

Soils, Plantings, and Irrigation for Bioretention Facilities

*Additional guidance for design and construction of
bioretention facilities and flow-through planters*

Bioretention facility owners are responsible for ensuring the following standards of performance are achieved throughout the life of the facility:

- Runoff must percolate through the imported bioretention soil mix at a minimum rate of 5" per hour.
- Plantings must be maintained in a healthy condition without use of conventional fertilizers or pesticides.
- Irrigation systems must minimize water use and be controlled to prevent overwatering and underdrain flow during dry weather.

As described in Chapter 5, municipalities will periodically verify these standards continue to be achieved. Operation and maintenance verification is required by the municipalities' stormwater NPDES permit issued by the Regional Water Quality Control Board.

The design criteria and checklists and other guidance in Chapter 4—including the design sheets on pp. 63-78—aim to ensure new bioretention facilities and planter boxes can reliably meet these standards of performance.

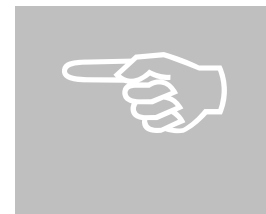
The additional guidance in this Appendix will assist applicants and

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their designers as they proceed from initial planning through design and construction.





Responsibility for design, construction, maintenance, and performance of stormwater treatment and flow-control facilities and their components rests with the applicant or property owner.



Soils

Soils for bioretention areas must meet two objectives:

- Be sufficiently permeable to infiltrate runoff at a minimum rate of 5" per hour during the life of the facility, and
- Have sufficient moisture retention to support healthy vegetation.

I C O N K E Y	Some native loamy sands may be suitable for both objectives; however, such soils are rare in Contra Costa and are not generally available from suppliers.
 Helpful Tip	
 Submittal Requirement	
 Terms to Look Up	Achieving both objectives with an engineered soil mix requires careful specification of soil gradations and a substantial component of organic material (typically compost).
 References & Resources	

The Contra Costa Clean Water Program has developed specifications for two bioretention soil mixes. Local soil products suppliers have expressed interest in developing “brand-name” mixes that meet these specifications. At their sole discretion, municipal construction inspectors may choose to accept test results and certification for a “brand-name” mix from a soil supplier. A list of suppliers who have submitted test results and certification to the Program is on the Program website. Updated soil and compost test results may be required; tests must be within 120 days prior to the delivery date of the bioretention soil to the project site.

Credit
 This Appendix was prepared based on recommendations by WRA Environmental Consultants, Inc.
www.wra-ca.com

Typically, batch-specific test results and certification will be required for projects installing more than 100 cubic yards of bioretention soil.

► SOIL SPECIFICATION

Bioretention soils should meet the following criteria.

1. **General Requirements**
 Bioretention soil shall achieve a long-term, in-place infiltration rate of at least 5 inches per hour. Bioretention soil shall also support vigorous plant growth.

Bioretention Soil shall be a mixture of topsoil or fine sand, and compost, measured on a volume basis.

Mix A – Topsoil Blend

- 10%-20% Topsoil
- 50%-60% Fine Sand
- 30%-40% Compost

Mix B – Fine Sand Blend

- 60%-70% Fine Sand
- 30%-40% Compost

1.1. Submittals

The applicant must submit to the municipality for approval:

- A. A sample of mixed bioretention soil.
- B. Certification from the soil supplier or an accredited laboratory that the Bioretention Soil meets the requirements of this guideline specification.
- C. Grain size analysis results of the fine sand component performed in accordance with ASTM D 422, Standard Test Method for Particle Size Analysis of Soils.
- D. Quality analysis results for compost performed in accordance with Seal of Testing Assurance (STA) standards, as specified in Section 1.4.
- E. Organic content test results of mixed Bioretention Soil. Organic content test shall be performed in accordance with by Testing Methods for the Examination of Compost and Composting (TMECC) 05.07A, “Loss-On-Ignition Organic Matter Method”.
- F. A description of the equipment and methods used to mix the sand and compost to produce Bioretention Soil.
- G. Provide the following information about the testing laboratory(ies) name of laboratory(ies) including
 - 1) contact person(s)
 - 2) address(es)
 - 3) phone contact(s)
 - 4) e-mail address(es)

- 5) qualifications of laboratory(ies), and personnel including date of current certification by STA, ASTM, or approved equal

1.2. Sand for Bioretention Soil

A. General

Sand shall be free of wood, waste, coating such as clay, stone dust, carbonate, etc., or any other deleterious material. All aggregate passing the No. 200 sieve size shall be non-plastic.

