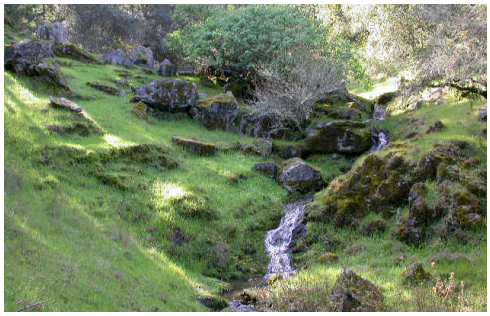
Salmon Creek Water Conservation Program

Conservation Strategy No.4: Stormwater Management for Coastal California Communities

Coastal Conservancy



Overview

In many California coastal communities, reliable access to fresh water is limited and watershed health and instream flows are growing concerns. Current trends toward longer droughts and more severe storms render traditional methods of stormwater management ineffective. Development of a robust, scalable, decentralized stormwater management strategy is critical for addressing watershed health and water security.

Target community

All landowners, residents, businesses, and land managers in all coastal California communities whose stormwater runoff is impacting natural waterways, especially those supporting endangered and threatened species.

Potential effect

Implementation of effective stormwater management measures will result in the following benefits, addressing both human needs and total watershed health.

Watershed:

- Increasing uplands water infiltration and retention capacity will improve water security by recharging groundwater aquifers, while increasing base flows in streams and reducing mortality in endangered fish populations
- Slowing down stormwater runoff will decrease topsoil loss, erosion, flooding and stream flow variance by reducing the volume and rate of peak flow events
- Removing pollutants in runoff will improve water quality in streams and aquifers
- Reducing the delivery of erosion products to streams will increase flows by keeping pools and riffles free of excessive sedimentation

Landowner:

- Recharged groundwater supplies will increase water security by improving the function of groundwater wells and alleviate the economic and resource costs of trucking in water
- Well-designed roads retain better drivability, with reduced maintenance needs
- Reduced flooding protects property values and lowers expenses for stopgap measures like pumping, levees and raising houses
- More infiltrated and stored water onsite helps increase fire suppression capacity and defensible space
- Retaining soil keeps land productivity high, lowering fertilizer costs

Implementation

This Conservation Strategy provides an overview of major elements in stormwater management common to all land uses, followed by land uses of special concern. Tools and resources are provided for further research.

What is stormwater?

Stormwater is water flowing on land surfaces during or within 24 hours of a precipitation event that is not infiltrated into the soil. Historically it has been viewed as a problem primarily of urban areas to be solved by the outmoded engineering practice of "pave it and pipe it". This method fails to properly manage stormwater in the uplands, with disastrous consequences—large, powerful volumes of water, moving too fast, resulting in severe erosion and flooding in low-lying areas. This excessive runoff requires expensive engineered systems that simply move the problem downstream until the runoff enters a stream and ultimately the ocean, leaving the ecosystem to absorb the excess volume and pollution. This paradigm creates a cascade of negative effects.

According to a comprehensive study done in 1997, "Streams with increasing imperviousness exhibit many of the following conditions: increased flood peaks, lower stream flow during dry conditions, degradation in stream habitat structure, increased stream bank and channel erosion, fragmentation of riparian forest cover, and decline in fish habitat quality." (Kauffman, Brant)

Instead of a problem, water can more accurately be viewed as an enormously valuable resource to be sequestered and re-used whenever possible, and from this perspective, it makes good sense to keep it around. Slowing, spreading and sinking stormwater as high in the uplands as possible will ensure that any water discharged from hardscapes will be clean and moving slowly enough to avoid erosion and sedimentation problems.

The trouble with impervious surfaces

It is important to note that,h in the context of stormwater management, the phrase "impervious surfaces" refers to a gradient of impermeability. This is expressed as a percentage of impermeability relative to the original, pre-human-use condition.

