PART V

Stormwater

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Stormwater: Infiltrating, Screening and Cleaning Runoff

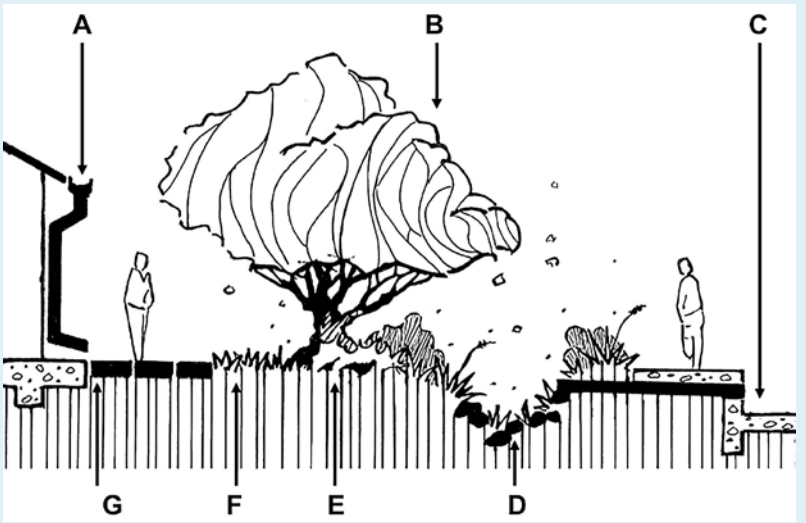
Water is essential for life, and stormwater management is important because it protects this essential resource. The EPA has said that stormwater runoff is the largest source of urban water pollution and a major source of pollution for all waterbodies in the U.S. In Southern California stormwater runoff creates 80% of all ocean pollution. California is aware of the impact of stormwater runoff and has taken action.

Whether through building codes, voluntary certification, or simple advocacy, California has built tens of thousands of small-scale stormwater management systems. All these systems need maintenance to properly perform. But, because up to 70% of urban areas are under impervious cover and up to 50% of all rainfall turns into runoff, managing stormwater systems requires both skill and time.

Managing stormwater involves slowing, infiltrating, and screening and cleaning runoff. This chapter is focused on the last three aspects of the process. Slowing runoff and managing surfaces, which are also a vital parts of stormwater management, are covered in the following chapter. At the end of this chapter is a bulleted checklist for action.

Just Before the Start of the Rains

Handling stormwater in Southern California means that a majority of the maintenance occurs in mid to late fall, just before the first rains. These annual tasks include:



A. Clean gutters, filters and screens.

B. Protect infrastructure, such as structures and utility lines, from vegetation.

C. Sweep and clean curbs and culverts.

D. Remove sediment from infiltration areas.

E. Mulch exposed soil.

F. Aerate compacted soils.

G. Sweep or vacuum impermeable surfaces.

Infiltrating Runoff

An infiltration basin, often called a rain garden, is an area designed to capture runoff and allow the water to sit and soak. There are two types of infiltration: above-ground and below-ground. Above-ground infiltration devices are preferred over below-ground. Above-ground devices are quickly and inexpensively constructed, and are also easily monitored, altered, and maintained. Below-ground devices are usually used only when space is limited.

Water that runs will move things. Leaves, litter and toxic residues all end up in infiltration basins. Maintenance is essential to a well functioning and healthy system.

Above Ground Infiltration

Dry Stack Walls: Dry stack walls are a quick and efficient way to stop runoff on low to medium steep slopes. They are usually short walls running mostly perpendicular to a slope or water path. Two types of problems occur and two types of maintenance are required. First, dirt and debris will collect on the wall's upslope side, reducing its water holding and slowing capacity, while increasing pressure on the structure. Remove this accumulation every 2 to 4 years. Second, the downward side of the wall will erode, eventually undermining it. Every 2 to 3 years pull the soil back up to the wall and either plant to stabilize or compact it.

Infiltration Basins/Seasonal Ponds: Landscaped depressions are anything that allows water to sit and slowly infiltrate. Infiltration areas require vegetation management, such as pruning and thinning as well as the removal of sediment. Ideally, dirt, debris and sludge should be removed from a basin when it loses 10% of its capacity, which occurs approximately every 2 to 6 years depending on use. Avoid trampling and compacting the soil when cleaning the basin; pick specific paths and lay down boards to protect soils. For vegetation management, see the sidebar later in the chapter.

The rocky depression pictured is plumbed to capture the roof water and regularly fills with debris, leaves and weeds. Like all depressions, this infiltration area needs a thorough cleaning every other year.

