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Southern Sonoma County  
Resource Conservation District  
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# CREEK CARE



A Guide for Rural Landowners  
and Residents of Petaluma and  
Sonoma Creek  
Watersheds





**Many thanks to those who helped review the creek care guide:**

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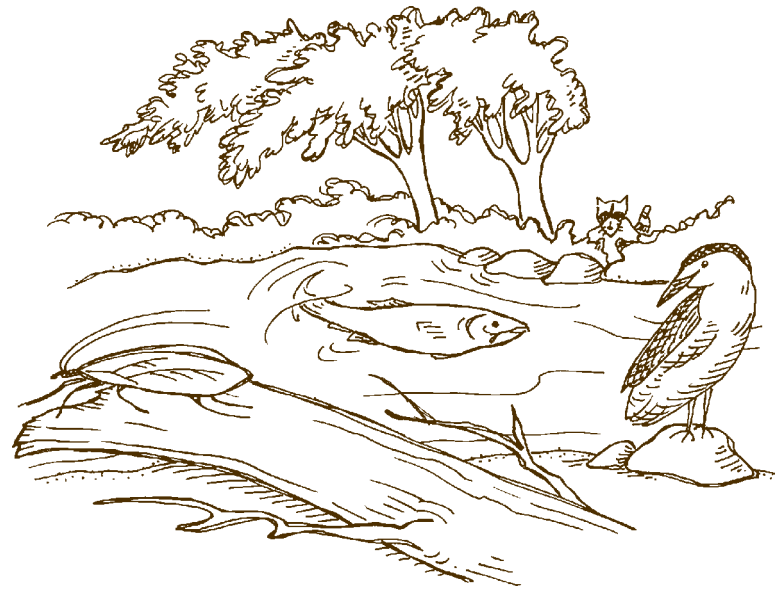
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## Preface

Wherever you live, your daily activities can affect our creeks.

Recently, members of our local communities came together to look at the history of our creeks and developed plans to make sure that they are well taken care of into the future. An important goal of these plans is to let neighbors know about creek concerns and how they can help. This creek care guide was created as a result.

This booklet covers what some of the issues are, how you can contribute to maintaining healthy creeks, and where you can get advice if needed. This guide will hopefully encourage and support your efforts.



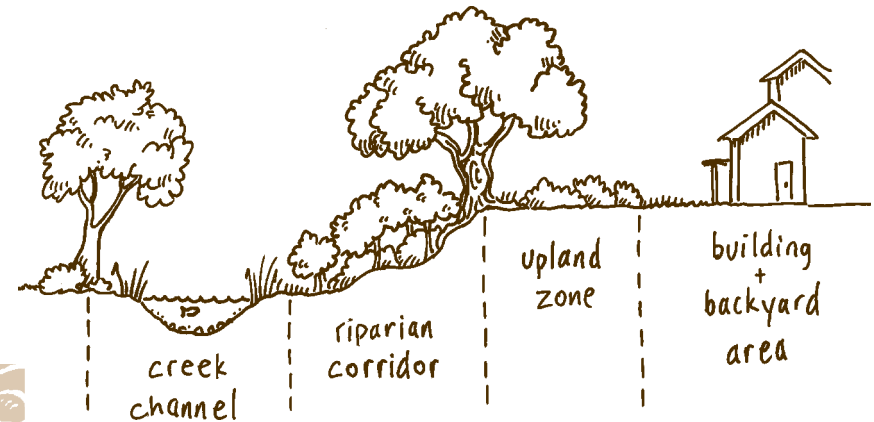
## Table Of Contents

<b>What is a Watershed?</b> .....	3
A Healthy Creek, A Healthy Watershed .....	6
What's Happening in our Watersheds?.....	8
Do we have Fish in Our Creeks? .....	9
Fish Facts .....	10
Plants Along the Creek .....	12
Common Watershed Concerns .....	14
<b>How Can I Care For Our Creeks?</b> .....	16
Creeks and Creek Banks .....	17
Tips for Planting Along a Creek .....	19
Watch Out for <i>Arundo donax</i> .....	20
How to Plant Willows .....	21
Soil Protection .....	23
Ways to Prevent Soil Loss .....	24
Guidelines for Repairing Erosion .....	25
Create a Riparian Pasture .....	27
Vineyard Planting and Replanting Ordinance...	28
Logs in the Creek .....	29
Landscaping and Yards .....	31
Care of Household Waste .....	32
Metal Matters .....	35
Animal Waste and Nutrients .....	36
Ways to Minimize Animal Waste Impacts .....	37
Runoff Management .....	38
Ways to Minimize Runoff .....	39
Ways to Keep Stormwater Clean .....	40
Septic Systems .....	41
<b>Resource Directory</b> .....	42
Technical Assistance .....	42
Local Watershed Groups .....	43
Useful Publications .....	44
Permitting Agencies .....	46

## What is a Watershed?

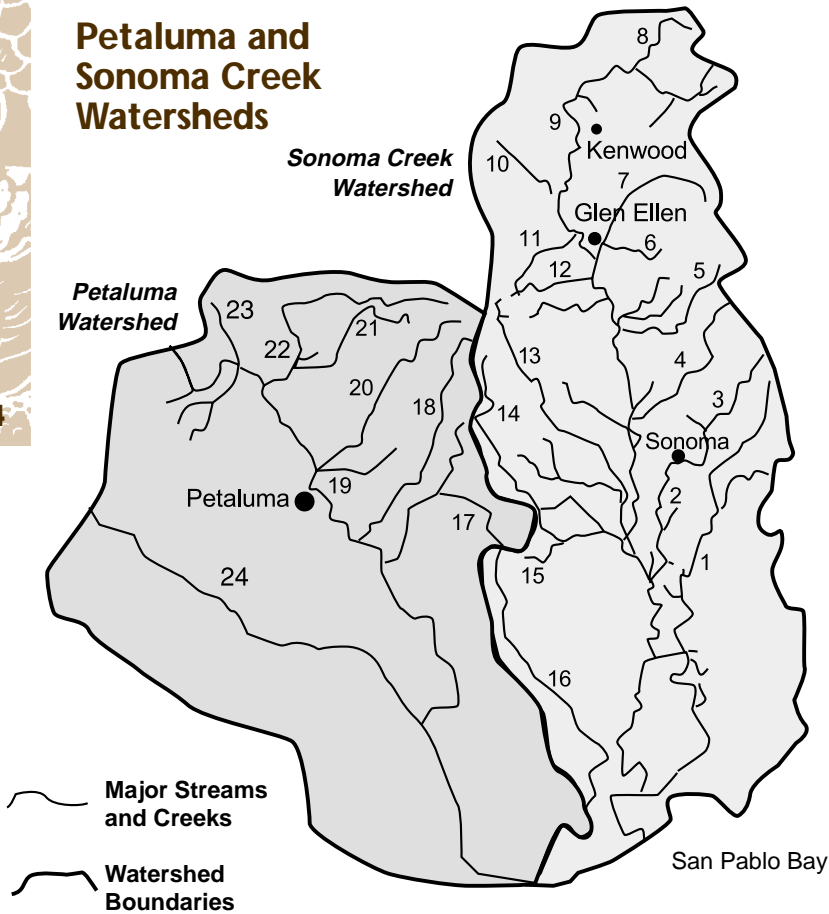
A watershed is the entire area of land that drains into a distinct creek or river system. It includes creeks, drainage areas, ditches, storm drains, flood plains, and land that water flows over or under on the way to a creek or bay.

Watersheds catch and store rain. Climate, elevation, soil, plants, steepness of the land, and size of the watershed affect the rate at which stored water is released from the watershed into creeks.



Large watersheds often have distinct subwatersheds that drain into a main creek or river. For example, San Antonio and Lynch Creeks are tributaries to the Petaluma watershed and subwatersheds to the Petaluma watershed. Graham and Calabazas Creeks are tributaries to Sonoma Creek and subwatersheds to the Sonoma Creek watershed.

