

# B

## Plant List and Planting Guidance for Landscape- Based Stormwater Measures

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### B.1 Introduction

The purpose of this appendix is to provide guidance on the planting techniques and selection of appropriate plant materials for the stormwater measures described in this handbook.

The plant lists described in this appendix are not prescriptive, but should serve as a guide. In selecting plant materials, it is important to consider factors that influence plant establishment and success, such as microclimate, type of soil, water availability, proximity to saltwater and exposure to sun. Numerous resources are available to assist in selecting appropriate plant species in San Mateo County, including Sunset's *Western Garden Book* and the East Bay Municipal Utility District's *Plants and Landscapes for Summer-Dry Climates of the San Francisco Bay Region*.

In addition, the function of the individual stormwater measure should be carefully considered when selecting plant materials. Factors to be considered include inundation period, expected flow of water, and access and maintenance requirements.

The plant lists described in this appendix are not prescriptive, but should **serve as a guide**. In selecting plant materials, it is important to consider factors that influence plant establishment and success, such as microclimate, type of soil, water availability, proximity to saltwater and exposure to sun.

## B.2 General Recommendations

- **Avoid the use of invasive species.** In selecting plants for stormwater measures, the use of invasive species should be avoided. A complete list of invasive plants can be found at [www.cal-ipc.org](http://www.cal-ipc.org), the California Invasive Plant Council's Invasive Plant Inventory.
- **Minimize or eliminate the use of irrigated turf.** Effort should be made to minimize the use of irrigated turf, which has higher maintenance requirements and greater potential for polluted runoff.

## B.3 Plants for Stormwater Measures

Plants play an important role in the function of landscape-based stormwater treatment measures:

- **Infiltration and evapotranspiration.** Plants aid in the reduction of stormwater runoff by both increasing infiltration, and by returning water to the atmosphere through evapotranspiration.
- **Sedimentation.** Some stormwater treatment measures, such as vegetated swales and vegetated buffer strips, are designed to remove coarse solids through sedimentation that is aided by dense, low-growing vegetation.
- **Pollutant trapping.** Vegetation helps to prevent the resuspension of pollutants associated with sediment particles. It is essential that pollutants removed during small storms are not remobilized during large storms.
- **Phytoremediation.** Plants for stormwater treatment measures are important for their role in phytoremediation, the uptake of nutrients and the ability to neutralize pollutants.
- **Soil stabilization.** As in any landscaped area, established plantings help control soil erosion. This is important both to keep sediment out of stormwater and to retain the surface soils, which help to remove pollutants from infiltrated runoff.
- **Aesthetic benefits.** Plants within or adjacent to stormwater facilities provide an aesthetic benefit.

Plants suitable for use in stormwater treatment measures are organized according to the following categories:

- **Emergent** refers to those species that occur on saturated soils or on soils covered with water for most of the growing season. The foliage of emergent aquatics is partly or entirely borne above the water surface.
- **Grasses** refer to those species that are monocotyledonous plants with slender-leaved herbage found in the in the Family Poaceae.
- **Herbaceous** refers to those species with soft upper growth rather than woody growth. Some species will die back to the roots at the end of the growing season and grow again at the start of the next season. Annuals, biennials and perennials may be herbaceous.
- **Shrub** is a horticultural distinction that refers to those species of woody plants which are distinguished from trees by their multiple stems and lower height. A large number of plants can be either shrubs or trees, depending on the growing conditions they experience.
- **Tree** refers to those species of woody plants with one main trunk and a rather distinct and elevated head.

Plants suitable for use in stormwater treatment measures are listed in two ways. First, a comprehensive list of all recommended plant species is provided in Table B-1, which lists the plants in alphabetical order by Latin name, in the categories described above. The columns in Table B-1 indicate stormwater treatment measures for which each plant species may be suitable. Following Table B-1 are brief descriptions of the stormwater measures for which technical guidance is included in this handbook, including the suitable plantings from Table B-1.

Table B-1 Plant List for Stormwater Measures

Green Roof - extensive	Green Roof - Intensive	Turf Block Pavers	Vegetated Swale	Vegetated Buffer Strip	Tree Well Filters	Flow-Through Planters	Bioretention Area	Infiltration Trench	Extended Detention Basin
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**Emergent Species**

Carex barbarae	Santa Barbara sedge	✓	✓			✓			
Carex densa	dense sedge			✓	✓	✓	✓		
Carex obnupta	slough sedge						✓		✓
Eleocharis macrostachya	creeping spikerush						✓		✓
Hydrocotyle spp.	pennywort						✓		✓
Juncus balticus <sup>1</sup>	baltic rush						✓		✓
Juncus bufonius	toad rush						✓		✓
Juncus effusus <sup>1</sup>	Pacific rush						✓		✓
Juncus leseurii	common rush						✓		✓
Juncus mexicanus	Mexican rush						✓		✓
Juncus patens	blue rush			✓		✓	✓		✓
Juncus xiphioides	iris-leaved rush						✓		✓
Phragmites spp.	common reeds								✓
Scirpus actutus	Tule								✓
Scirpus americanus <sup>1</sup>	three square						✓		
Scirpus californicus <sup>1</sup>	california bulrush								✓
Typha angustifolia	narrowleaf cattail								✓
Typha latifolia	cattail								✓

**Grass Species**

Agrostis exarata	spike bentgrass			✓					✓
Alopecurus aequalis	shortawn foxtail								✓
Alopecurus saccatus	Pacific foxtail								✓
Bromus carinatus	California brome			✓	✓		✓	✓	
Carex densa	dense sedge			✓	✓				
Carex obnupta	slough sedge			✓	✓				
Carex pansa	California meadow sedge			✓	✓	✓			
Carex praegracilis	clustered field sedge			✓	✓		✓		
Carex subfusca	rusty sedge			✓	✓		✓		
Carex tumulicola	Berkeley sedge			✓	✓		✓		
Danthonia californica	California oatgrass								✓
Deschampsia cespitosa <sup>1</sup>	tufted hairgrass			✓	✓		✓	✓	
Deschampsia cespitosa ssp. holciformis	Pacific hairgrass			✓	✓		✓	✓	
Deschampsia danthonioides	annual hairgrass			✓				✓	
Distichlis spicata	salt grass				✓		✓	✓	✓
Eleocharis palustris	creeping spikerush			✓			✓	✓	
Elymus glaucus	blue wild rye			✓	✓		✓		✓
Elytrigia intermedia	intermediate wheat grass	✓	✓	✓	✓	✓			
Festuca arundinacea <sup>1</sup>	tall fescue	✓	✓	✓	✓	✓		✓	
Festuca californica	California fescue						✓	✓	
Festuca idahoensis	Idaho fescue	✓	✓	✓	✓	✓			
Festuca rubra <sup>1</sup>	red fescue			✓	✓	✓			
Festuca rubra 'molate'	Molate fescue			✓	✓	✓			
Hordeum brachyantherum <sup>1</sup>	meadow barley			✓	✓		✓		✓
Leymus triticoides	creeping wildrye			✓	✓		✓	✓	✓
Linum usitatissimum <sup>1</sup>	flax						✓	✓	

\* Denotes riparian species with limited drought tolerance  
<sup>1</sup> Denotes species with phytoremediation capabilities

Table B-1 Plant List for Stormwater Measures

Green Roof - extensive	Green Roof - Intensive	Turf Block Pavers	Vegetated Swale	Vegetated Buffer Strip	Tree Well Filters	Flow-Through Planters	Bioretention Area	Infiltration Trench	Extended Detention Basin
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**Grass Species cont'd**

Lolium perenne <sup>1</sup>	ryegrass				✓			✓	✓	✓	
Melica californica	California melic				✓	✓					
Muhlenbergia rigens	deerglass				✓	✓		✓	✓	✓	✓
Nasella pulchra	purple needlegrass	✓	✓		✓	✓			✓	✓	
Nassella lepida	Foothill needlegrass	✓	✓		✓	✓				✓	
Panicum coloratum <sup>1</sup>	kleingrass				✓	✓		✓	✓	✓	
Panicum virgatum <sup>1</sup>	switchgrass				✓	✓		✓	✓	✓	
Phalaris californica	California canarygrass				✓	✓			✓	✓	
Pleuropogon californicus	semaphore grass				✓	✓				✓	
Sisyrinchium bellum	blue-eyed grass	✓			✓	✓		✓		✓	
Sisyrinchium douglasii	purple-eyed grass	✓			✓					✓	