B. Sand for Bioretention Soil Texture

Sand for Bioretention Soils shall be analyzed by an accredited lab using #200, #100, #40, #30, #16, #8, #4, and 3/8 inch sieves (ASTM D 422 or as approved by municipality), and meet the following gradation:

Sieve Size	Percent Passing (by weight)	
	<i>Min</i>	<i>Max</i>
3/8 inch	100	100
No. 4	90	100
No. 8	70	100
No. 16	40	95
No. 30	15	70
No. 40	5	55
No. 100	0	15
No. 200	0	5

Note all sands complying with ASTM C33 for fine aggregate comply with the above gradation requirements.

1.3. Topsoil for Bioretention Soil

A. General

Topsoil shall be free of wood, waste, or any other deleterious material.

B. Topsoil for Bioretention Soil Texture

The overall topsoil texture shall be loamy sand as analyzed by an accredited laboratory. The overall dry weight percentages shall be 60-90% sand, with less than 20% passing than the #200 sieve and less than 5% clay of the total weight with no gravel.

1.4. Composted Material

Compost shall be a well decomposed, stable, weed free organic matter source meeting the standards developed by the US Composting Council (USCC). The product shall be certified through the USCC Seal of Testing Assurance (STA) Program (a compost testing and information disclosure program).

A. Compost Quality Analysis

Before delivery of the soil, the supplier shall submit a copy of lab analysis performed by a laboratory that is enrolled in the US Composting Council's Compost Analysis Proficiency (CAP) program and using approved Test Methods for the Evaluation of Composting and Compost (TMECC). The lab report shall verify:

- 1) Feedstock Materials shall be specified and include one or more of the following: landscape/yard trimmings, grass clippings, food scraps, and agricultural crop residues.
- 2) Organic Matter Content: 35% - 75% by dry wt.
- 3) Carbon and Nitrogen Ratio: C:N < 25:1.
- 4) Maturity/Stability: shall have a dark brown color and a soil-like odor. Compost exhibiting a sour or putrid smell, containing recognizable grass or leaves, or is hot (120F) upon delivery or rewetting is not acceptable. In addition any one of the following is required to indicate stability:
 - a. Oxygen Test < 1.3 O₂ /unit TS /hr
 - b. Specific oxy. Test < 1.5 O₂ / unit BVS /
 - c. Respiration test < 8 C / unit VS / day
 - d. Dewar test < 20 Temp. rise (°C)
 - e. e. Solvita® > 5 Index value
- 5) Toxicity: any one of the following measures is sufficient to indicate non-toxicity.
 - a. NH₄⁻ : NO₃-N < 3
 - b. Ammonium < 500 ppm, dry basis
 - c. Seed Germination > 80 % of control
 - d. Plant Trials > 80% of control

STORMWATER C.3 COMPLIANCE

- e. e. Solvita® > 5 Index value
- 6) Nutrient Content: provide analysis detailing nutrient content including N-P-K, Ca, Na, Mg, S, and B.
 - a. Total Nitrogen content 0.9% or above preferred.
 - b. Boron: Total shall be <80 ppm; Soluble shall be <2.5 ppm
- 7) Salinity: Must be reported; < 6.0 mmhos/cm
- 8) pH shall be between 6.5 and 8. May vary with plant species.
- B. Particle size: 95% passing a 1/2" screen.
- C. Bulk density: shall be between 500 and 1100 dry lbs/cubic yard
- D. Moisture Content shall be between 30% - 55% of dry solids.
- E. Inerts: compost shall be relatively free of inert ingredients, including glass, plastic and paper, < 1 % by weight or volume.
- F. Weed seed/pathogen destruction: provide proof of process to further reduce pathogens (PFRP). For example, turned windrows must reach min. 55C for 15 days with at least 5 turnings during that period.
- G. Select Pathogens: Salmonella <3 MPN/4grams of TS, or Coliform Bacteria <10000 MPN/gram.
- H. Trace Contaminants Metals (Lead, Mercury, Etc.) Product must meet US EPA, 40 CFR 503 regulations.
- I. Compost Testing
The compost supplier will test all compost products within 120 calendar days prior to application. Samples will be taken using the STA sample collection protocol. (The sample collection protocol can be obtained from the U.S. Composting Council, 4250 Veterans Memorial Highway, Suite 275, Holbrook, NY 11741 Phone: 631-737-4931, www.compostingcouncil.org). The sample shall be sent to an independent STA Program approved lab. The compost supplier will pay for the test.