## Petaluma and Sonoma Creek Watersheds



### Creeks

1 Arroyo Seco	9 Sonoma	17 Ellis
2 Schell	10 Yulupa	18 Adobe
3 Nathanson	11 Graham	19 Washington
4 Agua Caliente	12 Asbury	20 Lynch
5 Hooker	13 Carriger	21 Willowbrook
6 Stuart	14 Rodgers	22 Lichau
7 Calabazas	15 Champlin	23 Petaluma
8 Bear	16 Tolay	24 San Antonio

Natural conditions and human activities influence the condition of a creek. What takes place in the upstream areas will affect the downstream area. Changes may happen suddenly as the result of a storm (such as new stream bank erosion), or accumulated problems in the watershed may take many decades to develop (such as pools in the creek becoming filled with soil that has washed off the land). Plants and animals that live in or near the water are highly susceptible to changes caused by human actions.

In suburban and urban areas, rooftops and roads cover much of the land. In these areas, rainwater that normally would have soaked into the soil is shed off (like water from an umbrella) and can create flooding in streams and increase erosion.

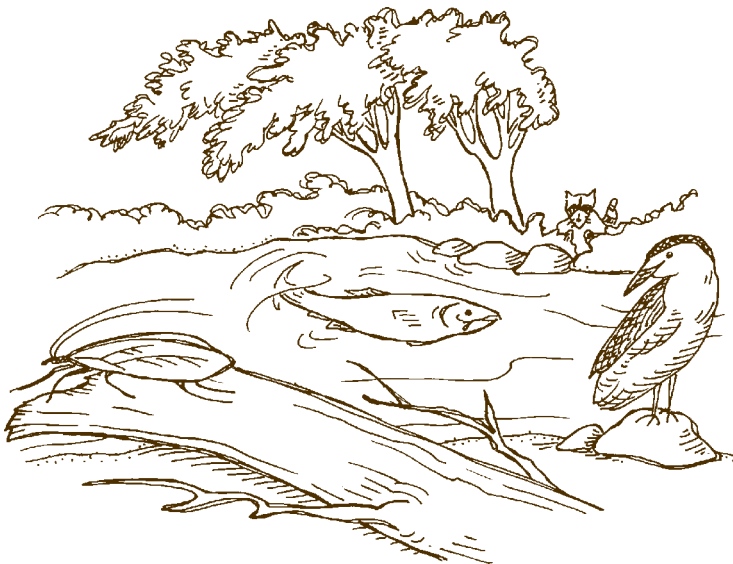
Healthy watersheds keep water quality high, provide food and shelter for fish and wildlife, control soil from washing into the creek (erosion), maintain creek flows in the dry season, and reduce flooding.

Locally, healthy watersheds keep San Francisco and San Pablo Bays clean. Our stream and bay systems provide valuable nursery habitat for many fish, and contribute to commercial and sport fishing industries, as well as recreational activities.

In a healthy watershed, water quality and other resources are maintained for the benefit of humans and wildlife.

## A Healthy Creek, A Healthy Watershed

Healthy creeks reflect a healthy watershed. Creek channels are constantly being reshaped through natural processes. All creeks are important, whether they flow year-round (perennial), part of the year (intermittent), or just during storms (ephemeral). Even the small grass-lined ditches, known as swales, are important because they eventually carry water, soil, and food for aquatic animals into larger creeks.



Creeks reflect what is happening on the surrounding land. A healthy creek will have:

- **Cool water.** This is critical for water-loving plants and animals. For example, steelhead and coho salmon need water temperatures between 40° and 60° F to survive. Cool water also helps reduce toxic levels of ammonia that come from decomposing waste such as animal manure.
- **Clean, clear water.** Fast moving water in streams usually has plenty of dissolved oxygen for fish to breath, but stagnant pools in the summer or ponds may not. Also, salmon and steelhead need clear water to see and capture their food (small fish and insects).
- **A variety of slow and fast water,** with abundant rocks and gravel for spawning and young fish.
- **A high level of groundwater,** known as a high water table.
- **Thriving fish, amphibians (such as salamanders), and insect populations** that are important for fish food.
- **Dense, overhanging native trees and other plants** along the creek with minimal stream bank erosion and some undercut banks for aquatic habitat. Trees provide shade to keep the water cool and provide homes for many insects.



## What's Happening in our Watersheds?

Since the 1850s, the **Petaluma Watershed** has been an agricultural center for eggs, poultry, dairy, and most recently, vineyards. Petaluma is the urban center and small rural communities and ranchettes are found throughout the watershed. Watershed residents have set goals to establish a watershed council, improve water quality and groundwater recharge, support the viability of agriculture, and conserve and enhance existing wildlife habitat.

The **Sonoma Creek Watershed** supports vineyards, livestock ranching, croplands, state parks, open space, and urban activities. Wine grapes and tourism are key parts of the local economy. Sonoma and other small towns are found throughout the watershed. Citizen goals for the watershed include maintaining local control of watershed planning and enhancement, conserving and improving natural resources, managing streams for wildlife habitat and flood control, and educating the community about the watershed.



## Do we have Fish in Our Creeks?

Steelhead were historically found in the Petaluma watershed, including Lichau, Adobe, and San Antonio Creeks, and possibly Lynch, Willow Brook, and Thompson Creeks. Other tributaries were, and still are, too small and dry for steelhead. The Petaluma watershed is not believed to have had historical coho salmon runs.

In the Sonoma Creek watershed, steelhead are found in Sonoma Creek and the major tributaries of Calabazas, Stuart, Graham, Asbury, and Bear Creeks. Coho salmon have been reported in Sonoma Creek but are not officially documented.

Chinook salmon seen in the Petaluma watershed and Sonoma Creek are believed to be hatchery strays from the Sacramento River.

In both watersheds, salmon and steelhead habitat problems include lack of plant cover and shade, lack of summer water flows, too much soil in streambeds, fish passage barriers, lack of woody debris (big logs), non-native predatory fish, and poor water quality—including high temperatures.

## FISH FACTS

Salmon and steelhead are anadromous fish—meaning they are born in fresh water and mature at sea. Coho salmon spend their first year in freshwater creeks, then migrate out to sea where they mature for two years before returning to their native creek to lay eggs (spawn) and die. Steelhead have a similar life cycle, but they live in fresh water for one or two years, spend one to four years at sea, and return to spawn as many as four times. This variable life cycle and migration timing make steelhead more resilient to change.

The number of native coho salmon and steelhead has dropped dramatically in the past 30 years. Many creeks have lost their entire runs of these fish. Both are federally listed as threatened species—this means that they are at risk of extinction.



Good quality instream habitat is essential for these fish. They need:

- A year-round supply of cool, high quality water (less than 60° F).
- Diverse habitat with deep, quiet pools and shallow, rocky areas with faster moving water known as riffles.
- Clean spawning cobble (rounded rocks) and gravels without fine soil.
- Relatively stable creek banks.
- Dense shade canopy from creekside plants that will cool water, provide insect habitat, and contribute nutrients.
- Lots of woody debris from fallen trees and branches.
- Adequate food supply—primarily insects.
- Abundant cover for refuge from predators and storm flows. This includes undercut banks, rocks, tree roots, overhanging creekside plants, deep quiet pools, and large logs.

This same habitat benefits other native species found in the Petaluma watershed and Sonoma Creek such as sticklebacks, sculpin, suckers, Sacramento squawfish, California roach, lampreys, and the California freshwater shrimp. Many other native wildlife species, such as herons, egrets, kingfishers, dragonflies, weasels, deer, muskrats, river otters, and raccoons rely on healthy creek habitat.

