



Swales Reduce Runoff

Background Information

Swales are densely vegetated drainageways with low-pitched slopes that collect and slowly convey runoff. They promote infiltration and reduce stormwater runoff volumes. Grass swales can replace curbs, gutters and storm sewer systems.

Grass swales typically cost less to construct than curbs, gutter or storm sewer systems. Using grass swales can also reduce the size and expense of constructing and maintaining downstream stormwater management facilities. However, swales require some maintenance, which may incur some additional cost.

Community Strategies

- Consider revising street standards, where appropriate, to encourage uncurbed roads, installing grass swales instead.
- Consider requiring swales in and around parking lots.

Examples

Please see backside for examples.

At a Glance

- Vegetated swales can often replace curbs, gutters and storm sewer systems.
- They promote infiltration and reduce stormwater runoff volumes.
- Swales can be a less expensive alternative to traditional curbs, gutters and stormwater management systems.

Swales Promote Infiltration



For More Information

[California Stormwater Best Management Practice Handbooks by the California Stormwater Quality Association \(CASQA\) www.cabmphandbooks.com](http://www.cabmphandbooks.com)

[Fact Sheet – Dry and Wet Vegetated Swales, Federal Highway Administration
www.fhwa.dot.gov/environment/ultraurb/3fs10.htm](http://www.fhwa.dot.gov/environment/ultraurb/3fs10.htm)

[Truckee Meadows Regional Stormwater Quality Management Program Structural Controls Manual
http://www.cityofreno.com/Index.aspx?page=1007](http://www.cityofreno.com/Index.aspx?page=1007)

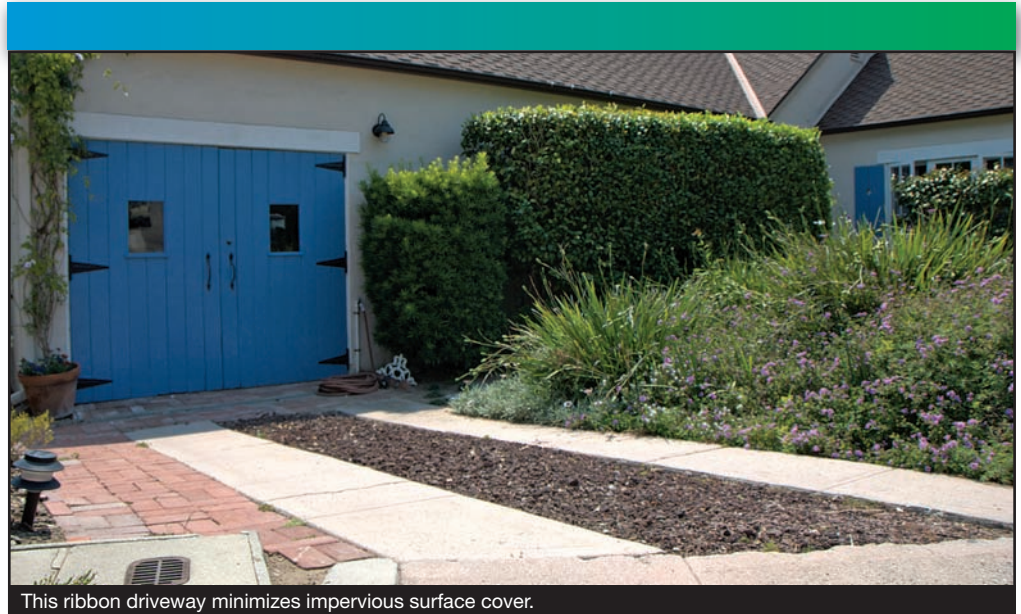
[U.S. Environmental Protection Agency, Vegetated Swales: Stormwater Technology Fact Sheet
www.epa.gov/owm/mtb/vegswale.pdf](http://www.epa.gov/owm/mtb/vegswale.pdf)

Ventura Countywide Stormwater Quality Management Program Technical Guidance Manual for Stormwater Quality Control Measures, July 2002

Photo Credits

Front: Monique Myers

Back: Nora Reyes



This ribbon driveway minimizes impervious surface cover.

Alternative Driveway Design

Background Information

Driveways add a significant amount of impervious cover in a community. Driveways often slope to the street and are direct conduits of pollutants from automobiles – emissions, leaks and deteriorating metal parts – as well as from household activities, such as washing and repairing vehicles, maintaining lawn equipment and applying salt for ice removal.