Micro Basins: Micro basins are simply small depressions dug into a landscape. They are quick to construct and effective on flat to medium steep slopes. Over time these basins will fill with dirt and debris, so re-grading will be necessary every 2 to 4 years.

Rain Gardens: Rain gardens are used when space is tight and runoff great. They might employ both above- and below-ground devices, such as an infiltration basin and dry well. They can also be as simple as a raised planter. The above ground areas fill rapidly with dirt, debris and plants and will need cleaning every other year. If runoff is run through aggregate with only cursory screening, then the small rock may have

to be pulled up and washed every 5 years. Because of the rich, porous soil, plants thrive in rain gardens. Consequently they will need regular maintenance. Vegetation Management is covered in detail later in this chapter.

Swales: Swales are built to move runoff through a landscape. Swales are earthen, or have earthen bottoms, and allow for infiltration. A grass and rock lined swale can stop up to 85% of the runoff from a small to medium rain event. Dirt and debris fill these sinuous depressions, and re-grading will be needed every 3 to 5 years. Soil slumps are not uncommon occurrences in swales, and rebuilding a swale's wall may be necessary during the rainy season. Weeds are a constant problem; their management is covered in the Weed Control chapter.

A colony of crabgrass has taken root in this rocky swale. If not removed, the crabgrass might affect the flow of water and cause unwanted pooling elsewhere.

Vegetation Management

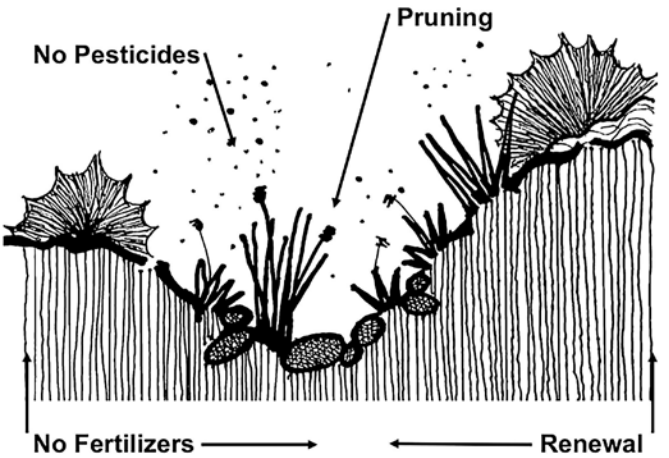
Vegetation is excellent at stopping rain from becoming runoff. Turf is good, but trees and shrubs are even better. As opposed to lawns, between to 30% to 50% more rain is captured in landscapes planted with trees, shrubs and ground covers. Unfortunately, vegetation has its own set of problems. Plants can change a soil's grade and become a nuisance to urban infrastructure. Use the tips below to effectively manage vegetation in infiltration areas.

Fertilizing: Because everything gravitates toward a depression, infiltration areas get plenty of nutrients and rarely need fertilization. Don't apply fertilizer unless you see signs of nutrient deficiency. If fertilization is needed, follow these guides to reduce leaching: Never fertilize before or during the rainy season; use easily digestible fertilizers, such as fish emulsion; and decrease the amount applied by half to two-thirds, but fertilize more frequently.

Pesticides: Because they are moister areas than the rest of the landscape, infiltration areas tend to attract weeds, insects, and fungus. However using pesticides and herbicides to control these problems undermines the whole purpose of the basin—which is improving the quality of our water. Therefore pesticides and herbicides should always be avoided; use the principles of Integrated Pest Management (IPM) instead. Refer to the chapter on Weed Control for alternatives to harmful herbicides.

Pruning: Plants grow vigorously in infiltration areas because they have moist and rich soil. Pruning is necessary to protect people, infrastructure, and to ensure good air circulation, which will reduce many pests. Whether dividing or thinning, try to avoid pruning just before or during the rainy season. Refer to the Plant chapters for specific pruning recommendations.

