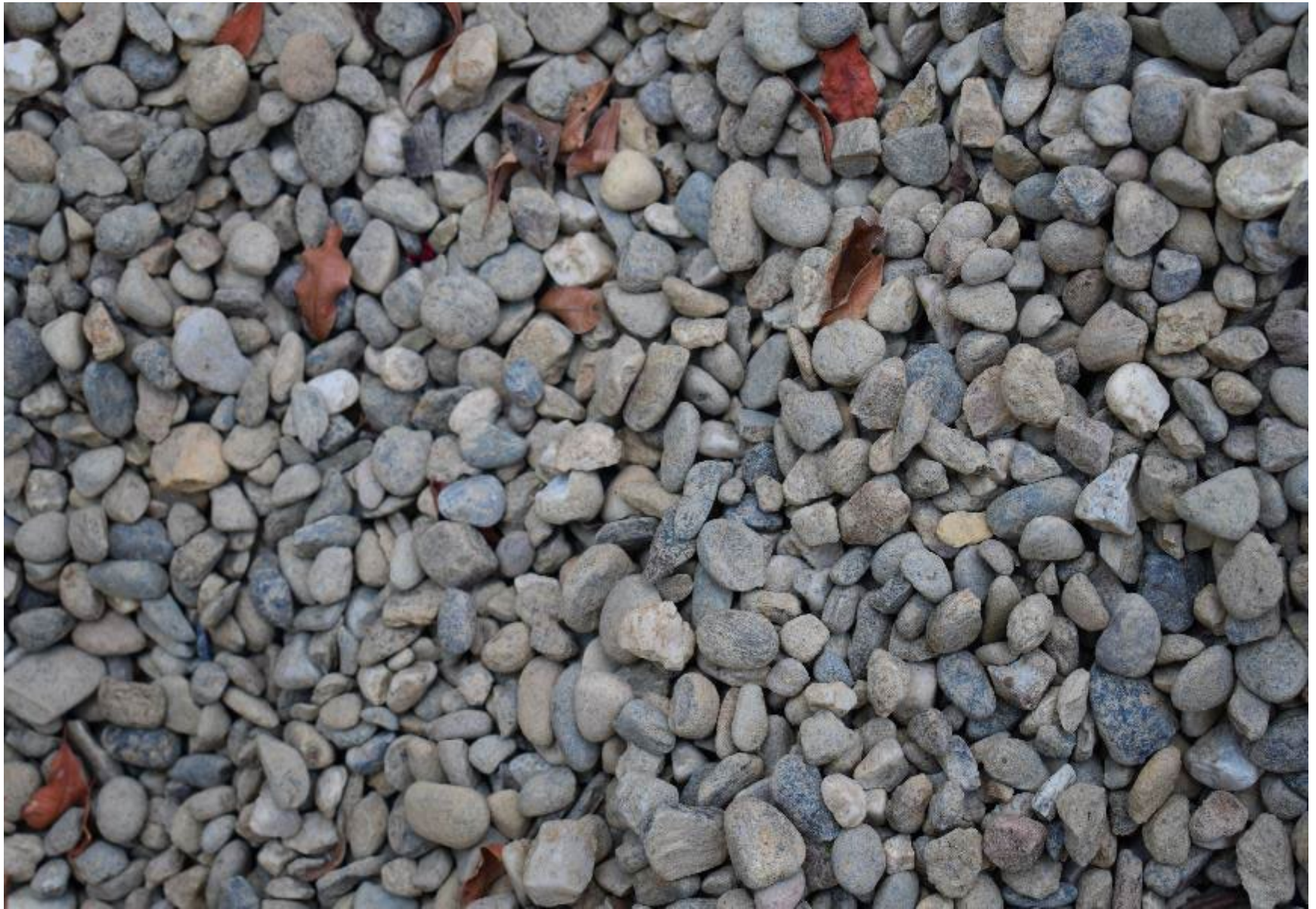
Rock Mulch (Medium)



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Rock Mulch (Medium and Large - Cobble)

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Combination Wood and Rock Mulch Design

Where space allows and when you have sloped sides, a combination of rock mulch in the flow line and wood mulch on the sides can be used