Virtually all surfaces modified for human use lose permeability, and the current perception of impervious surfaces as exclusively concrete, asphalt and roofing (100%) fails to address the total impact of reduced permeability. Many rural land uses such as poorly designed and maintained roads, subsurface drained hillside vineyards, overgrazing and excessive discing, while only partially impervious, tend to encompass a much larger total surface area resulting in stream flow variance, flooding and erosion that can be more severe even than urban areas.

Even small increases in impervious surfaces have a disproportionately large impact on watershed health. A study in Washington found that fish habitat quality and channel stability both deteriorate rapidly after watershed cover increases to 10% imperviousness (Booth, 1991), while Maryland found that brown trout abundance declined sharply at 10-15% (Galli, 1993).

Lost permeability prevents rain infiltration and creates higher volumes of runoff and greater water velocity, which:

- Cause topsoil loss, sedimentation and downcutting of watercourses
- Exacerbate flooding
- Reduce groundwater recharging rates
- Decrease stream base flow during dry months

Increased wet season flow rates also worsen pollution. Water moving faster in larger volumes will be carrying a higher sediment load as well as more of the pollutants accumulated from roads, lawns, vehicles, farms, vineyards, ranches and all other human uses. When these contaminants become waterborne they seriously impair watershed health. Decreased stream base flow during dry months concentrates pollutants and disconnects pools, dramatically increasing mortality for all aquatic life.

Performing a site assessment

To find out if your current stormwater management practices are successful, begin by performing a site assessment. Make it as comprehensive as possible, and remember that a walk in the rain is the best way to get good information.

1. Walk the perimeter of all impervious surfaces—a road, parking area, roof, patio, stable, pasture, or other modified surface. The surfaces themselves are not necessarily problems either—often the dangerous part is the drainpipe, culvert, ditch or other drainage structure where the water concentrated by the impervious surface gains volume and speed.
2. Find out whether the water that comes off these surfaces leaves your property.
3. If it leaves the property, find all the locations where stormwater exiting your property enters a natural waterway—a stream, river, wetlands, lake, or the ocean.

Having followed all the water leaving your property, answer the following questions:

- Where this runoff daylights (leaves a drainpipe or other subsurface drainage structure), do you see recent erosion scars or obvious fresh soil being removed?
- If causing erosion, is this runoff also carrying sediment to a natural body of water?
- Has this stormwater been running through manures, soils that have been exposed to or treated with chemicals, or other contaminated sites on your property?
- Have you seen or do you have reason to believe that the water has been exposed to any kind of contaminant upstream of your property?

If you answered yes to any of these questions, you will benefit from implementing updated stormwater management practices.

Strategies for stormwater management

With acute sediment delivery, all that can be done initially is to keep the water clean. Sediment controls are the first step, and will at least keep the erosion products from reaching a natural waterway, but they do nothing about the actual erosion problem.

- Sediment fences are sturdy, permeable fabric barriers that can be rapidly staked out in the path of an uncontained flow to catch soil.
- Straw bales packed tightly end to end will act as a sediment fence and keep erosion product from reaching a stream, but degrade over time.

- Straw wattles act like straw bales, but are lighter and more suitable for small-scale control.

Erosion controls will help retain valuable topsoil and buy time to trace the source of the problem upstream. While stabilizing the headcut (the actively eroding upper edge of the gully) at the erosion site may alleviate some erosion problems, it will not address the fact that the system is receiving too much water.

- For concentrated outflows, start by placing energy dissipators to break up the force of the water and protect the banks from further collapse. Depending on flow volume, you can use large rocks, brush check dams (a small dam constructed in a gully to stabilize the grade or control headcutting), or hand-place thick mats of brush at the headcut and bed of the gully downstream. These woody materials can be harvested through limbing and thinning forests as part of a fuel load reduction project.
- For large areas of bare soil showing rill erosion (small shallow channels no more than a few inches deep found in newly exposed soils), first select and plant an erosion control seed mix that uses native, non-invasive plants. Then mulch with straw to keep birds from eating the seeds, or use erosion control blankets—biodegradable woven textiles that keep soil in place and help plants get established. Do not use plastic netting products—they can trap and kill wildlife

There are many different strategies available for both sediment and erosion control—a testament to the ever growing need. For an excellent guide, read *Groundwork: A Handbook for Small Scale Erosion Control in Coastal California*, available online at http://www.mcstoppp.org/acrobat/groundwork.pdf

Contact your local supplier of erosion and sediment control products for information on current tools and reputable local contractors.