By reducing driveway length and width, less polluted runoff occurs, and construction and maintenance costs are lower.

Community Strategies

- Encourage the use of shared driveways to reduce impervious areas.
- Consider ribbon driveways, which are two strips of pavement with grass or other porous surface in between. They are cheaper to build and reduce impervious coverage.
- Do not allow roof gutters and downspouts to drain onto driveways.
- Allow and promote the use of porous driveway surfaces, such as porous pavers and reinforced grass grids.
- Consider maximum limits on driveway lengths, widths and curb cut widths.
- Consider relaxed front yard setback requirements to reduce driveway length.

At a Glance

- Driveways are a significant component of a community's impervious surface coverage.
- To reduce impervious cover, driveways should be designed to be as narrow, short and few as possible.

Alternative Driveway Design

Examples



For More Information

[NEMO Technical Paper Number 6 – Driveways](http://www.nemo.uconn.edu/tools/publications.htm#technical) <http://www.nemo.uconn.edu/tools/publications.htm#technical>

[California Stormwater Best Management Practice Handbooks by the California Stormwater Quality Association \(CASQA\)](http://www.cabmphandbooks.com) www.cabmphandbooks.com

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Monique Myers



Porous Pavement Reduces Surface Runoff

Background Information

Porous paving systems have been shown to reduce surface runoff volume and calm flooding. Permeable pavements can reduce total impervious surface, as well as minimize directly connected impervious areas.

Porous paving systems include modular concrete pavers, which interlock and allow water to drain through, and flexible plastic grid networks, which when used with grass, protect root systems and stabilize soil. In some applications, gravel can be used as an alternative to pavement.

Porous paving systems are particularly useful for sidewalks, overflow parking, driveways, fire lanes, road shoulders and other areas of low-traffic volumes and loads.

Permeable paving systems vary widely in cost and are generally more expensive than typical asphalt pavement. However, the use of permeable paving can reduce the need for construction and maintenance of stormwater management facilities, resulting in cost savings over the long term.

Community Strategies

- To reduce runoff, encourage the use of porous pavement systems for sidewalks and low-volume traffic and parking areas.

At a Glance

- Porous paving systems can reduce runoff volume while encouraging infiltration.
- Porous paving systems are best suited for low-traffic applications such as sidewalks, overflow parking, driveways and fire lanes.
- They may reduce the need for construction and maintenance of stormwater management infrastructure, resulting in cost savings.

Porous Pavement Reduces Surface Runoff

Examples



For More Information

[California Stormwater Best Management Practice Handbooks by the California Stormwater Quality Association \(CASQA\) www.cabmphandbooks.com](http://www.cabmphandbooks.com)

[The City of Santa Monica provides a list of permeable pavement products and supplier information http://www.smgov.net/epd/residents/Urban_Runoff/urban.htm](http://www.smgov.net/epd/residents/Urban_Runoff/urban.htm)

[Greenbuilder Sourcebook http://www.greenbuilder.com/sourcebook/PerVIOUSMaterials.html](http://www.greenbuilder.com/sourcebook/PerVIOUSMaterials.html)

[NEMO Technical Paper Number 8 – Pavements and Surface Material http://www.nemo.uconn.edu/tools/publications.htm#technical](http://www.nemo.uconn.edu/tools/publications.htm#technical)

[The Urban Drainage and Flood Control District Volume 3 - Drainage Criteria Manual provides guidelines. http://www.udfcd.org/downloads/down_critmanual.htm](http://www.udfcd.org/downloads/down_critmanual.htm)

Photo Credits
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This Southern California yard demonstrates the beauty of Xeriscaping™ in a semi-arid environment.

Natural Landscaping Reduces Runoff

Background Information

Natural landscaping involves both site design and plant selection.

Native plants are adapted to local climate, soil and environmental conditions. Properly placed, they require very little maintenance and water – and that means better water quality because there is less runoff, and less need for pesticides and fertilizers.

Non-native Xeriscape™ plants also require less water and chemical support, and may be good landscape choices as long as they are not on the state's noxious weeds list.