► PLACEMENT AND COMPACTION OF BIORETENTION SOILS

Place the bioretention soil in 8" to 12" lifts. Lifts are **not to be compacted** but are placed to reduce the possibility of excessive settlement. Allow time for natural

compaction and settlement prior to planting. Bioretention soil may be watered to encourage compaction.

Plantings

► PLANT SELECTION GUIDELINES

The plants tabulated in Attachment B-1 were selected for the following characteristics:

- Adaptation to Contra Costa's climate
- Drought tolerance
- Adaptation to well-drained soils
- Adaptation to low soil fertility
- Allow infiltration
- Are not invasive weeds
- Do not have aggressive roots

Characteristics noted in the table, including irrigation preferences and ability to tolerate heat, coastal conditions, flooding, and wind should be considered when selecting plants.

This list is not comprehensive, nor will all these species succeed at every site. Selection for a particular site should be done by experienced professionals familiar with the plants and site conditions. Avoid planting species on the California Invasive Plant Council's invasive plant inventory list.

► PLANT INSTALLATION

Trees and large shrubs installed in bioretention facilities are susceptible to blowing over before roots are established. They should be staked securely. Three stakes per tree are recommended at windy sites. Straps should be inspected once or twice a year and removed once trees are established to prevent girdling.

► FERTILIZATION

Due to the potential for conveying nutrients to storm drains, no fertilizer should be added to bioretention facilities or planter boxes. Compost tea, available from various nurseries and garden supply retailers, may be applied at a recommended rate of 5 gallons mixed with 15 gallons of water per acre.

Compost tea can be applied up to two weeks prior to planting and once per year between March and June. Application is not recommended when temperatures are

below 50°F or above 90°F or when rain is forecast in the next 48 hours. Additional applications may be made as needed to correct nutrient deficiencies.

► MULCH

Mulch is not required but is recommended for the purpose of retaining moisture, preventing erosion and minimizing weed growth. Aged mulch, also called compost mulch, reduces the ability of weeds to establish, keeps soil moist, and replenishes soil nutrients. Aged mulch can be obtained through soil suppliers or directly from commercial recycling yards. Apply 1" to 2" of composted mulch, once a year, preferably in June following weeding.

Compared to bark mulch, aged mulch has somewhat less of a tendency to float into overflow inlets during intense storms. To reduce mulch entering overflow inlets, it is recommended to use atrium or beehive grates with ¼" openings over overflow inlets.

► WEED CONTROL

Weeds should be controlled primarily by manual methods and soil amendment. In response to problem areas or threatening invasions, corn gluten, white vinegar, vinegar-based products such as Burn-out, or non-selective natural herbicides such as Safer's Sharpshooter may be used.

► PEST AND DISEASE CONTROL

Synthetic pesticides should not be used on bioretention facilities. Beneficial nematodes and non-toxic controls may be used. Acceptable natural pesticides include Safer® Aphid, Whitefly, and Mealybug Killer, Safer® Tree and Shrub Insect Attach, Safer® for Evergreens, and Neem oil.

Irrigation

Bioretention soils have a high infiltration rate and require a different irrigation system design than what is typically used for heavy clay soils in Contra Costa County. Irrigation systems must be designed to minimize water use, avoid overwatering, and prevent the underdrain discharges during dry weather.

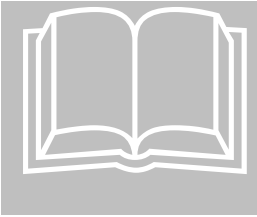
Bioretention facilities and planter boxes may need to be irrigated more than once a day. Irrigation controls should allow separate control of times and durations of irrigation for bioretention facilities and planter boxes vs. other landscape areas.

Smart irrigation controllers are strongly encouraged. Available controllers may access weather stations, use sensors to measure soil temperature and moisture, and allow input of soil types, plant types, root depth, light conditions, slope, and usable rainfall.

Drip emitters are strongly recommended over spray irrigation. Use multiple, lower-flow (one-half to two gallons per hour) emitters in fast-draining

bioretention soils. Use two or more emitters for perennials, ground covers, and bunchgrasses. Four to six emitters may be needed for larger shrubs and trees. Some types of emitters encourage horizontal distribution of water.

Spray heads must be positioned to avoid direct spray into bioretention facility or planter box outlet structures.