Protecting Plants

Protect system during plant establishment period

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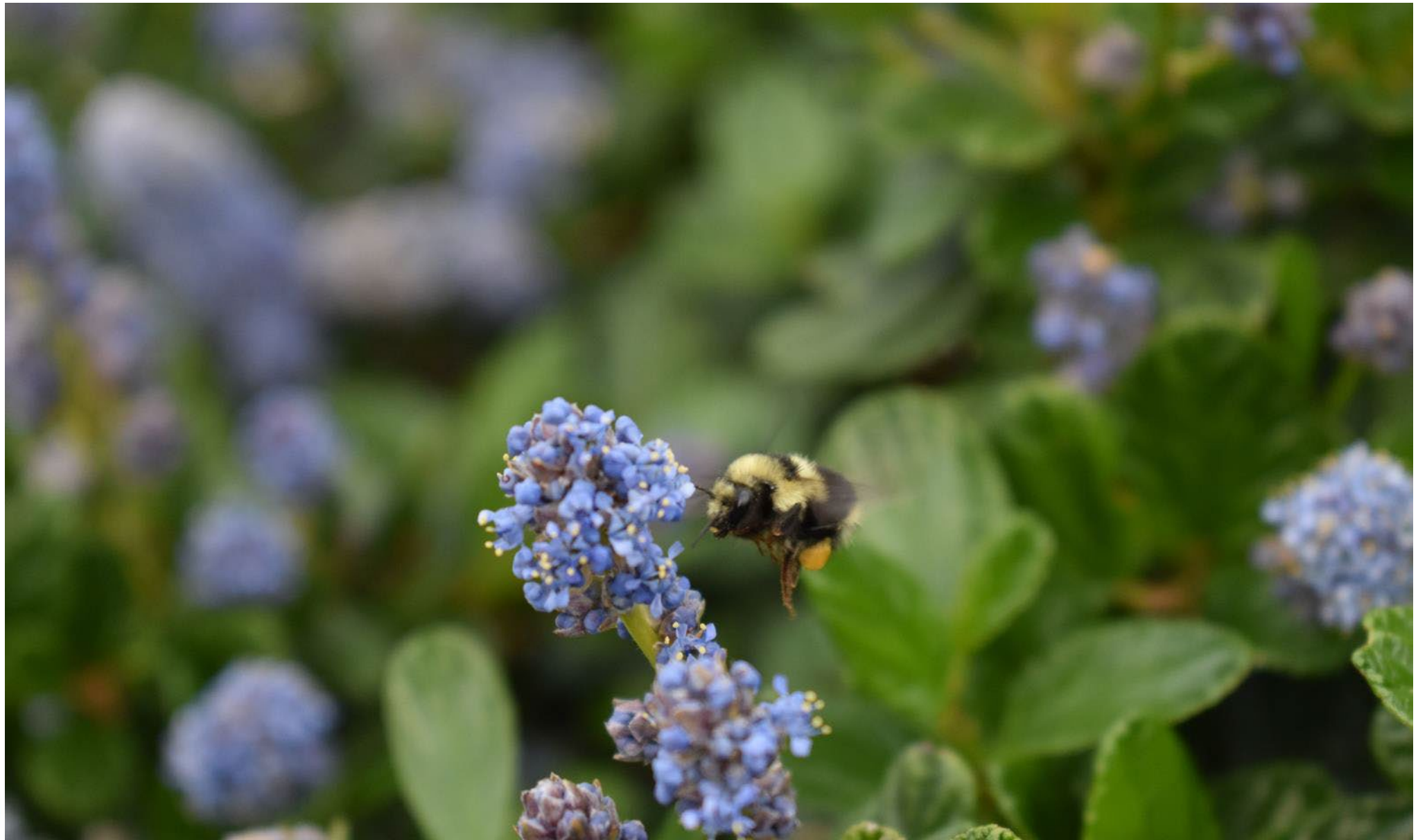
IPM & Avoiding Pesticides in Bioretention Areas



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IPM and Bioretention Maintenance

- **Understand how bioretention areas work**
  - Pesticides can exit system through underdrains
  - Pesticides can contribute to water quality issues
  - Pesticides can further dry out already dry soils
- **Know your plants - learn the top 10!**
  - Right plant, right place
  - Know your weeds
- **Pesticides kill beneficial insects and soil life**
- **Use compost and wood mulch to improve soils, reduce weeds, inoculate soil & fight soil disease**

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Example of Bioretention Area Maintenance Tasks

County of San Mateo
Maple Street Correctional Center

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At a ReScape O&M training, the attendees renovated a bioretention area in the parking lot to remove weeds, check and fix the irrigation system, prune plants, replace dead plants, and replenish compost and mulch

Compost

Composted
Wood Mulch

Contamination in mulch and compost can be an issue.

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Finished project

Contact Information

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Mimulus aurantiacus – Sticky Monkey Flower