THE TOWN OF SAN ANSELMO
525 San Anselmo Avenue
San Anselmo, CA 94960
Ph: (415) 258-4600



# Homeowner's Guide to Stormwater Management

*Picture source:* http://water.epa.gov/infrastructure/greeninfrastructure/images/gi_raingarden.jpg

## Provided by the Town of San Anselmo Department of Public Works

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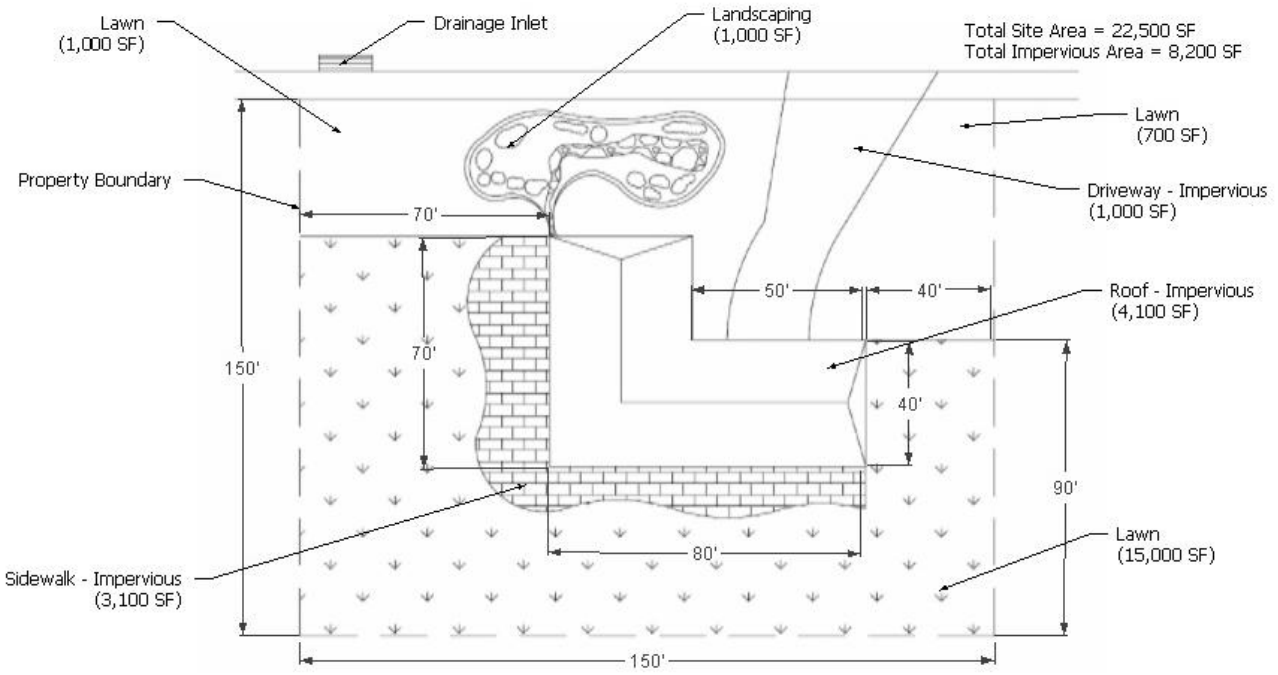
# Introduction to Stormwater Management

## Why is it necessary?

When natural landscape is replaced with hard surfaces, like roads, buildings, and driveways, rainwater (also called stormwater) no longer seeps into the ground but flows quickly off these surfaces, collecting pollutants along the way, like oil, grease, and dirt, and is routed into the storm drain system and then local creeks. The Ross Valley / Corte Madera Creek system is a valuable resource that provides both wildlife habitat and flood protection. Doing your part to slow down and detain rainwater will improve the health of local creeks by reducing pollutants, sedimentation, and erosion.

## How do I begin?

Make a simple sketch of your property like the one shown right. At a minimum, include dimensions and labels for the lot boundaries and any buildings or hard surfaces, like roofs, driveways, patios, and sidewalks (also called "impervious surfaces"). You will need the total area of your lot and impervious surfaces to design rainwater detention for your site. Then, read the pages following to start designing your rainwater detention system.