**Herbaceous Species**

Achillea millefolium <sup>1</sup>	common yarrow	✓	✓			✓		✓			
Anthemis nobilis (Chamaemelum nobile)	chamomile			✓	✓						
Armeria maritima	sea pink	✓	✓			✓		✓			
Epilobium canum (Zauschneria)	California fuchsia		✓			✓					
Epilobium densiflorum	dense spike-primrose				✓	✓		✓	✓	✓	✓
Eriogonum fasciculatum	flattop buckwheat					✓					
Eschscholzia californica	California poppy	✓	✓	✓		✓		✓	✓		
Fragaria chiloensis	beach strawberries	✓	✓			✓		✓			
Layia platyglossa	tidy tips	✓	✓			✓					
Lotus scoparius	deerweed	✓	✓			✓			✓		
Lupinus bicolor	miniature lupine	✓	✓			✓			✓		
Medicago sativa <sup>1</sup>	alfalfa				✓		✓	✓	✓	✓	
Mimulus aurantiacus	common monkeyflower		✓		✓	✓		✓	✓		
Mimulus cardinalis	scarlet monkeyflower		✓		✓	✓	✓	✓	✓		
Prunella vulgaris	self heal	✓	✓		✓	✓	✓	✓	✓	✓	
Sedum spp.	stonecrop	✓	✓			✓					
Sempervivum spp.	hen and chicks	✓	✓			✓					
Solidago spp. <sup>1</sup>	goldenrod	✓	✓		✓	✓		✓			
Thymus pseudolanuginosus	woolly thyme	✓	✓	✓	✓	✓		✓	✓		
Vigna unguiculata <sup>1</sup>	cowpea		✓		✓	✓		✓			

**Shrub Species**

Adenostoma fasciculatum	chamise		✓			✓					
Arctostaphylos densiflora 'McMinn'	manzanita 'McMinn'		✓			✓		✓	✓		
Arctostaphylos manzanita	common manzanita		✓			✓		✓			
Arctostaphylos uva-ursi 'Emerald Carpet'	manzanita 'Emerald Carpet'		✓			✓		✓	✓		
Baccharis pilularis 'Twin Peaks'	coyote brush prostrate		✓			✓	✓	✓	✓		
Baccharis salicifolia	mulefat					✓					
Berberis aquifolium	barberry					✓	✓	✓			
Calycanthus occidentalis	Spicebush				✓	✓		✓	✓	✓	
Carpenteria californica	Bush anemone				✓	✓		✓	✓		

\* Denotes riparian species with limited drought tolerance  
<sup>1</sup> Denotes species with phytoremediation capabilities

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Green Roof - extensive	Green Roof - Intensive	Turf Block Pavers	Vegetated Swale	Vegetated Buffer Strip	Tree Well Filters	Flow-Through Planters	Bioretention Area	Infiltration Trench	Extended Detention Basin
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Shrub Species cont'd

Ceanothus hearstiorum	ceanothus		✓			✓			
Ceanothus spp.	ceanothus			✓		✓			
Cephalanthus occidentalis	buttonbush		✓	✓	✓	✓			
Cercocarpus betuloides	mountain mahogany			✓					
Cistus spp.	rockrose			✓					
Cornus sericea (same as C. stolonifera)	western dogwood		✓	✓	✓	✓	✓	✓	
Cornus stolonifera	redosier dogwood		✓	✓	✓	✓	✓	✓	
Garrya elliptica	coast silk tassle	✓		✓		✓			
Heteromeles arbutifolia	toyon	✓		✓		✓	✓		
Lavandula spp.	lavender	✓		✓		✓			
Lavatera spp.	tree mallow			✓					
Lepechinia calycina	pitcher sage			✓					
Lupinus albilfrons	bush lupine			✓					
Mahonia aquifolium	Oregon Grape	✓		✓		✓	✓		
Mahonia repens	creeping Oregon grape	✓		✓		✓	✓		
Myrica californica	Pacific wax myrtle	✓		✓					
Philadelphus coronarius <sup>1</sup>	sweet mock orange	✓		✓					
Physocarpus capitatus	Pacific ninebark	✓		✓	✓		✓		
Pittosporum tobira	mock orange			✓		✓			
Rhamnus Californica	coffeeberry	✓		✓		✓	✓		
Rhus integrifolia	Lemonade Berry			✓					
Ribes malvaceum	chaparral currant			✓					
Ribes sanguineum	Red-flowering Currant			✓					
Rosa californica	California wild rose		✓	✓		✓	✓	✓	
Rubus parviflorus	Thimbleberry		✓	✓		✓	✓	✓	✓
Rubus spectabilis	Salmonberry		✓	✓		✓	✓	✓	✓
Rubus ursinus	California blackberry			✓			✓		
Salvia brandegii	black sage			✓					
Salvia melifera	black sage			✓					
Sambucus mexicana	elderberry			✓		✓	✓		
Symphoricarpos albus	snowberry			✓		✓			
Vaccinium ovatum	Evergreen Huckleberry			✓	✓	✓	✓		
Zauschneria californica (Epilobium c.)	California fuchsia	✓		✓					

\* Denotes riparian species with limited drought tolerance

<sup>1</sup> Denotes species with phytoremediation capabilities

Table B-1 Plant List for Stormwater Measures

Green Roof - extensive	Green Roof - Intensive	Turf Block Pavers	Vegetated Swale	Vegetated Buffer Strip	Tree Well Filters	Flow-Through Planters	Bioretention Area	Infiltration Trench	Extended Detention Basin
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Tree Species

<i>Acer circinatum</i>	Vine Maple		✓	✓	✓	✓	✓	✓	
<i>Acer macrophyllum*</i>	big leaf maple		✓	✓		✓	✓		
<i>Acer negundo* v. Californicum</i>	box elder		✓	✓	✓	✓	✓	✓	
<i>Aesculus californica</i>	buckeye			✓					
<i>Alnus rhombifolia *</i>	white alder		✓	✓	✓	✓	✓		
<i>Alnus rubra*</i>	red alder		✓	✓	✓	✓	✓	✓	
<i>Arbutus 'Marina'</i>	Madrone			✓					
<i>Arbutus menziesii</i>	Madrone			✓					
<i>Arbutus unedo</i>	Strawberry Tree			✓					
<i>Betula nigra</i>	river birch		✓	✓	✓	✓	✓	✓	
<i>Calocedrus decurrens</i>	Incense Cedar			✓					
<i>Celtis occidentalis</i>	common hackberry			✓					
<i>Cercidium floridum</i>	Blue Palo Verde			✓					
<i>Cercis occidentalis</i>	redbud	✓		✓					
<i>Chionanthus retusus</i>	Chinese fringe tree			✓					
<i>Corylus cornuta v. Californica</i>	California Hazelnut		✓	✓	✓	✓	✓		
<i>Fraxinus latifolia</i>	Oregon ash		✓	✓	✓	✓	✓	✓	
<i>Geijera parviflora</i>	Australian willow			✓					
<i>Lagerstroemia spp.</i>	crepe myrtle	✓		✓					
<i>Lyanthamnus floribundus asplendifolius</i>	Catalina Ironwood			✓					
<i>Morus alba (fruitless var.)<sup>1</sup></i>	white mulberry			✓					
<i>Platanus acerifolia</i>	London Plane Tree		✓	✓		✓			
<i>Platanus racemosa*</i>	sycamore		✓	✓		✓	✓		
<i>Populus fremontii*<sup>1</sup></i>	Fremont's cottonwood		✓	✓	✓	✓	✓	✓	
<i>Prunus, spp.</i>	Plum		✓	✓		✓			
<i>Quercus agrifolia</i>	California live oak			✓					
<i>Quercus kelloggii</i>	California Black Oak			✓					
<i>Quercus lobata</i>	valley oak			✓			✓		
<i>Quercus palustris</i>	pin oak			✓					
<i>Quercus virginiana</i>	Southern Live Oak				✓				
<i>Salix laevigata<sup>1</sup></i>	red willow		✓	✓		✓	✓	✓	
<i>Salix lasiolepis<sup>1</sup></i>	arroyo willow		✓	✓		✓	✓	✓	
<i>Salix lucida ssp. lasiandra<sup>1</sup></i>	shining willow		✓	✓		✓	✓	✓	
<i>Sequoia sempervirens</i>	Coast Redwood		✓	✓		✓			
<i>Umbellularia californica</i>	California Bay		✓	✓		✓			

\* Denotes riparian species with limited drought tolerance

<sup>1</sup> Denotes species with phytoremediation capabilities

A brief paragraph describing each stormwater measure is provided below, including the key factors that should influence planting techniques and plant selection, and a list of suitable plantings from Table B-1. The suitable plantings are reiterated in this manner for the landscape designer's convenience in preparing landscape plans for each type of stormwater measure.

**Green roof**

A green roof is intended to capture precipitation and roof runoff. Green roofs utilize a lightweight, porous planting substrate as a medium for plant growth. The depth and composition of this substrate is extremely important in determining types of plants that will be successful as part of a green roof system. Intensive green roofs, which can have up to 48" of substrate, can support a wider variety of plant types. The list below is only a sample of plants that could be suitable for an intensive green roof. Extensive green roofs, which have a depth of 3" to 7" of planting medium, are suitable for a limited number of grass and herbaceous species. These roofs generally require little maintenance and should be designed to succeed with minimal irrigation.

