This Technical Assistance Memo (TAM) provides plant selection guidance for the most common bioretention features, such as bioretention swales, stormwater planters and rain gardens. Bioretention systems are low impact development (LID) features that use landscaped areas to slow, treat, retain and infiltrate stormwater runoff, mimicking the natural, pre-development hydrology of a site.

The intent of this TAM is to offer designers, municipalities, developers and homeowners with guidelines for selecting plants for bioretention areas, including a list of appropriate species for the Central Coast. Bioretention systems look like regular landscaped areas, but are designed (engineered) to manage stormwater runoff created by urbanization. Specifying the appropriate plants and soil mix for a bioretention system is critical to its function.

This step-by-step guidance is specific to LID landscapes and will take you from plant selection and layout to installation and on-going maintenance. This guidance is intended to accompany standard landscape methods and point out areas where LID methods may differ.

### Step 1: LID Type and Plant Selection

**Surface grade** and **ponding area** of a bioretention structure are the first factors to consider when choosing which plants to specify. Is the soil surface of the structure sloped or uniform? Stormwater planters and some rain gardens have uniform surface grades. In these designs, ponding will be equal across the structure and all plants will have the same conditions (Zone A). In bioretention swales and some rain gardens, soil surface is sloped, resulting in differing planting conditions across the structure (Zones A and B). Plants located at the bottom where ponding occurs, will have different requirements than those placed on the sideslopes, which receive runoff, but not ponding. A third planting area may occur outside of Zones A and B, on the upper edges of rain gardens and bioswales. This area is not a functional component of the bioretention area, and therefore can be treated as a traditional landscape area.

**Uniform surface grade**: This stormwater planter has a flat bottom with consistent depth of ponding across the structure. All of the plants selected for this design must be tolerant of periodic inundation (Zone A).

**Varying slope and ponding levels**: Varying slope and ponding levels: This bioretention planting area has sloped edges. Plants in the bottom area will be inundated during storms (Zone A). Those planted on the sideslopes are above the level of ponding, but will experience seasonally wet conditions (Zone B).
Once the plant zones are identified (Zone A only or both Zone A and Zone B) for a structure, the plants may be selected. This TAM includes a plant list for bioretention areas (Table 1). There exist other LID plant lists for California and the Central Coast, but this “short list” was refined based on the following criteria: 1) Tolerant of varied moisture conditions (wet and dry), 2) tolerant of varied soil types and growing conditions, 3) available in Central Coast plant nurseries, 4) low maintenance requirements, 5) are not invasive weeds, 6) do not have aggressive/invasive root systems, and 6) exhibit an attractive appearance. When selecting plants from a list, additional site-specific information, such as tolerance to high and low temperatures, coastal conditions and prevailing winds should be considered. In addition, project specific aspects of the design, for example right-of-way vegetation height limits, approved street and parking lot tree lists and fire hazard landscape requirements may further influence selection. Although this plant list includes some non natives, using native plants is highly recommended because of the wide range of benefits they offer (food and forage for native wildlife, adaptation to local climate, low/no water use once established). Knowledge of invasive species is constantly evolving. To avoid specifying noxious plants on a project, check the California inventory at www.cal-ipc.org. Local agencies may also track potential invasives for your area.

Step 2: Plant Species Selection

Leymus condensatus ‘Canyon Prince’: This selection grows to 3’ and is tolerant of a wide range of conditions, including drought, seasonal wet conditions, poor soils and some shade.

Achillea millefolium: A native perennial that attracts pollinators and is tolerant of poor soils, seasonal flooding and deer. Available in many flower colors.

Muhlenbergia rigens: A native grass with dense bright, grey-green, evergreen foliage. It tolerates a range of soils, sun to part-shade, seasonal flooding and drought.

Juncus patens: An easy to grow native rush. It tolerates poor drainage, flooding, drought and shade. A strong performer in bioretention areas, more drought tolerant than J. effusus.

Specifying the correct soils for bioretention areas is critical in order to achieve stormwater objectives and plant health. Soils must balance three primary design objectives: 1) High enough infiltration rates to meet surface water draw down requirements, 2) infiltration rates that are not so high that they preclude pollutant removal function of soils and 3) soil composition that supports plant establishment and long-term health.