## What are my options?

Stormwater impacts can be mitigated by (1) decreasing the impervious areas on your site, like substituting a concrete driveway with a driveway with permeable pavers or replacing a brick patio with a vegetable garden, (2) constructing a rain garden, which can treat and detain rainwater more effectively than regular landscaping, and (3) add a rainwater harvesting system to store and reuse rainwater from at least a 10-year storm (a technical term for a rainstorm that is likely to occur every 10 years; this option is more complex and should be implemented with the assistance of a professional engineer or landscape architect). The first two options are discussed in greater detail in the following pages.

# Introduction to Stormwater Management (cont'd)

## Stormwater Management Requirements

All new developments must adhere to the following stormwater management requirements in the Town of San Anselmo:

| Town of San Anselmo<br>Requirements for New Developments |
|---|
| If site is ≤ 100 SF, requirements waived |
| If < 50% increase in total impervious area due to development, then treat and detain runoff from all the new impervious area |
| If ≥ 50% increase in total impervious area due to development, then treat and detain runoff from the entire site |

??

Piecemealing the work in order to reduce the stormwater management requirements for a development project is not allowed. If a project receives multiple permits, the cumulative area of impervious surfaces shall not exceed the limits specified in the ordinance for a period of one year.

## Important Note Regarding Liability

The rainwater detention improvement measures included in this guide are meant to be used as general guidelines and are not to be used as professional engineered specifications. Prior to implementation of any measures, seek technical assistance from a professional engineer or landscape architect. Certain site-specific measures may be necessary for implementation on your site.

## Overflow and Discharge Considerations

Stormwater management measures are typically designed to retain runoff from a small (10-year) storm. In larger storms, runoff will overflow into an overflow structure. If this overflow structure is clogged, water will instead spill out the sides of your rain garden or self-retained area, possibly causing flood damage to nearby properties. To ensure this doesn't happen, properly maintain your stormwater management system by clearing overflow grates of debris periodically and/or otherwise accommodate for the possibility of overflow in a large storm.

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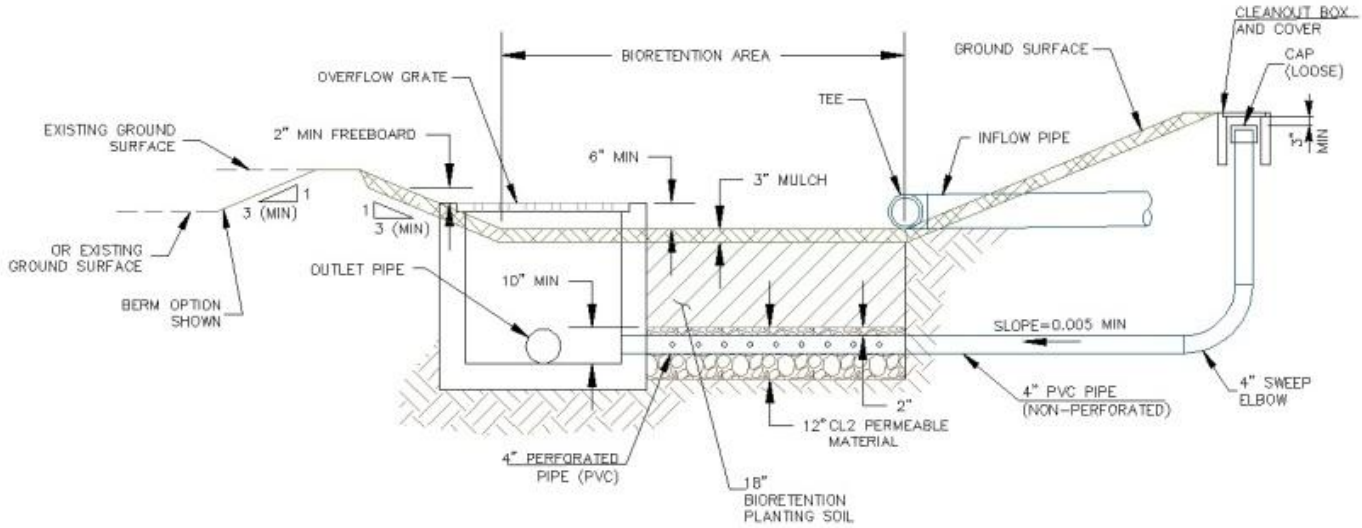
# Rain Garden (Bioretention) Design for Small Projects

Rain gardens are landscaped areas that capture and store runoff, giving it time to filter through plant roots and an engineered soil mix before infiltrating into the ground. In the Town of San Anselmo, native soils are not highly permeable, so an underdrain system is necessary to carry excess water (i.e. water that has not infiltrated) into the storm drain system. Though runoff is still routed to the storm drain system, it will be delayed, reducing the possibility of the storm drain system overflowing during a flash rainstorm.