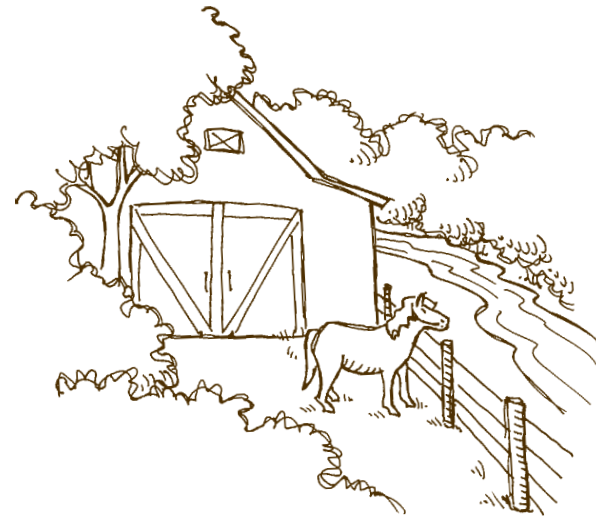
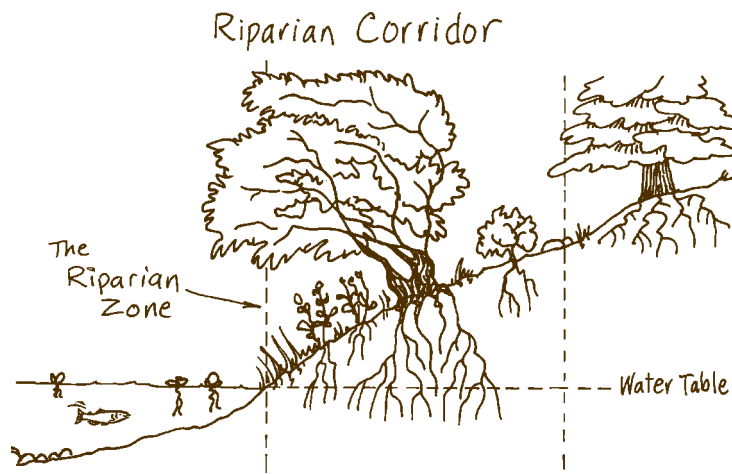




## Plants Along the Creek

A diversity of native trees, shrubs, and grasses are a key part of creek health. Dense plants and roots stabilize creek banks, help reduce soil loss, filter soil, and slow flood waters. Trees and shrubs help raise the water table, and their canopies cool the water. They provide food, shelter, and shade for fish, amphibians, and other wildlife such as deer and birds. Leaves, fallen branches, and logs form the base of the food chain by providing habitat for insects. Healthy creek areas are used by more species of wildlife than any other type of habitat.

12



13

Common plants along creeks in our local watersheds are:

**Petaluma watershed.** Willows, coast live oak, valley oak, California bay, buckeye, box elder, white alder, and Oregon ash.

**Sonoma Creek watershed.** Willows, alders, buckeye, and coast live oak.

In both watersheds, other typical creekside trees are California black oak, California black walnut, and big leaf maple.

Shrubs common to both watersheds include California blackberry, blue elderberry, California hazelnut, coffeeberry, dogwood, ninebark, salmonberry, snowberry, spice bush, thimbleberry, twinberry, toyon, and western azalea.

## Common Watershed Concerns

Common, inter-connected watershed problems are water quality, water quantity, and fish and wildlife habitat. Typical concerns include the following.

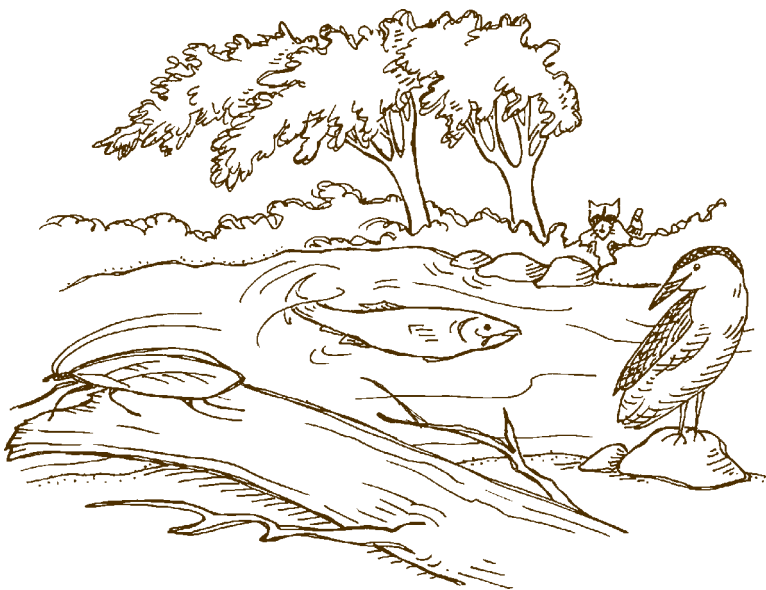
- **Excess nutrients** from fertilizer or manure can cause algae to grow at a high rate. When algae decompose, they use up oxygen in the water—stressing or killing fish.
- **Excessive soil from bare ground** fills in the creek and reduces its ability to carry flood waters, destroys habitat pools, smothers fish eggs in the gravel, and kills insects that fish eat.
- **Pollutants** such as metals, pesticides, oil, grease, and illegally dumped yard waste, trash, tires, and construction debris harm wildlife and their habitat. Excess landscape irrigation, household water, swimming pool or spa water, as well as sewage from leaking septic systems are also considered to be pollutants.
- **Warm water** (>60° F) from lack of shade will stress fish. Water over 75° F will kill both coho salmon and steelhead.
- **Bare, unstable stream banks** with little or no plants do not provide overhanging shade or wildlife cover. Plants are often removed by agricultural operations, hobby farms, home building, landscaping, or livestock. Creek channels that have cut too wide or deep with vertical and actively eroding banks can signal a problem. Loss of habitat can also occur from non-native plants or wooden or concrete walls along stream banks.

- **Illegal water pumps** that take creek water from small, instream pools (especially during the dry season) destroy summertime fish habitat.
- **Impervious (or hard) surfaces** such as roofs and roads that reduce the amount of water that soaks into the soil for groundwater recharge. This can increase flooding and lead to erosion problems.



## How Can I Care for Our Creeks?

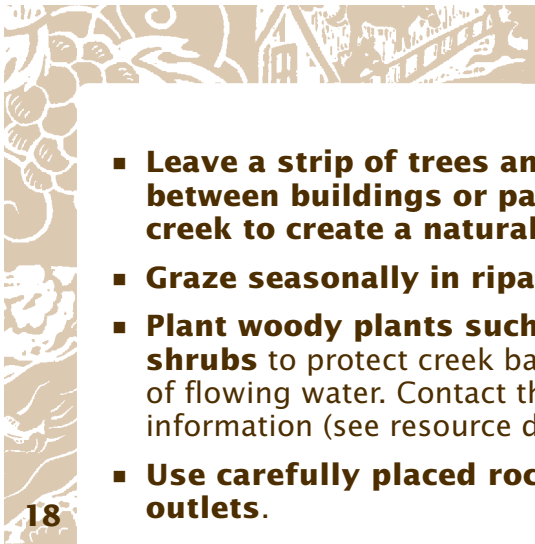
Good stewardship is essential for healthy creeks and wildlife habitat. Whether or not you live right next to a creek, you can still be a good watershed steward. Those who live along creeks can most easily help improve our creeks. Good land management, as well as landscape and home maintenance, will help improve wildlife habitat, reduce runoff and pollutants, and improve water quality. These guidelines are a starting point for keeping creeks and watersheds healthy.