In addition to the species listed below, pre-vegetated mats can be utilized on extensive green roofs. Information can be found at the following website: [www.hfmgv.org/rouge/livingroof.asp](http://www.hfmgv.org/rouge/livingroof.asp)

**EXTENSIVE GREEN ROOF**

**EMERGENT SPECIES**

Carex barbarae                      Santa Barbara sedge

**GRASS SPECIES**

Elytrigia intermedia	intermediate wheat grass
Festuca arundinacea <sup>1</sup>	tall fescue
Festuca idahoensis	Idaho fescue
Nasella pulchra	purple needlegrass
Nassella lepida	Foothill needlegrass
Sisyrinchium bellum	blue-eyed grass
Sisyrinchium douglasii	purple-eyed grass

**HERBACEOUS SPECIES**

Achillea millefolium <sup>1</sup>	common yarrow
Armeria maritima	sea pink
Eschscholzia californica	California poppy
Fragaria chiloensis	beach strawberries
Layia platyglossa	tidy tips
Lotus scoparius	deerweed
Lupinus bicolor	miniature lupine
Prunella vulgaris	self heal
Sedum spp.	stonecrop
Sempervivum spp.	hen and chicks
Solidago spp <sup>1</sup>	goldenrod
Thymus pseudolanuginosus	woolly thyme

**INTENSIVE GREEN ROOF****EMERGENT SPECIES**

Carex barbarae Santa Barbara sedge

**GRASS SPECIES**

Elytrigia intermedia intermediate wheat grass  
 Festuca arundinacea<sup>1</sup> tall fescue  
 Festuca idahoensis Idaho fescue  
 Nasella pulchra purple needlegrass  
 Nassella lepida Foothill needlegrass

**HERBACEOUS SPECIES**

Achillea millefolium<sup>1</sup> common yarrow  
 Armeria maritima sea pink  
 Epilobium canum California fuchsia  
 (Zauschneria)  
 Eschscholzia californica California poppy  
 Fragaria chiloensis beach strawberries  
 Layia platyglossa tidy tips  
 Lotus scoparius deerweed  
 Lupinus bicolor miniature lupine  
 Mimulus aurantiacus common monkeyflower  
 Mimulus cardinalis scarlet monkeyflower  
 Prunella vulgaris self heal  
 Sedum spp. stonecrop  
 Sempervivum spp. hen and chicks  
 Solidago spp.<sup>1</sup> goldenrod  
 Thymus pseudolanuginosus woolly thyme  
 Vigna unguiculata<sup>1</sup> cowpea

**SHRUB SPECIES ( MINIMUM 12" substrate depth )**

Adenostoma fasciculatum chamise  
 Arctostaphylos densiflora manzanita 'McMinn'  
 'McMinn'  
 Arctostaphylos manzanita common manzanita  
 Arctostaphylos uva-ursi manzanita 'Emerald Carpet'  
 'Emerald Carpet'  
 Baccharis pilularis coyote brush prostrate  
 'Twin Peaks'  
 Ceanothus hearstiorum ceanothus  
 Garrya elliptica coast silk tassel  
 Heteromeles arbutifolia toyon  
 Lavandula spp. Lavender  
 Mahonia aquifolium Oregon grape  
 Mahonia repens creeping Oregon grape  
 Myrica californica Pacific wax myrtle

Philadelphus coronaries <sup>1</sup>	sweet mock orange
Physocarpus capitatus	Pacific ninebark
Rhamnus Californica	coffeeberry
Zauschneria californica (Epilobium c.)	California fuchsia

**TREE SPECIES\*** (minimum 36" substrate depth)

Cercis occidentalis	redbud
Lagerstroemia spp.	crepe myrtle

<sup>1</sup> Denotes species with phytoremediation capabilities

\* Denotes riparian species with limited drought tolerance

+ Note: These species have been selected among trees suitable for stormwater. A large number of tree species are suitable for intensive green roofs, and will depend on the type and depth of soil mix, microclimate and available space.

Pervious paving – Turf Block Pavers

Some pervious paving systems can be planted with grass or herbaceous species in order to assist with erosion prevention as well as promote infiltration and pollutant uptake. Plant species should be tolerant of compaction, have the ability to neutralize contaminants, and should not interfere with maintenance and use of the paved surface. Most plant species cannot tolerate frequent vehicular compaction. Therefore, turf block pavers are best suited for areas requiring infrequent access, such as emergency vehicle access routes. Paver manufacturer should be consulted regarding recommended and acceptable plant species.

**GRASS SPECIES**

Agrostis exarata	spike bentgrass
Carex pansa	California meadow sedge
Elytrigia intermedia	intermediate wheat grass
Festuca arundinacea <sup>1</sup>	tall fescue
Festuca idahoensis	Idaho fescue
Festuca rubra <sup>1</sup>	red fescue
Festuca rubra 'Molate'	Molate fescue

**HERBACEOUS SPECIES**

Anthemis nobilis <sup>2</sup>	chamomile
Eschscholzia californica	California poppy
Thymus pseudolanuginosus <sup>2</sup>	woolly thyme

<sup>1</sup> Denotes species with phytoremediation capabilities

<sup>2</sup> Denotes species that cannot tolerate vehicular compaction

Vegetated Swale

Plants in a vegetated swale slow water movement, which assists with the sedimentation of coarse solids and increases infiltration through a layer of topsoil. Therefore, a vegetated swale should be planted with the intent of slowing water flow, retaining pollutants associated with solids that settle out, and stabilizing the topsoil. Species can include grass and

herbaceous species. All plants should be tolerant of extended periods of dry conditions. However, species tolerant to periodic inundation should be concentrated within the center of the swale where the soil would be saturated for a greater duration.

**EMERGENT SPECIES**

Carex densa dense sedge

**GRASS SPECIES**

Bromus carinatus California brome  
 Carex densa dense sedge  
 Carex obnupta slough sedge  
 Carex pansa California meadow sedge  
 Carex praegracilis clustered field sedge  
 Carex subfusca rusty sedge  
 Carex tumulicola Berkeley sedge  
 Deschampsia cespitosa<sup>1</sup> tufted hairgrass  
 Deschampsia cespitosa Pacific hairgrass  
   ssp. holciformis  
 Deschampsia danthonioides annual hairgrass  
 Eleocharis palustris creeping spikerush  
 Elymus glaucus blue wild rye  
 Elytrigia intermedia intermediate wheat grass  
 Festuca arundinacea<sup>1</sup> tall fescue  
 Festuca idahoensis Idaho fescue  
 Festuca rubra red fescue  
 Festuca rubra 'Molate' Molate fescue  
 Hordeum brachyantherum meadow barley  
 Leymus triticoides creeping wildrye  
 Lolium perenne<sup>1</sup> ryegrass  
 Melica californica California melic  
 Muhlenbergia rigens deergass  
 Nasella pulchra purple needlegrass  
 Nassella lepida Foothill needlegrass  
 Panicum coloratum<sup>1</sup> kleingrass  
 Panicum vigatum<sup>1</sup> switchgrass  
 Phalaris californica California canarygrass  
 Pleuropogon californicus semaphore grass  
 Sisyrrinchium bellum blue-eyed grass  
 Sisyrrinchium douglasii purple-eyed grass

**HERBACEOUS SPECIES**

Anthemis nobilis chamomile  
 (Chamaemelum nobile)  
 Epilobium densiflorum dense spike-primrose  
 Medicago sativa<sup>1</sup> alfalfa  
 Mimulus aurantiacus common monkeyflower  
 Mimulus cardinalis scarlet monkeyflower  
 Prunella vulgaris self heal

Solidago spp. <sup>1</sup>	goldenrod
Thymus pseudolanuginosus	woolly thyme
Vigna unguiculata	cowpea

**SHRUB SPECIES**

Calycanthus occidentalis	spicebrush
Carpenteria californica	bush anemone
Cephalanthus occidentalis	buttonbush
Cornus sericea (same as C. stolonifera)	western dogwood
Cornus stolonifera	redosier dogwood
Physocarpus capitatus	Pacific ninebark
Rosa californica	California wild rose
Rubus parviflorus	thimbleberry
Rubus spectabilis	salmonberry
Vaccinium ovatum	evergreen huckleberry

**TREE SPECIES**

Acer circinatum	vine maple
Acer macrophyllum*	big leaf maple
Acer negundo* v. Californicum	box elder
Alnus rhombifolia*	white alder
Alnus rubra*	red alder
Betula nigra	river birch
Corylus cornuta v. Californica	California hazelnut
Fraxinus latifolia	Oregon ash
Platanus acerfolia	London plane tree
Platanus racemosa*	sycamore
Populus fremontii*	Fremont's cottonwood
Prunus spp.	plum
Salix laevigata <sup>1</sup>	red willow
Salix lasiolepis	arroyo willow
Salix lucida ssp. lasiandra <sup>1</sup>	Shining willow
Sequoia sempervirens	coast redwood
Umbellularia californica	California bay

<sup>1</sup> Denotes species with phytoremediation capabilities

\* Denotes riparian species with limited drought tolerance

**Vegetated Buffer Strips**

Vegetated buffer strips should be designed to function and appear as natural vegetated areas adjacent to development. They treat surface runoff from adjacent impervious areas so a variety of trees, shrubs, and grass and herbaceous species should be included in order to maximize water and nutrient uptake, as well as to retain sediment.