Landscape design documents for LID projects must include a bioretention soil specification that specifies the exact materials to be used in the mix (aggregates and compost), the percent of each material included in the mix, how they are to be placed (i.e. in 8” to 12” lifts) and the soil mix depth. Sample bioretention soil specifications and detailed information on BMP design and construction may be found in the LID documents listed under Additional Resources in this TAM.

Step 3: Soil Specification for Biofiltration

Specifying the correct soils for biofiltration is critical in order to achieve stormwater objectives and plant health. Soils must balance three primary design objectives: 1) High enough infiltration rates to meet surface water draw down requirements, 2) infiltration rates that are not so high that they preclude pollutant removal function of soils and 3) soil composition that supports plant establishment and long-term health.

Landscape design documents for LID projects must include a bioretention soil specification that specifies the exact materials to be used in the mix (aggregates and compost), the percent of each material included in the mix, how they are to be placed (i.e. in 8” to 12” lifts) and the soil mix depth. Sample bioretention soil specifications and detailed information on BMP design and construction may be found in the LID documents listed under Additional Resources in this TAM.

Organic Compost: A main ingredient of biofiltration soil mixes, compost is the product of natural decomposition of organic wastes by bacteria, fungi, worms and other beneficial organisms. Compost increases the soil’s water holding capacity and improves soil structure, nutrient levels and biology, all of which support plant health.

Bioretention Soil Mix: Construction documents for any LID project should include specifications for the bioretention soil mix that define the ratio of materials in the mix, the content, gradation, quality analysis and other requirements for each of the materials. Specifications will also provide guidelines for blending and placement of the soil mix.
### Step 4: Plant Establishment and Care

Irrigation is an important aspect of any landscape establishment. Typically, new plantings need two to three years of irrigation to become established. After that period, native plants will need little if any supplemental irrigation to survive. Plants may enter a dry season dormancy, which affects their appearance. Where this “dry look” is not desired, summer irrigation may be utilized. Systems should include a weather-based controller to avoid watering during wet weather. Because bioretention soils are formulated to infiltrate, irrigation application rates must be properly designed to avoid overwatering and prevent potential discharges via underdrains.

Compost Mulch (1" - 2") should be applied to bioretention areas to retain moisture, prevent erosion, and suppress weed growth. Reapply annually as the mulch breaks down. Use a specified compost mulch and avoid bark mulches that can float during storm events.

Fertilizer should not be used in bioretention areas. Instead, a compost top dressing or application of compost tea can be used to introduce nutrients and beneficial microorganisms to the soil. Apply compost mulch once per year in spring or fall or spray apply compost tea once per year between March and June.

Synthetic herbicides and pesticides should not be used in bioretention areas because of their potential toxicity risk to aquatic organisms. There are a variety of natural methods and products that can be used to control weeds and pests. See the technical manuals included under Additional Resources.

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### Table 1. Plants for Bioretention Areas