## Creeks and Creek Banks

Here are some basic ways to protect creek banks and riparian areas:

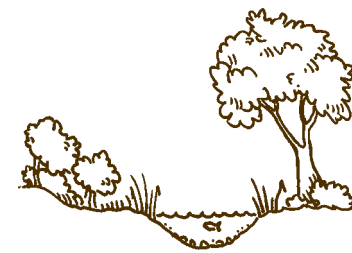
- **Leave native plants on the banks.** If clearing must occur, leave as many plants as possible and replant with native plants. Contact the Resource Conservation District (RCD) for assistance (see resource directory in the back of this guide).
- **Leave rocks in the creek.** These are homes for creek critters. Don't remove for landscaping projects.
- **Divert water only if it is legal for you to do so.** Water diversions have many legal requirements. Contact the State Water Resources Control Board, Division of Water Rights and the California Department of Fish and Game for information (see resource directory in the back of this guide).
- **Avoid building structures such as sheds, barns, or decks near creeks.** Check your local building department for setback requirements.
- **Avoid building livestock corrals and feeding and watering areas near creeks.**
- **Store manure and animal waste so that runoff doesn't enter creeks.**
- **Restrict or control livestock and horse access to the creeks.**



- **Leave a strip of trees and other plants between buildings or pastures and the creek to create a natural “buffer.”**
- **Graze seasonally in riparian areas.**
- **Plant woody plants such as native trees and shrubs** to protect creek banks against the force of flowing water. Contact the RCD for plant information (see resource directory).
- **Use carefully placed rock around pipe outlets.**
- **Avoid planting invasive non-native plants.** They often crowd out native plants and do not provide the same wildlife habitat. **Some plants to avoid are:**

Giant reed ( <i>Arundo donax</i> )	Bamboo
Periwinkle ( <i>Vinca major</i> )	Pampas grass
Scotch, French, or Spanish broom	Ice plant
German or English ivy	Acacia
Himalayan blackberry	Tree-of-heaven

If removing non-native plants, use caution to minimize erosion. Be sure to replant with native plants.



### Tips for Planting Along a Creek

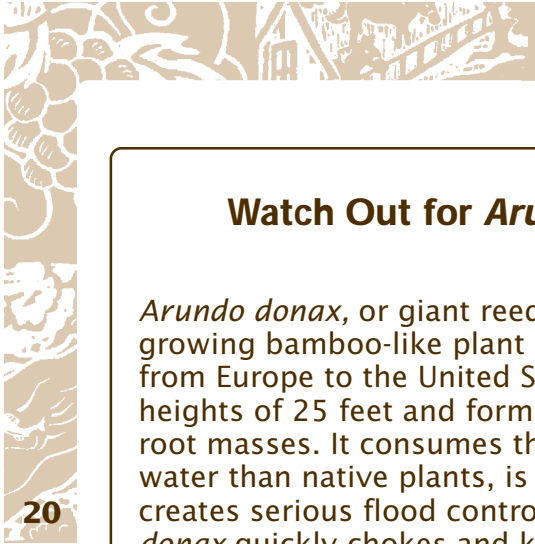
Although many creeks have not had riparian plants for decades, they were not always bare. Plants or trees removed by humans, livestock, or high intensity storms should be replaced.

Use native species for replanting and select plants that already grow along the creek. Local plant stock is best adapted to specific local conditions and will be the easiest to grow. For example, oak trees that grow in flood prone areas are better adapted to saturated soil than oaks from drier upland areas. Local plants form the base of the food chain and are part of the complex web between insects, birds, fish, and other species.

Native plants often require less water and do not need fertilizers and pesticides. They can be more resilient to disease than many ornamental, non-native plants and many are good for erosion control.

Care for your new plants during the first few years to help them become established. Dry season watering and regular weeding will increase survival rates. Be sure to replant plants that die. For more information sources, see resources directory in back of this guide.

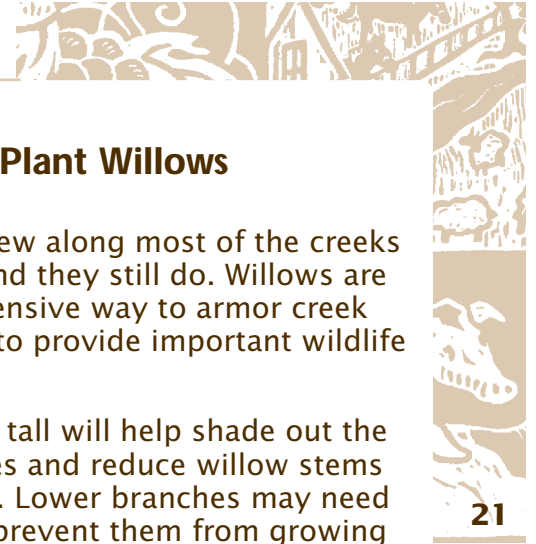
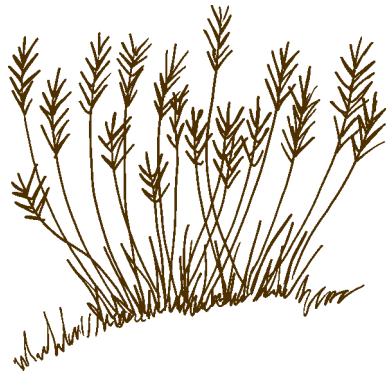




### Watch Out for *Arundo donax*!

*Arundo donax*, or giant reed, is a dense, fast growing bamboo-like plant that originally came from Europe to the United States. It reaches heights of 25 feet and forms large, continuous root masses. It consumes three times more water than native plants, is a fire hazard, and creates serious flood control problems. *Arundo donax* quickly chokes and kills other plants in its path, destroying wildlife habitat. Biologists and land managers consider this invasive species to be one of the primary threats to healthy streams in the western United States.

*Arundo donax* is a major problem in both the Petaluma and Sonoma Creek watersheds. Contact the Sonoma Ecology Center for information about local eradication efforts (see resource directory in the back of this guide).

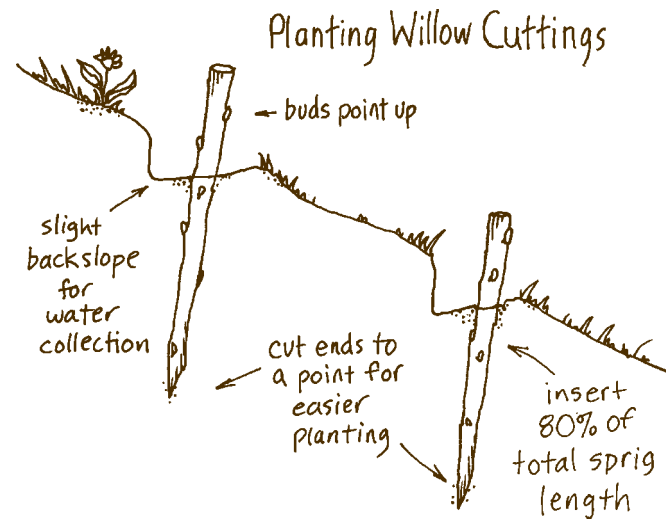


### How to Plant Willows

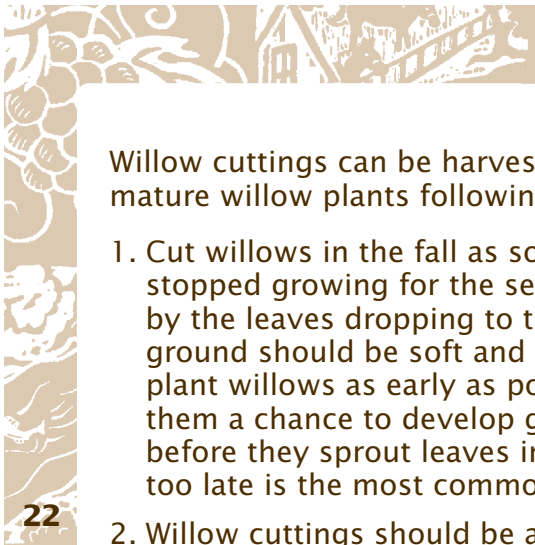
Historically, willows grew along most of the creeks in coastal California, and they still do. Willows are an effective and inexpensive way to armor creek banks and gullies and to provide important wildlife habitat.

Allowing trees to grow tall will help shade out the lower growing branches and reduce willow stems growing into the creek. Lower branches may need occasional pruning to prevent them from growing into the bottom of the creek. Native red and yellow willows are less likely to grow into the bottom of the creek than arroyo willows.

Adequate year-round water and sun are key for willows to establish and survive. Even if a creek doesn't have year-round, above ground flows, the ground water may be close enough to the surface to support willows.







