



SHORE STEWARDS GUIDE FOR SHORELINE LIVING

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By

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Abstract

Whether you live on the Salish Sea or another shoreline, your actions go a long way toward helping protect and preserve the way of life near the water. Loving the wildlife, waters, and spectacular scenery means practicing stewardship in order to preserve the shoreline. This publication provides ten guidelines that can help you practice stewardship in your shoreline lifestyle. *This publication replaces EM4928E.*

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Shore Stewards Guide for Shoreline Living

Introduction

The Salish Sea is a unique and spectacular place. Consisting of a network of coastal waterways between British Columbia and Washington State, the Salish Sea includes the Strait of Juan de Fuca, the Strait of Georgia, and Puget Sound (Figure 1). It offers beautiful scenery, a multitude of opportunities for recreation, and wonderful fish, shellfish, and wildlife.

Whether you live directly along the shoreline or further inland—if you love and want to protect the wildlife, waters, and way of life the area offers—this publication is for you! Your actions can go a long way toward helping to protect and preserve our way of life here.

We hope that your commitment to preserving this landscape for future generations will include following the Shore Steward guidelines set forth in this manual. Additional resources can be found on the [Shore Steward website](#).

Guideline 1: Taking Care of Waste from People, Pets, Livestock, and Products

Disposing of waste is an everyday occurrence. Waste comes from dogs, cows, horses, and people. Harmful pathogens such as bacteria, viruses, and parasites from failing septic systems and animal waste can pollute water. Other waste such as medicines and household chemicals flushed down the drain may also make its way to groundwater or waterways. In this section, you will learn the best ways to keep harmful waste out of our waterways. Doing so can save you money and keep you and your family safe from illness.

Sewers and On-Site Septic Systems

The Differences Between Septic and Sewer

Everyone uses running water and flush toilets in their home or workplace. The water running down the drain and toilet goes to either a private or community septic system or a public sewer system. If you have a septic system, you have a personal responsibility to maintain it and protect your investment (Figure 2). If you are on sewer, you pay a monthly bill, and someone else manages a treatment plant for your community. No matter how human waste is handled, there are steps you can take to protect your personal investment, or the investment your community has made in a treatment plant.



Figure 1. Map of the Salish Sea. Courtesy of Stefan Freelan.



Figure 2. Pumping your septic tank is part of maintaining your system. Photo by Alan Chapin.

What Should Go Down the Drain

Whether you are connected to a large sewer system or your own on-site septic, the only things that should go down the drain are human waste, toilet paper, mild soaps, and detergents. Many items can clog the screens at your community's sewage treatment plant or compromise your septic tank or drainfield—even those that say they are “flushable.”

To avoid damaging your septic system or community sewage treatment plant, you should:

Limit use of chlorine bleach to less than 1/2 cup per laundry load. Bleach kills the “good” bacteria in the tank and drainfield.

Avoid using a garbage disposal, as the microbes in your septic tank don't do a good job of breaking down undigested fruit, coffee grounds, eggshells, vegetables, and meats.

Use the trash bin to dispose of used baby wipes, cleaning wipes, facial tissues, sanitary napkins, tampons, condoms, Band-Aids or bandages, cotton balls or swabs, Q-tips, dental floss, disposable diapers, hair, and paper towels.

Keep kitty litter and pet waste out of the toilet. These do not break down like human waste and should be bagged and placed in the trash.

Use an ashtray, not the toilet, for cigarette butts and matches. They do not disintegrate and can harm your septic system and clog your drainfield.

Use drain screens to keep hair, fruit sticker labels, and other small items from going down the drain.

Scrape cooled grease and other food waste into the compost or trash before washing, so there is less work for your septic to do.

Use a drain snake for plumbing system clogs, which is readily available at hardware stores, or follow this recipe:

- Mix 1/2 cup baking soda, 1/2 cup vinegar, and 1/2 cup boiling water.
- Pour the mixture quickly into clogged drain and let stand for two to three minutes.
- Flush with water.

How Your Septic System Works

All septic systems are composed of a septic tank and drainfield (Figure 3). Wastewater from your household flows into the septic tank, where heavy solids settle to the bottom of the tank and form a layer of sludge. Grease, toilet paper, and other light solids float to the top and form a scum layer. In between the sludge and the scum is a semi-clear layer of wastewater, called effluent, that does not include solids. As more wastewater enters the septic tank, the clear effluent layer of the tank flows through an outlet in the tank to the drainfield in your yard. The “good” bacteria living in the soil clean the wastewater by consuming harmful bacteria and viruses before this wastewater seeps into groundwater.

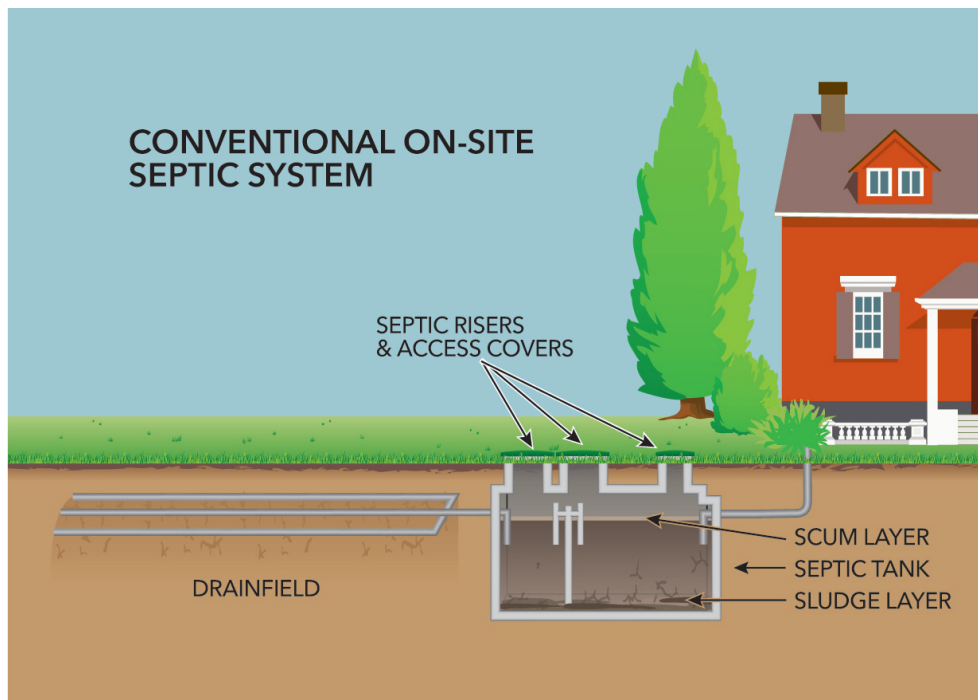


Figure 3. How a typical septic system works. Illustration by Shelby Ruiz, CAHNRS Communications.

There are several types of septic systems, and it is important to understand what kind you have and the requirements for its specific maintenance and inspection. The most common type is the gravity system, which does not require a pump to operate. Others include the pressure distribution system, sand filter system, mound system, and aerobic treatment units such as the Glendon BioFilter system.

Maintaining Your Septic System

Maintaining your septic system is a good investment. Here is a list of actions you can take to ensure your system has a long life:

Get a copy of your septic system’s “as-built” drawing from your health department if you do not have one. This drawing should show the location of your septic tank, drainfield, and all septic parts.

Ensure that no vehicles or heavy machinery drive over any portion of your system.

Keep records of any pumping or repairs.

Inspect your system regularly. Depending on the type of system you have, the recommended inspection frequency may vary from every six months to every three years at most. Check with your health department to see how often you need to have your type of system inspected. Some counties allow you to complete your own inspection, and offer literature, classes, or videos on how to do so.

Pump your system when necessary.

Clean septic tank filters as recommended or at least annually, if you have them.

Install inspection risers (extension tubes from the top of the tank to the surface that make it easier to access your system to inspect or pump).

Spread out the timing of water use around the house. Take showers and baths when the dishwasher or washing machine is not in use. Limit dishwashing or laundry loads to one cycle daily, or space out loads to allow the system to process the water.

Reduce water use. Guideline 8 has some great ideas on how to conserve water.

Consider renting a portable toilet for large events to avoid putting stress on your system.

Protecting Your Drainfield

Your drainfield is critical to the health of your septic system and needs to be protected. The pipes and other components in your system may not be buried very deep below ground and could be easily crushed (Figure 4). The soils in your drainfield contain oxygen-loving bacteria that break down and filter the effluent. If the area is compacted by driving or parking on it, the bacteria won’t be as effective and will reduce the ability of the water to percolate through the soil. You will also want to avoid doing anything that overwhelms the system with too much water.



Figure 4. Drainfield pipes are not buried very deep. Photo by Alan Chapin.

To protect the lifespan of your drainfield, avoid these activities:

Building structures on the drainfield, including tool or garden sheds, decks, sport courts, patios, swing sets, sand boxes, or compost bins.

Parking or driving vehicles or construction equipment on the drainfield.

Planting trees and large shrubs near the drainfield. They should be planted at least 30 feet away to prevent roots from getting into and breaking or clogging the drainfield pipes.

Using a rototiller, which could damage the system parts that are close to the surface.

Over-irrigating in the drainfield area, as this could saturate the soil and decrease the ability of the system to function properly.

Directing water from your downspouts and surface water runoff onto your drainfield.

Burning piles of leaves or branches over the drainfield, as the heat could damage the plastic pipes below, if they are buried shallowly.

Using plastic sheeting over these areas in an attempt to block weed growth.

Using too much topsoil or compost. Limit use to no more than two to three inches over the drainfield.

A good rule of thumb for landscaping over drainfields is to use shallow-rooted plants.

Many grasses have shallow root systems and are the simplest and most frequently recommended plantings over the drainfield. Choose a traditional lawn or perhaps an un-mowed meadow. You may include permeable pathways, garden ornaments, bird baths, sundials, tables, and benches.

In sunnier locations, perennial gardens can be created with mixes of ornamental grasses of different heights and can be inter-planted with ground covers, small bulbs, and sun-loving perennials as well as smaller, shallow-rooted shrubs. Avoid larger ornamental grasses and bamboo, which are known to harm septic fields.

TIP: Avoid planting vegetables over your drainfield. Vegetables often need daily watering and excess water in the soil reduces the drainfield's ability to treat wastewater. Roots of some vegetables may grow deep enough to damage or clog drain pipes. If the drainfield is not working properly, the effluent in the drainfield could contaminate the vegetables.

Signs of a Failing Septic System

Septic systems are designed to have a lifespan of 20 to 30 years, although many last longer. The most common cause of early failure is improper maintenance. A well-maintained system is one that is inspected at the recommended frequency and maintained as necessary. A system that is not pumped when needed will result in a build-up of sludge and floating solids, such as grease and toilet paper, inside the septic tank. If these build up too much, they will flow out of the tank into the drainfield, causing it to become clogged beyond repair (Figure 5). Other causes of failure can include pipes blocked by roots, crushed pipes, over-saturation of the soils, flushing of inappropriate items (e.g., cigarette butts), poor design, or poor installation.



Figure 5. Dye test showing a failing septic system. Photo by Michael Dawson.

You know you have a serious problem if you experience any of the following:

- Sewage backing up in your toilets, sinks, or bathtubs.
- Toilets and drains that are draining much slower, even after using plungers or “plumbers’ snakes.”
- Water pooling in your yard or accumulating near your septic tank. This water may or may not be accompanied by a foul odor.
- Black or dark grey stains in soil or grasses on the drainfield or surrounding areas.
- Overly moist or mushy areas in your drainfield area.
- Algae growth on sub-surface drainage pipe outlets, bulkheads, or visible seeps on the beach or along the stream.

If your septic system appears to be failing:

Avoid using septic system “miracle cures” that promise to get rid of the sludge and scum in your system. “Miracle cures” may dissolve the sludge and scum, sending dissolved particles into your drainfield, potentially clogging the soils in the drainfield and requiring expensive drainfield repair or replacement.

Contact your local health department or surface water agency to find out if their staff may be able to assess your situation and give you advice on how to solve the problem. Your local conservation district may also be helpful. These organizations may also be able to connect you with special loan programs for repairing your system.