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Zone(s)</th>
<th>Height/ Width</th>
<th>Light</th>
<th>Notes:</th>
<th>Climate Zones</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Trees</strong></td>
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</tr>
<tr>
<td>Western Redbud</td>
<td>Cercis occidentalis</td>
<td>B</td>
<td>20'-20'</td>
<td>sun</td>
<td>small tree or large shrub, tolerates clay, winter wet, drought. Flowers stronger with frost</td>
<td>all but coastal</td>
</tr>
<tr>
<td>Desert Willow</td>
<td>Chilopsis linearis</td>
<td>B</td>
<td>25'-30'</td>
<td>sun</td>
<td>tolerates alkaline soil, sand, clay, seasonal flooding and drought, not coastal condition</td>
<td>all, but 1A-3A</td>
</tr>
<tr>
<td>Western Sycamore</td>
<td>Platanus racemosa</td>
<td>B</td>
<td>40'-80'</td>
<td>sun</td>
<td>tolerates sand and clay soils, seasonal flooding, needs space to grow, avoid underground water/sewer pipes</td>
<td>all, but 1A-3A</td>
</tr>
<tr>
<td><strong>Coast Live Oak</strong></td>
<td>Quercus agrifolia</td>
<td>B</td>
<td>25'-40'</td>
<td>shade</td>
<td>tolerates drought and winter wet conditions, mature trees produce significant litter limiting understory plantings, need space to grow</td>
<td>all, but 1A-3A</td>
</tr>
<tr>
<td><strong>Large Shrubs</strong></td>
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<tr>
<td>Toyon, Christmas Berry</td>
<td>Heteromeles arbutiloides</td>
<td>B</td>
<td>8'-20'/8'-30'</td>
<td>sun/pt shade</td>
<td>tolerates sand, clay and serpentine soils, seasonal water with good drainage</td>
<td>all, but 1A-3A</td>
</tr>
<tr>
<td>Pacific Wax Myrtle</td>
<td>Myrica californica</td>
<td>B</td>
<td>10'-30'/10'-30'</td>
<td>sun/pt shade</td>
<td>large shrub or small tree, tolerates coastal conditions, sand, clay and seasonal inundation</td>
<td>all, but 1A-3A</td>
</tr>
<tr>
<td>Western Elderberry</td>
<td>Sambucus mexicana</td>
<td>B</td>
<td>10'-30'/8-20'</td>
<td>sun/pt shade</td>
<td>large shrub to tree, tolerates clay, seasonal flooding and drought, good wildlife food source</td>
<td>all, but 1A-3A</td>
</tr>
<tr>
<td><strong>Shrubs and Subshrubs</strong></td>
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<tr>
<td><strong>Coyote Brush</strong></td>
<td>Baccharis pilularis</td>
<td>B</td>
<td>wide variation</td>
<td>sun/pt shade</td>
<td>adaptable evergreen shrub, provides quick cover and bank stabilization, tolerant of coastal conditions, alkaline soil, sand, clay and seasonal wet</td>
<td>all, but 1A-3A</td>
</tr>
<tr>
<td><strong>California Wild Rose</strong></td>
<td>Rosa californica</td>
<td>A,B</td>
<td>3'-6'/spreads</td>
<td>sun/pt shade</td>
<td>tolerates a wide variety of soils, seasonal flooding and some drought, spreads aggressively, avoid edges of walkways because of thorns</td>
<td>all, but 1A-3A</td>
</tr>
<tr>
<td><strong>Perennials</strong></td>
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<tr>
<td>Yarrow</td>
<td>Achillea millefolium</td>
<td>B</td>
<td>1'/3'/2</td>
<td>sun/pt shade</td>
<td>tolerates alkaline soil, sand, clay, seasonal wet conditions, foot traffic and deer will self sow</td>
<td>all, but 1A-3A</td>
</tr>
<tr>
<td>Beach Strawberry</td>
<td>Fragaria chiloensis</td>
<td>B</td>
<td>2'/4'/spreads</td>
<td>sun/pt shade</td>
<td>vigorous spreading ground cover, tolerates sand, clay, wet conditions, prefers good drainage</td>
<td>all, but 1A-3A</td>
</tr>
<tr>
<td>Douglas Iris</td>
<td>Iris douglasiana</td>
<td>B</td>
<td>1.5'/3'/spreads</td>
<td>sun/pt shade</td>
<td>tolerates sand, clay and serpentine soils, seasonal wet (but not soggy) soils and drought</td>
<td>all, but 1A-3A</td>
</tr>
<tr>
<td>Hummingbird Sage</td>
<td>Salvia spathacea</td>
<td>B</td>
<td>1'/3'/5'/4-5'</td>
<td>sun/pt shade</td>