Willow cuttings can be harvested and planted from mature willow plants following these steps:

1. Cut willows in the fall as soon as the plant has stopped growing for the season. This is indicated by the leaves dropping to the ground. The ground should be soft and wet. It is critical to plant willows as early as possible. This gives them a chance to develop good root systems before they sprout leaves in the spring. Planting too late is the most common cause of failure.
2. Willow cuttings should be at least 3/4 inches in diameter. Bigger is better. Cuttings should be at least 14 inches long.
3. Plant cuttings by pushing the cut end into soft soil, or make a hole with a sharp stick or pick. If you make a hole, be sure to compress soil tightly around the cuttings. They may need to be pounded in with a hammer. To give plenty of area for root growth, bury at least two-thirds of the length of the cutting. Angle sprigs slightly downstream to prevent them from being undermined by storm flows.
4. Plant willows low enough on the bank to ensure adequate soil moisture during the summer. Even if streams or gullies have year-round water, willows that are planted too high are likely to dry out and die. Cuttings should not need water if they are planted in an appropriate area.



## Soil Protection

Erosion is a natural process by which soil is moved by wind or moving water. Some soil, also known as sediment, is needed to bring nutrients to creeks and create habitat for aquatic plants and animals, but too much soil causes problems.

Erosion can occur in bare areas such as creek banks, pastures, fields, roads, stockpiled soil, areas cleared for the construction of new homes and buildings, or other places where soil is not protected from the erosive forces of rainfall, gravity, or wind. When water flows over bare ground, the exposed soil moves downhill and often ends up in a creek.



## Ways to Prevent Soil Loss

Basic strategies to prevent erosion are:

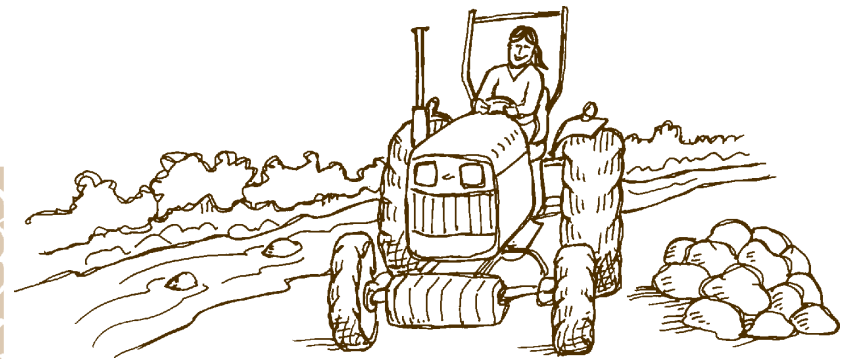
- **Protect bare soil surfaces.** Native trees, shrubs, grasses, and cover crops hold the soil in place and allow water to soak into the soil. Use erosion control methods in construction areas.
- **Minimize disturbing existing plants.**
- **Avoid concentrating water flows.** Protect water or pipe outlets by using carefully placed rock.
- **Limit livestock and human use** near creek banks, gullies, seasonal drainage areas, unsurfaced roads, replanted areas, and landslides.
- **Prevent heavy grazing.** Use cross fencing to create pastures.
- **Seed and fertilize pastures.**
- **Use no-till and minimum till cultivation.** Planting seed through old stubble will not expose soil to winter rains.
- **Maintain plant and/or grass borders** around horse paddocks to act as a filter.
- **Separate water and salt blocks** to spread animals more evenly in grazed areas.
- **Develop springs or water troughs for livestock and horses** that are located away from the creek.

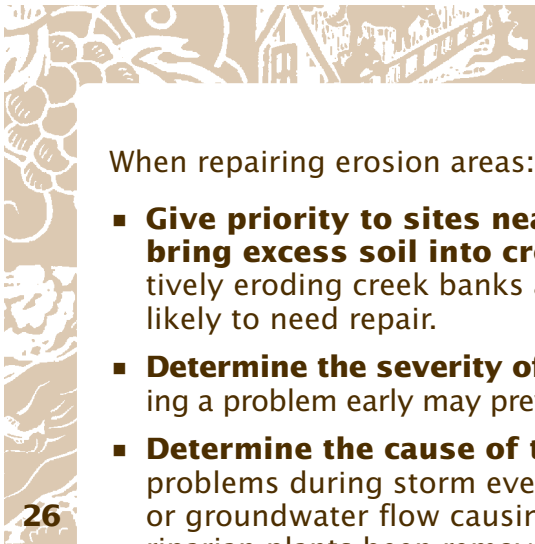
## Guidelines for Repairing Erosion

Not all erosion is harmful. Along streams, undercut banks and fallen trees provide important habitat for steelhead and other aquatic animals. Repairs may be necessary if property, structures, roads, or riparian habitat are threatened.

Most creek repair work requires permits. Before starting work, contact the California Department of Fish and Game, Sonoma County, U.S. Army Corps of Engineers, and Regional Water Quality Control Board. See the back of this guide for permit information.

The Southern Sonoma County RCD and the Natural Resources Conservation Service provide free technical assistance and information about potential funding for projects (see resource directory for more information).





When repairing erosion areas:

- **Give priority to sites near creeks or that bring excess soil into creeks.** Vertical, actively eroding creek banks and active gullies are likely to need repair.
- **Determine the severity of the problem.** Treating a problem early may prevent costly fixes later.
- **Determine the cause of the problem.** Watch problems during storm events. Is surface water or groundwater flow causing trouble? Have riparian plants been removed? Has the creek channel been changed on site or upstream? Are lawns being over-watered?
- **Use native plants in the repair.** Plant willows and other plants in areas where rock has been placed to provide habitat.
- **Don't use old car bodies, tires, old appliances, or concrete debris.** It's illegal to use these and they are not as effective as carefully placed rock and willow. They can be undermined by water flows and may be hazardous to creek life.
- **Be sure not to constrict the channel.** Flooding is a potential problem on any creek.
- **Monitor and maintain your projects.** Be sure to water plants and make sure fences are in good repair. Taking before and after pictures is a great way to show success.
- **Consult with qualified professionals** (civil engineers, biologists, and other restoration specialists) for assistance.



## Create a Riparian Pasture

Livestock (including horses) can destroy plants, trample creek banks, and reduce water quality. In some situations, fencing can be used to create a riparian pasture. This protects the creek corridor by keeping livestock out of the creek and allows for controlled grazing.



After the fencing is installed, the pasture may need to be rested for a few seasons until the plants become established. Native trees and shrubs may need to be planted in bare areas. Developing other water sources and stable creek crossings will create a successful riparian pasture. With short duration grazing, animals can take advantage of late spring/early summer forage. During this time of year, creek banks are firm, there is soil moisture for riparian plants to regrow before winter, and plants may still be green.



## Vineyard Planting and Replanting Ordinance

Sonoma County's Vineyard Planting and Replanting Ordinance restricts vineyard development on steep slopes. All vineyards must register with the Agricultural Commissioner and erosion control plans are required for vineyards on steep slopes and erodible soils. A minimum 25-foot riparian setback is required on each side of the creek. For information, contact the Sonoma County Agricultural Commissioner's Office.

Two resources for vineyard operators are *The Vineyard Manual: A Grapegrowers Manual for Vineyard Development and Maintenance* (available from the Southern Sonoma County RCD) and the *Fish Friendly Farming Farm Assessment and Conservation Plan Workbook* (available from Sotoyome RCD). See resource directory for contact information.