Fence off areas if there is liquid waste seeping to the surface of your yard so that pets and people, especially children, are not in contact with the liquid.

Conserve water as described in Guideline 8. This can extend the life of your system if it turns out it has not failed completely.

Have your system pumped and filters cleaned. Combined with some drastic water conservation around the home, this may help solve the problem temporarily, as an empty tank can hold up to several days of waste.

Ways to Save Money

Maintaining and repairing your septic system can be expensive. Because of the importance of maintaining your system for public health, there are sometimes coupons, classes, incentives, and low-interest loans available. Check with your health department, surface water agency, or conservation district to see if they have any incentives.

Scooping Pet Waste

Cat litter should be placed in a plastic bag and disposed of in the trash.

If pet waste is left on lawns, streets, trails, or in parks, rainwater can carry it into roadside ditches or storm drains which often drain directly into lakes, creeks, rivers, and eventually into Puget Sound. This untreated waste may contain E. coli and other harmful bacteria, viruses, roundworms, and other pathogens. Some of these contaminants can last in your yard as long as four years and can sicken adults, pets, and children who play in their yards.

Preventing contamination from dog waste in our yards, streams, and Puget Sound is a simple task:

1. Scoop the poop.
2. Place it in a plastic bag and seal it.
3. Place it in the trash.
4. Wash your hands.

Bacteria and other disease-causing organisms in pet waste are also one of the top causes of contamination in our streams. This contamination can make people and pets sick if they come in contact with the water. One gram of pet waste, approximately the size of a pea, can contain up to 23 million fecal coliform bacteria as well as other pathogens. When carried into Puget Sound, these pathogens can end up in shellfish, sickening people who eat them and causing closure of recreational and commercial shellfish growing areas. This not only restricts our ability to gather shellfish for personal consumption, but can have a significant impact on our economy.

Managing Livestock Waste

To protect the quality of our fresh and marine waters, it's very important for livestock owners to pick up, store, and utilize or dispose of manure properly.

Some of the beneficial reasons for managing livestock manure include:

Protecting livestock and horses from living in an unhealthy environment. Manure can contaminate animal feed and sicken animals.

Avoiding the creation of a breeding ground for nuisance insects that carry diseases.

Lessening the chance of parasite re-infestation, which can happen when internal parasites hatch in the manure and mud and are then ingested by the animals.

Preventing the contamination of groundwater and surface waters by manure, which is harmful to fish, aquatic life, and people, and stimulates growth of aquatic weeds.

In order to benefit from the natural fertilizers in your animal manure, improve your soil, and reduce the costs of chemical fertilizers, manage your manure by:

Collecting manure from stalls, paddocks, confinement areas and pastures every day or two, and storing it in a covered storage bin or an area covered with a tarp (Figure 6). The covering will keep the manure from being saturated in the winter and from weed seeds landing on it in the summer.

Applying composted manure to pastures only during the growing season, April through October. Apply about a half-inch of compost at a time, but limit coverage to a maximum of three to four inches per year. This provides macro and micro nutrients for the soil and adds organic material that improves water infiltration, moderates compaction, and adds healthy probiotics to the soil. Compost also improves the pH of the soil, making it more ideal for grass growth.

Selling, trading, or giving away composted manure, which is often coveted by community gardens, neighbors, nurseries, garden clubs, or topsoil businesses.

Disposing of Yard Waste

Dumping yard waste over a bluff, into a lake or stream, or into the marine water for the tide to take away was once a common practice. Today, we know that leaves and grass clippings dumped into these areas can cause algal blooms and reduce oxygen levels in the water. The recommended option for disposing of leaves, grass clippings, and other yard waste is to compost them at home or use a yard debris collection service, which may be offered by your local solid waste collector (Figure 7). Your local Extension or conservation district offices are good sources of information on home composting. For more information, visit: <http://gardening.wsu.edu/compost-and-mulch>.



Figure 6. A properly covered manure storage area. Photo by Erin Ewald.



Figure 7. Yard waste disposal. Photo by Judy Chapman.

Eliminating Medical, Chemical, and Microplastics Waste

Whether you live in a house connected to a sewer or you use a septic system, it's very important to limit what you flush down your toilet or pour down your sink. The only things you should flush down the toilet are human waste and toilet paper. Period. Anything else should go into the trash. Even items labeled "flushable" or that say they are safe for the sewer or septic systems should be discarded in the trash. These items can increase the frequency that you'll need to pump your septic tank or cause clogs in your pipes, which can cause overflows that can damage property and make people sick.

Avoid harming water quality and fish and wildlife, and protect your septic or sewer treatment plant by doing the following:

Disposing of Drugs

Drugs, medications, and other pharmaceuticals should never be flushed or poured down the sink. If you are concerned about keeping medications away from children and pets, first mix them with old coffee grounds or kitty litter before disposing of them in the garbage. Alternatively, some pharmacies and police stations accept narcotics and other prescription drugs for free and safe disposal.

Disposing of Chemicals

Never pour harsh cleaning products, chemicals, solvents, antifreeze, automotive fluids, cements and glues, nail polish remover, or pesticides into the toilet or down the sink. Do not use the sink to clean up after painting, whether the paint is oil or water-based. Paints can harm your septic system, and if you are connected to sewer, the paints may enter Puget Sound and harm marine life. Check with your solid waste facility to see if they accept any of these items; many offer free disposal of hazardous substances.

Microplastics in Personal Care Products

Many common products used in the home contain tiny beads of plastic, called microplastics. These products include toothpaste, deodorants, eye shadow, exfoliates, body washes, and abrasives used in hand-washing products (Figure 8). The tiny beads wash down the drain, through the filters at the sewage treatment plant, and into the water. These microplastics can be ingested by marine life, sickening or killing them. Avoid purchasing or using products that may contain microplastic beads. Look for the ingredient polyethylene. If the word is followed by a comma, you may have found a source of microplastics.

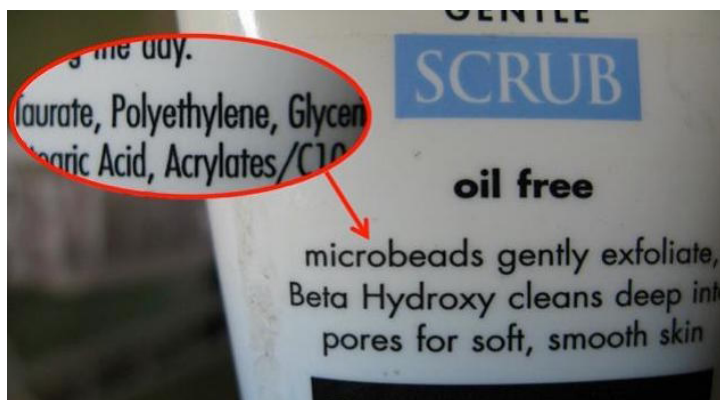


Figure 8. Microplastics that harm the environment are found in common products. Photo courtesy of 5 Gyres Institute.

Discovering How Waste Affects Human, Shellfish, and Marine Life

Shellfish, such as oysters, mussels, and clams are filter feeders that subsist by eating tiny particles floating in the water. Bacteria found in the feces of humans and other warm-blooded animals are monitored in recreational and shellfish harvesting areas because they are good indicators that other harmful pathogens may be present. When high bacteria levels are found, beaches are closed to shellfish harvesting and swimming.

How to Know When Water is Polluted

Bacterial pollution monitoring is conducted by the Washington State Department of Health (DOH), the Washington State Department of Ecology (Ecology), and by some counties, tribes, and local municipalities. In a given area, the monitoring is often well coordinated and done on a regular basis at various locations. Unfortunately, monitoring is expensive and is often only done on a monthly basis, which may not catch contamination quickly enough to prevent harm (Figure 9). Before you harvest shellfish call the hotline at 1-800-562-5632 to see the status of your beach, or visit the [Washington Department of Fish and Wildlife \(WDFW\) website](#).



Figure 9. Most contaminants, such as chemicals and bacteria, can't be seen, so water quality testing is important. Photo by Matt Brincka.

Guideline 2: Working with Nature

Nature can play an important role in helping you protect your property. By working with nature you can reduce property maintenance time and cost, provide protection from natural forces such as waves, wind, and flooding, help clean polluted water, and provide a habitat for wildlife.

Designing with Nature

Nature can work for you! By working with nature, you can cool your home, save energy, provide privacy, reduce your water bill, save time, avoid introducing invasive species and increase bird and wildlife activity. You can also prevent erosion and water runoff. Many Shore Stewards find that with careful site planning, nature can provide all of these things, inexpensively and attractively. By observing and understanding your property, you can begin to design with nature, taking full advantage of the benefits it provides.

For example, if you keep trees like big leaf maple, vine maple, and bitter cherry on the south side of your house, your home will be shady and cool in the summer. Dense, existing vegetation can maintain your privacy and provide a screen from future development on neighboring properties. Dead trees or snags can be attractive and will provide homes for many birds such as woodpeckers, flickers, osprey, and bald eagles. Keep them if they are not a hazard. Carefully planning pathways to the beach can prevent erosion. Maintaining your views can be accomplished by carefully pruning limbs instead of cutting down or topping a tree.

You might start by drawing a simple map of your property (Figure 10). Note where your home is and any paved surfaces, driveways, and paths. Show the slopes, where water is and how it moves through your property, the soil conditions (e.g., clay or sand), existing trees and shrubs, and special views.

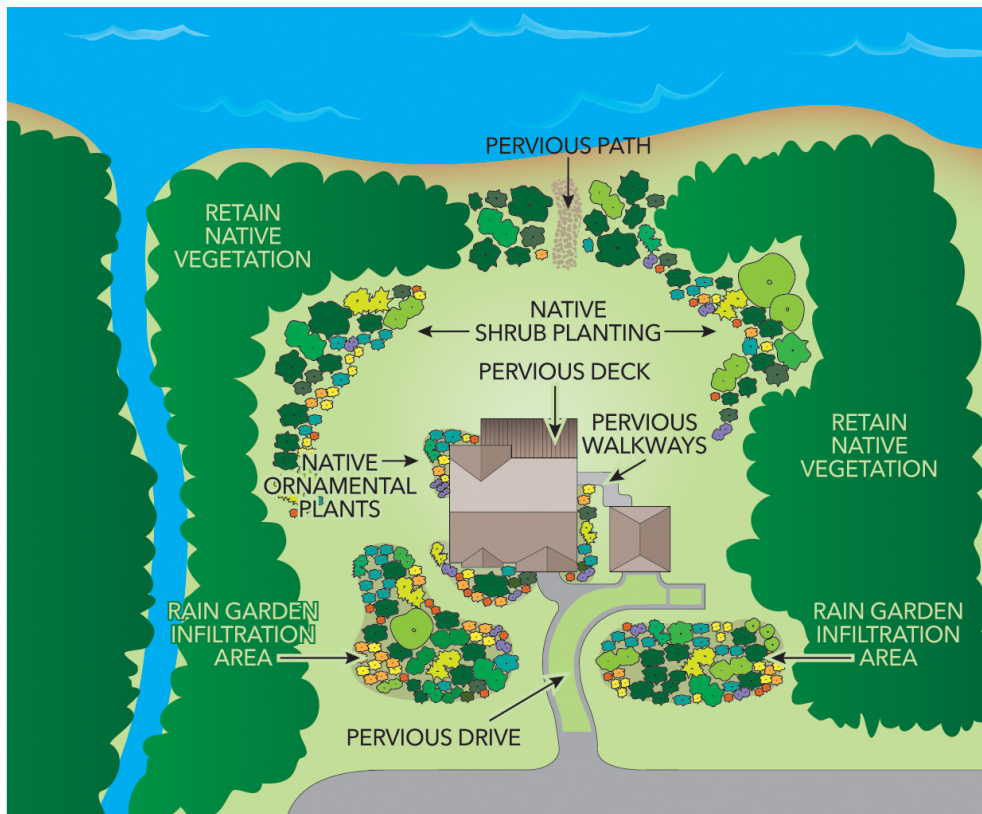


Figure 10. Sketch your property to understand how water moves in the landscape. Illustration by Shelby Ruiz, CAHNRS Communications.