## Design Checklist

*List adapted from the Stormwater Quality Manual for Development Projects in Marin County, 2008.*

- ❑ Sizing factor: 4% of tributary area (see next page for details).
- ❑ Overflow designed to prevent clogging by debris.
- ❑ Minimum 18" deep soil mix with an infiltration rate of 4 to 5 inches per hour.
- ❑ Perforated pipe underdrain with cleanouts and adequately sloped piped connection to storm drain or approved discharge point. Bed perforated pipe in Class 2 permeable material (Caltrans 2010 Standard Specifications, Section 26). Do not use filter fabric.
- ❑ Splash blocks or cobbles at inflow pipes.
- ❑ Plants selected for viability and to minimize need for fertilizers and pesticides.
- ❑ Native soils protected against compaction during construction.
- ❑ Irrigation system with connection to water supply.
- ❑ Reapply 1" to 2" of mulch once a year, preferably in June.
- ❑ Runoff is directed away from building foundations and basements.
- ❑ Runoff does not create ponding around trees.
- ❑ Plants tolerate wet conditions.




CROSS SECTION

## Is Bioretention Right for My Project?

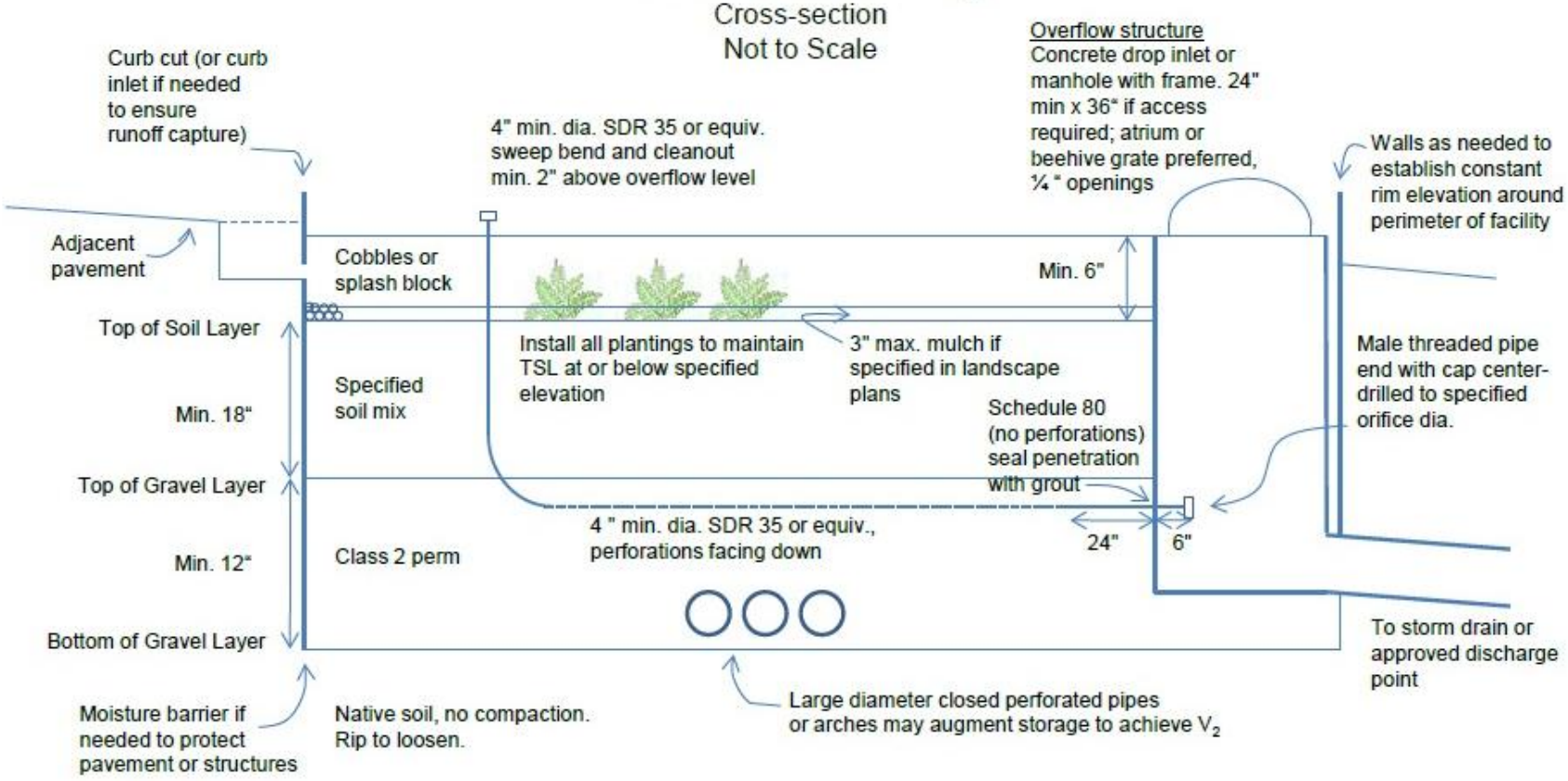
Directing stormwater runoff to bioretention areas is suitable for sites with the following conditions:

- ❑ Roofs, driveways, parking areas, patios, and walkways that can drain to a bioretention area.
- ❑ Sites with a slope of 5% or less.
- ❑ Sites with well-drained soil; soil amendments may be used in areas with poor drainage.

*List adapted from the Bay Area Stormwater Management Agencies Association Landscape Dispersion Fact Sheet, 2012 (Draft).*

# Bioretention Facility

Cross-section
Not to Scale



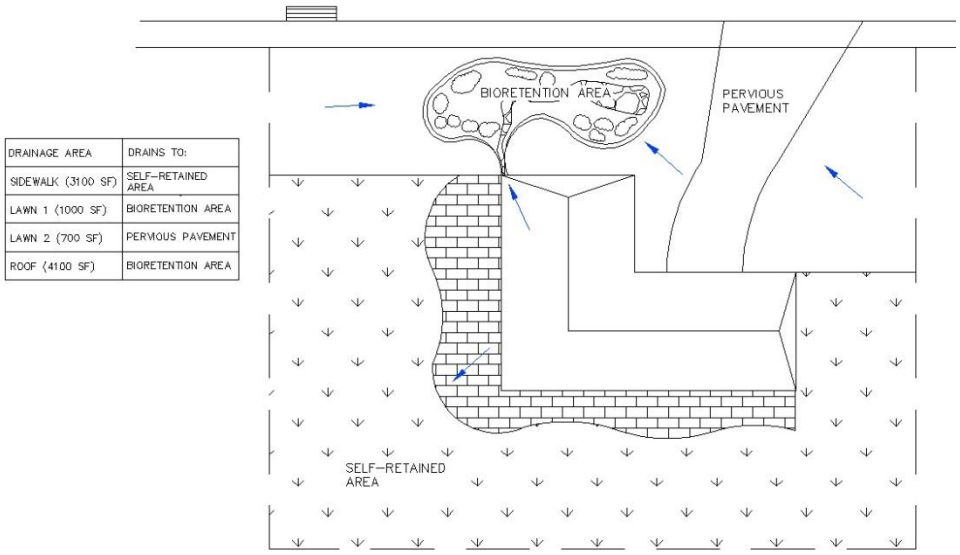

Notes:
- No liner. no filter fabric. no landscape cloth.
- Class 2 perm layer may extend below and underneath drop inlet.
- Elevation of perforated pipe underdrain is near top of gravel layer, except when zero infiltration is expected.

*Picture adapted from the Contra Costa Clean Water Program C.3 Guidebook, 6th Edition, 2012.*

# Rain Garden (Bioretention) Design for Small Projects (cont'd)

## Sizing Your Rain Garden

Before sizing your rain garden, determine how much of your site will be draining to it. To do this, make a simple sketch of your site and separate it into subareas (see page 2 for more information), then draw arrows to represent where the water from each subarea is flowing. An example is shown below. Once you determine how much of your site is flowing to the rain garden, use the table on the right to determine the required size, surface depth, subsurface depth, and orifice diameter.




| Area Draining to Rain Garden (SF) | Minimum Rain Garden Area (SF) | Minimum Surface Depth (in) | Minimum Subsurface Depth (in) | Orifice Diameter (in) |
|---|---|---|---|---|
| **0 - 100** | 0 | 0 | 0 | n/a |
| **101 - 200** | 8 | 15 | 21 | 0.25 |
| **201 - 300** | 12 | 15 | 20 | 0.30 |
| **301 - 400** | 16 | 15 | 20 | 0.35 |
| **401 - 500** | 20 | 15 | 20 | 0.39 |
| **501 - 600** | 24 | 15 | 20 | 0.43 |
| **601 - 700** | 28 | 15 | 20 | 0.46 |
| **701 - 800** | 32 | 15 | 20 | 0.49 |
| **801 - 900** | 36 | 15 | 20 | 0.52 |
| **901 - 1000** | 40 | 15 | 20 | 0.55 |
| **1001 - 1500** | 60 | 15 | 20 | 0.58 |
| **1501 - 2000** | 80 | 15 | 20 | 0.70 |
| **2001 - 2500** | 100 | 15 | 20 | 0.80 |
| **2501 - 3000** | 120 | 15 | 20 | 0.89 |
| *For larger areas, consult a professional engineer.* | | | | |