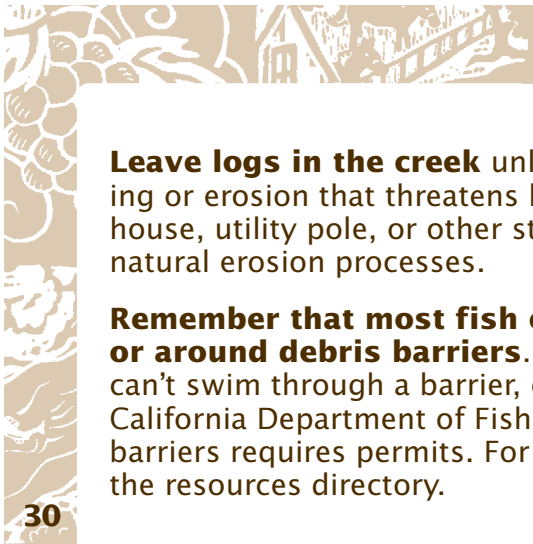


Tree blocking creek flow

## Logs in the Creek

Natural debris in the creek—branches, logs, and root wads—creates food and shelter for fish and wildlife. This woody debris may need to be repositioned, removed, or partially removed if it threatens life or property. Because removing woody debris can harm fish habitat, it is important to observe a situation before taking action. It's often best to take small, incremental steps toward resolving a problem.

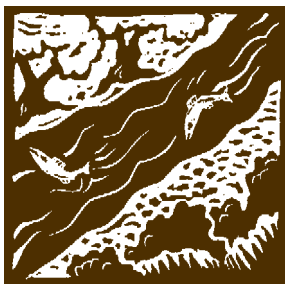
**Consider repositioning or removing woody debris if it blocks creek flow and causes upstream flooding,** or if it causes stream bank erosion by redirecting flow. This work requires permits.



**Leave logs in the creek** unless they cause flooding or erosion that threatens life or property (a house, utility pole, or other structure) or speeds up natural erosion processes.

**Remember that most fish can swim through or around debris barriers.** If you know that fish can't swim through a barrier, contact the RCD or California Department of Fish and Game. Removing barriers requires permits. For more information, see the resources directory.

30



## Landscaping and Yards

Managing your landscape properly will help keep creeks healthy.

- **Compost leaves, grass clippings, and other organic waste away from the creek.** Never dump leaves, grass clippings, or prunings onto creek banks or into the creek. Although leaves and organic waste are biodegradable, adding them to a creek system depletes oxygen in the water. This can stress or even kill fish and other aquatic life.

Yard waste pick up services are listed in the resource directory at the back of this guide.

- **Keep leaves and litter out of street gutters and ditches** so they won't clog storm drains.
- **Avoid or minimize use of fertilizers and pesticides** (including insecticides and herbicides). Follow the directions. Many home gardeners over-apply fertilizers and pesticides. Excessive nitrogen and phosphorous that wash into creeks directly or through ditches and storm drains can create algal blooms that deplete the oxygen supply in the water. Excessive amounts of some nutrients are toxic to aquatic life.

Use slow-release fertilizers to minimize nitrogen runoff. Consider using more ecologically-friendly landscape methods and products, including native plants and ground covers.

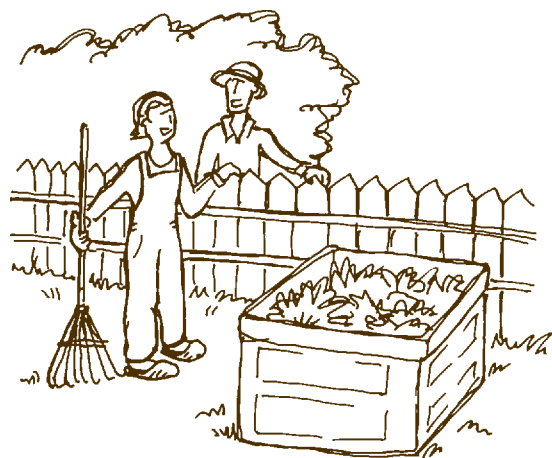
Avoid applying fertilizers or pesticides during the rainy season or on windy days. Pesticide drift threatens riparian plants and aquatic life.

- **Properly irrigate lawns and gardens.** Use meters and timers to control water use. Overwatering adds excess water, fertilizers, pesticides, and soil to ditches and storm drains. It is also a common cause of stream bank erosion.

31







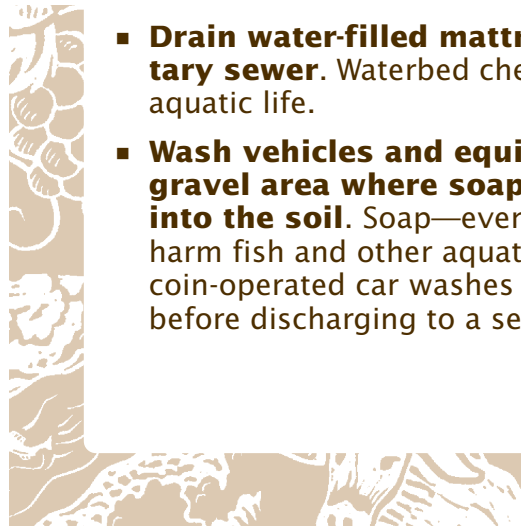
### Care of Household Waste

Even in small amounts, hazardous materials such as paint, motor oil, solvents, pool chemicals, batteries, and many cleaners will contaminate a creek and harm fish and wildlife. It's illegal to dispose of or dump hazardous materials on roadways or into storm drains or ditches. Violators are liable for cleanup costs and fines.

- **Keep trash and dumped debris out of the creek, off the street, and out of ditches and storm drains.** Remove trash that may have piled up in the creek. (See the "Logs in the Creek" section of this guide for information about natural debris).
- **Take all hazardous items (paint, solvent, pesticides, etc.) to a household hazardous waste collection event.** Call the Sonoma County EcoDesk for dates, times, and locations (see the resource directory).

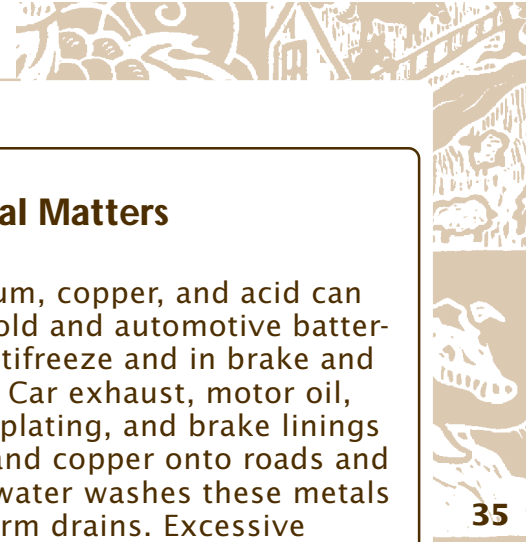


- **Use water-based paint and paint removers** when possible.
- **Place paint thinner or turpentine in a container to clean oil-based paintbrushes and rollers.** Allow the solids to settle out and carefully transfer liquid to another container for reuse. Take the solids to a hazardous waste collection event.
- **Clean latex paint brushes so that wash water does not reach a gutter, ditch, or creek.**
- **Dispose of water used to clean carpets, upholstery, or floors down sinks or toilets.** If you are on a septic tank, use septic safe products.
- **Use non-toxic cleaning products** in your home.
- **Use mechanical methods to clean drains** that are blocked by roots. Avoid copper-based root control products.
- **Avoid hosing down paved surfaces like driveways.** Use a broom instead and put debris in a trash can.
- **Discharge water from your washing machine away from creeks, ditches, or storm drains.**
- **Drain water-filled mattresses to the sanitary sewer.** Waterbed chemicals can be toxic to aquatic life.
- **Wash vehicles and equipment in a grassy or gravel area where soapy water can filter into the soil.** Soap—even biodegradable—can harm fish and other aquatic life. Commercial and coin-operated car washes must recycle water before discharging to a sewer system.