References and Resources

- *Recommendations for Soils Specification, Planting, and Irrigation of Bioretention Facilities*, WRA Environmental Consultants, November 5, 2008.
- [US Composting Council](#)
- [ASTM International](#)
- *Plant List and Planting Guidance for Landscape-Based Stormwater Measures*. Appendix B in the [Alameda County Clean Water Program C.3 Technical Guidance](#) (2006).
- *Plants and Landscapes for Summer Dry Climates*, Nora Harlow, Ed. East Bay Municipal Utility District, Oakland
- *California Native Plants for Your Garden and Wildlife*, Las Pilitas Nursery, 2008.
- *Native Treasures: Gardening with the Plants of California*. M. Nevin Smith, 2006. University of California Press.
- [The California Database, 2008.](#)
- [California Invasive Plant Council](#)
- *A Guide to Estimating Irrigation Water Needs of Landscape Plantings in California*, University of California Cooperative Extension and California Department of Water Resources
- [Our Water Our World](#), website developed to assist consumers in managing home and garden pests in a way that helps protect water.
- [Bay-Friendly Landscaping for Professionals](#), a whole systems approach to the design, construction, and maintenance of the landscape to support the integrity of the San Francisco Bay watershed.
- [University of California Statewide Integrated Pest Management \(IPM\) Program](#)

Plant Recommendations for Bioretention Facilities and Planter Boxes

Grasses and Grass-like Plants															
Scientific name Common name	Light Preference			Size (feet)		Watering				Tolerates				CA Native	Other Notes
	Sun	Part	Shade	Ht.	Width	L	M	H	Summer	Heat	Coast	Flood	Wind		
<i>Bromus carinatus</i> California brome	✓			2	1	✓			ok	✓		✓	✓	✓	
<i>Bouteloua gracilis</i> blue grama	✓			1.5	1	✓				✓		✓	✓		Tolerates no summer water, good for non-irrigated remote sites
<i>Carex densa</i> dense sedge	✓			1	1		✓	✓	✓	✓		✓		✓	
<i>Carex obnupta</i> slough sedge	✓			2	1		✓	✓	✓	✓	✓	✓	✓	✓	
<i>Carex praegracilis</i> clustered field sedge	✓	✓		1.5	1.5		✓	✓	✓	✓	✓	✓	✓	✓	
<i>Carex subfusca</i> rusty sedge	✓	✓		1	1		✓		ok	✓	✓	✓	✓	✓	Great for swales
<i>Carex divulsa</i> Berkeley sedge		✓	✓	1	1		✓		ok		✓	✓	✓	✓	AKA <i>Carex tumulicola</i> ,. Full sun along coast.
<i>Deschampsia cespitosa</i> tufted hairgrass	✓			2	1		✓		ok			✓	✓	✓	Can look weedy
<i>Distichlis spicata</i> salt grass	✓			0.3	3		✓	✓	✓	✓	✓	✓	✓	✓	Looks like bermuda grass, withstands foot traffic, for soils with high salt
<i>Eleocharis palustris</i> creeping spikerush	✓			1	1		✓	✓	ok	✓	✓	✓	✓	✓	
<i>Elymus glaucus</i> blue wildrye	✓			1.5	2		✓	✓	ok	✓	✓	✓	✓	✓	good for grazing, difficult to mow, messy looking lawn
<i>Festuca californica</i> California fescue	✓	✓	✓	2	2	✓			ok	✓	✓		✓	✓	
<i>Festuca idahoensis</i> Idaho fescue	✓	✓		1	1	✓	✓		ok	✓	✓		✓	✓	Can mow. Needs light summer water at hot sites
<i>Festuca rubra</i> red fescue	✓	✓		1	1.5	✓	✓		ok	✓	✓	✓	✓	✓	Can mow. Lawn alternative
<i>Festuca rubra 'molate'</i> molate fescue	✓	✓		1	1.5	✓	✓		ok	✓	✓		✓	c	Can mow. Lawn alternative
<i>Hordeum brachyantherum</i>	✓	✓		1.5	1		✓	✓	ok	✓	✓		✓	✓	