Permanent stormwater management solutions are by far the preferred method because they stop problems before they start. Using source control strategies means working as far upstream as possible to slow down stormwater, spread the water out on the landscape, and sink it into the soil to avoid excess runoff. These decentralized stormwater techniques are effective because:

- Dealing with the source of the problem means you only have small amounts of water to manage, and the scale and expense of the actions you need to take are proportionately smaller but have greater impact
- Increasing the frequency of energy/flow dispersion provides many small opportunities to infiltrate water that would otherwise become runoff

At the community level the ideal is to disconnect those land uses with decreased permeability from direct discharge/drainage to the stream network as completely as possible.

The following effective, long-term stormwater management or low impact development strategies have proven track records, and are detailed in the references available in the "Tools" section below:

- **Roofwater Harvesting** captures rain and retains it onsite to prevent runoff entirely. See our Roofwater Harvesting Strategy for more information.
- **Contour Infiltration Trenches** are shallow trenches dug on contour that catch, temporarily hold and infiltrate runoff and, when full, direct water to an appropriate catchment or overflow area.

- **Rain Gardens** are excavated and planted depressions designed to thrive on the high volumes of water and nutrients in stormwater runoff while slowing down the water and soaking it into the soil.
- **Bio-Swales** are gently draining, off-contour channels that are heavily planted to improve water quality prior to discharge.
- **Ground Covers** such as mulch, gravel, or vegetation keep soil in place and trap water, giving it time to infiltrate.
- **Mycofiltration** is a strategy that uses fungus to break down nutrients, chemicals and other pathogens such fecal coliform bacteria that harm waterways. Paul Stamet's book *Mycelium Running* is the definitive guide to all uses of fungus.
- **Pervious Hardscapes** (grass pavers, porous concrete, etc.) allow water to seep into the ground naturally, while retaining useful hard surfaces.
- **Enlist your upstream neighbor**—Sometimes a friendly chat can move your ideas upstream and make them more effective. Try giving them this guide and offering a helping hand, or offer them a tour after installing your own measures.

Specific site challenges

No one strategy is right for all locations, so consider the following before beginning any new stormwater management measures.

- Steep slopes and landslide areas are inherently unstable, so avoid directing or infiltrating runoff at them, and be sure all drainage systems end well away from them. Landslide zones are too dangerous to modify without professional consultation, and can put others at risk. Proceed with caution.
- In low-lying areas and floodplains where infiltration is not possible, increasing the available surface area of bio-filtration will at least clean up the water before it leaves your property and help as part of flood control management downstream.
- Coastal bluffs are highly sensitive to erosion, and require considerable planning for successful site drainage.

Land uses of special concern

For the purposes of this Conservation Strategy, commercial logging operations, dairies, construction sites and vineyards will not be discussed. Please refer to professionals and authorities for help with these land uses as needed.

Regulations and Permitting

Before starting any work, research existing plicies or ordinances that regulate land use and stormwater. Checking with your county resource management or planning department is a good place to start.

Roads

If you do only one thing, work with your roads. Nothing impairs the natural drainage and infiltration functions of a watershed more than roads. Without exception, more roads mean more degraded natural stream networks. By acting as a network of artificial streams, all flowing dramatically faster and carrying

much higher sediment loads than natural streams, roads create excessive water volume that worsens erosion, sedimentation and downcutting of stream beds. For the complete manual on roads, see *Handbook for Forest And Ranch Roads*, by William E. Weaver & Danny K. Hagans.