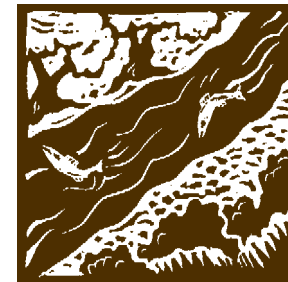


- **Properly care for pools and spas.** Water and backwash filter rinse water should be drained to the sewer or be allowed to dissipate and drain into a field. Make sure discharges don't reach creeks or cause erosion. Chlorine and algaecides used in pools and spas are toxic to plants and aquatic life. Use diatomaceous earth (DE) cautiously. If DE gets into the creek, it can cut the gills of aquatic animals, making them more susceptible to infection and disease.
- **Properly care for your cars and boats.** For proper disposal of used motor oil and other automotive products, call the Eco-Desk (see resources directory in this guide). Motor oil can coat fish gills (depriving them of needed oxygen) and bird feathers (interfering with their ability to keep warm and dry). Oil can also poison animals when they ingest it in an effort to clean themselves.



### Metal Matters

Lead, nickel, cadmium, copper, and acid can be found in household and automotive batteries. Metals are in antifreeze and in brake and transmission fluids. Car exhaust, motor oil, grease, worn metal plating, and brake linings deposit lead, zinc, and copper onto roads and parking lots. Stormwater washes these metals into ditches and storm drains. Excessive levels of some metals can lead to adverse health effects in humans and wildlife.



## Animal Waste and Nutrients

Animal wastes, decaying plant matter (such as silage), and pasture fertilization can contribute excess nutrients to creeks. Animal waste can come from a thousand cows or five dogs.

While nutrients are an important part of the food chain, excessive amounts, especially when combined with warm water temperatures, will consume the oxygen in the water and can cause harm or even kill fish or other aquatic life.

Most animal waste contamination is from confined livestock areas where the waste is concentrated. Corrals, horse paddocks, and feeding or watering areas are potential sources of water quality problems, especially if these areas are located near creeks or where runoff could carry wastes into creeks.



## Ways to Minimize Animal Waste Impacts

- **Apply manure and other fertilizers at rates appropriate** for the crop being fertilized.
- **Store silage properly.** Improper storage can allow highly concentrated nutrients to run off into creeks or percolate into the groundwater.
- **Relocate corrals, paddocks, manure or compost piles, and feeding and watering areas away from creeks.**
- **Manage horse waste** by regular clean up and proper storage, maintaining moisture in paddocks, diverting clean runoff around bare and manured areas, and capturing runoff before it reaches grass-lined ditches and creeks. Consider developing a compost program for horse waste and used bedding.

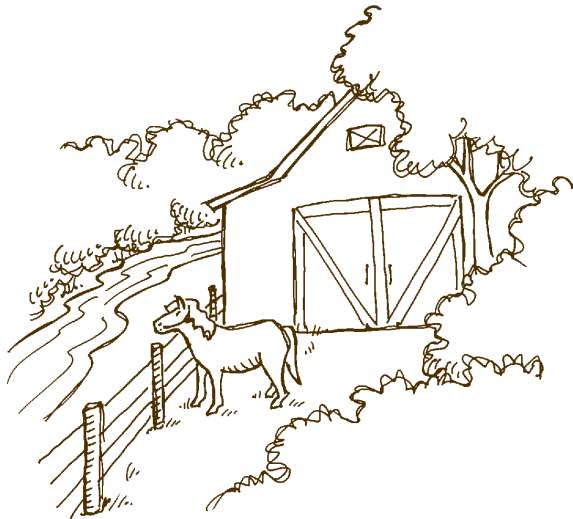
The Equine Facilities Assistance Program is a Bay Area-wide effort to work with horse owners to protect the water quality in the San Francisco Bay area. Contact the RCD for more information (see resources directory at the back of this guide).

## Runoff Management

All water flowing off pastures, corrals, crop land, bare areas, lawns, gardens, roofs, and paved areas can flow directly into creeks, or it can flow through ditches and underground pipes before reaching a creek. This runoff can pick up soil, manure, chemicals, and garbage that is carried directly into creeks and then on to San Francisco and San Pablo Bay without treatment.

It's important to both minimize the runoff from your property and keep stormwater runoff from picking up pollutants such as soil before reaching a swale or creek.

Storm water that flows off land without soaking into the ground can add to creek flows and reduces ground water recharge. The higher flows in the creek can cause erosion of the creek bed and banks and flooding problems downstream.



38

## Ways to Minimize Runoff

- **Direct all gutters or downspouts to areas where the water can soak into the ground.**
- **Minimize paved or other hard-surfaced areas.** Driveways, walkways, and patios increase the amount of water that flows into creeks, ditches, and storm drains. Instead of concrete, use wooden decks, brick or stone paths, gravel, paving stones, or concrete blocks so that water can permeate through spaces and soak into the ground.
- **Keep water and pipes from flowing directly to the creek or onto creek banks.** Guide water to the creek in a protected way and use carefully placed rock at the outlet.
- **Keep plants on stream banks.** Roots of riparian plants will help stabilize the banks.

For more ideas, consult *Start at the Source: Design Guidance Manual for Stormwater Quality Protection* (see the resource directory at the end of this guide).



39

## Ways to Keep Stormwater Clean

Agricultural areas to be concerned about are milking and loafing barns, waste storage facilities, paddocks, corrals, horse arenas, horse wash areas, and areas with bare soil.

- **Direct runoff around areas that may contain manure or are bare.** Make sure that runoff isn't diverted in a way that later causes erosion problems.
- **Use gutters, downspouts, and drains to carry roof runoff away from manure or bare areas.**
- **Route runoff water that has picked up manure or soil** into a filter area with grasses, shrubs, and trees.
- **Keep horse wash water from running into swales and creeks.**



## Septic Systems

Most rural residences use septic systems for sewage disposal. Septic systems operate by collecting sewage in a concrete tank and allowing the liquid portion to percolate into the ground through perforated pipe (leach lines). Solids are pumped out of the collection tank and hauled off-site for disposal.

Septic systems are safe and effective, as long as they are properly designed, installed, and maintained. If not, they can be a source of groundwater and surface water contamination. Leaky septic systems can pollute domestic water systems by contaminating the aquifer from which a residential well draws. Older homes may have a primitive system composed of a redwood or metal box with no leach lines. These systems are now illegal.

Human waste leaking from faulty septic systems can be a source of water pollution. Like livestock waste, human sewage contains nutrients and pathogens. Human sewage poses a more serious health risk than livestock waste because there is a much greater chance that it contains human disease organisms.

Septic tanks should be pumped regularly—usually every two to three years. A licensed septic tank pumper can recommend appropriate service. Minimizing the amount of liquid that goes into the system and avoiding unnecessary solid waste (such as paper towels, rags, diapers, etc.) helps a septic system operate properly.



# Resource Directory

## Technical Assistance

**Southern Sonoma County Resource Conservation District (RCD) ..... (707) 794-1242, ext. 3**  
1301 Redwood Way, Suite 170, Petaluma, CA 94954  
ssrcrd@ca.nacdn.net.org  
www.SonomaMarinRCDs.org

*The RCD assists rural landowners with stewardship and conservation through technical assistance and funding for on-the-ground projects. The RCD sponsors and supports outreach and educational programs, watershed planning projects, and implementation projects to improve water quality while supporting agricultural viability. They have publications on a wide variety of topics. The RCD serves residents in southern Sonoma County, primarily in the Sonoma Creek, Petaluma, and Stemple Creek watersheds.*

**U.S.D.A. Natural Resources Conservation Service (NRCS)..... (707) 794-1242, ext. 3**  
1301 Redwood Way, Suite 170, Petaluma, CA 94954  
*The NRCS can provide free technical assistance to agricultural landowners, as well as information about possible financial assistance through U.S.D.A programs.*

**California Department of Fish and Game**  
P.O. Box 47, Yountville, CA 94599 ..... **(707) 944-5500**  
**Area Biologist: Bill Cox..... (707) 823-1001**  
*Biologists can also provide free practical advice on making effective repairs that reduce erosion and help wildlife.*

**University of California Cooperative Extension**  
2604 Ventura Avenue, Santa Rosa, CA 95403  
**Farm Advisor ..... (707) 565-2621**