# Specifications for Bioretention Materials

## Gradation Specifications

Bioretention planting soil should be comprised of 60-70% sand, 30-40% compost, and 20% topsoil (by volume). The mixture should have an organic content between 4 to 10% (weight/weight), clay content less than 5% (weight/weight), and a long-term design hydraulic conductivity of 5 in/hr.

| Gradation for Sand | |
|---|---|
| **Sieve Size** | Percent Passing *(by weight)* |
| **3/8"** | 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 |

| Gradation for Compost | |
|---|---|
| **Sieve Size** | Percent Passing *(by weight)* |
| **1"** | 99-100 |
| **½"** | 90-100 |
| **¼"** | 40-90 |
| **No. 200** | 2-10 |

*Source: Municipal Regional Stormwater Permit, Order No. R2-2009-0074, Attachment L.*

| Class 2 Permeable Material Grading Requirements | |
|---|---|
| **Sieve Size** | Percent Passing *(by weight)* |
| **1"** | 100 |
| **¾"** | 90-100 |
| **⅜"** | 40-100 |
| **¾"** | 25-40 |
| **No. 4** | 18-33 |
| **No. 30** | 5-15 |
| **No. 50** | 0-7 |
| **No. 200** | 0-3 |

*Source: 2010 Caltrans Standard Specifications, Section 68-2.02F(3).*

## Testing Requirements

Bioretention planting soil must be analyzed by an accredited geotechnical lab.

*Source: Municipal Regional Stormwater Permit, Order No. R2-2009-0074, Attachment L.*

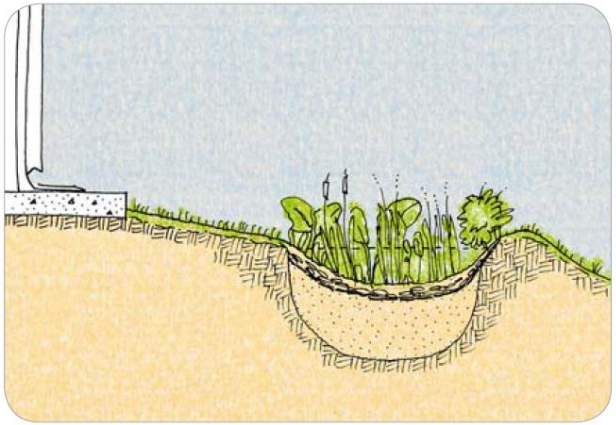
- Bioretention soil texture (ASTM D422)

| Gradation for Complete Soil Mix | |
|---|---|
| **Sieve Size** | Percent Passing *(by weight)* |
| **½"** | 97-100 |
| **No. 200** | 205 |

- Bioretention soil permeability
  - Moisture-density relationships (compaction tests): Bioretention soil for the permeability test shall be compacted to 85 to 90 percent of the maximum dry density (ASTM D1557).
  - Constant head permeability testing (ASTM D2434) on a minimum of two samples with a 6" mold and vacuum saturation.

# Self-Retained Areas

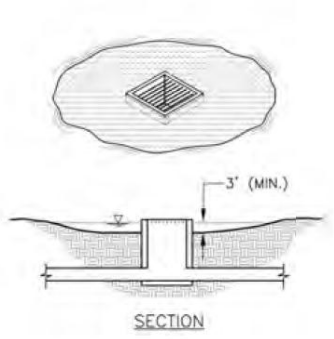
A self-retained area is a landscaped area which retains (or holds) a certain volume of water during a rainstorm so that, like a bioretention area, it allows runoff to infiltrate rather than flowing directly into the storm drain system. It does not have an underdrain system, like a rain garden does, but it must be much larger than a rain garden to meet the stormwater management requirements. A good way to think of a self-retaining area is that it acts like a bathtub – during a storm, it fills up before spilling out the sides or into the bathtub drain.