**EMERGENT/GRASS SPECIES**

Bromus carinatus	California brome
Carex barbarae	Santa Barbara sedge
Carex densa	dense sedge
Carex obnupta	slough sedge
Carex pansa	California meadow sedge
Carex praegracilus	clustered field sedge
Carex subfusca	rusty sedge
Carex tumulicola	Berkeley sedge
Deschampsia cespitosa <sup>1</sup>	tufted hairgrass
Deschampsia cespitosa ssp. holciformis	Pacific hairgrass
Distichlis spicata	salt grass
Elymus glaucus	blue wild rye
Elytrigia intermedia	intermediate wheat grass
Festuca arundinacea <sup>1</sup>	tall fescue
Festuca idahoensis	Idaho fescue
Festuca rubra <sup>1</sup>	red fescue
Festuca rubra 'Molate'	Molate fescue
Hordeum brachyantherum <sup>1</sup>	meadow barley
Juncus patens	blue rush
Leymus triticoides	creeping wildrye
Melica californica	California melic
Muhlenbergia rigens	deergrass
Nasella pulchra	purple needlegrass
Nassella lepida	Foothill needlegrass
Panicum coloratum <sup>1</sup>	kleingrass
Panicum vigatum <sup>1</sup>	switchgrass
Phalaris californica	California canarygrass
Pleuropogon californicus	semaphore grass
Sisyrinchium bellum	blue-eyed grass

**HERBACEOUS SPECIES**

Achillea millefolium <sup>1</sup>	common yarrow
America maritime	sea pink
Epilobium canum	California fuchsia
Epilobium densiflora	dense spike-primrose
Eriogonum fasciculatum	flattop buckwheat
Eschscholzia californica	California poppy
Fragaria chiloensis	beach strawberries
Layia platyglossa	tidy tips
Lotus scoparius	deerweed
Lupinus bicolor	miniature lupine
Mimulus aurantiacus	common monkeyflower
Mimulus cardinalis	scarlet monkeyflower
Prunella vulgaris	self heal
Sedum spp.	stonecrop
Sempervivum spp.	hen and chicks

Solidago spp. <sup>1</sup>	goldenrod
Thymus	woolly thyme
pseudolanuginosus	
Vigna unguiculata <sup>1</sup>	cowpea
<b>SHRUB SPECIES</b>	
Adenostema fasciculatum	chamise
Arctostaphylos densiflora	manzanita 'McMinn'
'McMinn'	
Arctostaphylos manzanita	common manzanita
Arctostaphylos uva-ursi	manzanita 'Emerald Carpet'
'Emerald Carpet'	
Baccharis pilularis	coyote brush prostrate
'Twin Peaks'	
Baccharis salicifolia	mulefat
Berberis aquifolium	barberry
Calycanthus occidentalis	Spicebush
Carpenteria californica	Bush anemone
Ceanothus heartiorum	ceanothus
Ceanothus spp.	ceanothus
Cephalanthus occidentalis	buttonbush
Cercocarpus betuloides	mountain mahogany
Cistus spp.	rockrose
Cornus sericea	western dogwood
(same as C. stolonifera)	
Cornus stolonifera	redosier dogwood
Garrya elliptica	coast silk tassle
Heteromeles arbutifolia	toyon
Lavandula spp.	lavender
Lavatera spp.	tree mallow
Lepechina calycina	pitcher sage
Lupinus albifrons	bush lupine
Mahonia aquifolium	Oregon grape
Mahonia repens	creeping Oregon grape
Myrica californica	wax myrtle
Philadelphus coronarius <sup>1</sup>	sweet mock orange
Physocarpus capitatus	Pacific ninebark
Pittosporum tobira	mock orange
Rhamnus Californica	coffeeberry
Rhus integrifolia	lemonade berry
Ribes malvaceum	chaparral currant
Ribes sanguineum	red-flowering currant
Rosa californica	California wild rose
Rubus parviflorus	thimbleberry
Rubus spectabilis	salmonberry
Rubus ursinus	California blackberry
Salvia brandegii	black sage
Salvia melifera	black sage

<i>Sambucus mexicana</i>	elderberry
<i>Symphoricarpos albus</i>	snowberry
<i>Vaccinium ovatum</i>	evergreen huckleberry
<i>Zauschneria californica</i> ( <i>Epilobium c.</i> )	California fuchsia

**TREE SPECIES**

<i>Acer circinatum</i>	vine maple
<i>Acer macrophyllum</i> *	big leaf maple
<i>Acer negundo</i> *	box elder
v. <i>Californicum</i>	
<i>Aesculus californica</i>	buckeye
<i>Alnus rhombifolia</i> *	white alder
<i>Alnus rubra</i> *	red alder
<i>Arbutus 'Marina'</i>	madrone
<i>Arbutus menziesii</i>	madrone
<i>Arbutus unedo</i>	strawberry tree
<i>Betula nigra</i>	river birch
<i>Calocedrus decurrens</i>	incense cedar
<i>Celtis occidentalis</i>	common hackberry
<i>Cercidium floridum</i>	blue palo verde
<i>Cercis occidentalis</i>	redbud
<i>Chioanthus retusus</i>	Chinese fringe tree
<i>Corylus cornuta</i>	California hazelnut
v. <i>Californica</i>	
<i>Fraxinus latifolia</i>	Oregon ash
<i>Geijera parviflora</i>	Australian willow
<i>Lagerstroemia</i> spp.	crepe myrtle
<i>Lycium floribundus</i> <i>asplendifolius</i>	Catalina ironwood
<i>Morus alba</i> (fruitless var.) <sup>1</sup>	white mulberry
<i>Platanus acerifolia</i>	London plane tree
<i>Platanus racemosa</i> *	sycamore
<i>Populus fremontii</i> * <sup>1</sup>	Fremont's cottonwood
<i>Prunus</i> spp.	plum
<i>Quercus agrifolia</i>	California live oak
<i>Quercus kelloggii</i>	California black oak
<i>Quercus lobata</i>	valley oak
<i>Quercus palustris</i>	pin oak
<i>Salix laevigata</i> <sup>1</sup>	red willow
<i>Salix lasiolepis</i> <sup>1</sup>	arroyo willow

Salix lucida ssp. lasiandra <sup>1</sup>	shining willow
Sequoia sempervirens	coast redwood
Umbellularia californica	California bay

\* Denotes riparian species with limited drought tolerance

<sup>1</sup> Denotes species with phytoremediation capabilities

Tree Well Filter

Trees and shrubs planted in tree well filters should be an appropriate size for the space provided. Because plant roots are confined to the container, it is recommended that small trees and shrubs with shallow, fibrous roots be planted in the tree well filter. Provided that site conditions allow, it may be possible to work with the manufacturer to design a container that would allow for the planting of larger trees or shrubs. Plants for tree well filters should be tolerant of frequent, but temporary periods of inundation as well as adapted to extremely well-drained soils. Species with the ability to neutralize contaminants are preferred.

**EMERGENT/HERBACEOUS SPECIES**

Carex densa	dense sedge
Medicago sativa <sup>1</sup>	alfalfa
Mimulus cardinalis	scarlet monkeyflower
Prunella vulgaris	self heal

**SHRUB SPECIES**

Baccharis salicifolia	mulefat
Berberis aquifolium	barberry
Cephalanthus occidentalis	buttonbush
Cornus sericea (same as C. stolonifera)	western dogwood
Cornus stolonifera	redosier dogwood
Ceanothus spp.	ceanothus
Heteromeles arbutifolia	toyon
Physocarpus capitatus	Pacific ninebark

**TREE SPECIES**

Acer circinatum	vine maple
Acer negundo	box elder
v. Californicum	
Alnus rhombifolia*	white alder
Alnus rubra*	red alder
Betula nigra	river birch
Corylus cornuta	California hazelnut
v. Californica	
Fraxinus latifolia	Oregon ash
Populus fremontii <sup>1</sup>	Fremont's cottonwood
Quercus virginiana	southern live oak

\* Denotes riparian species with limited drought tolerance

<sup>1</sup> Denotes species with phytoremediation capabilities

## Flow-Through Planter

Plant species for flow-through planters will depend on the size of the planter. Shrubs and trees should be planted in planters only when there is sufficient space. Recommended minimum soil depth for shrubs is 18", and for small trees is 36". Plant species should be adapted to well-drained soils. Irrigation is typically required, but selecting plants adapted to extended dry periods can reduce irrigation requirements.