<td>low growing perennial, tolerates clay, winter wet, summer drought, prefers light shade, provides nectar for birds and insects, does well under oaks</td>
<td>all, but 1A-3A</td>
</tr>
<tr>
<td>Bog Sage</td>
<td>Salvia uliginosa*</td>
<td>B</td>
<td>3'/6'/spreads</td>
<td>sun</td>
<td>quick growing, spreading perennial, tolerates wet to dry, cut back winter, divide rhizomes</td>
<td>all, but 1A-3A</td>
</tr>
<tr>
<td>Blue-eyed Grass</td>
<td>Sisyrinchium bellum</td>
<td>B</td>
<td>6'/1'/5'/1'</td>
<td>sun</td>
<td>a semi-evergreen perennial, tolerates sand, clay, seasonal wet soils and deer, dormant in summer, but can be delayed with supplemental irrigation</td>
<td>all, but 1A-3A</td>
</tr>
<tr>
<td><strong>California Goldenrod</strong></td>
<td>Solidago californica</td>
<td>B</td>
<td>1'/4'/1'</td>
<td>sun/pt shade</td>
<td>tolerates poor soil, seasonal wet and drought, can spread aggressively if over irrigated</td>
<td>all, but 24</td>
</tr>
<tr>
<td><strong>Grasses and Grass-like Plants</strong></td>
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<tr>
<td>Berkeley Sage, Grey Sedge</td>
<td>Carex divulsa*</td>
<td>A,B</td>
<td>12'/18'/12'-18'</td>
<td>sun/pt shade</td>
<td>tolerates foot traffic, some drought and boggy soils</td>
<td>all, but 1A-3A</td>
</tr>
<tr>
<td>California Meadow Sedge</td>
<td>Carex pansa</td>
<td>A,B</td>
<td>6'/12'/spreads</td>
<td>sun/pt shade</td>
<td>good lawn substitute, tolerates wide range of growing conditions, seasonal inundation, drought, foot traffic and mowing</td>
<td>all, but 1A-3A</td>
</tr>
<tr>
<td>Clustered Field Sedge</td>
<td>Carex preglacialis</td>
<td>A</td>
<td>1'/spreads</td>
<td>sun/pt shade</td>
<td>useful lawn substitute and bank stabilizer, good planted in masses, tolerates wide range of growing conditions, foot traffic and mowing, may look weedy when mixed with other plants</td>
<td>all, but 1A-3A</td>
</tr>
<tr>
<td>San Diego Sedge</td>
<td>Carex spissa</td>
<td>B</td>
<td>3'/6'/5'/2-5'</td>
<td>sun/pt shade</td>
<td>a large grass, tolerates alkaline soil, clay, serpentine, seasonal inundation, and deer</td>
<td>all, but 1A-3A</td>
</tr>
<tr>
<td>Small Cape Rush</td>
<td>Chondropetalum rostratum*</td>
<td>A,B</td>
<td>2'/3'/5'/3'/6'/4'</td>
<td>sun/pt shade</td>
<td>A tough, attractive need-like plant, tolerates boggy or clay soils and drought once established, Chondropetalum rostratum is a much larger species</td>
<td>all, but 1A, 2A, 3A, 7</td>
</tr>
<tr>
<td>Molate Red Fescue</td>
<td>Festuca rubra 'Molate'*</td>
<td>A,B</td>
<td>5'/1'/2'/1'/2'/1'</td>
<td>sun/pt shade</td>
<td>A tough, spreading bunchgrass, good lawn substitute, provides erosion control, tolerates wet conditions, but looks best with regular water, tolerates drought only once established</td>
<td>all, but 1A, 2A, 3A, 7</td>
</tr>
<tr>
<td>Soft Rush</td>
<td>Juncus effusus</td>
<td>A</td>
<td>2'/3'/2'/3'</td>
<td>sun/pt shade</td>
<td>tolerates poor drainage, heavy soils, needs more supplemental water than Juncus patens</td>
<td>all, but 1A, 2A, 3A, 7</td>
</tr>
<tr>
<td>Wire Grass, Blue Rush</td>
<td>Juncus patens</td>
<td>A</td>
<td>1'/2'/1'</td>
<td>sun/pt shade</td>
<td>strong performance in bioretention areas, tolerates poor drainage, seasonal inundation, drought, shade</td>
<td>all, but 1A-3A</td>
</tr>
<tr>
<td>Canyon Prince Wild Rye</td>
<td>Leymus condensatus 'Canyon Prince'</td>
<td>B</td>
<td>2'/3'/spreads</td>
<td>sun/pt shade</td>
<td>a large grass, tolerates both wet and drought, provides nectar for birds and insects, does well under oaks</td>
<td>all, but 1A-3A</td>
</tr>
<tr>
<td>Deer Grass</td>
<td>Muhlenbergia rigens</td>
<td>B</td>
<td>4'/5'/4'/6'</td>
<td>sun/pt shade</td>
<td>a semi-evergreen perennial, tolerates sand, clay, seasonal wet soils and deer, dormant in summer, but can be delayed with supplemental irrigation</td>
<td>all, but 1A-3A</td>
</tr>
</tbody>
</table>