Once you have your map, you will start to see ways to work with nature. Observe your property over a few months to see the conditions in your yard. This will help you decide which plants would thrive on your property. Some plants do best in full sunshine, others prefer shade, and some work well anywhere (Figure 11). One plant might prefer dry locations, while another likes areas that remain moist. If you haven't built your home yet and your land is not cleared, you have even more opportunities to work with nature.



Figure 11. Plant the right plant in the right place in your landscape. Photo by Erica Guttman.

One of the best ways to get nature working for you is to simply keep existing soils and native plants, shrubs, and trees. If you retain what you have, you'll save money, because buying replacement plants and trees can be expensive. You can reduce your water use, because established native plants are adapted to our dry summers. When you clear vegetation, you open that area up to erosion and invasive weeds. For more on native plants, see Guideline 3.

If you hire a contractor to do work on your land, make sure they understand your wishes regarding clearing. Mark the areas you want to protect. Walk the land with your contractor to agree on which trees should be protected. Heavy equipment damages tree roots and compacts soils. Compacted soils inhibit plant growth and lead to ponding of water because the pores in the soil are gone. Most trees will likely survive if at least 60% of the root system is unharmed. Keep ground disturbance at least as far out as the drip-line (outermost circumference of the tree canopy). Ask your contractor how the trees will be cleared. The quickest way is to scrape them away with a bulldozer, but using a chainsaw will protect the surrounding trees better.

Clearing on a bluff or slope has special considerations due to the hazards of landslides. If your property is located on a bluff, you may want shoreline access, whether by trail or stairwell. Sometimes it is easier and cheaper to share shoreline access with a neighbor, or use a community access nearby.

If not, look for a natural trail to the shoreline along durable surfaces, or if you have room, design a trail that meanders, rather than going straight down to the beach.

Keeping a Buffer Along the Water's Edge

One of the ways you can put nature to work is to maintain a buffer of native vegetation along your bluff or shoreline. Buffers provide a transition between aquatic and upland areas and provide a number of important benefits to you and our waterways (Figure 12). Vegetation helps stabilize slopes and bluffs, and can calm heavy wave action, reducing the need for expensive bulkheads. Along streams, the vegetation in the buffer can help prevent erosion and slow damaging floodwaters. Healthy buffers can protect water quality by filtering out sediment and pollutants such as nitrogen, phosphorus, heavy metals, pesticides, harmful bacteria, and other pathogens common in runoff from streets, homes, and agricultural areas (Figure 12). Buffers also provide shade, food sources, and habitats for birds, fish, wildlife, and essential insects such as pollinators. Buffers require little in the way of irrigation or maintenance once the plants are established. Additional information on shoreline buffers can be found in Guideline 5.

Maintaining a buffer is not only important in protecting your property, but it is also required by current regulations. See Guideline 10 for details on permitting and the Shoreline Management Act, which covers Washington's marine shoreline and rivers and lakes. Streamside buffer requirements are discussed in Guideline 6.



Figure 12. Natural buffers along the shoreline are important for water quality and are now required. Photo by Matt Brincka.

Retaining Rain On-Site

A great way to use nature for your benefit is to collect rain using rain barrels or cisterns to water your landscaping (Figure 13). You may also consider building a rain garden or installing permeable paving choices that allow water to flow into the soil rather than run off the surface, helping to keep pollutants out of our waterways. These techniques are discussed in more detail in Guideline 4.



Figure 13. Rain barrels collect runoff that can be used later to water your landscape. Photo by Erica Guttman.

Improving Your View while Protecting Your Trees

The most beautiful views in Washington State can be found on or near the Puget Sound shoreline. Attempting to maintain these views are one of the main reasons people cut or top trees. However, cutting and topping trees can cause bigger problems than they solve. Alternatives are available.

Benefits of Retaining Trees

Trees help stabilize the land. Roots hold sand and soil in place as well as take up large amounts of water that may otherwise flow down the face of the slope. Leaves and needles intercept and slow rain as it falls to the ground. These both help minimize the effects of erosion and the potential for slides. Trees, shrubs, and groundcovers help prevent some invasive plant species from becoming established.

Problems Caused by Topping or Cutting Trees

Removing the top or crown of the tree lowers its vigor and leaves it susceptible to various diseases, fungi, and harmful insects. This can ultimately lead to tree mortality and blowdown. Topping can also activate branch buds, causing multiple shoots to pop up quickly below each cut in the tree's effort to regain lost energy. The shoots can reach the previous height within two years, requiring continuous topping and associated dangers.

Alternatives to Topping or Cutting Trees

When it is absolutely necessary to prune a tree to preserve a view, there are a few recommended alternatives that cause the least amount of harm to the tree, including windowing, interlimbing, or skirting up. It is best to hire a professional arborist who has a trained crew with required safety equipment and liability insurance. This is especially good advice when working with tall trees or near a bluff. An arborist should be certified by the International Society of Arboriculture. Consider asking for bids, using the American National Standards Institute A-300 National Tree Pruning Standards. That way you are covered against damages and can compare bids easily. Remember that most local governments have some restrictions about tree removal within a buffer zone and there may be other restrictions, including homeowner association rules or covenants.

Guideline 3: Making Wise Choices When Landscaping

Landscaping is one of the most important features of your property. Your landscaping choices as a Shore Steward will affect soil stability, fish and wildlife habitats, water usage, and water quality.

Choosing Native Plants

Benefits of Native Plants

Native plants are ideal for home gardens. They provide interest and diversity to a landscape and create habitat for wildlife. These plants thrive in our nutrient-poor soils, unique temperature and moisture conditions, and they rarely, if ever, need fertilizer. Native plants usually don't succumb to fungi and molds, which occur naturally in our region.

Besides improving water quality by filtering out pollutants and sediment, some of the other benefits of native plants on shoreline properties include:

Increased soil stability. The best way to maintain soil stability is to retain existing native vegetation. Plant roots can reinforce the soil, increasing the lateral soil shear strength and cohesion during wet or saturated conditions. In addition, plants absorb and remove water from soils. Evergreen trees and shrubs are ideal choices since they continue to use water from the soil, even in our wet winter months when deciduous plants have gone dormant.

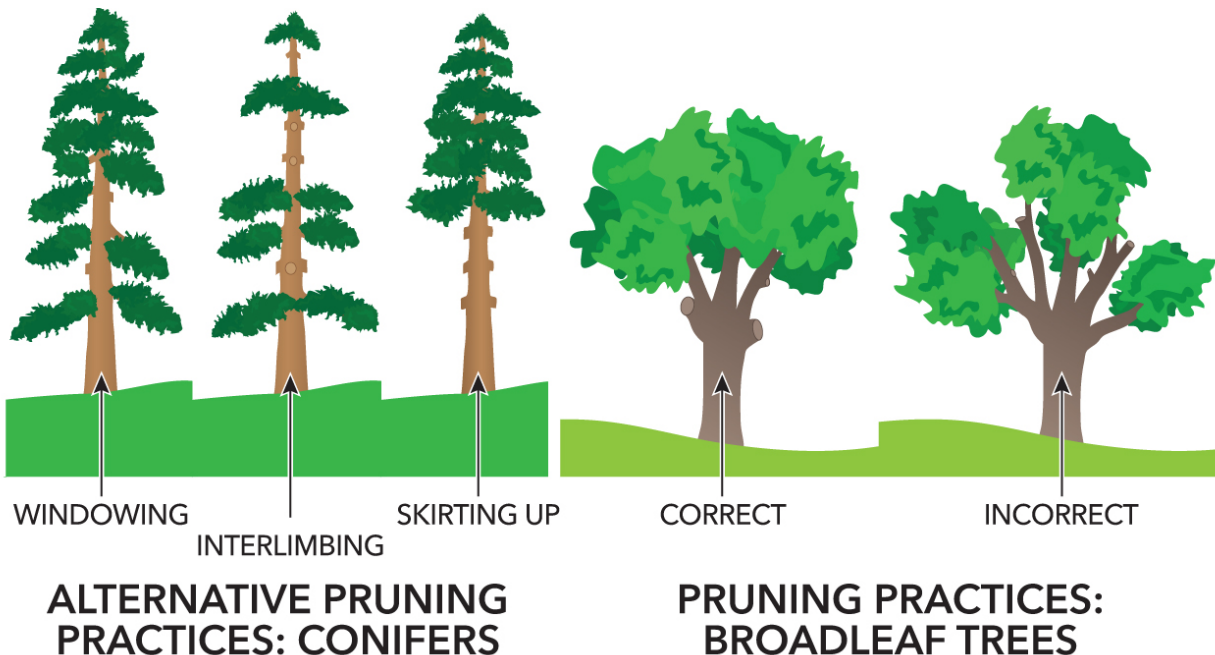


Figure 14. There are important differences in how you prune conifers and evergreen trees. Illustration by Shelby Ruiz, CAHNRS Communications.

Increased shade. Temperature and moisture conditions on beaches are greatly impacted by the availability of shade from overhanging vegetation. Sand lance and surf smelt lay their eggs on the highest part of the beaches just below or among driftwood. In 2001, WDFW biologist Dan Penttila found much higher mortality of spawning sites on sun-exposed beaches than on shady beaches. Forage (or bait) fish such as these are an important part of the food chain that supports marine mammals and salmon. Many other species dependent on cool, moist environments experience increased stress or mortality when tree cover is lost.

Increased salmon food. Marine fish, like salmon, have been found to eat insects from the terrestrial environment that are provided by overhanging vegetation. More research is still needed to determine the true extent of salmon dependence on these terrestrial bugs. However, it is believed that as vegetation is eliminated along our marine shorelines, the food supply is diminished for a range of fish.

Selecting Native Plants

To increase the plant survival rate in your yard, do some research before you buy any plants. Some native plants like dry rocky soils and others like moist, humus-rich soils (like the duff in a forest). It's important to know what the cultural requirements are for each plant. Things to consider include soil type, water requirements, sun and shade requirements, and potential for contact with salt spray. Placing the wrong plant in the wrong place—whether native or not—may result in plants that are unhealthy, scraggly, and unattractive due to stress and inability to thrive vigorously.

Native plants blend in well with other ornamental plants. The trick to selecting and incorporating native plants is to determine how much area (height and width) is available for the plants to inhabit. Some plants tend to spread, so avoid those if you want your plant to stay contained in a small space. Be sure to note the mature size and shape of the plant since they can be vastly different sizes from what you purchase. You can always use good pruning techniques to manage their size to some extent, but you still want to select the right-sized plant from the start. There are many excellent resources available to learn about specific growing needs for each plant—both in books and on the internet.

When choosing native plants, shrubs, and trees for shoreline locations, be sure to select salt-tolerant species. Some suggested species that should thrive on the shoreline include:

Trees

- Big-leaf maple (*Acer macrophyllum*)
- Douglas fir (*Pseudotsuga menziesii*)

- Grand fir (*Abies grandis*)
- Pacific madrone (*Arbutus menziesii*)
- Pacific yew (*Taxus brevifolia*)
- Red alder (*Alnus rubra*)
- Shore pine (*Pinus contorta*)
- Sitka spruce (*Picea sitchensis*)
- Vine maple (*Acer circinatum*)
- Western hemlock (*Tsuga heterophylla*)
- Western red cedar (*Thuja plicata*)
- Western white pine (*Pinus monticola*)

Shrubs and Small Trees

- Elderberry (*Sambucus* species)
- Nootka Rose (*Rosa nutkana*)
- Ocean Spray (*Holodiscus discolor*)
- Salal (*Gaultheria shallon*)
- Serviceberry (*Amelanchier alnifolia*)
- Snowberry (*Symphoricarpos albus*)
- Tall Oregon-grape (*Mahonia aquifolium*)
- Wax Myrtle (*Myrica californica*)

Herbaceous Plants

- Bracken fern (*Pteridium aquilinum*)
- Coastal lupine (*Lupinus littoralis*)
- Coastal strawberry (*Fragaria chiloensis*).
- Fireweed (*Epilobium angustifolium*)
- Honeysuckle (*Lonicera* species)
- Sword fern (*Polystichum munitum*)

There are also many ornamental grasses that do well along the shoreline. Look for grasses that clump instead of spread, and be sure they are not listed as either invasive or too aggressive.