**EMERGENT/GRASS SPECIES**

Carex densa	dense sedge
Juncus patens	blue rush
Carex tumulicola	Berkeley sedge
Festuca californica	California fescue
Festuca idahoensis	Idaho fescue
Festuca rubra <sup>1</sup>	red fescue
Festuca rubra 'molate'	Molate fescue
Linum usitatissimum <sup>1</sup>	flax
Lolium perenne <sup>1</sup>	ryegrass
Muhlenbergia rigens	deergrass
Panicum coloratum <sup>1</sup>	kleingrass
Panicum virgatum <sup>1</sup>	switchgrass
Sisyrinchium bellum	blue-eyed grass

**HERBACEOUS SPECIES**

Achillea millefolium <sup>1</sup>	common yarrow
America maritime	sea pink
Epilobium densiflorum	dense spike-primrose
Eschscholzia californica	California poppy
Fragaria chiloensis	beach strawberries
Medicago sativa <sup>1</sup>	alfalfa
Mimulus aurantiacus	common monkeyflower
Mimulus cardinalis	scarlet monkeyflower
Prunella vulgaris	self heal
Solidago spp. <sup>1</sup>	goldenrod
Thymus pseudolanuginosus	woolly thyme
Vigna unguiculata <sup>1</sup>	cowpea

**SHRUB SPECIES**

Arctostaphylos densiflora 'McMinn'	manzanita 'McMinn'
Arctostaphylos manzanita	common manzanita
Arctostaphylos uva-ursi 'Emerald Carpet'	manzanita 'Emerald Carpet'
Baccharis pilularis 'Twin Peaks'	coyote brush prostrate
Berberis aquifolium	barberry
Calycanthus occidentalis	spicebush
Carpenteria californica	bush anemone

Cephalanthus occidentalis	buttonbush
Cornus sericea (same as C. stolonifera)	western dogwood
Cornus stolonifera	redosier dogwood
Garrya elliptica	coast silk tassel
Heteromeles arbutifolia	toyon
Lavandula spp.	lavender
Lavatera	tree mallow
Mahonia aquifolium	Oregon grape
Mahonia repens	creeping Oregon grape
Pittosporum tobira	mock orange
Rhamnus Californica	coffeeberry
Rosa californica	California wild rose
Rubus parviflorus	thimbleberry
Rubus spectabilis	salmonberry
Sambucus mexicana	elderberry
Symphoricarpos albus	snowberry
Vaccinium ovatum	evergreen huckleberry

**TREE SPECIES**

Acer circinatum	vine maple
Acer macrophyllum*	big leaf maple
Acer negundo* v. Californicum	box elder
Alnus rhombifolia*	white alder
Alnus rubra*	red alder
Betula nigra	river birch
Corylus cornuta v. Californica	California hazelnut
Fraxinus latifolia	Oregon ash
Platanus acerfolia	London plane tree
Platanus racemosa*	sycamore
Populus fremontii	Fremont's cottonwood
Prunus, spp.	plum
Salix laevigata <sup>1</sup>	red willow
Salix lasiolepis <sup>1</sup>	arroyo willow
Salix lucia spp. lasiandra <sup>1</sup>	shining willow
Sequoia sempervirens	coast redwood
Umbellularia californica	California bay

Bioretention Area

Bioretention areas are intended to act as filters with plants. Plants in bioretention areas help with phytoremediation and infiltration. Therefore, nutrient uptake and the ability to neutralize pollutants are priorities for species selection. Plants for these areas should be able to withstand periods of inundation as well as extended periods of drought. Emergent, grass and herbaceous species can be planted in the bioretention area, while shrub and tree species should be concentrated on the outer edges. Grasses can also be planted along the exterior to slow the velocity of flow and allow the sedimentation of coarse solids, which helps minimize

clogging of the bioretention area. Supplemental irrigation will be necessary to maintain emergent species during extremely dry conditions.

#### **EMERGENT SPECIES**

Carex densa	dense sedge
Carex obnupta	slough sedge
Eleocharis macrostachya	creeping spikerush
Hydrocotyle spp.	pennywort
Hydrocotyle spp.	pennywort
Juncus balitcus <sup>1</sup>	baltic rush
Juncus bufonius	toad rush
Juncus effusus <sup>1</sup>	Pacific rush
Juncus leseurii	common rush
Juncus mexicanus	Mexican rush
Juncus patens	blue rush
Juncus xiphioides	iris-leaved rush
Scirpus americanus	three square

#### **GRASS SPECIES**

Bromus carinatus	California brome
Carex praeegracilus	clustered field sedge
Carex subfusca	rusty sedge
Deschampsia cespitosa <sup>1</sup>	tufted hairgrass
Deschampsia cespitosa ssp. holciformis	Pacific hairgrass
Distichlis spicata	salt grass
Eleocharis palustris	creeping spikerush
Elymus glaucus	blue wild rye
Festuca californica	California fescue
Hordeum brachyantherum <sup>1</sup>	meadow barley
Leymus triticoides	creeping wildrye
Linum usitatissimum <sup>1</sup>	flax
Lolium perenne <sup>1</sup>	ryegrass
Muhlenbergia rigens	deergrass
Nasella pulchra	purple needlegrass
Panicum coloratum <sup>1</sup>	kleingrass
Panicum virgatum <sup>1</sup>	switchgrass
Phalaris californica	California canarygrass

#### **HERBACEOUS SPECIES**

Epilobium densiflorum	dense spike-primrose
Eschscholzia californica	California poppy
Lotus scoparius	deerweed
Lupinus bicolor	miniature lupine
Medicago sativa <sup>1</sup>	alfalfa
Mimulus aurantiacus	common monkeyflower
Mimulus cardinalis	scarlet monkeyflower
Prunella vulgaris	self heal

Thymus woolly thyme  
 pseudolanuginosus

**SHRUB SPECIES**

Shrubs and trees are recommended to be planted at a rate of 2,500 shrubs and trees per hectare (1,000 per acre). The shrub-to-tree ratio should be 2:1 to 3:1 (California Stormwater Quality Association, 2003).

Arctostaphylos densiflora manzanita 'McMinn'  
 'McMinn'  
 Arctostaphylos uva-ursi manzanita 'Emerald Carpet'  
 'Emerald Carpet'  
 Baccharis pilularis coyote brush prostrate  
 'Twin Peaks'  
 Calycanthus occidentalis spicebush  
 Carpenteria californica bush anemone  
 Ceanothus hearstiorum ceanothus  
 Ceanothus spp. ceanothus  
 Cephalanthus occidentalis buttonbush  
 Cornus sericea western dogwood  
 (same as C. stolonifera)  
 Cornus stolonifera western dogwood  
 Heteromeles arbutifolia toyon  
 Mahonia aquifolium Oregon grape  
 Mahonia repens creeping Oregon grape  
 Myrica californica wax myrtle  
 Physocarpus capitatus Pacific ninebark  
 Rhamnus californica coffeeberry  
 Rosa californica California wild rose  
 Rubus parviflorus thimbleberry  
 Rubus spectabilis salmonberry  
 Rubus ursinus California blackberry  
 Sambucus mexicana elderberry  
 Vaccinium ovatum evergreen huckleberry

**TREE SPECIES**

Acer circinatum vine maple  
 Acer macrophyllum\* big leaf maple  
 Acer negundo\* box elder  
 v. Californicum  
 Alnus rhombifolia \* white alder  
 Alnus rubra\* red alder  
 Betula nigra river birch  
 Corylus cornuta California hazelnut  
 v. Californica  
 Fraxinus latifolia Oregon ash  
 Morus alba (fruitless var.) white mulberry  
 Platanus racemosa\* sycamore

Populus fremontii* <sup>1</sup>	Fremont's cottonwood
Quercus agrifolia	California live oak
Quercus lobata	valley oak
Salix laevigata <sup>1</sup>	red willow
Salix lasiolepis <sup>1</sup>	arroyo willow
Salix lucida ssp. lasiandra <sup>1</sup>	shining willow

\* denotes riparian species with limited drought tolerance

<sup>1</sup> denotes species with phytoremediation capabilities

### Infiltration Trench

An infiltration trench is an aggregate filled trench that receives and stores stormwater runoff in the void spaces between the aggregate and allows it to infiltrate into the surrounding soil. Vegetated filter strips of grass species on either side of the trench can slow and pre-treat the runoff while the trench can physically remove fine sediment and other suspended solids.

#### **GRASS SPECIES**

Bromus carinatus	California brome
Deschampsia cespitosa <sup>1</sup>	tufted hairgrass
Deschampsia cespitosa ssp. holciformis	Pacific hairgrass
Deschampsia danthonioides	annual hairgrass
Distichlis spicata	salt grass
Eleocharis palustris	creeping spikerush
Festuca arundinacea <sup>1</sup>	tall fescue
Leymus triticoides	creeping wildrye
Lolium perenne <sup>1</sup>	ryegrass
Muhlenbergia rigens	deergass
Nasella pulchra	purple needlegrass
Nassella lepida	Foothill needlegrass
Panicum coloratum <sup>1</sup>	kleingrass
Panicum virgatum <sup>1</sup>	switchgrass
Phalaris californica	California canarygrass
Pleuropogon californicus	semaphore grass
Sisyrinchium bellum	blue-eyed grass
Sisyrinchium douglasii	purple-eyed grass

#### **HERBACEOUS SPECIES**

Epilobium densiflora	dense spike-primrose
Medicago sativa <sup>1</sup>	alfalfa
Prunella vulgaris	self heal

#### **SHRUB SPECIES**

Calycanthus occidentalis	spicebush
Cornus sericea (same as C. stolonifera)	western dogwood
Cornus stolonifera	western dogwood
Rosa californica	California wild rose

Rubus parviflorus	thimbleberry
Rubus spectabilis	salmonberry

**TREE SPECIES**

Acer circinatum	vine maple
Acer negundo* (v. Californicum)	box elder
Alnus rubra*	red alder
Betula nigra	river birch
Fraxinus latifolia	Oregon ash
Populus fremontii* <sup>1</sup>	Fremont's cottonwood
Salix laevigata <sup>1</sup>	red willow
Salix lasiolepis <sup>1</sup>	arroyo willow
Salix lucida ssp. lasiandra <sup>1</sup>	shining willow

Extended Detention Basin

Extended detention basins are intended to capture and detain water for much longer periods (up to 72 hours) than bioretention areas. They are designed to drain completely between storms. Plants in extended detention basins increase pollutant removal and assist with soil stabilization, therefore nutrient uptake and the ability to neutralize pollutants are priorities for species selection. Because extended detention basins are intended to capture and move large quantities of water, trees should not be planted in the basins. Shrubs are typically not specified for extended detention basins, but may be included only on the outer perimeter (top of bank) that they do not interfere with detention. Species should be adapted to periodic inundation and saturation and extended periods of dry conditions. Emergent, grass and herbaceous species for extended detention basins should consist of species that are able to withstand extended periods of inundation. Supplemental irrigation will be necessary to maintain emergent species during extremely dry conditions.