Plant Recommendations for Bioretention Facilities and Planter Boxes

meadow barley														
<i>Juncus patens</i> blue rush	✓			2	1	✓	✓	✓	✓		✓		✓	
<i>Leymus triticoides</i> creeping wildrye	✓	✓		3	1	✓	✓		ok	✓	✓	✓	✓	Can mow. Recommended for swales.
<i>Melica californica</i> California melica	✓	✓		1	1	✓				✓		✓	✓	
<i>Melica imperfecta</i> melic	✓	✓		1	1	✓			ok		✓	✓	✓	Part shade inland, light water in Summer to keep green or goes dormant
<i>Muhlenbergia rigens</i> deergrass	✓			3	3	✓	✓		ok	✓		✓	✓	
<i>Nasella pulchra</i> purple needlegrass	✓	✓		2	1	✓	✓		ok	✓		✓	✓	
<i>Nassella lepida</i> foothill needlegrass	✓	✓	✓	1.5	1	✓	✓		ok	✓	✓		✓	
<i>Phalaris californica</i> California canarygrass		✓	✓	1.5	1		✓	✓	ok		✓	✓	✓	Can be aggressive spreader

Plant Recommendations for Bioretention Facilities and Planter Boxes

Herbaceous Perennials and Groundcovers															
Scientific name Common name	Light Preference			Size (feet)		Watering				Tolerates				CA Native	Other Notes
	Sun	Part	Shade	Ht.	Width	L	M	H	Summer	Heat	Coast	Flood	Wind		
<i>Achillea filipendulina</i> fernleaf yarrow	✓			3	3	✓			✓	✓					
<i>Achillea millefolium</i> common yarrow	✓			1.5	1	✓			ok	✓				✓	Good for hot sites
<i>Achillea tomentosa</i> woolly yarrow	✓	✓		1	1.5	✓	✓		ok	✓			✓		
<i>Aloe striata</i> coral aloe	✓	✓		2	2	✓			ok						Sun along coast, afternoon shade inland
<i>Arctostaphylos hookeri</i> Monterey manzanita	✓	✓		1	4	✓	✓		ok		✓		✓	✓	Better in part shade in hot sites
<i>Arctostaphylos uva-ursi</i> kinnick-kinnick	✓	✓		1	15	✓	✓		ok		✓		✓	✓	Full sun at coast, part shade inland. Cultivars to try include 'emerald carpet,' 'Point Reyes,' 'San Bruno Mountain' depending on site
<i>Ceratostigma plumbaginoides</i> dwarf plumbago		✓		0.75	5	✓	✓		✓	✓					
<i>Epilobium canum</i> California fuchsia	✓	✓		1	4	✓			ok					✓	
<i>Eriogonum fasciculatum</i> flattop buckwheat	✓			3	4	✓				✓				✓	
<i>Eschscholzia californica</i> California poppy	✓			1	1	✓			ok	✓	✓	✓	✓	✓	
<i>Fragaria chiloensis</i> beach strawberries	✓	✓	✓	0.3	2	✓			ok		✓			✓	
<i>Gazania spp.</i> treasure flower	✓			0.5	2	✓	✓		✓	✓			✓		
<i>Iris douglasiana</i> Douglas iris	✓	✓		1.5	2	✓	✓		ok	✓	✓		✓	✓	Also, Iris hybrids

Plant Recommendations for Bioretention Facilities and Planter Boxes

Scientific name Common name	Light Preference			Size (feet)		Watering				Tolerates				CA Native	Other Notes
	Sun	Part	Shade	Ht.	Width	L	M	H	Summer	Heat	Coast	Flood	Wind		
<i>Lotus scoparius</i> deerweed	✓			4	3	✓				✓		✓		✓	
<i>Lupinus bicolor</i> miniature lupine	✓			1	1	✓					✓	✓		✓	Adds nitrogen
<i>Mimulus aurantiacus</i> common monkeyflower	✓	✓		3	3	✓			ok			✓		✓	
<i>Mimulus cardinalis</i> scarlet monkeyflower	✓	✓	✓	3	3		✓	✓	✓			✓		✓	Aggressive seeder
<i>Polygonum capitatum</i> pink knotweed	✓	✓		0.5	4	✓			✓	✓	✓		✓		
<i>Prunella vulgaris</i> self heal	✓	✓				✓	✓		ok		✓	✓	✓	✓	
<i>Rudebeckia californica</i> California coneflower	✓			3	2	✓	✓		ok	✓		✓		✓	
<i>Salvia clevelandii</i> Cleveland sage						✓									
<i>Scaevola 'mauve clusters'</i> fan flower	✓	✓		1	4	✓				✓			✓		
<i>Sedum spathulifolium</i> stone crop	✓					✓			ok	✓			✓	varies	For above the high water line
<i>Sisyrinchium bellum</i> blue eyed grass				1	1	✓			ok	✓	✓	✓	✓	✓	
<i>Sisyrinchium californicum</i> yellow eyed grass	✓	✓		1	1		✓		✓	✓	✓	✓	✓	✓	
<i>Solidago californica</i> California goldenrod		✓		3	2	✓	✓		ok	✓		✓		✓	
<i>Stachys byzantine</i> lamb's ears	✓	✓		1	3	✓			ok	✓	✓		✓		
<i>Verbena tenuisecta</i> moss verbena	✓			0.5	5	✓			ok	✓	✓		✓		