## Design Checklist

*List adapted from the Stormwater Quality Manual for Development Projects in Marin County (2008) and the Stormwater C.3 Guidebook 6th Edition (Contra Costa Clean Water Program, 2012).*

- The self-retained area must be designed to retain the first 1" of rainfall without producing runoff.
- The self-retained area must be at least half the area of the impervious area draining to it (i.e. 2:1 ratio of impervious area to landscape).
- The entire area must consist of lawn or landscape.
- The slope of the self-retained area cannot exceed 4%.
- Drainage inlets must be 3" above the surrounding grade.




- Amended soils, vegetation, and irrigation may be needed to maintain soil stability and permeability.

| Area Draining to Self-Retained Area (SF) | Minimum Self-Retained Area (SF) | Minimum Surface Volume (CF) |
|---|---|---|
| **0 - 100** | 0 | 0 |
| **101 - 200** | 100 | 8 |
| **201 - 300** | 150 | 13 |
| **301 - 400** | 200 | 17 |
| **401 - 500** | 250 | 21 |
| **501 - 600** | 300 | 25 |
| **601 - 700** | 350 | 29 |
| **701 - 800** | 400 | 33 |
| **801 - 900** | 450 | 38 |
| **901 - 1000** | 500 | 42 |
| **1001 - 1500** | 750 | 63 |
| **1501 - 2000** | 1000 | 83 |
| **2001 - 2500** | 1250 | 104 |
| **2501 - 3000** | 1500 | 125 |
| *For larger areas, consult a professional engineer.* | | |

*Picture (top left) from the San Francisco Stormwater Design Guidelines (November 2009). Picture (left) from the Stormwater C.3 Guidebook 6th Edition (Contra Costa Clean Water Program, 2012).*

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# Recommended Planting List for Rain Gardens in Marin County

Note: Avoid the use of pesticides, herbicides, and fertilizers, especially in a rain garden, as these will flow directly into the storm drain system and have harmful effects on local creeks.