Where to find native plants: A great way to increase native plants in your landscape is to dig seedlings from your yard and transplant them elsewhere. There are several excellent native plant nurseries in the region. Most local conservation districts have annual native plant sales in mid-winter, and many have guides on their websites. WSU Master Gardeners also have plant sales. The Washington Native Plant Society has plant sales, classes, field trips, and online resources. On their website you'll find Native Plants for Western Washington Gardens and Restoration Projects, with a link to Native Plants for Saltwater Shoreline and Saltwater Habitats.

Planting Tips

Don't plant too deep. The top of the root ball or plant crown should be at the same level or just one-half inch above the surrounding soil. If planted too deep, the plant stem can rot and the roots suffocate.

Disturb roots. Remove the plant from the pot and pull loose roots outward and cut or straighten any that are encircling the root ball. This encourages the roots to grow into the surrounding soil. If it no longer looks like a root ball, you've done well.

Don't dig your hole too deep. Dig a saucer-shaped hole that is two to three times the width of the root mass. Build a mound of soil at the bottom of the hole. Splay out the roots so they are pointing to the surrounding soils (Figure 15).

Don't add soil amendments. Coastal plants are adapted to low-nutrient soils. Adding fertilizer or compost in your planting hole will encourage weeds as well as discourage the roots from spreading into native soils.

Don't stomp! We were taught to really pack those roots down—sometimes even pushing down with our feet. This can tear the roots off your plant, which definitely isn't good for them. Compact the soil with your hands.

Water plants immediately. Watering will settle the soil and eliminate air pockets. Add more soil to holes that appear. If you are adding mulch as a weed suppressant, be sure to keep the mulch from touching the stem of the plant. Newly planted natives need regular watering their first two to three years until they're established in a landscape. Water more the first summer, and much less with each passing year so the plants adapt to the drought conditions they'll ultimately have to endure on their own.

For more home gardening information go to <http://gardening.wsu.edu>.

Managing Weeds

When a plant is growing in a place where it is unwanted, we call it a weed. Many weeds were brought to our area as garden plants that have now spread into the wild. These plants are often adaptable, hardy, and have the ability to choke out native species. Invasive weeds are particularly aggressive, non-native plants and are considered noxious if they are harmful to the environment, people, livestock, or agriculture.

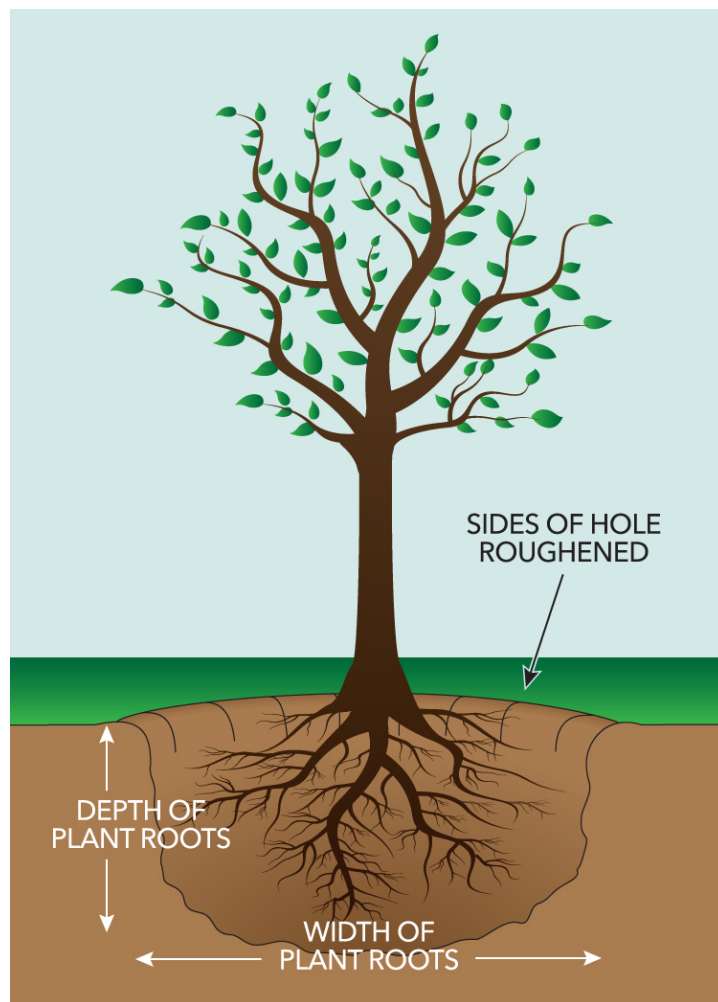


Figure 15. Plant at the right depth. Illustration by Shelby Ruiz, CAHNRS Communications.

An example is Himalayan knotweed, which can take over stream corridors, choking out native plants and reducing wildlife habitats. Some weeds are legally listed by the state and county as noxious weeds; these weeds are required to be controlled. Check with your county [Noxious Weed Control Board](#) to identify listed noxious weeds.

Some methods to managing weeds include:

Avoid disturbing the soil. Many weed seeds remain in the soil, waiting for light to initiate germination. If left undisturbed, they will likely remain dormant. Avoid the use of tillers, and hand-cultivate lightly, if at all.

Use organic mulch. Smothering the weed seeds with organic mulches (straw, layers of newspaper, mulch, and cardboard) will block the light out and eventually degrade, improving the soil.

Use wet paper or cardboard. Wet the paper or cardboard, and the ground beneath, to keep it from blowing away. Spread mulch two to four inches deep above the cardboard, which will retain moisture while suppressing weeds. Be sure to use straw, not hay (which contains seeds that will sprout).

Remove invasive weeds as quickly as possible. Invasive weeds should be removed as quickly as possible before they spread. Other weeds, however, such as non-spreading annuals, may be beneficial by allowing their roots to hold valuable topsoil in place and not allowing it to be blown or washed away.

Think twice before removing weeds from bluffs. When considering removing weeds from a bluff, exercise extreme caution. Some weeds have deep taproots and removing them could cause erosion or even a landslide. Sometimes cutting the weed off at the ground (scotch broom) will work, but sometimes it is best to leave the weeds on bluffs alone.

Safely Controlling Pests

Because you live so close to the water, it is especially important for Shore Stewards to practice safe pest control. Most pesticides and herbicides contain synthetic chemicals that could have harmful effects on non-target plants and animals, including pets, humans, and beneficial insects. Even some of the safer alternatives can be harmful to the environment. You can eliminate or reduce the use of dangerous chemicals and still control unwanted plants or pests by using the following methods.

Limit Your Pesticide Use

Incorporate Northwest native plants into your landscape. These plants seldom need pesticides or fertilizer and many require little or no extra watering once established.

Encourage habitats for beneficials. Native plants create a welcoming environment to beneficial insects and animals. Some of these insects provide safe pest control and are not bothersome to humans.

Provide healthy soil for a healthy garden. According to WSU, healthy plants that are attacked by pests produce chemicals that attract beneficial insects. Keep your non-native plants healthy by giving them compost and mulch. Compost will boost soil health and increase microorganism populations, creating a vibrant soil ecosystem resulting in healthy plants in your garden.

Try to tolerate some pests. Insecticides can often harm the soil microorganisms needed for healthy soils and the beneficial insects that are predators to garden pests. For almost every pest, there is another organism that preys on it. By using some “broad spectrum” pesticides you may be killing the natural predators of the pest. Keep in mind that healthy plants can survive some pest damage.

Use safe and effective alternatives. Horticultural oils, insecticidal soaps and the bacteria *Bacillus thuringiensis* (Bt) are sometimes referred to as “soft pesticides.” They do less damage to beneficial insects and are effective when used properly.

Always follow instructions. When using any pesticide product, follow the directions carefully and use only when they are appropriate.

Safely dispose of pesticides. All pesticides are considered hazardous waste and must be disposed of at a hazardous waste site. In Washington, it is illegal to dump them in the trash or down the drain. For more information on hazardous waste disposal, contact your local solid waste department. In many counties, it is free to dispose of household hazardous waste.

Use the WSU Hortsense website. For comprehensive recommendations from experts at Washington State University go to <http://hortsense.cahnrs.wsu.edu>.

Using Fertilizers Properly

Applying fertilizer according to the directions will reduce the chance of water pollution. Excess fertilizer can wash off the lawn and pollute surface or groundwater. Overuse of fertilizers may also cause thatch build-up in your lawn. Chemical fertilizers may reduce earthworm and soil microorganism populations, which help aerate your lawn. On the shoreline, over-fertilization may also contribute to algal blooms and consequentially cause reduced oxygen levels in the water below the limits needed for salmon and other aquatic organisms.

Consider applying organic or time-released fertilizer, making several applications throughout the year instead of a single large application. A suggested lawn fertilization schedule is November 15, April 15, June 15, and September 1 for western Washington. Be sure to fertilize at least 24 hours prior to any forecasted rain. This will ensure that fertilizers stay on your lawn instead of washing into the water. Reducing the size of your lawn is a great way to reduce your fertilizer use altogether.

Transforming Yard Waste into Compost

The use of compost helps to improve the soil structure, allowing roots to easily penetrate the soil and increase water retention. Nutrients in compost are released slowly and are less likely to leach out of the root zone. You can make your own compost bin and fill it with yard waste and kitchen scraps (Figure 16). Compost is also commercially available for those who want the benefits without the work of creating their own compost.



Figure 16. Transform waste into compost and create your own rich soil amendment. Photo by Darcy McNamara.

Guideline 4: Managing Water Runoff

Rain is a part of life in the Pacific Northwest, and it's mostly a good thing. But too much rain can cause flooding, especially when the water hits hard surfaces, such as pavement and roofs, and doesn't soak into the ground. Rain can also become a carrier of pollution, since water picks up everything in its path and delivers it to the nearest waterway. There's plenty that Shore Stewards can do to reduce pollution in local creeks, rivers, lakes, and streams.

Understanding the Impacts of Runoff

After a rainstorm, you have probably noticed water running over large, flat surfaces, such as parking lots, roofs, driveways, sidewalks, farm fields, roads, and lawns. This surface water runoff is known as stormwater. As we replace forests and fields with hard, impervious surfaces, more rain runs off the land instead of soaking into the soil.

This increases the amount of stormwater runoff, which has been identified as the leading contributor to water quality pollution in the Puget Sound. Pollutants carried by stormwater, such as heavy metals, petroleum products, excess nutrients, and pathogens, have harmed many creeks, lakes, rivers, and bays in Washington.

Orca whales, two species of salmon, and bull trout are protected under the federal Endangered Species Act and are threatened with extinction. Loss of habitat due to development and stormwater pollution are both contributing factors to their status. Shellfish harvesting at many of our beaches is restricted or prohibited due to pollutants carried in stormwater runoff.

Some other effects from stormwater runoff include:

Property damage. Flooding has increased in some areas because water can't soak slowly into the ground. Instead, it runs off hard surfaces and, in a heavy rain, can lead to flooding, erosion, and property damage.

Water pollution. Water becomes polluted as it runs across lawns, driveways, and other hard surfaces and collects oil, gas, fertilizers, pet waste, and more. Water eventually carries these contaminants to our lakes, streams, rivers, wetlands, and marine waters.

Beach and shellfish closures. Bacteria, viruses, and other pathogens from pet and livestock waste, as well as failing septic systems, can close beaches for swimming and shellfish harvesting and harm pets and wildlife (Figure 17).



Figure 17. Call before you dig for shellfish and read closure signs. Photo by Maribeth Crandell.

Increased algal growth. Nutrient pollution from livestock manure, croplands, landscape runoff, and failing septic systems can cause excessive algal growth. As the algae die and decompose, they consume dissolved oxygen in the water to the detriment of fish and other organisms that need it.

Clouded water. Sediment (loose soil) can cause turbidity (cloudiness) in water, reducing the amount of light penetrating the water. This inhibits growth of aquatic plants that fish and shellfish depend on. It can also clog up the gravel in streambeds that salmon use to lay their eggs. Sediment can enter stormwater from construction sites, eroding stream banks, agricultural fields, and other disturbed areas.

Preventing Pollution

Simple actions can help reduce pollution in our local waters. The main idea is to stop pollutants from reaching impervious surfaces on the ground, where the next rainstorm could carry them into a storm drain and into a nearby creek, lake, or Puget Sound.