Plant Recommendations for Bioretention Facilities and Planter Boxes

Small Shrubs															
Scientific name Common name	Light Preference			Size (feet)		Watering				Tolerates				CA Native	Other Notes
	Sun	Part	Shade	Ht.	Width	L	M	H	Summer	Heat	Coast	Flood	Wind		
<i>Artemisia californica</i> California sagebrush	✓			2-5	4-5	✓				✓	✓		✓	✓	Will not tolerate sprinklers
<i>Baccharis pilularis</i> 'Twin Peaks' or Pigeon Point' dwarf coyote brush	✓			2	6	✓	✓		ok	✓	✓	✓	✓	c	
<i>Cistus skanbergii</i> hybrid rockrose	✓			3	5	✓	✓		✓	✓	✓	✓	✓		Best with annual shearing
<i>Correa 'Carmine Bells'</i> or 'Ivory bells' Australian fuchsia	✓	✓		3	6	✓	✓		✓	✓			✓		Ivory bells does not tolerate wind. Attracts hummingbirds. Sunset Zones 16-17 (not recommended for E. Contra Costa)
<i>Erigeron glaucus</i> seaside daisy	✓			1	1.5				ok		✓			✓	
<i>Eriogonum crocatum</i> saffron buckwheat	✓			1.5	1.5	✓				✓	✓		✓	✓	
<i>Eriogonum umbellatum</i> sulfur buckwheat	✓			0.7	3	✓			ok	✓			✓	✓	
<i>Grevillea lanigera</i> woolly grevillea	✓			4	6	✓				✓			✓		Sunset Zones 15-24 (not recommended for E. Contra Costa)
<i>Lavandula spp.</i> lavender	✓			1.5	1.5	✓			ok	✓	✓				
<i>Mahonia pinnata</i> California holly grape	✓	✓	✓	4	4	✓	✓			✓		✓	✓	✓	
<i>Mahonia repens</i> creeping Oregon grape	✓	✓		2	3	✓	✓		ok		✓	✓		✓	
<i>Rosmarinus officinalis</i> rosemary	✓			2.5	5	✓			✓	✓	✓		✓		
<i>Rubus ursinus</i> California blackberry		✓	✓	3	5		✓	✓	ok	✓	✓	✓	✓	✓	Thorns. Harbors beneficial insects

Plant Recommendations for Bioretention Facilities and Planter Boxes

<i>Symphoricarpos albus</i> common snowberry	✓	✓	✓	4	4	✓	✓	✓	ok	✓			✓	Adaptable to many conditions
<i>Westringia fruticosa</i> coast rosemary	✓			4	8	✓				✓	✓		✓	
<i>Whipplea modesta</i> whipplevine		✓	✓	0.5	3		✓	✓	✓		✓	✓	✓	Sunset zones 16-17, 19-24 only (not recommended E. Contra Costa), best for moist shady spots

Large Shrubs

Scientific name Common name	Light Preference			Size (feet)		Watering				Tolerates				CA Native	Other Notes
	Sun	Part	Shade	Ht.	Width	L	M	H	Summer	Heat	Coast	Flood	Wind		
<i>Alyogyne huegelii</i> blue hibiscus	✓			6	5	✓				✓					Very low water after second year, Sunset zones 15-17 & 20-24 (not recommended E. Contra Costa)
<i>Arctostaphylos densiflora</i> 'Howard McMinn' McMinn manzanita	✓	✓		3	7	✓				✓			✓	c	
<i>Baccharis pilularis</i> coyote brush	✓			6	7	✓	✓		ok	✓	✓	✓	✓		Fast-growing, short-lived
<i>Berberis darwinii</i> Darwin's barberry	✓	✓		6	6	✓				✓		✓	✓		Sprinklers will kill foliage
<i>Carpenteria californica</i> Bush anemone	✓	✓		6	4	✓	✓		✓	✓				✓	Interior climate with occasional water otherwise low water needs
<i>Ceanothus spp.</i> Various ceanothus	✓	✓		varies	varies	✓				✓			✓	✓	fast-growing but short-lived
<i>Cercis occidentalis</i> western redbud	✓			12	8	✓				✓		✓	✓	✓	Prune low branches for small tree form, susceptible to disease if overwatered
<i>Cotinus coggygia</i> smoke bush	✓			15	15	✓						✓	✓		No water after second year
<i>Eriogonum arborescens</i> Santa Cruz Island buckwheat	✓			3	5	✓			✓	✓	✓	✓	✓	✓	Low water after second year