| Trees | Shrubs | Perennials | Biennials, Annuals, and Succulents |
|---|---|---|---|
| *Acer negundo,* Box Elder* | *Achillea millefolium,* Yarrow* | *Armeria maritima,* Sea Thrift* | *Bromus carinatus,* California Brome* |
| *Acer rubrum,* Red Maple | *Arctostaphylos densiflora,* Howard McMinn Manzanita* | *Asarum caudatum,* Wild Ginger | *Nemophila menziesii,* Baby Blue Eyes* |
| *Acer saccharinum,* Silver Maple | *Arctostaphylos hookeri ssp. ravenii,* Presidio Manzanita* | *Dicentra formosa,* Bleeding Hearts | *Sedum spathulifolium,* Broadleaf Stonecrop* |
| *Alnus spp.,* Alder* | *Ceanothus 'Julia Phelps',* Julia Phelps Ceanothus* | *Equisetum hyemale,* Scourgrush Horsetail* | |
| *Betula spp.,* Birch* | *Epilobium canum spp. canum,* California Fuchsia* | *Eschscholzia californica,* California Poppy* | |
| *Carya ovata,* Buttonbush | *Eriogonum fasciculatum,* California Buckwheat* | *Fragaria chiloensis,* Coastal Strawberry* | Ferns |
| *Carya illinoinensis,* Pecan | *Gaultheria shallon,* Salal* | *Fragaria vesca,* Mountain Strawberry* | *Polystichum munitum,* Western Sword Fern* |
| *Casuarina spp.,* She-oak | *Heteromeles arbutifolia,* Toyon* | *Iris douglasiana,* Douglas Iris* | |
| *Cercis occidentalis,* Western Redbud* | *Lupinus albifrons,* Silver Bush Lupin* | *Iris longipetala,* Coast Iris* | |
| *Diospyros virginiana,* Persimmon* | *Rhamnus californica,* Coffeeberry* | *Mimulus aurantiacus,* Sticky Monkeyflower* | Grasses |
| *Eucalyptus citriodora,* Lemon-scented Gum | *Rosa californica,* California Wild Rose* | *Mimulus guttatus,* Creek Monkeyflower* | *Acorus gramineus,* Sweet Flag |
| *Eucalyptus erythrocorys,* Red-cap Gum | *Rubus ursinus,* California Blackberry* | *Oxalis oregana,* Redwood Sorrel | *Agrostis pallens,* Bentgrass* |
| *Fraxinus latifolia,* Oregon Ash* | *Sambucus nigra cerulea,* Blue Elderberry* | *Salvia spathacea,* Hummingbird Sage* | *Carex comosa,* Bristly Sedge |
| *Gleditsia triacanthos,* Honey Locust | *Symphoricarpos albus,* Common Snowberry* | *Sisyrinchium bellum,* Blue-eyed Grass* | *Carex densa,* Dense Sedge* |
| *Liquidambar styraciflua,* American Sweet Gum | *Vaccinium ovatum,* California Huckleberry* | *Solidago confinis** | *Carex praegracilis,* Clustered Field Sedge* |
| *Magnolia grandiflora,* Southern Magnolia | | *Tradescantia virginiana,* Virgina Spiderwort* | *Carex tumulicola,* Berkeley Sedge* |
| *Magnolia virginia,* Sweet Bay | | *Typha latifolia,* Common Cattail* | *Deschampsia cespitosa,* Tufted Hairgrass* |
| *Melaleuca quinquenervia,* Cajeput Tree | | | *Eleocharis macrostachya,* Creeping Spike Rush* |
| *Myrica californica,* Pacific Wax Myrtle* | | | *Festuca californica,* California Fescue* |
| *Nyssa sylvatica,* Black Tupelo | | | *Festuca idahoensis,* Idaho Fescue* |
| *Oxydendrum arboreum,* Lily of the Valley Tree | | | *Festuca rubra,* Red Fescue* |
| *Picea sitchensis,* Sitka Spruce | | | *Juncus spp.,* Rushes (various)* |
| *Platanus occidentalis,* American Sycamore | | | *Juncus xiphiodes,* Irisleaf Rush* |
| *Platanus racemosa,* California Sycamore* | | | *Koeleria macrantha,* Prairie Junegrass* |
| *Platanus x acerifolia,* London Plane Tree | | | *Melica californica,* California Melic* |
| *Quercus agrifolia,* Coast Live Oak* | | | *Miscanthus sinensis,* Japanese Silver Grass |
| *Quercus macrocarpa,* Bur Oak | | | *Muhlenbergia rigens,* Deer Grass* |
| *Quercus palustris,* Pin Oak | | | *Nassella lepida,* Neddlegrass* |
| *Salix lasiolepis,* Arroyo Willow* | | | *Nassella pulchra,* Purple Needlegrass* |
| *Thuja occidentalis,* Arborvitae | | | *Scirpus maritimus** |
| * = native to California | | | |
| Source: San Francisco Stormwater Design Guidelines, Appendix D: Vegetation Palette (Draft, No Date) | | | |

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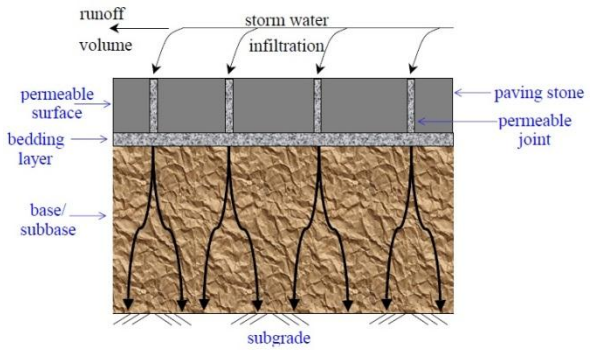
# Permeable Pavement Design for Small Projects

## Design Checklist

*List adapted from the Bay Area Stormwater Management Agencies Association Landscape Dispersion Fact Sheet, 2012 (Draft).*

- An open-graded base of crushed stone, which has 35-45% pore space, is installed below the surface pavement. The recommended base thickness is 6" for pedestrian use and 10" for driveways to provide adequate structural strength.
- Slope is flat or nearly flat (<2%)
- Flow directed to pervious pavement is dispersed so as not to be concentrated at a small area of pavement.
- No erodible areas drain onto the pavement.
- The subgrade is uniform and compaction is the minimum required for structural stability.
- If a subdrain is provided, outlet elevation is a minimum of 3" above the bottom of the base course.
- A rigid edge is provided to retain granular pavements and unit pavers.
- If paving is close to a building, a barrier or impermeable liner may be required to keep water away from the building foundation.
- Pavers are set in sand or gravel with minimum 3/8"gaps between pavers.
- Proprietary products installed per the manufacturer's specifications.
- Project complies with applicable sections of the current municipal code, including disabled access requirements and site drainage requirements if applicable.