**EMERGENT SPECIES**

Carex obnupta	slough sedge
Eleocharis macrostachya	creeping spikerush
Hordeum brachyantherum	meadow barley
Hydrocotyle spp.	pennywort
Juncus balticus <sup>1</sup>	baltic rush
Juncus bufonius	toad rush
Juncus effusus <sup>1</sup>	Pacific rush
Juncus leseurii	common rush
Juncus mexicanus	Mexican rush
Juncus patens	blue rush
Juncus xiphioides	iris-leaved rush
Phragmites spp.	common reeds
Scirpus actutus	tule
Scirpus californicus <sup>1</sup>	california bulrush
Typha angustifolia	narrowleaf cattail
Typha latifolia	cattail

**GRASS/HERBACEOUS SPECIES**

Agrostis exarata	spike bentgrass
Alopecurus aequalis	shortawn foxtail
Alopecurus saccatus	Pacific foxtail
Danthonia californica	California oatgrass
Distichlis spicata	salt grass
Elymus glaucus	blue wild rye
Hordeum brachyantherum <sup>1</sup>	meadow barley
Leymus triticoides	creeping wildrye
Muhlenbergia rigens	deergass
Epilobium densiflorum	dense spike-primrose

**SHRUB SPECIES**

Rubus parviflorus	thimbleberry
Rubus spectabilis	salmonberry

<sup>1</sup> denotes species with phytoremediation capabilities

## B.4 Planting Specifications

Planting plans and specifications must be prepared by a qualified professional and coordinated with other site development details and specifications including earthwork, soil preparation and irrigation (if used). Plans indicating a planting layout, with species composition and density, should be prepared on a site-specific basis. Reference the Bay Friendly Landscaping Guidelines prepared by Stopwaste.Org (available at [www.bayfriendly.org](http://www.bayfriendly.org)), which outline principles and practices to minimize waste, protect air and water quality, conserve energy and water, and protect natural ecosystems, including:

- Evaluate site and assess the soil;
- Consider potential for fire;
- Select plants for appropriate size upon maturity, do not over-plant;
- Irrigation, if required, should be designed as a high efficiency, water conserving system; and
- Utilize compost (see the specification in the Bay-Friendly Landscaping Guidelines) and mulch to build healthy soils and increase the water holding capacity of the soil.

### Propagation and Planting Methods

The propagation methods for different species will vary, depending upon type of plant and stormwater adaptation. In general, container stock will be utilized most commonly for green roofs, flow-through planters, tree well filters, vegetated swales and buffer strips and infiltration trenches. Bioretention areas and extended detention basins will generally utilize native plants available as transplants (plugs), pole cuttings and seed mixes.

**Container Stock.** Planting holes for container stock should be twice as wide and only as deep as the container size. Plant spacing should be determined on a site-specific basis. When planting, the root collar and base of the stem should be 1" above the adjacent soil

surface. Soils should be backfilled and tamped down to assure contact with the roots. The planting should be watered-in promptly to promote the settling of soil. If appropriate, container plantings may receive a balanced time-released fertilizer tablet, quantity and placement per manufacturer's recommendation, placed in the planting hole prior to installation of the plant. Planting berms for water retention and mulch shall be used to enhance plant establishment. Trees shall be staked or guyed to provide interim support until established.

**Transplants (Plugs).** Transplanted plant divisions, referred to here as "plugs", should be planted during the fall dormant period, preferably between October 1 and November 15 after first soaking rain. Plugs should be collected from a suitable collection site in the vicinity of the constructed basins. Plugs are clumps of plant roots, rhizomes or tubers combined with associated soil that can be manually removed, or salvaged with an excavator or backhoe. The maximum recommended size is 1 foot x 1 foot. Whole plants or plant divisions can be utilized. The plugs should be from healthy specimens free of insects, weeds and disease. The plugs should be spaced from 1 foot to 6 feet apart, depending on the size of the plug. Smaller plugs can be planted at the minimum distance to promote faster spreading and cover. Larger plugs from cattail and bulrush species should be planted at 3-foot to 6-foot intervals.

To plant a plug, a hole slightly wider than the diameter of the plug should be prepared and the roots system of the plug placed in the hole. Do not over-excavate the hole depth or the plant will settle below grade. A shovel could be used to create the planting hole. Manual planting with a spade is recommended for wet soils. Power augers can be used for creating holes in dry soils. Alternatively, a trench could be created along the narrow axis of the extended detention basin, and planting material manually placed at specified elevations in relation to the proximity of permanently saturated soils. To plant a plug with an established root system, the base of the stem and top of the root collar should be level with the ground surface. Tubers should be secured to prevent floating. Rhizomes should be placed in the soil with a slight upward angle.

The hole or trench containing the plug(s) should be backfilled with soil and the soil tamped down to assure good soil contact and secure the plug. The vegetative portion of the plant should be cut back to prevent water loss and wilting, and encourage the growth of roots and new shoots. Plugs of wetland plants should be grown in saturated soil. The soil should not be allowed to dry out after planting. Plugs should be planted immediately, when possible. When necessary, plugs can be stored in a cool, moist, shaded location for a maximum of one day. Plants must be thoroughly watered.

**Pole Cuttings.** Pole cuttings should be collected from the 1-year old wood of dormant trees and have a minimum of 5 viable nodes. The parent material should be healthy and free of diseases. The basal area of the pole cutting should be a minimum of one to two inches in diameter; however, the diameter at the base should not exceed 2 inches. The optimum diameter width of the base is 1 inch. The length of the cutting should be a minimum of 2 feet and should not exceed a maximum of 4 feet in length. Generally, 75 percent of the length of the cutting should be planted beneath the soil surface.

Pole cuttings should be collected no more than 2 days prior to planting. Cuttings should be placed in cool water to promote swelling of the nodes. Water should be kept fresh by aeration and/or by daily replacement. The pole cuttings should be placed in a hole approximately 3

feet deep (as determined by the length of the cutting) and backfilled with native soil, or a rich organic medium mixed with native soil. Soil should be tamped down to remove air pockets and assure soil contact with the cutting.

**Seeding.** Seeding should be conducted after plugs, container stock and pole cuttings are installed. Hydroseeding or broadcast method shall be utilized as appropriate for the size and accessibility of the area. The soil surface should be scarified prior to seeding. Do not damage previously planted vegetation. The seeds should be planted in fall, ideally in October.

Seeds should be broadcast or hydroseeded over the specified planting area. With broadcast seeding, the seed should be applied with hand-held spreaders to scarified soil. The soil surface should then be raked to cover the seeds with about one-eighth to one-quarter inch of soil to discourage predation, and tamped or rolled to firm soil surface.

Seeds should be planted at the ratios and rates specified by the supplier. The seed should be free of weeds and diseases. The certified germination percentage should be provided by the supplier.

#### Water Level Management and Irrigation for Plant Establishment

All newly planted material will need careful attention to watering requirements to ensure proper establishment. As mentioned in the introduction, it is important to select plants based on specific site conditions, which will affect the availability of water for plant use. In addition, grouping plants with similar water requirements can help reduce irrigation needs. The specific approach will vary for irrigated and non-irrigated conditions, and for each stormwater application. In most cases, stormwater applications will require a permanent irrigation system which shall be designed to maximize water conservation. Irrigation specifications and design plans shall be provided.

Plants such as shrubs and trees grown in naturalized areas that are not saturated to the surface or inundated shall be irrigated with drip irrigation. The irrigation system shall remain in place for a minimum of three years, and should continue until it is demonstrated that the plantings can survive on annual rainfall and/or groundwater. Seeded areas do not need irrigation in years of normal rainfall. If a period of drought occurs after seeding, supplemental watering may be needed for germination in the first year.

The plants on the bottom and edge of the constructed basins should be allowed to become established for one growing season prior to the onset of significant flooding that will inundate the plantings for extended periods. The types of plants recommended for these locations are rushes, sedges, grasses and herbaceous species. Initially, saturated soils are required for the bioretention areas and extended detention basins during the establishment period of the plantings. After the plants have become established, inundation with a surface depth of 1 cm to 2 cm alternating with short dry periods is recommended for the basins during the first year. Periodic shallow flooding of these basins can slow the growth of non-native weedy terrestrial species in the wetland system; however, the water depth should not be greater than the height of the plants. This initial irrigation regime will prevent plant mortality from dry periods or excessive flooding in the first year, and reduce the growth of non-native weedy species.