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Scientific name Common name	Light Preference			Size (feet)		Watering				Tolerates				CA Native	Other Notes
	Sun	Part	Shade	Ht.	Width	L	M	H	Summer	Heat	Coast	Flood	Wind		
<i>Eriogonum giganteum</i> St. Catherines lace	✓			5	6	✓					✓	✓	✓	✓	best at coast, tolerant of unwatered inland garden
<i>Fremontodendron californicum</i> flannel bush	✓			20	14	✓				✓		✓		✓	Fast-growing, short-lived
<i>Garrya elliptica</i> Coast silktassel	✓	✓		8	8	✓	✓		✓	✓		✓	✓	✓	'Evie' is compact variety
<i>Heteromeles arbutifolia</i> toyon	✓	✓	✓	7	5	✓	✓		✓	✓	✓	✓		✓	Doesn't respond well to pruning low branches
<i>Juniperus chinensis</i> 'Mint Julep' mint julep juniper	✓	✓		3	6	✓	✓		✓	✓	✓	✓			
<i>Lonicera hispidula</i> California honeysuckle	✓	✓	✓	4	2		✓	✓	✓		✓	✓		✓	Climbing vine-like. Best in part shade. Attracts birds
<i>Lonicera involucrate</i> twinberry honeysuckle	✓	✓	✓	6	3		✓	✓	✓		✓	✓		✓	Best in part shade. Attracts birds
<i>Nandina domestica</i> heavenly bamboo	✓	✓		4	3	✓	✓		✓	✓	✓	✓			
<i>Philadelphus coronaries</i> sweet mock orange	✓	✓		10	10		✓		✓				✓		Best with annual pruning
<i>Physocarpus capitatus</i> Pacific ninebark	✓	✓		5	5	✓	✓	✓	ok		✓	✓		✓	Part shade and summer water required in hot locations
<i>Pittosporum eugeniodes</i> Pittosporum	✓	✓		40	15	✓	✓		✓	✓	✓	✓			shear to control height
<i>Pittosporum tenuifolium</i> Pittosporum	✓	✓		40	15	✓	✓		✓	✓	✓	✓			shear to control height
<i>Prunus illicifolia</i> holly leaf cherry	✓	✓		15	15	✓	✓			✓	✓	✓	✓	✓	
<i>Prunus lyonii</i> Catalina cherry	✓	✓		15	15	✓	✓			✓	✓	✓	✓	✓	
<i>Rhamnus californica</i> California coffeeberry	✓	✓		3-15	6	✓			✓	✓		✓	✓	✓	'Eve Case' is compact with broad foliage
<i>Rhus integrifolia</i>	✓	✓		8	6	✓			✓	✓		✓	✓	✓	Shear to hedge if desired

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lemonade berry															
<i>Ribes malvaceum</i> chaparral currant	✓	✓		5	5	✓	✓		ok	✓				✓	
<i>Ribes sanguineum</i> flowering currant		✓	✓	5-12	5-12	✓	✓		✓	✓	✓		✓	Needs good air movement to avoid white fly	
<i>Ribes speciosum</i> fuchsia-flowered gooseberry	✓	✓	✓	3-6	3-6	✓	✓		✓	✓	✓		✓		
<i>Rosa californica</i> California wild rose	✓	✓		3	3-6		✓	✓	ok	✓	✓	✓	✓	hooked thorns not compatible with foot traffic	
<i>Rosa gymnocarpa</i> wood rose	✓	✓		2	3		✓		ok	✓	✓	✓	✓		
<i>Vitis californica</i> California grape	✓	✓		10	2-10	✓	✓		✓	✓	✓	✓	✓	Climbing vine. Best in full sun. Can be aggressive in moist area.	
<i>Vitis girdiana</i> desert grape	✓			8	2-11	✓	✓		✓		✓	✓	✓	Climbing vine. May be more suited to biofilter soils than californica.	