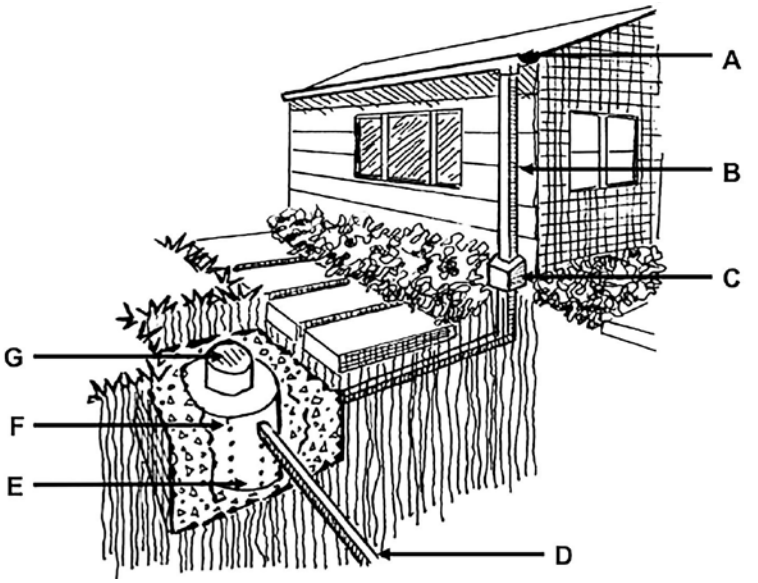
Renewal: Replant dead, dying and diseased vegetation with evergreen plants, not deciduous ones. A deciduous tree can catch up to 760 gallons of rainwater a year, a mature evergreen up to 4,000 gallons. Deciduous trees not only intercept less rain, they also litter profusely. Some can drop 400 pounds of leaf litter a year. Deciduous vegetation is not recommended near impervious surfaces that lead to storm drains, such as parking lots and streets.



Below-Ground Infiltration

Below-ground infiltration devices are used where space is limited. These devices are expensive to construct and demand a greater amount of attention. Because debris and sediment will eventually fill or clog these devices, screening and cleaning the incoming water is essential to system longevity.

Dry/Infiltration Wells: A dry well is a large pit lined with filter fabric and filled with a variety of porous objects. See the illustration below for specific maintenance tasks.



A.* Make sure leaf guards are secure and in working condition.

B. Test the first-rain diversion device to make sure it is operational.

C. Clean the ¼" screen within the downspout once a month during the rainy season.

D.* Check or install a flap gate on the overflow pipe if mosquitos or vermin are a problem.

E. Remove sediment from the below-ground canister every year to every third year, depending on use and number of screens

F. Lift up, wash, and reset the entire system if infiltration falls to unacceptable levels. If new aggregate is needed, then use rounded drain rock 1" to 1.5" in diameter.

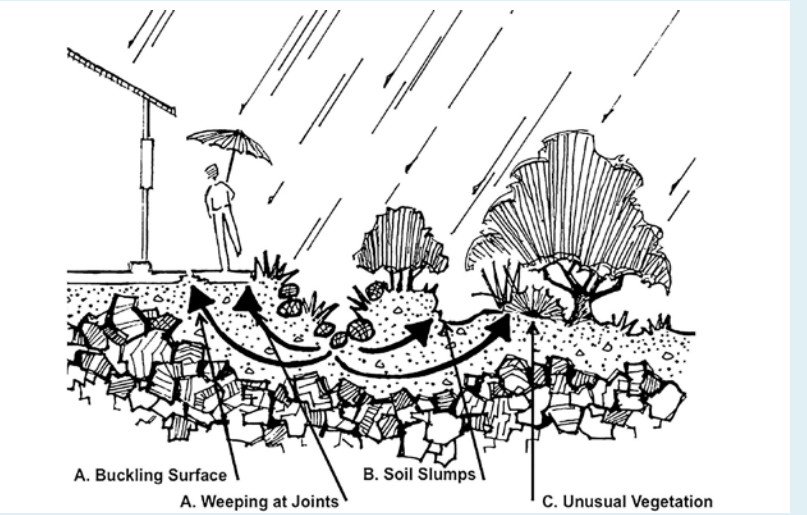
G.* Make sure that the inspection port has no opening so that insects cannot enter the chamber below

***Note:** *Mosquitoes will fly surprisingly long distances down pipes to reach water. It is critical, especially for below ground cisterns, that pipes and vents be screened if they are open to the atmosphere and one-way valves or flaps are installed on overflow pipes.* ■

French Drains/Infiltration Trenches/Recharge Trenches: These three types of infiltration drains are long, fabric-lined trenches filled with rounded aggregate and gravel. They are used to sink water and transport it, typically away from a structure. Unfortunately, and due to dirty run-off, these devices can the fail within 5 years. Debris and grit will fill the aggregate's void space and/or clog the fabric's pores. System longevity depends on slowing the water and properly screening it.

Infiltration and Surfacing Water

Once underground, water will move in any direction that provides the least resistance, and sometimes that direction can lead back to the surface. Unfortunately surfacing water can have some unfortunate consequences. It can speed the decay of walkways and roadways, it can cause soil to move, and it can increase rates of erosion. Surfacing water needs to be identified and its risks known. Below are some of the signs and risks of surfacing water.