You can help by:

Maintaining your car and driving it less. Maintain your vehicle by making sure all fluid leaks are fixed. If you do your own maintenance, recycle used motor oil, antifreeze, and other fluids. Vehicle exhaust contains many contaminants that end up on the road and ultimately in stormwater. Driving less and driving a low-emission vehicle will reduce the amount of harmful pollution.

Washing vehicles. Wash your car or boat at a commercial carwash where water is collected and treated. If you wash vehicles at home, do it over a part of the lawn that allows water to soak into the soil, not on the pavement—and use a mild, phosphate-free soap. Never wash your vehicle over your septic system or drainfield, which could harm your septic system.

Disposing of fluids properly. Never dump fluids, including solvents, paint, herbicides, pesticides, fertilizers, or other harmful fluids or chemicals, into a storm drain or ditch. These eventually drain to a stream, wetland, beach, or groundwater.

Reducing fertilizer and pesticide usage. Minimize or eliminate your use of fertilizers and pesticides. Avoid fertilizing before a rainstorm. See Guideline 3 for more information.

Maintaining your septic system. If you have a septic system, have regular inspections and pumping to avoid system failure. A failing septic system allows sewage to seep to the surface of your yard, where children and pets can get into it and rain runoff could carry it to local waterways.

Disposing of pet waste. Pick up pet waste, bag it, and dispose of it in the garbage. Keep animals and livestock out of streams. Pick up and store manure in a covered area, making sure it does not wash into nearby waterways.

Reducing rooftop runoff. Direct your downspouts to a place where water can soak in to the ground, and not to a driveway or the storm drain in your street.

Educating yourself and your family. Learn about your local watershed. Consider volunteering for stream restoration or other local volunteer projects. You will learn a lot about where your water comes from, where it goes, and how healthy it is.

Using Low Impact Development Methods

Good stormwater management not only prevents damage to property and people from flooding, but it also protects the quality of our water. Stormwater management is done by most cities and towns at a large scale, but you can do a lot on your own property to help out. These home-based Low Impact Development (LID) techniques include rain gardens (Figure 18), permeable pavement, rainwater catchment, and soil amendments for better absorption.

LID can be applied to a new development or an existing home and can be successful in many different situations, from urban to rural. Some techniques are simple and others require some engineering. All require a good understanding of how water flows to and from your home and land.



Figure 18. Build a rain garden with neighbors to reduce the amount of pollution reaching nearby waters. Photo by Kim Gridley.

LID doesn't belong everywhere: There are certain situations when LID practices are not advised or recommended. While infiltration of rainwater into the soils is usually desirable, directing water to some locations can create problems with septic system drainfields, may flood crawlspaces, or de-stabilize slopes and bluffs. Check out WA Dept of Ecology's *Managing Drainage on Coastal Bluffs* publication and seek professional advice regarding drainage methods if needed. Refer to Guideline 5 for more information about reducing erosion and landslides.

Some LID techniques you might consider for your own property include:

Preservation. Keep as much of the desirable, existing soils and vegetation as possible.

Amending soils. Adding compost to soils disturbed during construction allows you to restore the soil's health and rainwater's ability to infiltrate. This is also something that can be done with your existing property.

Pervious paving. Alternative forms of asphalt and concrete paving allow rainwater to soak through the paving rather than flow across it (Figure 19). Pervious pavers and grids are also available (Figure 20). These options provide filtration, reduce runoff, and enable water to soak in to replenish groundwater.



Figure 19. Permeable pavers and porous concrete allow water to soak through. Photo by Kathleen Chase.



Figure 20. Installing permeable pavers allows water to flow into the ground via the cracks. Photo by Scott Chase.

Rain gardens. A rain garden is essentially a shallow depression constructed to fit your yard, that uses a special soil mix and a variety of plants specifically selected for rain gardens. The soil mix supports plant growth, holds moisture, and allows the water to soak in. Rain gardens are not suitable in every location, especially near a bluff. Detailed guidance can be found at <http://raingarden.wsu.edu/>.

Rooftop rainwater catchment systems. Installation of a rain barrel next to your home allows you to collect rainwater, conserving it for future use in your yard and garden. Several can be installed, or you might want to collect more rain through the use of a cistern. For every 1,000 square feet of rooftop, you can collect over 600 gallons of water for every inch of rain that falls on the roof! Websites contain information on creating a variety of rain barrel systems and cistern systems.

Vegetated (green) roofs. Top your structure with plants instead of shingles, helping you to reduce pollutants and slow down roof water runoff. Make sure your building can bear the weight of snow and soil before doing so.

More information about low-impact development strategies can be found at <http://raingarden.wsu.edu/>

Guideline 5: Reducing Erosion and Landslides

Most shoreline and bluff landowners are keenly aware of the problems that can occur from erosion and landslides. We’ve all seen media coverage of a home teetering on the edge of a bluff, lives lost in a mudslide, and floods sweeping entire neighborhoods away. This guideline will give you a better understanding of how water moves and how erosion occurs, as well as what steps you can take to reduce risks.

Understanding the Causes of Erosion

Erosion is the process by which soil and rock from one location are transported to another location where they are deposited. The main producers of erosion are water, wind, and human activities. Puget Sound itself was developed by the erosion caused by water and ice movement from retreating glaciers nearly 15,000 years ago. Even today, erosion is a continual natural process along the shoreline through water runoff, wind, and waves.

Limiting the Risk of Erosion

To minimize the risks from erosion to your property:

Establish or maintain a buffer zone between your yard and the water. Buffer zones are areas of densely planted or naturally occurring vegetation composed of trees, shrubs, and plants along bluffs and streams. They hold soils in place. This helps to prevent erosion, as well as prevents sediment from washing into the water. When developing your site, do so with minimal disturbance, leaving as much native vegetation as possible, including an undisturbed vegetation buffer along the top of the bluff. If you choose to plant trees on a slope or along streams, use bare rootstock and plant directly into the native soils of your site. Mulching heavily around the planting helps retain moisture and prevents erosion.

Plant bare areas. Bare soils will erode or invite weeds. When planting, use hardy, deep-rooted native species appropriate to the site, except when it’s over your drainfield. Choose trees and shrubs to stabilize the soil and provide erosion control (Table 1). These species have large, complex root systems that help hold soils.

Consider building location. Locate your home, outbuilding, or patio deck sufficiently far from the water or bluff so it is not susceptible to erosion or landslides. Resist the urge to trade off safety for the sake of a slightly improved view.

Table 1. Trees and shrubs for shoreline and streamside erosion control.

Marine Shore Trees	Marine Shore Shrubs	Stream Trees
Douglas fir	Ocean spray	Douglas fir
Bigleaf maple	Salal	Bigleaf maple
Madrone	Snowberry	Western red cedar
Western red cedar	Vine maple	Black cottonwood
Willow	Serviceberry	Willow
Shore pine	Oregon grape	Paper birch
Vine maple	Evergreen huckleberry	Bitter cherry
Sitka spruce		Vine maple
Grand fir		
Cascara		
	Stream shrubs	
	Ocean spray	
	Red-osier dogwood	
	Red elderberry	
	Sitka alder	

Divert runoff away from the bluff face. Excessive groundwater and surface water runoff are leading causes of landslides and bluff erosion. Coordinate with neighbors to avoid concentrating runoff, if possible.

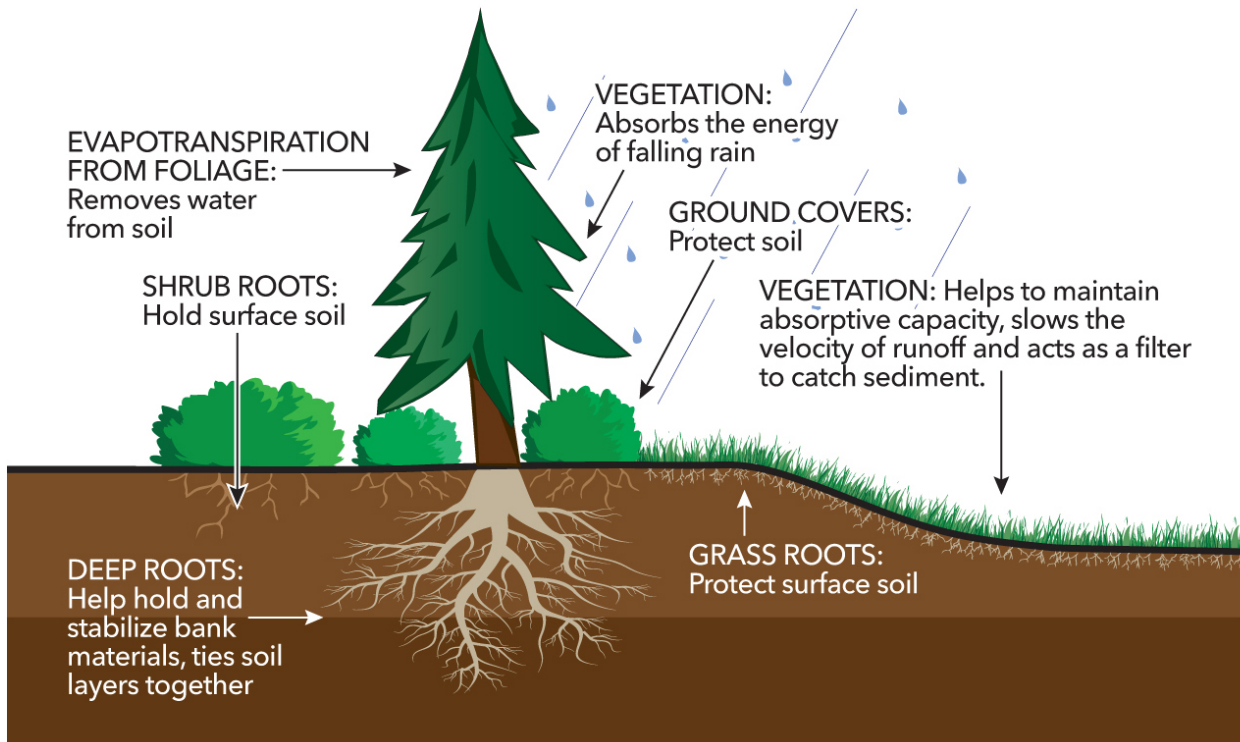
Plan your beach access for minimal erosion. Paths can cause erosion that goes straight to the beach and into the water. When possible, consider sharing access with neighbors to minimize disturbance and cost. Consider building a “hybrid” system (a combination of trail, ladder, winding paths, and stairs) to limit disturbance on the bluff.

Consider natural erosion protection methods. Try using beach logs or downed trees to protect your shoreline. Engineered bulkheads only encourage erosion, often on your neighbor’s property.

Do not dump yard waste over the edge of your bluff. It sets the stage for future erosion because these piles of green waste smother native plants holding fragile slopes in place. Even small heaps of grass clippings can take years to break down. To learn more, please refer to Guideline 1.

Using Plants and Trees for Stability

There are times when property owners feel that a tree or several trees should be removed. Unless the tree is a hazard to your life or property, or presents some other major problem, it should be retained whenever possible to keep the soil stabilized (Figure 21). Factors you should consider prior to removal include the stability of the slope, species, age, health, current health of the tree, position of the slope, surrounding vegetation and density of the stand, rooting habit, soil type, and the ability of the tree to sprout after it is cut.



EFFECTS OF VEGETATION IN MINIMIZING EROSION

Figure 21. Vegetation can reduce erosion. Illustration by Shelby Ruiz, CAHNRS Communications.

Effects of vegetation in minimizing erosion:

- Roots hold surface soil and stabilize bank materials.
- Helps the ground to absorb water.
- Slows the velocity of runoff and traps sediment.
- Absorbs the energy of falling rain.
- Removes water from soil and transpires it into the air.

For those who live along the water's edge, trees provide multiple benefits, such as:

Reducing stormwater runoff. Trees reduce stormwater runoff by intercepting falling rain in their leafy canopies, slowing the force of rain that falls to the ground. The water is held in the bark and leaves and absorbed through the roots.

Reducing risk of erosion. Tree root systems help reduce erosion by holding soil in place. Even after being cut, the roots attached to the stump help stabilize soil for years.