Community Strategies

- As a key part of site planning, preserve and enhance existing natural areas such as prairies, wetlands and floodplains.
- Encourage the use of native species and/or Xeriscaping™ in your community's landscape design criteria.

Examples

Please see backside for examples.

At a Glance

- Low maintenance plants that require little water result in better water quality because there is less runoff, and less need for pesticides and fertilizers.
- Native plants, which are adapted to local climate, soil and environmental conditions, are often used in natural landscaping design.
- Non-native Xeriscape™ plants may be good choices as long as they are not on the state's noxious weeds list.

Natural Landscaping Reduces Runoff



For More Information

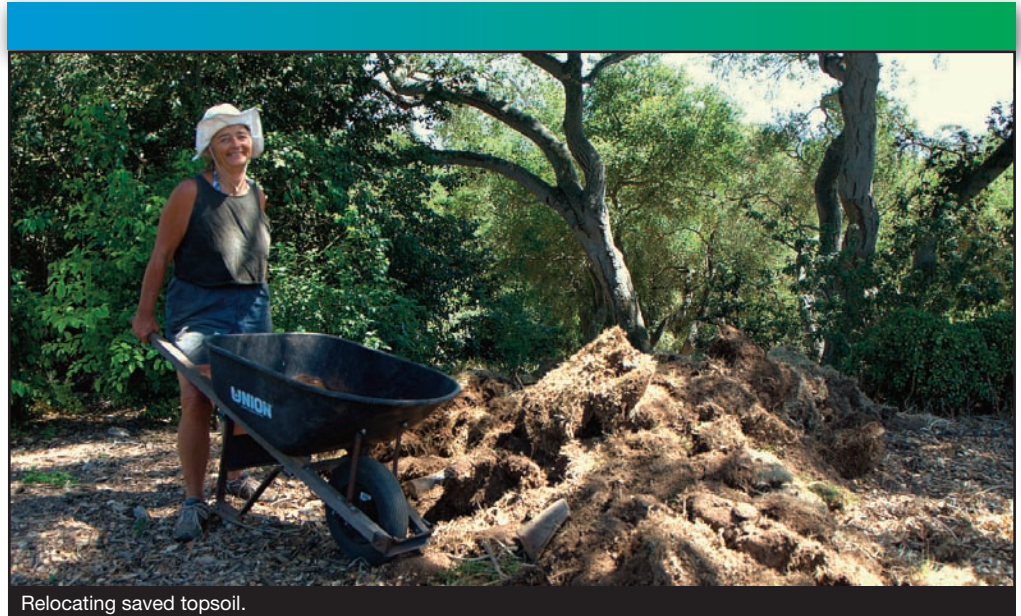
[EPA – A Sourcebook on Natural Landscaping for Public Officials
www.epa.gov/glnpo/greenacres/toolkit/chap1.html#WHAT%20IS](http://www.epa.gov/glnpo/greenacres/toolkit/chap1.html#WHAT%20IS)

[California Stormwater Best Management Practice Handbooks by the California Stormwater Quality Association\(CASQA\) http://www.cabmphandbooks.com/Documents/municipal/sc-73.pdf](http://www.cabmphandbooks.com/Documents/municipal/sc-73.pdf)

[Greenbuilder Sourcebook http://www.greenbuilder.com/sourcebook/Xeriscape.html](http://www.greenbuilder.com/sourcebook/Xeriscape.html)

[USDA Invasive and Noxious Weed List http://plants.usda.gov/java/noxious](http://plants.usda.gov/java/noxious)

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Saving and Amending Topsoil

Background Information

Topsoil, which contains organic matter, is often removed when sites are graded during construction. The removal of topsoil, and compaction of soil by heavy equipment during construction, reduces the land's ability to absorb water, leading to increased imperviousness, especially in clay soils.

By saving and replacing the topsoil removed during construction, or amending soil with organic materials such as compost, the perviousness of the land can be re-established.

In addition, phased construction, in which smaller areas are cleared and graded, can help reduce imperviousness. Phased construction requires smaller grading equipment, which lessens the extent of areas affected by compaction and other disturbances. It also reduces exposed soils, on-site erosion and off-site sediment transport.

Community Strategies

- Require the saving and reuse of topsoil on site, or the amendment of soil with organic materials after construction.