A. Seepage from underneath concrete or asphalt, such as sidewalks and roadways, will cause the surface to crack and will widen those cracks. It will also weaken the bonds in asphalt and speed its decay. If infiltration leads to seepage in concrete or asphalt, then steps should be taken to stop or reduce it.

B. Soil moves with water and sometimes that movement is harmful. Soil slumps may occur around the edges of infiltration basins, micro basins and swales. The movement and slumps can redirect water and cause further problems. If movement occurs, rebuild the slope and either use plants or rocks to hold it in place.

C. The outcropping of certain weeds can indicate surfacing water. Plants such as curly dock, moss, nutgrass, and reeds will naturally colonize areas of seepage. Problems with these areas include soil movement and a breeding ground for pests, such as mosquitos and fungus. If soil movement or pests persist, then reduce or stop infiltration.

Screening Runoff

Directing runoff through a device to remove debris is essential to stormwater management—it is vital in protecting the state's waterbodies. Of all the stormwater strategies, screening devices are the most common and require the most maintenance.

Core Maintenance Tasks

Although there are many different screening devices, they all share some core maintenance tasks:

- Clean all screening devices before the start of the rain in mid to late fall. They should also be checked again after any rain event of a 1" or more.
- Maintain good accessibility. Maintenance may be required frequently and good accessibility will make the job quick and easy, especially in areas with a lot of leaf litter.
- Clean the overflow outlet at least once a year. At some point all screening devices will become overwhelmed and if the runoff is not quickly ushered away, then erosion and infrastructural problems will follow.

Catch Basins: Clean all catch basins and sediment traps before the start of the rains. These devices may need additional cleaning throughout the wet season, especially in areas with a lot of leaf litter.

Once a year the grate to this catch basin should be lifted and the debris and sediment scooped out.

Curb Cuts: Cutting into curbs and culverts allows runoff to flow into the landscape. Making sure that runoff can flow freely through these inlets is essential before the start of the rains in late fall. Both debris and excess vegetation will have to be removed.

Stormwater management will only work with a long-term commitment to maintenance. The grasses blocking the curb cut pictured above will cause water to pool on the asphalt, which speeds the surface's decay and creates a public hazard.

Fiber Rolls: Fiber rolls are straw, rice hulls or coconut waste bound by strong plastic mesh. They are used around storm drains and on slopes. Fiber rolls degrade quickly and need to be removed before they become a litter problem; their life span is normally no more than two years.

Filter Cloth: Typically made from nylon, these fabrics are not only used to filter solids out of runoff, but also particles out of the air. They are a common feature on construction sites, where fabric may surround a property and/or has been laid over storm drains. Filter cloth has a limited life and should be removed after two years.

Gabions: Gabions, which are large or small walls made from rock bound by a wire cage, are used to protect storm drains, act as check dams, or simply put in front of the flow of runoff to slow and screen the water. Every 2 to 4 years gabions will need to be cleaned by a power-washer to remove accumulated debris and dirt.

Mulch: Mulches can slow runoff, increase infiltration and filter out debris. For greater detail on mulches, refer to the next chapter.

Sediment Pond/Trap: A sediment pond is a widening in a channel that allows the water to slow enough to drop its heavier particles. These areas can be permeable or not, vegetated or not. Every 2 to 5 years, depending on use, the sediment from these areas will have to be removed.

Trench Drain Grates: Typically used at the end of driveways, trench drains stop sheeting water from going into the street or storm drain system. Trench drains need to be cleaned before the rains every year. Grates will weaken in high traffic areas and will need replacing if broken.

Cleaning Runoff

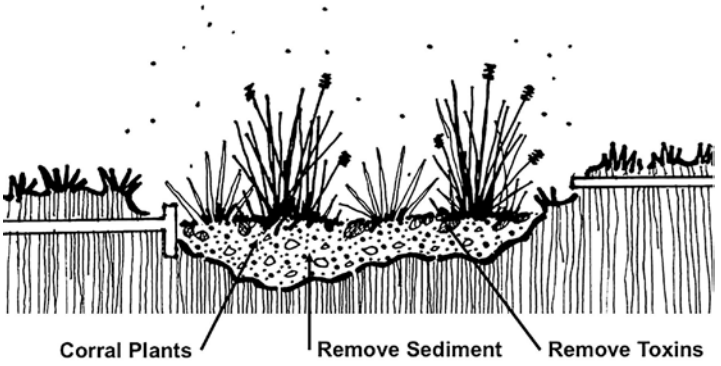
Constructed wetlands are built on large commercial and institutional properties to handle the site's polluted runoff. They employ bacteria, bugs, fungus and plants to clean the water. Chromium, fertilizers, hydrocarbons, iron, lead, mercury, oil, pathogens, pesticides and solvents are either pulled from the water, or transformed into less harmful substances. Professionals generally maintain constructed wetlands and are knowledgeable in handling water and managing waste.