Reducing risk of landslides. The roots absorb the water in the soil and release it back into the atmosphere through a process called evapotranspiration, removing a significant amount of potentially landslide-causing water in the bluff's soil.

Protecting embankments. Fallen trees on the beach protect embankments from wave action. These fallen trees may also serve as "sediment traps," helping build beaches or provide more buffer at the water's edge. If branches on fallen trees are in your way, prune them instead of removing the trees.

Understanding how shorelines move: Incoming waves often come ashore in a diagonal direction, with the backwash of the waves flowing perpendicular to the beach. This flow carries sediment in a zigzag pattern along the beach, which is known as littoral drift or shore drift. This movement of sediment is called a drift cell. Areas where sediment is deposited is called a "sink" and can be seen in the form of a beach, spit, hook, bar, or tideflat.

Recognizing How Bulkheads Change the Shoreline

Bulkheads, seawalls, and riprap are some of the words that describe man-made structures meant to hold back the erosion caused by waves, wind, and tides. This armoring also includes boat ramps, piers, docks, and any other structure on the beach.

Such structures contribute to the armoring or hardening of the shorelines of Puget Sound (Figure 22). It is estimated that more than a quarter of Puget Sound shorelines are currently armored.

While armoring may serve to protect the bluff against wave erosion, the energy of the waves may be diverted elsewhere, often toward the bottom of the bulkhead. This water movement scoops away sand and may eventually cause the bulkhead to be undermined and lean towards the water. In all cases, however, the wave energy is also directed back towards the beach, scouring away the sand and small gravel, leaving larger gravel and sometimes bedrock in place of the once sandy beach.

When several homes or a community have hundreds of feet of bulkhead along the beach, this effect may be more dramatic. The finer sand and gravel may end up being moved from in front of the bulkheads to sites at one or the other end of the bulkheads due to littoral drift. If the beach was a location where fish like surf smelt or sand lance deposited their eggs, the change of sand and gravel compositions could cause the beach to no longer be a reliable spawning location for these important forage fish. Salmon, seabirds, and many other marine species depend on such forage fish in their diet.

Likewise, the change in a beach's characteristics could mean the end of its ability to support the important habitat provided by eelgrass beds, which are nature's nurseries for a wide range of marine species. Over the past century, there have been significant reductions in the size and number of eelgrass beds in Puget Sound.



Figure 22. Eroding wood bulkhead. Photo by Scott Chase.

Without armoring, long-term erosion is generally quite slow, often less than one foot per decade. Some locations of Puget Sound that experience more dynamic wave action have higher erosion rates. Erosion usually does not occur at a constant rate, so it is hard to predict erosion patterns. You could experience little erosion of your property for 40 years, and then a landslide removes a large piece of your bluff at one time. Sometimes these landslides are not caused by erosion from wave action but are due to heavy rains, which cause heavy, super-saturated soils.

Replacing Bulkheads with Natural Solutions

Alternatives to shoreline armoring, known as soft-shore protection, have been developed to help protect the shoreline. Soft-shore protection projects rebuild the upper beach area to provide protection of property and homes while preserving natural beach functions. These approaches use natural materials, such as gravel, sand, logs, and root masses, to absorb wave energy and reduce erosion. One approach is to bury large rocks or concrete blocks below the beach surface, which are used to anchor large woody debris or drift logs (Figure 23). Placement of soft-shore features are carefully engineered and should not be attempted without assistance from an expert and the necessary permits.

Sometimes soft-shore protection comes to you! The natural presence of driftwood and other large, woody debris helps to retain sediments and absorb wave energy. If you find them washed up on your beach, leave them in place (Figure 23). Also, intertidal plants, dune grass, and other berm vegetation can greatly increase the resilience of beaches to storm waves. Native vegetation on shorelines and bluffs are your best first line of defense against erosion.

Living on Bluffs

Appreciating the Importance of Bluffs

The shoreline of Puget Sound is rimmed by slopes and steep bluffs that range from five to several hundred feet high. Looking at the bluff faces, you can often see many layers of sand, silt, gravel, and clay, which were deposited during the glacial and interglacial periods. As these bluffs erode, they provide the building materials that make up our beaches. Whether the cause is from slide activity or wave action, the sediment falls off the bluffs, where it is carried along the shoreline by wave and wind action. These are often referred to as feeder bluffs, and they can feed miles of beaches, creating shore forms such as spits and barrier beaches.



Figure 23. Top: A natural shoreline. Photo by Bob Simmons. Bottom: Before bulkhead replacement (left). After bulkhead is removed and replaced with soft-shore protection (right). Photos by Sarah Schmidt.

Specific compositions of sand and gravel along a beach are important to many species of marine life. Surf smelt, a forage fish, lay their eggs in the high intertidal zone in fine gravel and sand substrate. Sand lance, or candlefish, another important forage fish, spawn in shallow water at high tide on sand-gravel beaches, or sometimes on sand beaches. Forage fish are important food sources for salmon, seabirds, and other marine species.

Sand and mud beaches support eelgrass beds, which are important habitats for small fish and other marine organisms. Pacific herring, an important forage fish, deposit their eggs on eelgrass blades. Larger fish like salmon depend on healthy eelgrass beds for their survival, as do Dungeness crabs, seabirds, and several other marine species.

Understanding Bluff Anatomy

On the upland side (top of bluff), slope failures may occur as a result of water build-up in the soil. This can happen naturally, or it can happen as a result of development activities, clearing of vegetation, and modification of site drainage (Figure 24). At the bottom of a bluff, waves and fluctuating high water levels due to tides can undercut the toe of the bluff and cause collapse. In both cases, bluff erosion is usually due to a combination of water and gravity, with the encroaching influence of development adding to the natural erosion. Our rainy climate keeps our soil moisture levels high the majority of the year, and the levels can be at or near the saturation point during the wet months of winter.

Living at the Base of a Bluff

Many beachfront communities in the Puget Sound region were built along the shoreline on a flat area at the base of a bluff. These communities are often accessed by roads that cut across the bluff, often zigzagging down the bluff's face. Up until the practice was halted by the state in the 1960s, some developers would use heavy equipment and large hoses to wash bluff material down the slope and on to the beach, creating a base of soil, dirt, and rocks on which they could build new homes. In many locations, these were originally feeder bluffs, naturally eroding to nourish the beach below. If your home is in one of these communities, between the bluff and shoreline, you should consider what actions you and your neighbors can take to minimize the likelihood of slides. Not all landslides are the same. Learning about the bluff where you live can help you understand the type of landslide it could be prone to (Figure 25).

If there are trees on the slope behind you, leave them in place whenever possible. If they appear to be in danger of falling onto your house, contact a reputable arborist to determine the health of the trees prior to removing them. You should also leave native vegetation in place. These trees and plants help stabilize the bluff with their root systems and by removing water from the soil and transpiring it into the air. If neighbors at the top of the bluff want to cut trees on or near the bluff's edge you may want to discuss your slope stability concerns with them. You should also check with your planning department since removing or topping the trees may not be allowed within a certain distance from the bluff's edge. Guideline 2 offers alternatives to topping or cutting trees by pruning in a manner that retains or improves the view yet doesn't harm the health of the tree.

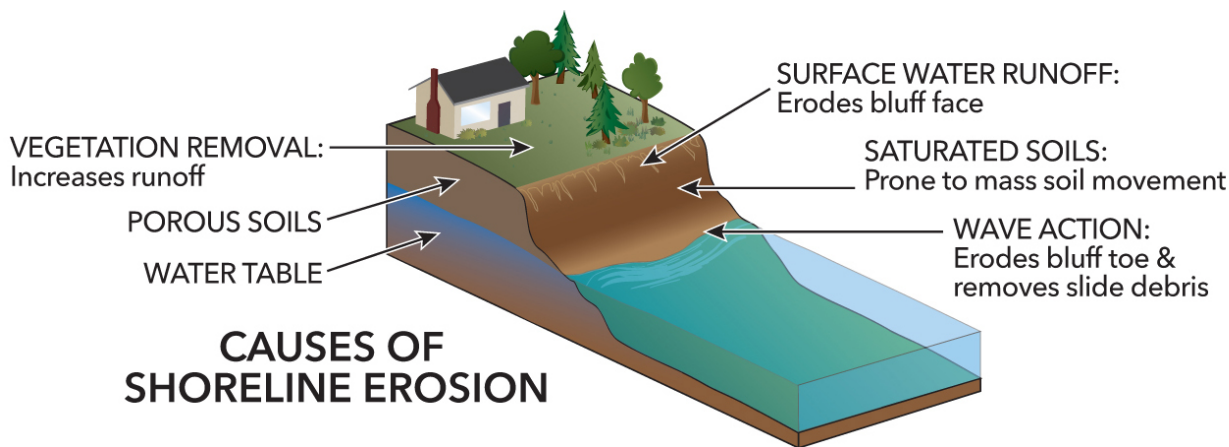
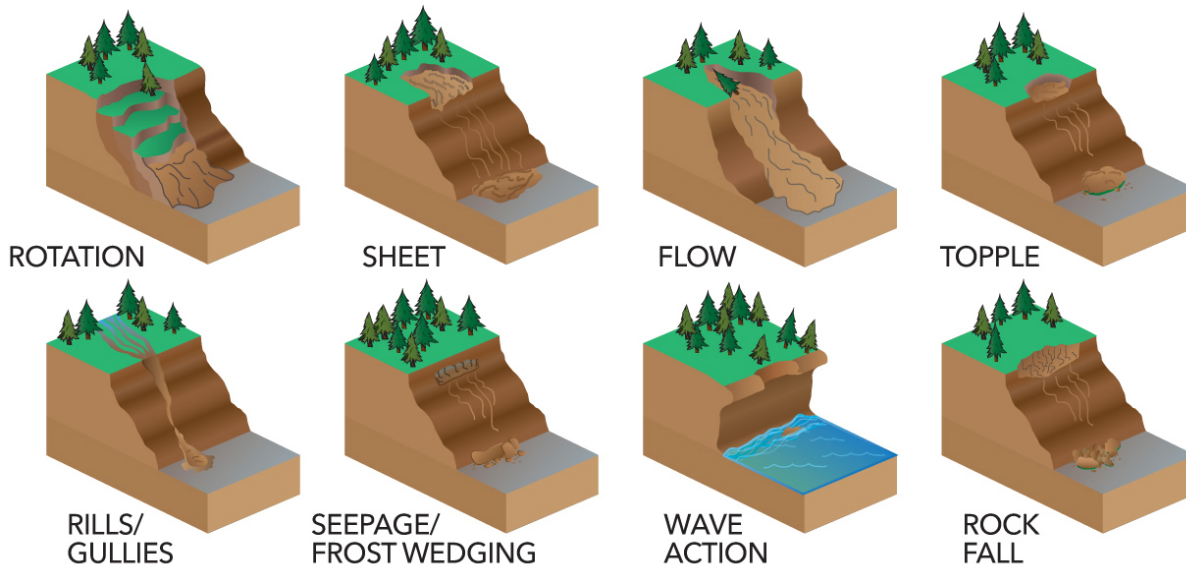


Figure 24. Bluffs along shorelines are susceptible to erosion and landslides. Illustration by Shelby Ruiz, CAHNRS Communications.



TYPES OF LANDSLIDES

Figure 25. Types of landslides. Illustration by Shelby Ruiz, CAHNRS Communications.

If there are roads or pathways down the slope, have an engineer design a method to channel runoff along these hardened surfaces to the beach without flowing down or across the slope and causing erosion. Do not try to dig ditches or channel the water yourself, as this can do more damage than good.

Diverting Runoff to the Beach from Your Bluff

If you live at the top of a bluff, taking care of your water runoff is critical. Homeowners have caused landslides by directing water over bluffs. The routing of surface runoff to the beach in a tightline (i.e., a closed pipe) is standard practice in the Puget Sound region, although the degree to which it helps is highly site dependent. It is important to make sure that pollutants do not enter the tightline, as they will be flushed directly into the water.

You can divert runoff by:

Designing and constructing a tightline. If your surface waters are tightlined to your beach, it is very important that these lines are properly designed, constructed, and maintained. The tightline pipe material has to be sufficiently strong to withstand the elements, anchored securely to the bluff, and not perforated. Water from a tightline should never be discharged at the top or middle of a slope.