At a Glance

- Removal of topsoil during construction increases imperviousness on site.
- Saving and replacing topsoil, or amending soil with organic matter, can help retain the site's ability to absorb water and prevent runoff.
- Phased construction can help reduce imperviousness since the smaller equipment used lessens soil compaction.

Saving and Amending Topsoil

Examples



For More Information

[Manual of Standards for Erosion Control Measures by the Association of Bay Area Governments and California State Water Resources Control Board, Order from <http://store.abag.ca.gov/environment.asp#ec1>](http://store.abag.ca.gov/environment.asp#ec1)

[CA EPA State Water Resources Control Board Non Point Source Pollution Control Program <http://www.swrcb.ca.gov/nps/index.html>](http://www.swrcb.ca.gov/nps/index.html)

[CA Nonpoint Source Encyclopedia by CA EPA and State Water Resources Control Board <http://www.swrcb.ca.gov/nps/encyclopedia.html>](http://www.swrcb.ca.gov/nps/encyclopedia.html)

[Sonoma County Vineyard Erosion and Sediment Control Ordinance \[www.sonoma-county.org/agcomm/vesco.htm\]\(http://www.sonoma-county.org/agcomm/vesco.htm\)](http://www.sonoma-county.org/agcomm/vesco.htm)

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Tall trees provide welcome shade on a Southern California street.

Tree Cover Provides Multiple Benefits

Background Information

Trees increase real estate values by as much as 15 percent, according to the National Association of Home Builders.

A 2005 report shows tree cover in Boulder, Colo. reduces stormwater runoff by an estimated six million cubic feet annually, saving the city approximately \$532,311. The average tree intercepts 1,271 gallons of stormwater annually, with a value to the community of \$15 per tree.

Tree ordinances that specifically relate to planting and managing trees can be a useful tool in maintaining a community's healthy tree canopy and protecting aquatic resources. These ordinances can be grouped into three categories:

1. Street trees: Deals with the planting and removal of trees in rights-of-ways, parking lots, etc.
2. Tree protection: Intended to protect native or historical trees. These laws can relate to removal, building near, pruning, etc.
3. View: Relates to trees blocking views or sunlight.

At a Glance

- Urban forests are an essential part of cities, rural areas, streets, backyards, parks and open spaces. They reduce the volume and intensity of runoff, as well as minimize the heat effect on receiving waters.
- A study of stormwater prevention provided by tree canopy in Boulder, Colo., showed a significant reduction in polluted runoff.
- Tree ordinances that are well written and are part of a well-planned strategy can promote community tree cover and protect aquatic resources.

Tree Cover Provides Multiple Benefits

Community Strategies

- Consider adopting a tree ordinance that will maintain the existing tree canopy. However, not all trees are worth saving, and your community should be specific about which trees it wants to protect.
- Require that trees destroyed during development be replaced with desirable species.

Examples

The Los Angeles County Oak Tree Ordinance protects oak trees 8" in diameter or more in recognition of their significant ecological, aesthetic and historical attributes.

The City of Manhattan Beach has an ordinance protecting all street trees in residential zones that are 12" or larger in diameter with the exception of Washingtonia palms and fruit trees.

The Ventura County Tree Protection Ordinance governs the trimming and removal of all oaks, sycamores and trees with a specific historical designation.



For More Information

[Built Green Communities™ Checklist www.builtgreen.org/community/community_checklist.pdf](http://www.builtgreen.org/community/community_checklist.pdf)

[Calculating the Value of Boulder's Urban Forest
http://www.bouldercolorado.gov/](http://www.bouldercolorado.gov/)

[Guidelines for Developing and Evaluating Tree Ordinances www.phytosphere.com/treeord/ordprt1a.htm](http://www.phytosphere.com/treeord/ordprt1a.htm)

[Protecting Our Waters - Street Trees http://clean-water.uwex.edu/plan/streettrees.htm](http://clean-water.uwex.edu/plan/streettrees.htm)

[Tree Preservation Ordinance - National Association of Homebuilders
www.nahb.org/generic.aspx?genericContentID=19086](http://www.nahb.org/generic.aspx?genericContentID=19086)

[Washoe County Development Code, Division 4, Development Standards
www.co.washoe.nv.us/comdev_files/dc/012505_division_four.pdf](http://www.co.washoe.nv.us/comdev_files/dc/012505_division_four.pdf)

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