Animal Husbandry

This includes small-scale animal operations from goats, chickens and a few horses to larger scale equestrian facilities, commercial dairies and livestock grazing operations. When improperly managed, concentration of manures results in increased nutrient flows in streams, leading to algal blooms, low oxygen conditions (eutrophication) and fish mortality. Good practices include:

- Keep roofwater and hardscape drainage from running through all areas where manures are concentrated, and prevent direct runoff to the creek
- Move manure to safe containment and composting areas that exclude stormwater
- Employ riparian fencing to reduce livestock "loafing time" in the creeks

Other strategies are available online at: www.mcstopp.org/acrobat/Horse%20Keeping%20Guide.pdf

Tillage Based Agriculture

"Agricultural activities account for the largest percentage of non-point source pollution in the United States. Soil erosion and runoff of pesticides are the major problems…" (General Accounting Office, 1990). Regardless of scale or regulatory conditions, all intensive agricultural operations need to pay special attention to erosion, sedimentation and chemical runoff. Some successful strategies include:

- Using contour plowing, cover crops and/or no-till techniques
- Maintaining vegetation in ditches to act as bioswales
- Incorporating sediment basins and tailwater ponds

For more information, see www.agwaterstewards.org/txp/Resource-Center

Rural Residential Wastewater Systems

Improperly maintained or aged and failing septic tanks and leach fields can become sources of significant nutrient and fecal coliform pollution during peak runoff events.

Owners of septic systems need to test and maintain their systems annually to ensure proper function. *Wells and Septic Systems* by Max and Charlotte Alth is a useful guide.

Urban Areas

Urban stormwater from various sources (golf courses, ball fields, median strips and industrial park landscaping) has been proven to significantly increase pollution in runoff. Low Impact Development (LID) is a well-developed collection of strategies for urban stormwater management. More information on LID design and maintenance practices is available from the *Bay-Friendly Landscaping Guidelines: Sustainable Practices for the Landscape Professional* by Alameda County Waste Management Authority. Visit www.stopwaste.org

Tools

Web

The Center for Watershed Protection is one of the most comprehensive sources of information on stormwater management. See: http://www.cwp.org/Resource_Library/Better_Site_Design/index.htm

The Low Impact Development (LID) Urban Design Tools Website offers excellent design ideas for the numerous techniques and examples of applied LID at http://www.lid-stormwater.net/

Most coastal counties now have stormwater management websites. For a list of bay area municipal websites, visit the Bay Area Stormwater Management Agencies Association: http://www.basmaa.org/About-BAstormwater managementAA/tabid/55/Default.aspx

Books

One of the best guides, written in a very accessible style with many homeowner-scale examples, is *Slow It Spread It Sink It: A Homeowners Guide to Greening Stormwater Runoff* by the Santa Cruz RCD.

http://www.rcdsantacruz.org/media/brochures/pdf/HomeDrainageGuide.v25.pdf

For the ultimate guide to managing water with earthen structures, see *Rainwater Harvesting for Drylands, Volume 2: Water Harvesting Earthworks* by Brad Lancaster. http://www.harvestingrainwater.com

For help with designing and installing a rain garden, read *Rain Gardens: Managing Water Sustainably in the Garden and Designed Landscape* by Nigel Dunnett and Andy Clayton, www.timberpress.org

Design for Water by Heather Kinkade-Levario offers a suite of creative approaches and applications of stormwater management, and includes many case studies.

Coastal Conservancy

This conservation strategy was produced by Brock Dolman and Kate Lundquist, Occidental Arts and Ecology Center's WATER Institute and Kevin Swift, Swift Writing, for the Salmon Creek Water Conservation Program (SCWCP). The SCWCP is a multi-year, multi-stakeholder effort focused on developing alternative water supply solutions that support human needs while protecting and restoring instream flows for fish and wildlife.