Small Trees

Scientific name Common name	Light Preference			Size (feet)		Watering				Tolerates				CA Native	Other Notes
	Sun	Part	Shade	Ht.	Width	L	M	H	Summer	Heat	Coast	Flood	Wind		
<i>Acer Negundo</i> box elder	✓	✓	✓	30	30	✓	✓		ok	✓	✓	✓	✓	✓	Tough shade tree, deciduous
<i>Arbutus unedo</i> strawberry tree	✓	✓		15-30	15-30	✓	✓		✓	✓	✓				'Elfin King' is dwarf from 6' tall
<i>Arctostaphylos manzanita</i> common manzanita	✓			6-15	8-12	✓				✓			✓	✓	Prune to be small tree. "Dr. Hurd" is more tolerant of summer water.
<i>Cercis occidentalis</i> western redbud	✓	✓		12	8	✓				✓			✓	✓	Prune low branches for small tree form; susceptible to disease if overwatered.
<i>Eriobotrya deflexa</i> bronze loquat	✓	✓		18	25	✓	✓		✓	✓		✓			Monthly deep watering
<i>Eriobotrya japonica</i> Japanese loquat	✓	✓		25	20	✓	✓		✓	✓		✓			Susceptible to blight under stress
<i>Fraxinus angustifolia</i> raywood ash	✓			30	30		✓		✓	✓					Fall color
<i>Fraxinus dipetala</i> California ash	✓	✓		20	20				ok	✓		✓		✓	

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Scientific name	Light Preference			Size (feet)		Watering				Tolerates				CA Native	Other Notes
	Common name	Sun	Part	Shade	Ht.	Width	L	M	H	Summer	Heat	Coast	Flood		
<i>Fraxinus latifolia</i> Oregon ash	✓	✓	✓	30	25		✓	✓		✓	✓	✓		✓	
<i>Fraxinus velutina</i> velvet ash	✓			25	15	✓	✓		ok	✓		✓	✓		
<i>Garrya elliptica</i> coast silk tassel	✓	✓		20	20	✓	✓		ok		✓				Afternoon shade inland, responds well to pruning
<i>Laurus 'Saratoga'</i> hybrid laurel	✓	✓		12-40	12-40	✓				✓		✓	✓		prune for tree form
<i>Myrica californica</i> Pacific wax myrtle	✓	✓	✓	10-30	10-30	✓	✓				✓				best at coast
<i>Pinus thumbergiana</i> Japanese black pine	✓	✓		25	20	✓			✓	✓	✓			✓	Asymmetrical, often leaning habit
<i>Pittosporum undulatum</i> victorian box	✓	✓		15	15	✓	✓		✓	✓					Sunset zones 16-17, 21-24 only (not recommended E. Contra Costa. Prune low branches for tree form.
<i>Prunus ilicifolia</i> holly leaf cherry	✓	✓		15	15	✓	✓			✓	✓		✓	✓	
<i>Prunus lyonii</i> Catalina cherry	✓	✓		15	15	✓	✓			✓	✓		✓	✓	
<i>Prunus serrulata</i> "shirofugen" cherry	✓			25	25		✓				✓	✓	✓		Additional cultivars

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Key

Water Preference- Low/Moderate/High	We have provided recommendations for irrigation. All plants should be watered with more frequency during the first two years after planting. After this establishment period, Low water use plants will only need supplemental irrigation at the hottest and driest sites. Plants with Moderate irrigation needs will be best with occasional supplemental water (once per week to once per month) and plants with High irrigation needs will be best with more frequent watering especially during periods of drought in the cooler seasons.
Water Preference- Summer Irrigation	Plants with a check in this column will not withstand a long period of summer drought without irrigation. Plants with an 'ok' in this column are tolerant of, but do not require, frequent summer irrigation. Plants with nothing in this column may not tolerate summer irrigation.
Tolerates Heat	A check in the heat column indicates that the plant will tolerate hot sites. It should not be confused with a plants preference for sun. Absence of the check indicates it should only be used in areas close to the Bay or other cool sites.
Tolerates Coast	The coast column indicates plants that perform well within 1,000 feet of the ocean or bay. Most of these plants tolerate some amount of salt air, fog, and wind.
Tolerates Wind	A check in the wind column means that the plant will tolerate winds of ten miles per hour or more.
CA Native - c	Cultivar of California native. Cultivars offer habitat benefits to native wildlife and are adapted to the local climate but have reduced genetic diversity.
Other Notes - Sunset Climate Zones	Under the Other Notes category, we have indicated appropriate Sunset Climate Zones only for plants that will not do well across all of Contra Costa County. Please refer to the <i>Sunset Western Garden Book</i> which defines climate zones in the Bay Area based on elevation, influence of the Pacific Ocean, presence of hills and other factors.

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