*Mitigate for improvements by reducing the impervious surfaces on your site through the use of permeable pavement.*




| PERMEABLE PAVEMENT SELECTION MATRIX | | DESIGN METHOD ☐=unacceptable, ☒=acceptable, ■=best | | | | | | |
|---|---|---|---|---|---|---|---|---|
| PARAMETER | SITE CONDITION | Pervious Concrete (Asphalt Concrete or Portland Cement) | Porous Asphalt | Turf Block | Brick | Natural Stone | Concrete Unit Pavers | Crushed Aggregate |
| SOIL TYPE | Clay | ☐ | ☐ | ☒ | ☒ | ☒ | ☒ | ■ |
| | Loam | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ■ |
| | Shallow Bedrock | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| SLOPE | 0% to 3% | ☒ | ☒ | ■ | ■ | ■ | ■ | ■ |
| | 4% to 7 % | ■ | ■ | ■ | ■ | ■ | ☒ | ☒ |
| | 8% to 12% | ■ | ■ | ☒ | ☒ | ☒ | ☒ | ☐ |
| | >12% | ■ | ■ | ☐ | ☐ | ☐ | ☒ | ☐ |
| CLIMATE | SE Marin County | ■ | ☒ | ■ | ☒ | ■ | ■ | ■ |
| PROXIMITY TO WATER/STORM DRAIN | >1,000 ft *(usually rural areas)* | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| | 500 ft to 1,000 ft *(usually rural, some urban areas)* | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| | 100 ft to 500 ft *(usually urban, some rural areas)* | ☒ | ☒ | ■ | ☒ | ■ | ■ | ■ |
| | 50 ft to 100 ft *(usually urban areas)* | ☒ | ☒ | ■ | ☒ | ☒ | ■ | ☒ |
| COST *H=High M=Moderate L = Low* | Initial | H | H | M | H | H | H | L |
| | Maintenance | H | H | H | M | M | M | M |
| Effectiveness for reducing runoff | | ■ | ■ | ■ | ☒ | ☒ | ☒ | ■ |
| Durability/Life Span | | ☒ | ☒ | ☒ | ■ | ■ | ■ | ☐ |

*Table adapted from the "Condensed Planning & Design Guide for Surface Water Pollution Control Planning and Permanent Best Management Practices", Marin County Stormwater Pollution Prevention Program (no date).*
*Picture (left) source:*
*http://www.sfconcrete.com/products/sfrima/SFRimaEngineering.pdf*

# Permeable Pavement Design for Small Projects

## Local Contractors, Suppliers, and Landscape Architects

*Typical Costs:*
*Pervious Concrete = $15-$18/SF*
*Porous Asphalt = $13.50-$16.50/SF*
*Permeable Pavers = $20/SF*

**Suppliers – Aggregate**

*West Coast Aggregates*
37350 Bird Road
Tracy, CA 95304
209-835-5020

*Pavex Construction*
7700 Edgewater Drive, Suite 322 Building B
Oakland, CA 94621-3025
521-729-5075

**Suppliers – Permeable Pavers**

*Belgard/OldCastle/ Turfstone Pavers*
www.belgard.biz

*Cambridge Pavingstones*
www.cambridgepavers.com

*Unilock Paving Stones*
www.unilock.com

**Contractors – Permeable Pavers**

*Black Diamond Paver Stones & Landscape, Inc.*
4040 Civic Center Drive
San Rafael, CA 94903
408-353-2992

*Van Midde & Son Concrete*
490 B Street
San Rafael, CA 94901
415-459-2530

*True Nature Landscape Management, Inc.*
P.O. Box 2031
Fairfield, CA 94533
888-456-0769

*Legacy Paver Group*
Santa Rosa, CA 95405
707-573-9080

**Contractors – Permeable Pavers and Decomposed Granite**

*Herzer Landscaping*
510-278-8001

**Contractors – Pervious Concrete**

*Van Midde & Son Concrete*
490 B Street
San Rafael, CA 94901
415-459-2530

**Consultant – Landscaper/Landscape Architect**

*Pedersen Associates*
24 H Street
San Rafael, CA 94901
415-456-2070

*Catlin Landscape Architecture*
1501-A San Anselmo Ave.
San Anselmo, CA 94960

*Jeffrey McLane + Associates Inc.*
330 Sir Francis Drake Blvd., Suite G
San Anselmo, CA 94960

*Leigh Designs*
Richmond, CA 94804
510-559-6969

*Mitchell Landscapes*
Petaluma, CA
415-717-6214