**Watershed Management Advisor ... (707) 565-2621**  
*U.C. Advisors offer educational workshops, demonstrations of best management practices, and individual consultation. The U.C.C.E. office has an extensive list of publications.*

**Sonoma County Master Gardeners .. (707) 565-2608**  
**www.mastergardeners.org**  
*Master Gardeners provide information on plant health and gardening practices for vegetables, trees, soils, lawns, ornamental horticulture, insects, diseases, and use of pesticides.*

**Sonoma County ..... (707) 565-2371**  
**Agricultural Commissioner's Office**  
2604 Ventura Avenue, Rm. 101  
Santa Rosa, CA 95403-2810

*The Agriculture and Vineyard Conservation Coordinator manages the Vineyard Erosion Control and Sediment Control Ordinance.*

**Sonoma Ecology Center ..... (707) 996-9744**  
205 First Street West, Sonoma, CA 95476  
*The Sonoma Ecology Center is an environmental group working in the Sonoma Creek watershed, providing guidance and technical assistance on a wide variety of topics.*

**Sonoma County Waste Management Agency**  
**Eco-Desk Hotline ..... (707) 565-3375**  
**www.recyclenow.org**  
*Comprehensive information on recycling programs and reuse programs for a wide variety of materials, as well as hazardous waste collection events. They publish an annual recycling guide.*

## Local Watershed Groups

*To find out about the **Sonoma Creek Conservancy** and the **Petaluma Watershed Partnership**, contact the Southern Sonoma County Resource Conservation District at 794-1242, ext. 3.*

## Useful Publications

*Groundwork: A Handbook for Erosion Control in North Coastal California.* 1987. Liza Prunuske for the Marin County Resource Conservation District. *To review a copy, contact the Southern Sonoma County Resource Conservation District at 794-1242, ext. 3.*

*Rangeland Watershed Program Fact Sheets.* U.C. Cooperative Extension and U.S.D.A. Natural Resource Conservation Service. *For an order form, call the U.C.C.E. office in Santa Rosa at (707) 565-2621. The fact sheets cover a wide range of topics, some of which include water quality, different monitoring techniques, grazing management, ranch plans, and riparian areas.*

*Ranch Plan Workbook.* 1995. U.C. Cooperative Extension Service. *Copies are available from U.C.C.E. in Novato at (415) 499-4204 or Santa Rosa at (707) 565-2621.*

*Simply the Facts.* 1995. NRCS and AmeriCorps Water Quality Fact Sheets. *This clear, easy to follow information on conducting different types of water quality tests is available from the NRCS at (707) 794-1242, ext. 3.*

*Handbook for Forest and Ranch Roads.* 1994. William Weaver, PhD., and Danny Hagans for the Mendocino County Resource Conservation District. *This \$20 book is available from the Mendocino County Resource Conservation District. Call (707) 468-9223.*

*Sonoma Creek Watershed Enhancement Plan.* 1997. Southern Sonoma County Resource Conservation District. *Call RCD at 794-1242, ext.3, for more information.*

*Petaluma Watershed Enhancement Plan.* 1999. Southern Sonoma County Resource Conservation District. *Call the RCD at 794-1242, ext.3, for more information.*

*Stemple Creek/Estero San Antonio Watershed Enhancement Plan.* 1994. Prunuske Chatman, Inc. for the Marin County and Southern Sonoma County RCDs. *Call the RCD at 794-1242, ext.3, for more information.*

*Restoration Design and Management Guidelines for the Petaluma River.* Vols. I & II. 1996. Questa Engineering Corporation and Waxman Environmental Consulting & Services for the City of Petaluma and the Sonoma County Water Agency. *Call SSCRCD at 794-1242, ext.3, to review a copy.*

*Informational Manual: Riparian Vegetation Management for Pierce's Disease in North Coast California Vineyards.* 2000. The Pierce's Disease/Riparian Habitat Workgroup. *Contact the RCD at 794-1242, ext.3, to review or purchase a copy.*

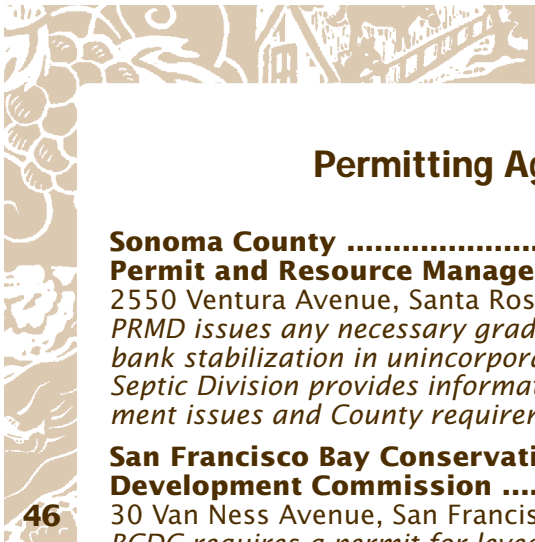
*The Vineyard Manual: A Grapegrowers Manual for Vineyard Development and Maintenance.* Revised July, 1999. Southern Sonoma County Resource Conservation District. *Reference manual for environmentally-sound vineyard design, development, and maintenance. Contact the RCD at 794-1242, ext.3, to purchase a copy.*

*Equine Facilities Assistance Program Fact Sheets.* 1998. Council of Bay Area Resource Conservation Districts. *Covers a range of topics for both small landowners and large-scale operations. Contact the RCD at 794-1242, ext.3, for more information.*

*Horsekeeping: A Guide to Land Management for Clean Water.* 2001. Council of Bay Area Resource Conservation Districts. *Contact the RCD at 794-1242, ext.3, for more information.*

*Start at the Source: Design Guidance Manual for Stormwater Quality Protection.* 1997. Tom Richman and Associates. Bay Area Stormwater Management Agencies Association (BASMAA). New York: Forbes Custom Publishing. *Resource on stormwater management in the greater Bay Area and north coast. Contact [www.basmaa.org](http://www.basmaa.org) for more information.*

*Fish Friendly Farming Certification Program and Farm Assessment and Conservation Plan Workbook.* Sotoyome Resource Conservation District. *Program and workbook focus on vineyards. Contact the Sotoyome RCD at (707) 569-1448.*



## Permitting Agencies

**Sonoma County ..... (707) 565-1900**  
**Permit and Resource Management Department**  
 2550 Ventura Avenue, Santa Rosa, CA 95403  
*PRMD issues any necessary grading permits for stream bank stabilization in unincorporated areas. The Well and Septic Division provides information on septic management issues and County requirements.*

**San Francisco Bay Conservation and Development Commission ..... (415) 557-8778**  
 30 Van Ness Avenue, San Francisco, CA 94102  
*BCDC requires a permit for levee maintenance or work within 100 feet of Bay waters.*

**San Francisco Bay Regional Water Quality Control Board ..... (510) 622-2300**  
 1515 Clay Street, Suite 1400, Oakland, CA 94612  
*RWQCB issues water quality certifications for all projects requiring a permit from the U.S. Army Corps of Engineers. They also issue permits for animal facilities.*

**California Department of Fish and Game ..... (707) 944-5500**  
 P.O. Box 47, Yountville, CA 94599  
 Area Biologist: Bill Cox ..... (707) 823-1001  
*CDF&G requires a 1600 series permit for stream bank alterations.*

**State Water Resources Control Board Division of Water Rights ..... (916) 341-5300**  
 P.O. Box 2000, Sacramento, CA 95812-2000  
[www.waterrights.ca.gov](http://www.waterrights.ca.gov)  
*SWRCB provides information on water rights and diversions.*

**U.S. Army Corps of Engineers ..... (415) 977-8462**  
 333 Market Street, 8th Floor, San Francisco, CA 94105  
*The ACOE issues permits for work done in waters under their jurisdiction, which includes most creeks, rivers, and wetlands.*

**National Marine Fisheries Service.. (707) 525-6050**  
 777 Sonoma Ave, Suite 325, Santa Rosa, CA 95404  
*The National Marine Fisheries Service has authority over salmon and steelhead resources.*