Choosing a discharge point location. Carefully consider the discharge point location for your tightline. An energy dispersion device or method should be used at the discharge point to prevent beach erosion.

Checking tightlines regularly. Vegetation should not be allowed to cover the tightline, so you easily inspect the line to ensure that it remains securely fastened and that there are no leaks. If you find a maintenance problem, be sure to fix it immediately to ensure bank stability. Inspect your tightline and its discharge after a major storm. Tightlines can fail during large storm events, concentrating huge flows of water onto your bluff face. They can also be damaged by falling tree limbs, small landslides, and heavy winds. They can be clogged by ice, debris, and animal nests, so you need to check regularly during the rainy season to verify that water runoff is actually exiting the lower end of the pipe. If there is a failure, severe erosion can occur over a very short period of time.

Checking the regulations. Consult your county or city regarding current regulations and resources that can help with site assessment, design, and construction. Some tightline materials and installment methods may not be allowed in your area, so it is important to check before installing.

Words to Know:

bulkheads. Manmade structures constructed along shorelines to control beach erosion.

seawalls. Hard, engineered structure of considerable length, built parallel to the shore to prevent erosion from wave action.

riprap. A sustaining wall of stones or chunks of concrete piled together to prevent erosion from wave action.

littoral drift. The process by which beach sediment is moved along the shoreline.

forage fish. Small fish which are preyed on by larger predators for food (e.g., surf smelt, Pacific herring, and Pacific sand lance).

soft-shore protection. Natural shoreline protection, including vegetation and drift logs, as an alternative to bulkheads, seawalls, and riprap.

tightline. A closed pipe that carries water to a safe point below the slope.

Guideline 6: Living Along Lakes and Streams

Freshwater shorelines are unique ecosystems that can provide important wildlife habitats and water quality benefits, as well as enjoyment for people. As a Shore Steward, it is important to protect these valuable ecosystems that feed into our bays and inlets. Within this guideline, you will learn how to protect your lake or stream.

Learning the Importance of Streamside Plants and Trees

The area alongside a stream or river is referred to as a riparian zone (Figure 26). Plants growing along the banks are called riparian vegetation, which is primarily made up of water-loving plants. Riparian zones are sometimes called buffers since they help filter pollutants out of water flowing across the landscape towards waterways. Riparian buffer areas may be natural or engineered for restoration or soil stabilization.

One of the most important functions of riparian vegetation is its ability to control erosion and prevent sediment pollution in the stream. Increased sediment and silt in stream water can clog fishes' gills, bury their eggs, cover their food sources on the stream bottom, and cloud the water, shading out the sun needed for aquatic life. Vegetation on the shoreline, combined with the meandering curves of the stream or river, helps dissipate stream energy, resulting in less soil erosion and flood damage.



Figure 26. Natural vegetation along a stream in the riparian zone. Photo by Matt Brincka.

Shoreline and overhanging vegetation provides habitats that support microbes, stream insects, and other food sources for fish and other aquatic life. The shading effect of vegetation also helps keep water temperatures cool, which is necessary for salmon to reproduce and thrive. Fallen trees and branches in streams can also provide pools and hiding areas for juvenile fish and other aquatic life.

Shoreline vegetation also provides a natural biofilter that helps reduce pollution in surface runoff and shallow groundwater. Plants take up nitrogen and phosphorus from fertilizers and animal waste. This helps prevent algal blooms, which consume oxygen in the water (when they naturally die off) that is essential for the health of fish and other aquatic organisms.

In many cases, clearing along our streams and waterways has come too close to our waters, which warrants an increase in the buffer width of natural vegetation. In general, studies show that buffers along ditches and streams trap eroded soils, filter pollutants such as fecal bacteria from pets and livestock, and can provide wildlife corridors.

The National Marine Fisheries Service offers recommendations for buffer widths based on stream type. In general:

- For man-made ditches and streams without anadromous fish (e.g., salmon), minimum buffer widths of 35 to 50 feet are recommended.
- For fish-bearing streams, minimum buffer widths of 100 feet are recommended.
- For fish-bearing tidal streams, minimum buffer widths of 35 to 75 feet are recommended.

Local regulations and site conditions vary, and some sources of financial assistance for installing a vegetation buffer may include specific buffer width requirements. For more detailed guidance and assistance, please contact your local conservation district or planning department.

Living with Lakes

If you live on or near a lake, you are probably already aware of the unique joys and challenges of lakeside living. Whether you enjoy your lake by swimming, boating, fishing, or watching birds, everything depends on the health of your lake and good water quality. Unlike rivers or streams, lakes are often calm or have slow-moving water that stays in the lake for a long time. This presents unique challenges for homeowners, but there is plenty that lakeside Shore Stewards can do to keep their lakes clean and healthy.

Many of the over 7,800 lakes in our state were created around 11,000 years ago when the glaciers from the last ice age retreated north of the Canadian border. The glaciers formed lake basins by gouging and piling loose soil and bedrock, burying ice chunks that melted to form lake basins, or depositing gravel and boulders across streambeds, damming the water and forming lakes. Lakes constantly evolve, reflecting changes in their watersheds, whether natural or man-made. They are all filling slowly with decaying plant materials as well as soil washed in by floods and streams.

These gradual changes affect the succession of plant and animal communities, but dramatic changes can be made in just a few years as a result of human activities.

Although many of our lakes have fairly good water quality, some lakes may be getting too many nutrients. This often occurs due to fertilizer use, failing septic systems, or pet waste left on the ground, all of which can get carried into lakes by water runoff. Some nutrients also get into lakes once they soak into the ground near the lake, such as when too much fertilizer is used, or even from properly functioning septic systems since they are not typically designed to remove all the nutrients. These additional nutrients fertilize lake plants and algae.

While some algae is important to the health of all lakes, providing food and energy to fish and other lake organisms, too much algae can actually harm fish and freshwater organisms and is undesirable to recreational users. There are some algae species, such as blue-green algae, that produce toxins as well. The regular occurrence of algal blooms may indicate that the levels of phosphorus or nitrogen are too high. If the scums appear near the shoreline and the toxin levels are dangerously high, local health departments will close the lake to recreation until the danger is passed or advise people (and pets) to stay out of the water.

Though most of the tips and guidelines in this manual apply to living on or near a lake, lakeside dwellers need to take special care to:

Use organic or slow-release fertilizers on your lawn, or use none at all. Abide by the label recommendations for application amounts, and be sure not to use immediately before predicted rain.

Shrink your lawn by adding native plant gardens. Less lawn means less maintenance, watering, mowing, fertilizing, and expense. More rain will soak into the ground instead of running off into the lake. Geese love large lawns, so reducing your lawn may also mean less geese.

Plant a buffer of native plants and vegetation between your lawn and your lake, using the right plants for the site. This will help decrease runoff from your property and also make it less attractive to nuisance geese.

Landscape to slow rainwater runoff between your house and the lake. Make it easier for water to soak in to the ground by placing small swales where water will naturally drain off your property, taking caution that it does not flow over a bluff, which could cause erosion or landslides. Create twists in your driveways or paths.

Plant a rain garden, which will help prevent excess nutrients and contaminants from flowing into the lake.

Consider removing your bulkhead, if you have one, or developing your property without the installation of bulkheads, which cause erosion below the waterline and eliminate habitats for juvenile Chinook salmon. Retain native vegetation whenever possible, which provides food and habitat for birds, animals, and fish.

Practice natural yard care to protect water quality by using compost to build healthy soil and watering the right amount and only when necessary. Seek natural alternatives to pesticides.

Maintain your septic system, since failed septic systems can cause significant water quality problems for lakes. Get regular inspections by an experienced professional.

Never dump aquarium contents, fish, or amphibious animals into the lake. These can quickly multiply, creating serious negative impacts to lake ecology.

Clean up pet waste promptly, as it can run off when it rains, contributing significant fecal contamination to your lake.

Learn to identify noxious weeds around or in your lake. Some to watch for include Eurasian watermilfoil, purple loosestrife, fragrant water lily, yellow flag iris, and Brazilian elodea. Find out what you can do to eradicate and control them before they become a problem, and notify your county's noxious weed coordinator if it does.

If you are doing any construction or lake management activity, including aquatic plant control, you may be required to obtain one or more special permits. Check into this with your local planning department early in your planning stages to avoid violation of federal, state, or local laws. See Guideline 10 for additional information on permits.

Everyone around your lake has a stake in the health of the lake. Working together will benefit everyone. Consider joining your lake association or homeowners' association to work together on common objectives and goals. Working with neighbors and other property owners around your lake, and understanding how your lake works, will help you protect it.

Following Permitting Procedures

Permitting for streamside and lakeside properties may differ from those that are located along a marine shoreline. An overall review of permitting procedures is covered in Guideline 10. One difference between streamside and marine shoreline properties is the width of the buffer required. In most cases, stream buffers are measured horizontally from the edge of the ordinary high water mark (OHWM), or the top of the stream bank if the OHWM cannot be determined. The size of the setback may differ significantly in different counties and cities since they each have their own regulations. It is best to check with your local planning department to determine this information and anything else that is required by your local government's Critical Areas Ordinance, or you can also check the Shoreline Master Program, which covers marine shorelines, larger streams, wetlands, and lakes.

When applying for a permit to do work in or along a stream or lake, you may also need to go through the WDFW's Hydraulic Project Approval (HPA) process. Thousands of HPAs are issued each year for activities ranging from work on bulkheads, piers, and docks to culvert replacements and mineral prospecting. WDFW administers the HPA program under the state Hydraulic Code, designed to protect fish life. WDFW habitat biologists are available to help people and groups apply for an HPA and ensure their projects meet state conservation standards for aquatic life. If you are unsure whether you need an HPA for your project, you can contact a WDFW habitat biologist in your area for help.

The state's Hydraulic Code Rules (Chapter 220-110 WAC) identify projects and activities that require an HPA, ranging from bulkhead construction to mineral prospecting. Refer to Guideline 10 for a list.

Recreating with Nature in Mind

When we recreate in and along streams, rivers, and lakes, we may trample stream banks and damage the plants that are vital to fish, wildlife, and water quality. Plants can be damaged and eliminated through trampling, soil compaction, and even by dogs fetching sticks. Noxious weeds, which compete with native plants, can be spread via the soles of boots, tire treads, and boat propellers and trailers.

Protect riparian habitats and water quality in streams, lakes, and rivers:

Keep all animals, including pets and pack animals, out of streams, wetlands, and lakes to prevent fecal matter from entering the water and reduce the amount of damage caused to riparian plants.

Use official access points to prevent damage to shoreline plants and stream banks.

If you fish, do not release leftover bait into the water; use it or dispose of it properly. If you get a hook caught and need to cut your line, try to remove and properly dispose of as much of the fishing line as possible.

Clean all of your gear when moving between water bodies, including your boots and boat. This can help prevent the spread of invasive species.

If you are using a motorized boat, please refer to Guideline 7 for proper care and use.

Raising Livestock

Cattle and other livestock with access to streams, lakes, or wetlands deposit manure into the water or onto nearby land, which runs off into the streams and lakes during rain events. Manure can contaminate waterways with bacteria, viruses, parasites, and other pathogens. Livestock that congregate near streams often strip stream banks of vegetation causing stream bank instability and erosion. Stream channels start to widen because there's nothing to hold the bank in place. Livestock like to be near streams because it's less distance for a drink of water and it's often cooler. Thus, they tend to overgraze near streams, turning the area into a mud pit during the winter, increasing erosion and providing little in the way of feed.

The responsible management practice is to fence animals away from streams and waterbodies, providing an adequate riparian buffer zone to protect water quality. Fences can range from multi-strand, high-tensile fences that can be electrified to more robust woven wire fencing (Figure 27). For interior paddock fences, animals accustomed to electric fences can often be controlled by a single strand of wire. When placing fencing consider the animal species, the number of animals, vegetation density, and slope.

Another benefit of keeping livestock out of streams is that it reduces the risk of disease from hoof-rot and waterborne bacteria and provides firm footing to reduce the chance of leg injury. Fencing strategies that include rotating livestock from pasture to pasture, preventing overgrazing and allowing for quicker regrowth of moderately grazed areas, can also create more productive pastures.