Emergent species should be planted in saturated soil so the plants will become established. For emergent species, the water level in the first year should be maintained to allow for soil saturation or shallow inundation around the base of the plants. Significant flooding and inundation of stems and leaves of the plants should be avoided the first year. Tall plugs and plantings can tolerate greater depths of inundation if a significant portion of the stems and leaves of the plantings remain above the water surface.

## B.5 Monitoring and Maintenance

### General Requirements

All planted areas shall be monitored and maintained as required to ensure proper establishment by a Contractor with a valid California C-27 contractor's license. Frequency of site visits and required maintenance practices will vary depending upon the stormwater measure and plant selection. Maintenance shall include watering, cultivation, weeding and pruning as necessary to maintain optimum growth conditions and, as appropriate to the specific stormwater measure, to keep the planted areas neat and attractive in appearance. In all instances, controlling weeds and unwanted growth with chemical applications is prohibited.

The contractor shall be familiar with the design and function of the specific stormwater measure(s) to ensure that the plantings are maintained appropriately and do not interfere with the efficient runoff drainage and filtration.

Ongoing management of invasive weed species will be required in all applications. Monthly hand weeding will allow the naturalized vegetation to take hold, and will ultimately be less costly than less frequent, and more intensive clearing. Regular application of arbor chip mulch, or other mulch material that will knit together and resist floating with surface runoff, will also help control weed growth.

### Erosion Control

Particularly with landscapes that are not fully established, contractors will need to monitor and evaluate potential for erosion and sediment accumulation in the runoff, which will influence irrigation scheduling and as well as determine the need for additional erosion control measures. Soil can be protected from erosion by a number of methods including:

- Keep the soil covered with vegetation to the extent possible;
- Slow water runoff by using compost berms, blanket, socks or tubes along slopes;
- Cover bare soil with a minimum of 2" mulch cover;
- Minimize the use of blowers in planting beds and on turf;
- On slopes use coarse shredded mulch that is not prone to washing into storms drains; and
- Store leaf litter as additional mulch in planting beds as appropriate.

### Irrigation Systems

Where irrigation systems have been installed for temporary or permanent irrigation, the contractor shall maintain the irrigation system for optimum performance, as per manufacturer's specifications. Contractor shall inspect the entire system on an ongoing basis, including cleaning and adjusting all sprinkler and bubbler heads, drip emitters and valves for proper coverage. Contractor shall monitor the irrigation system while operating to identify and correct problems with water runoff or standing water.

Monitor soil moisture within plant root zones using a soil probe or shovel and adjust irrigation schedules accordingly if a soil moisture sensor is not being utilized to signal the irrigation controller. If a Weather-Based Irrigation Controller (WBIC), otherwise known as a "Smart" Controller is not utilized on the project, irrigation shall be scheduled using a water budget approach, basing irrigation frequency on evapotranspiration data (ET) to avoid over-irrigation of plant material. Adjust irrigation frequency within each hydrozone area a minimum of every four weeks to respond to expected adjustments in ET data.

If a standard turf mix is used in lieu of a no-mow variety, implement grasscycling, where appropriate to the stormwater treatment measure. Grass clippings shall not be carried into the drainage structures. Refer to A Landscaper's Guide to Grasscycling available from StopWaste.Org at [www.bayfriendly.org](http://www.bayfriendly.org).

### Bioretention and Extended Detention Basins

In bioretention and extended detention basins, in particular, non-native invasive plant species should be carefully monitored and controlled to reduce competition with the native plantings and to assure the success of the revegetation activities. The establishment of weeds and invasive species in the bottom of the basins can be partially controlled during the establishment period by implementing the watering schedule of initial saturation followed by alternating periods of shallow inundation and dry soil. Manual methods of weed removal should be conducted on the bottom, edge and side of the basins when these areas are not inundated. Areas with hydroseeding on the banks of the basins should be weeded carefully to avoid removal of the native species.

Weeding should be conducted regularly the first two years to prevent the growth, flowering, and seed set of non-native weeds and invasive species. After the first two years, weeding frequency will be determined on a site-specific basis as determined by the type of weeds and seasonal growth cycle of the weed species. In general, weeding once a month will be necessary to avoid more extensive and costly eradication in the future.

Long-term maintenance tasks on the banks of the basins will include continued control of nonnative weeds and invasive plants, and control of erosion. Erosion could include gullies, rills and sheet erosion. Actions to control erosion should include redirecting or dissipating the water source. Recontouring and subsequent mulching and/or reseeding with erosion control species may be required in bare areas. In the event of extensive die-off of the native plant species, the bare areas should be replanted. Where the event that caused plant mortality was not a natural catastrophic occurrence, the site condition that resulted in the die-off should be investigated and remedial action to correct the problem should be undertaken prior to replanting.

## B.6 Bay-Friendly Landscaping and Integrated Pest Management

This section provides a summary of Bay-Friendly landscaping and integrated pest management techniques, based on the Bay-Friendly Landscaping Guidelines prepared by Stopwaste.Org (available at [www.bayfriendly.org](http://www.bayfriendly.org)).

### Bay Friendly Landscaping

Bay-Friendly landscaping is a whole systems approach to the design, construction and maintenance of the landscape in order to support the integrity of the San Francisco Bay watershed. Project sponsors are encouraged to use landscape professionals who are familiar with and committed to implementing Bay-Friendly landscaping practices from the initial plant selection through the long-term maintenance of the site. This section summarizes Bay-Friendly Landscaping practices that may be implemented information that project sponsors need about how these practices can benefit water quality of the Bay and its tributaries.

Bay-Friendly landscaping is based on 7 principles of sustainable landscaping and features the following practices

1. **Landscape Locally.** Landscapes designed to be part of the larger ecosystem of the Bay Area can both protect the health, diversity and sustainability of this valuable resource while making the most of the natural processes of a well-functioning ecosystem. By selecting plants appropriate to the climate, exposure, soils, drainage and topography, plantings can be established more successfully with less consumption of resources and intensive maintenance. Landscape designers are also encouraged to use local, well-adapted plant communities as models and to consider the potential for fire when developing the plant palette for a project.
2. **Less to the Landfill.** Reducing waste –and thus conserving landfill space and fossil fuel for hauling this material to the landfill - starts with not generating it in the first place. Plant trimmings pruning can be reduced by selecting plants that can grow to their natural size in the space allotted them, by avoiding the use of sheared hedges as design elements and not specifying invasive species (see the list in Appendix B). Prune selectively, and avoid excessive plant growth by applying water and fertilizer judiciously.

The second step is to recognize the value of plant debris, and to keep this organic matter on the site, using it as a gardening resource for mulching and composting.

3. **Nurture the Soil.** Returning organic matter to the soil, in the form of plant debris, is the link between protecting our watershed and protecting our watershed. Healthy soil that is rich in organic matter is full of life and can store water and actively cycle nutrients, regulate and partition water flow, neutralize pollutants, and resist pests. The following practices will encourage a complex soil community of microorganisms, worms, and other beneficial creatures. Base the landscape design on a soil analysis and understanding of soil texture, structure and drainage. The following practices are recommended during construction:
  - Remove and store the topsoil for re-spreading after grading;
  - Limit construction traffic to areas that will not be landscaped;

- Control soil erosion;
- Amend the soils with compost before planting; and
- Specify and maintain an adequate layer of organic mulch, taking into account water flow and designing to avoid the loss of mulch with runoff.

Maintenance practices to benefit soils and the watershed include allowing grass clippings to remain on the lawn; feeding soils with naturally based products including compost and a water extract of mature compost, instead of synthetic, fast release fertilizers and avoiding pesticides.