There are 3 primary tasks for maintaining constructed wetlands: removing toxins, removing sediment, and corralling plants.

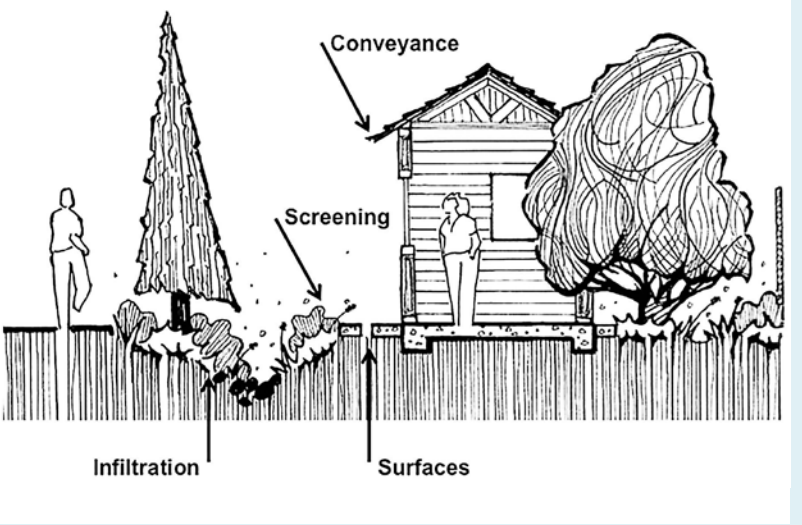
Removing Toxins: While many of the toxins may have been removed from the runoff, they are still present in the environment, either locked in soils and/or plant tissue. These harmful pollutants, mainly metals, still need to be disposed of in a place where they will not be able to harm humans or other organisms. If heavy metals are detected in the plant tissue or sediment, the wetland's debris must be hauled to a local hazardous waste facility.

Removing Sediment: Ideally, dirt, debris and sludge should be removed from a constructed wetland when it loses 10% of its capacity (approximately every 2 to 6 years). Avoid trampling and compacting the soil when cleaning the basin. If the sediment contains metals, such as lead or mercury, it should be hauled to a hazardous waste facility.

Corralling Plants: The plants able to thrive in constructed wetlands are special. They are fast breathers, heavy feeders, and rapid growers. Cattail, reeds, sedges and willow dominate these environments and all will overrun a wetland if not corralled. Dividing, pruning, removing, thinning, and replanting are ongoing tasks, and maintenance should be expected no less than twice a year.



A Stormwater Checklist



Conveyance Systems: Gutters, Culverts and Curbs

- Remove debris and leaves from storm drain transport systems before rain. Poorly maintained storm drain systems are the leading cause of erosion in urban areas.
- Remove the build up of debris and sludge from swales. Soil slumps are not uncommon in swales and rebuilding may be necessary during the rainy season.
- Always guide runoff away from bare dirt areas, such as garden paths, because it causes rutting and gullies.

Screening Systems

- Clean all catch basins and sediment traps before the start of the rains. These devices may need additional cleaning throughout the wet season, especially in areas with a lot of leaf litter.
- Repair or replace leaf guards in gutters and downspouts.
- Fix or replace stormwater drain grates.
- Clean gabions with high-pressure water.
- Remove debris and sediment from behind any device running perpendicular to a slope, such as check dams and fiber rolls.
- Check screening systems after any rain event of 1" or more.

Surfaces

- Every year vigorously sweep or vacuum pervious surfaces. Hosing a surface does not always improve its permeability.
- Mulch planted areas to buffer soil from rain. Ideally, the mulch will come from material generated onsite.
- Aerate landscaped areas that are compacted or trampled; then cover in 1" to 2" of mulch.
- Keep planted areas below paved or semi-permeable surfaces. Refer to the section on grading a California Friendly landscape in the next chapter.

Infiltration Area

- Remove sediment and leafy debris from infiltration basins when 10% of the capacity has been reduced.
- Divide, prune, thin, and/or remove overgrown plants at least once a year.
- Dig up and clean underground infiltration devices every 5 to 10 years, depending on use and the cleanliness of the water flowing through it.