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1. See: [www.centralcoastlidi.org](http://www.centralcoastlidi.org) for a photo gallery of the plants in this list.
2. Refers to Sunset Western Garden Book Climate Zones. The Central Coast includes Zones 1A, 2A, 3A, 7, 9, and 14-24. [www.sunset.com/garden/climate-zones](http://www.sunset.com/garden/climate-zones) *Indicates non-native species. Non natives are only recommended for use in urbanized settings and should not be used on sites in proximity to natural areas.*
Plant Establishment and Care (cont.)

provide extra support to trees planted in bioretention areas, especially in high wind areas. They should be securely staked during establishment and inspected once or twice a year and following storm events. Stakes should be removed as soon as they are no longer needed to stabilize the tree (between one and two years).

Weeds compete with plants for nutrients, water and sunlight. They should be regularly removed, with their roots, by hand pulling or with manual pincer-type weeding tools. Care should be given to avoid unnecessary compaction of soils while weeding.

Replace plants that die due to unsuitable plant conditions, disease, underwatering or other unforeseen issues. Dead and dying plants must be removed and replaced to avoid spreading disease, establishment of weeds in bare areas and reduced LID function. Before replacing with the same species, determine if another species may be better suited to the conditions.

Tree Placement Guidance

Including trees in bioretention areas provides additional aesthetic and performance benefits. Following these guidelines will maximize their success and survival:

- Provide sufficient landscape width (a rule of thumb is 8’ min.)
- Locate trees on the side slopes (Zone B), not in areas that pond (Zone A). Trees improperly located, in narrow planters that pond, are unlikely to thrive and may eventually fail.
- Select trees that will tolerate seasonally wet soils.
- Do not specify trees with invasive roots.

Guidelines for Municipalities

Project managers who are preparing RFPs or bid packages for public projects that include bioretention systems should clearly define expectations for the following:

- Bioretention soil mix specification
- Guidance for plant species selection
- Appropriate plant zone placement
- Operations and maintenance protocols

To assist in defining vegetative requirements for LID projects, Central Coast municipalities may use this TAM as a reference or attachment to their project description.

Plant Nurseries

This is a partial list of Central Coast nurseries who regularly stock the plants included in this TAM.

- Central Coast Wilds, Santa Cruz
  831-459-0656
  www.centralcoastwilds.com

- Last Pilitas, Santa Margarita
  805-438-5992
  www.laspilitas.com

- Native Sons, Arroyo Grande
  805-481-5996
  www.nativesonsnursery.com

- Rana Creek, Carmel Valley
  831-659-3820
  www.ranacreeknursery.com

- San Marcos Growers, Santa Barbara
  805-683-1561
  www.sanmarcosgrowers.com

- Santa Barbara Natives, Santa Barbara
  805-698-4994
  www.sbnatives.com

For additional resources on bioretention plant guidance:
www.centralcoastlidi.org

For questions or to contact the Central Coast Low Impact Development Initiative:
info@centralcoastlidi.org

Additional Resources

- The Low Impact Development Manual for Southern California: Technical Guidance and Site Planning Strategies

- The California Stormwater Quality Association (CASQA) BMP Handbook for New Development and Redevelopment
  http://www.cabmphandbooks.com/

- Contra Costa Clean Water Program (C3 Guidebook)
  http://www.cccleanwater.org/c3.html

- City of Santa Barbara: Storm Water BMP Guidance Manual
  http://www.santabarbaraca.gov/Resident/Major_Planning_Efforts/Storm_Water_Management_Program/

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