4. **Conserve Water.** Amending the soil with compost and keeping it covered with mulch can increase soil permeability and water-holding capacity, reduce water loss through evaporation and decrease the need for irrigation. Planting appropriate, drought tolerant California natives or Mediterranean plants also reduces water consumption for irrigation, as well as consumption of other resources for mowing, fertilizing, and spraying. Minimize the use of turf grasses that require regular watering and fertilizing to remain green, particularly on slopes or in narrow, irregular hard to water shapes. Arrange plants in “hydrozones” of low, medium or high water demand. Onsite collection systems can allow the use of rainwater, or the reuse of “graywater” – uncontaminated wastewater from sinks, bathtubs, and washing machines. Specify, install and maintain high-efficiency irrigation systems, and train landscaping staff to manage irrigation according to need.
5. **Conserve Energy.** Conventional landscapes are very fossil fuel consumptive. Selecting plantings that do not require regular mowing or pruning, fertilizing and watering can help reduce this demand and restore our landscapes to those that are more productive than consumptive. Tree plantings can be used to moderate building temperatures, and to shade paved areas and air conditioners. Trees can also intercept significant amounts of rainfall each year and thus help control stormwater runoff. Specify as large a tree as possible but be sure that it will be allowed to grow to its natural shape and size in the allotted space. Outdoor lighting should be designed to use less energy and minimize “light pollution.” Choose and maintain energy-efficient landscaping equipment to conserve fuel. Specifying local products and suppliers reduces the energy needed to transport products and supports local economies.
6. **Protect Water and Air Quality.** Bay-Friendly landscaping can help protect water quality by increasing on-site infiltration and reducing runoff, reducing pollutants in runoff, and increasing the soil’s ability to remove pollutants from runoff. It can help protect air quality by reducing fossil fuel consumption, recycling plant debris onsite, and planting trees to remove carbon dioxide and absorb air pollutants. Many of the practices described previously, such as minimizing high input decorative lawns, keeping soil covered with mulch and planting trees play a critical role in protecting water and air quality. An additional very important component of Bay-Friendly landscaping is reducing the use of pesticides through integrated pest management, which is described in a separate section, below.
7. **Create and Protect Wildlife Habitat.** Although we tend to rely on parks and open space to preserve wildlife habitat, developed landscapes can also provide food, water, shelter and nesting sites for birds, butterflies, beneficial insects, and other creatures. This can be accomplished by providing a diverse landscape that includes annuals, biennials and perennials of many different sizes, shapes, colors and textures; by choosing California

natives first; providing appropriate water and shelter for wildlife; eliminating the use of pesticides; and planning sites to conserve or restore natural areas and wildlife corridors.

### Integrated Pest Management

All creeks in the San Francisco Bay Area exceed water quality toxicity limits, primarily due to the pesticide Diazinon entering urban runoff. Although the residential use of Diazinon is currently being phased out, the use of a group of highly toxic chemicals, called pyrethroids, is increasing. Because all pesticides are toxins, a integrated pest management (IPM) places a priority on avoiding their use. IPM is a holistic approach to mitigating insects, plant diseases, weeds, and other pests. Projects that require a landscaping plan as part of a development project application are required encouraged to use IPM, as indicated in each agency's source control measures list, which is based on the countywide Source Control Model. Avoiding pesticides and quick release synthetic fertilizers are particularly important when maintaining stormwater treatment measures, to protect water quality.

IPM encourages the use of many strategies for first preventing, and then controlling, but not eliminating, pests. It places a priority on fostering a healthy environment in which plants have the strength to resist diseases and insect infestations, and out-compete weeds. Using IPM requires an understanding of the life cycles of pests and beneficial organisms, as well as regular monitoring of their populations. When pest problems are identified, IPM considers all viable solutions and uses a combination of strategies to control pests, rather than relying on pesticides alone. The least toxic pesticides are used only as a last resort. IPM features the following practices:

- **Prevent Pest Problems.** Fostering a healthy soil and selecting appropriate plant communities for the site helps reduce the susceptibility to disease and other pests. Landscape designs should include a diversity of species that are well-suited to the site; specify resistant varieties and native species, including plants that attract beneficial insects; place plants a proper distance from buildings; avoid over-planting; and include compost in the soil specifications. Cultural methods of avoiding pests during construction and maintenance include the following:
  - Selecting plant material that is free from disease and insects;
  - Planting at the right depth;
  - Watering thoroughly but not over-watering;
  - Keeping mulch on the soil surface at all times, keeping it away from root crowns;
  - Using slow release fertilizer, if necessary, and not over-fertilizing;
  - Pruning judiciously;
  - Eliminating noxious weeds before they go to seed or spread;
  - Cleaning equipment after use on infected plants;
  - Inspecting and removing invasive plant parts or seeds from clothing, tools and vehicle before leaving an infected site; and
  - Cleaning up fruit and plant material that is infected with insects or diseases.
- **Watch for and Monitor Problems.** Landscaping firms should provide their staff with the time and resources to learn to identify both pest and beneficial organisms, and train

residential clients to monitor and record pest problems. Plants should be checked often for vigor and signs of pests. Clarify which problems are the result of pests and not other environmental problems. Evaluate the results of any treatments, and check regularly with the Bio-Integral Resource Center ([www.birc.org](http://www.birc.org)) or UC Davis ([www.ipm.ucdavis.edu](http://www.ipm.ucdavis.edu)) for up-to-date resources and information.

- **Education is Key.** Many property owners have unrealistic standards of absolute pest control and need to learn how landscapes can tolerate a certain level of pests without resulting in significant, or even noticeable, damage. Landscape professionals should educate their clients and refer them to [www.ourwaterourworld.org](http://www.ourwaterourworld.org) for fact sheets and information on alternative pest control strategies.
- **Use Physical and Mechanical Controls.** If pests are identified as the source of unacceptable levels of damage, physical barriers or mechanical techniques are the first line of control. This can include the carefully timed and conducted pruning of infested plant material or removal of whole plants, spraying aphids with a strong jet of water, using pheromone or sticky traps to keep ants and other insects away or hand-picking large adult insect pests and larvae as they appear
- **Use Biological Controls.** Living organisms can also be used to keep pest populations under control. The most important biological controls appear naturally and will be abundant in a landscape that is not heavily treated with pesticides. Encourage beneficial insects by planting a wide range of plants that flower throughout the year (a list is provided in the Bay-Friendly Landscaping Guidelines), and introduce natural predators. Buy all biological controls from a reputable source, and do not use pesticides except as a last resort.
- **Least Toxic Pesticides are a Last Resort.** The least toxic and least persistent pesticide is used only when monitoring indicates that preventative and non-chemical methods are not keeping pests below acceptable levels. Pesticides are not used on a calendar basis. When used, their efficiency is maximized by understanding the pest and beneficial life cycles, by careful timing and targeted application.

## B.7 Planting Tips for Single-Family Homes

It is recommended that homeowners and builders follow the practices of Bay Friendly Landscaping and Integrated Pest Management (see Section B.6) to minimize pesticide usage and over-watering. Planting tips for single-family homes include:

- Avoid using invasive species such as iceplant and eucalyptus;
- Minimize turf grass areas to reduce need for fertilizer and excessive watering;
- Use appropriate species for soil and climate conditions; and
- Use compost instead of fertilizer.

Please review Section B.6 for complete information on Bay Friendly Landscaping and Integrated Pest Management.

## B.8 Nursery Sources for Native Plants

It is recommended that the native plants used in treatment controls be grown by a qualified nursery. Seed collection should be conducted by a qualified botanist and/or nursery staff. Seed should be collected locally from selected sites to maintain the genetic integrity of the native plant species. The seeds shall be propagated by the nursery for planting during the fall dormant season. The appropriate container size for each species shall be used by the nursery. An asterisk (\*) indicates a nursery with a dedicated native plant section.

Berkeley Horticultural Nursery\*  
1310 McGee Ave., Berkeley, CA  
510-526-4704  
<http://www.berkeleyhort.com/>

Clyde Robin Seed Company  
Castro Valley, CA  
510-785-0425  
[www.clyderobin.com](http://www.clyderobin.com)

East Bay Nursery\*  
2332 San Pablo Ave., Berkeley, CA  
510-845-6490  
<http://www.eastbaynursery.com/>

Golden Nursery  
1122 2<sup>nd</sup> Street  
San Mateo, CA 94401  
(650) 348-5525  
[www.goldennursery.com](http://www.goldennursery.com)

Larner Seeds  
PO Box 407  
Bolinas, California  
415-868-9407  
[info@larnerseeds.com](mailto:info@larnerseeds.com)  
[webmaster@larnerseeds.com](mailto:webmaster@larnerseeds.com)

Mines Road Natives  
17505 Mines Road, Livermore, CA  
925-371-0887  
Note: by appointment only.

Mostly Natives Nursery  
27235 Highway 1, Tomales, CA  
707-878-2009  
[www.mostlynatives.com](http://www.mostlynatives.com)

Native Here Nursery  
101 Golf Course Road, Berkeley, CA  
510-549-0211  
<http://www.ebcnps.org/NativeHereHome.htm>

Oaktown Native Plant Nursery  
1019 Bella Vista Ave., Oakland, CA  
510-534-2552  
<http://www.oaktownnativenursery.info/>

Pacific Coast Seed  
533 Hawthorne Place  
Livermore, CA  
925- 373-4417  
[www.pcseed.com](http://www.pcseed.com)

Redwood City Nursery  
2760 El Camino Real  
Redwood City, CA 94061  
(650) 368-0357  
[www.rcnursery.com](http://www.rcnursery.com)

Roger Reynolds Nursery  
133 Encinal Ave  
Menlo Park, CA 94025  
(650) 323-5612  
[www.rogerreynoldsnursery.com](http://www.rogerreynoldsnursery.com)

Watershed Nursery  
Berkeley, CA  
510-548-4714  
[www.thewatershednursery.com](http://www.thewatershednursery.com)

Wegman's Nursery  
492 Woodside Road  
Redwood City, CA 94061  
(650)368-5821  
[www.wegmannursery.com](http://www.wegmannursery.com)

Yerba Buena Nursery  
19500 Skyline Blvd.  
Woodside, CA 94062  
(650) 851-1668  
[www.yerbabuenanursery.com](http://www.yerbabuenanursery.com)

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