Figure 27. Fencing livestock away from streams will protect water quality. Photo by Scott Chase.

Providing an alternative source of water, as well as providing shade, salt, and supplemental feed in a location away from a stream or lake, will help keep livestock out of the water. Watering troughs that mechanically or electrically pump water from the stream or lake are available. They provide water for the livestock while protecting stream or lake banks and keeping manure a safe distance from the waterbody. Check with your conservation district about the options. Stream crossings are sometimes required to provide livestock access to pastures on the other side of the stream. A stable, firm crossing will reduce access to the stream and provide solid footing for the livestock. Grazing near riparian areas should be very limited during the dormant fall and winter seasons.

Refer to Guideline 1 for how to manage livestock waste.

Words to Know:

riparian zone. The interface between land and a river or stream.

riparian habitat. Wildlife habitat found along the banks of a river, stream, or lake, and may be home to a wide range of plants, insects, birds, and amphibians.

Guideline 7: Enjoying Your Boat

Boating is a common pastime on our rivers, lakes, and on the Salish Sea. Fun on the lake or sea with family and friends is a great way to pass a summer afternoon. This guideline is full of pointers to ensure you can navigate your way to being a great boater!

Boating for Clean Water

In 2011, there were nearly 145,000 vessels registered in the counties that border Puget Sound. This does not include the thousands of rowboats, kayaks, canoes, sailboats, inflatable boats, and other personal watercraft that do not require registration. If everyone is a responsible boater, we can protect water quality and aquatic life.

Did you know? All boaters born after December 31, 1954, must have a Washington State Boater Education Card if operating a personal watercraft or boat of 15 horsepower or more. The card is available through [Washington State Parks](#).

Being Careful with Your Trash

Litter, such as plastic bags, fishing line, Styrofoam, and other debris can injure, trap, or kill animals and birds. It can also foul propellers and block the cooling water intake on your engine. It's illegal to dump trash overboard, so dispose of it in a proper location on land.

Storing Untreated Sewage Onboard

It is against the law to discharge untreated sewage within three miles of shore, which includes the San Juan Islands, all of Puget Sound, and all fresh water tributaries. Many boaters pump out their sewage at pump out facilities located at many state parks and marinas. A portable toilet is a good option for small boats.

Preventing Bilge Waste from Entering Puget Sound

The bilge collects a variety of fluids that have dripped or leaked in your boat, including oil, fuel, and antifreeze. People used to squirt detergent into the bilge, but this only breaks oils into smaller floating droplets that end up covering a greater surface of the water. This is now illegal and harms the larval stages of many marine creatures.

Many marinas do not allow bilge water to be pumped into their oil recycling containers. The best practice is to keep oil from entering the bilge in the first place.

You can reduce bilge in your boat by:

Maintaining your engine and frequently checking it for leaks.

Fitting a drip tray under your engine to catch leaks.

Wiping up drips, splatters, and spills immediately.

Securing an oil-absorbent pad in your bilge or placing it under your engine. The pads do not soak up water, only the oil, and are very effective. Use gloves to wring out oil into a container for recycling, and reuse the pad.

Installing an inline bilge filter designed to remove petroleum products from bilge water without restricting the performance of the bilge pump. This allows a clean discharge.

Stopping fuel spills

In North America, recreational boating contributes more than a quarter billion gallons of hydrocarbon pollution into our waters every year, which is more than 15 times the amount of oil spilled by the Exxon Valdez. It is the tiny little spills that most boaters experience that add up to this huge number.

Prevent spills by:

- Filling your fuel tank to no more than 90% of capacity.
- Filling your tank slowly to prevent overflow.
- Installing a “no spill” device to catch spills from the fuel vent.
- Not transferring fuel when you are on the water.
- Upgrading to a four-stroke or 2006-compliant two-stroke engine.

You are legally responsible to report spills to both Ecology's Spills Aren't Slick hotline (1-800-OILS-911) and the Coast Guard (1-800-424-8802).

Practicing Slip-Side Maintenance

A quick freshwater rinse when you return to dock will prevent the need for harsh cleaners and keep your boat looking good. Because cleaning products and paint can harm marine life, clean, sand, and paint your boat on land when possible. If you must work on your boat in the water, prevent cleaning agents, scraped paint, or solutions from getting in the water.

Protecting Eelgrass Habitats

As a boater, you can have a great impact on eelgrass. Although it may just look like a grassy field growing underwater, an eelgrass meadow is brimming with life (Figure 28). Your propeller, anchor or crab pot can quickly harm and even destroy an eelgrass meadow.

The eelgrass meadow is used as a nursery by perch, crab, salmon, and Pacific herring. Juvenile salmon use eelgrass beds as a protective location to grow, feed, and hide from predators. Eelgrass meadows can cushion the impact of currents and waves, trapping sediments and protecting against erosion. When eelgrass leaves die, they break down, providing food for worms, shellfish, and sea stars.

Eelgrass grows in locations without strong wave action and with good water clarity, on sandy and muddy bottoms from the intertidal zone down to a depth of about 35 feet. The leaves are long and slender, measuring about a half inch in width and up to three feet long.

Protect eelgrass beds by:

Slowing down or stopping when cruising over eelgrass. Propellers can cut eelgrass and boat wakes can disturb the sediment that protects the root system.

Not anchoring over eelgrass beds. Anchors hold poorly in eelgrass, tear out eelgrass when pulled up, and the chain acts like a slow-moving weed trimmer as the boat rotates around the anchor below.

Not dropping crab pots into eelgrass beds. Eelgrass will wrap around your crab pot rope and trap, tearing out eelgrass as you retrieve the trap and make a mess on the deck of your boat.

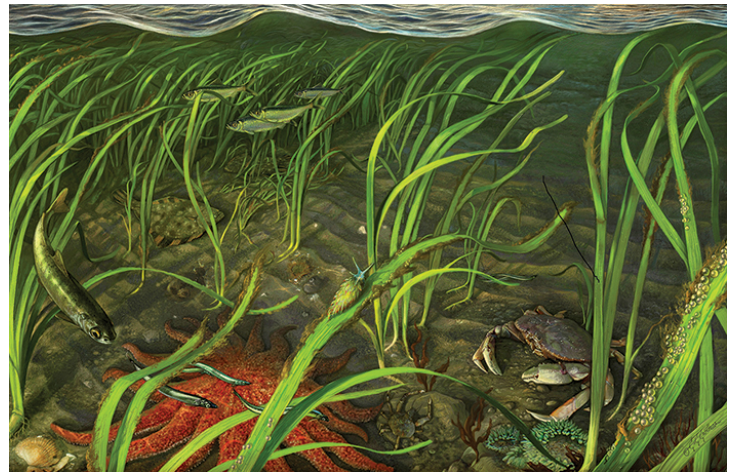


Figure 28. Eelgrass provides a habitat for many marine creatures. Artists Cory and Catska Ench. Courtesy of Jefferson County Marine Resources Committee.

Installing mooring buoys correctly. Rotating mooring chains scour eelgrass habitats. The Department of Natural Resources (DNR) must approve mooring buoys and other agencies may also require authorization.

Preventing the Spread of Invasive Species

Aquatic nuisance species, such as the New Zealand mud snail and Eurasian milfoil, pose a serious threat to the biological diversity and economy of Washington. Many non-native invasive species spread rapidly in areas that do not have their natural predators. These organisms are spread unintentionally as hitchhikers on boats, trailers, and gear (Figure 29). It is against Washington State law to transport any aquatic nuisance species. Be sure to thoroughly inspect and rinse your boat (including jet skis and kayaks), fishing equipment, and wading boots.

Before Leaving or Launching: Inspect Everything!

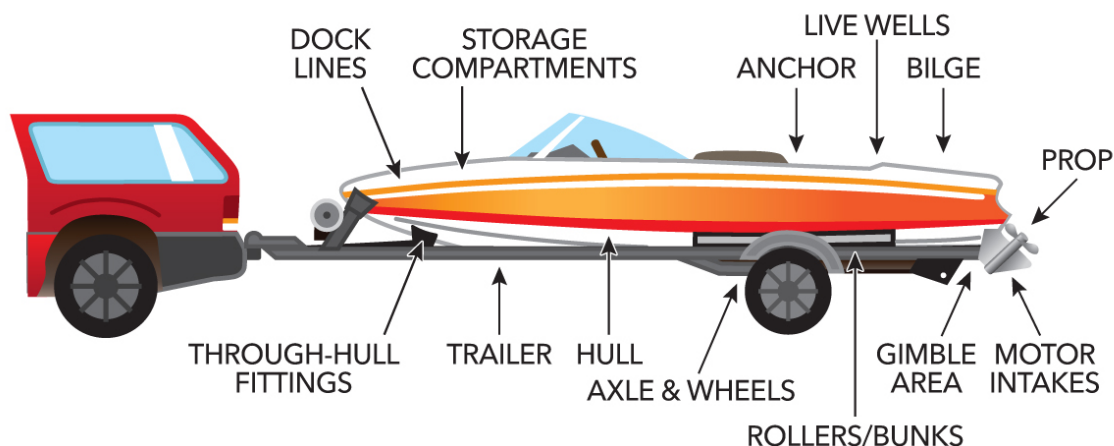


Figure 29. Locations to inspect for invasive species on your boat after a day on the water. Illustration by Gerald Steffen, CAHNRS Communications.

Watching Whales

You may come across a whale when out boating. Keep your distance and know the laws (Figure 30). There are specific laws protecting killer whales (Orcas) and other marine mammals. When encountering marine mammals, slow down or stop and avoid the path of the animal. Stay on the offshore side if whales are traveling close to shore.



Figure 30. Keep a legal and safe distance from Orca whales when boating. Photo by Jill Hein.

Crabbing Successfully

Everyone wants to go home with crabs, and their crab pots, after a day of crabbing. In recent years, we've seen record numbers of Dungeness crabs being harvested in Puget Sound, and it is important that all crabbers follow the rules to sustain the population for future years. Recreational crabbers are the largest population of crabbers out there, so our cumulative actions can have an immense impact.

Help keep the crab population strong by:

- Checking the current Fish & Wildlife Regulations before you go.
- Keeping only male crabs 6 1/4 inches and larger.
- Checking for soft-shell crabs in your pot and returning them.
- Recording your catch.
- Ensuring your traps are well secured to prevent loss in the water.

Learn more by picking up your free regulation booklet, which has maps of crab catch areas, how to measure crabs and check for shell hardness, equipment regulations, sizes, and limits. Check the WDFW website for seasonal information and which days of the week you may crab.

How to Keep Your Crab Pots

Each year, over 12,000 crab pots are lost and wind up on the bottom of Puget Sound. Those pots trap and kill the equivalent of 178,000 male harvestable crabs annually!

Keep your pot by:

Staying with your pots whenever possible.

Using a GPS unit to record the exact position of your pots.

Using an escape (or rot) cord that is 100% natural, such as cotton, jute, or hemp is the law in Washington. These biodegradable cords rot away in two to three months and leave an opening for crabs to escape if your pot is lost. This will prevent an estimated 30 legal size crabs a year from dying in your lost pot!

Weighting your lines because a passing boat will not see a floating line and can cut it as it passes by. Buy leaded line or purchase weights and attach those to your line. You should weight your pot, too, especially if you are crabbing in areas with strong currents or during large tidal exchanges.

Checking the water depth before you lower your pots. Use a line that is one-third longer than the water depth to ensure that you won't lose your pot due to deep water, high tides, or strong currents that pull the pot sideways as you lower it to the ground.

Steering clear of high traffic areas, such as shipping lanes and ferry routes. Commercial vessels do not detour for crab pots. Also avoid sailing regatta courses since boats under sail are not very maneuverable and their deep keel can easily snag your crab line.

Guideline 8: Conserving Water in Your Home and Garden

Water is a limited resource, and too much down the drain and on the landscape is wasteful. The average American family uses 320 gallons of water around the house each day. As a Shore Steward, there are many ways you can conserve water in your home and yard. This can save you money and help conserve a precious resource.

Conserving Water in Your Home

There are many things you can do to conserve water, whether you are on a well or municipal water system. Examine your water bill each month, or if you don't have one, have a water meter installed and keep track of your water usage (Figure 31). See if you can reduce your use each month for a year.

How Much Water Do We Use?

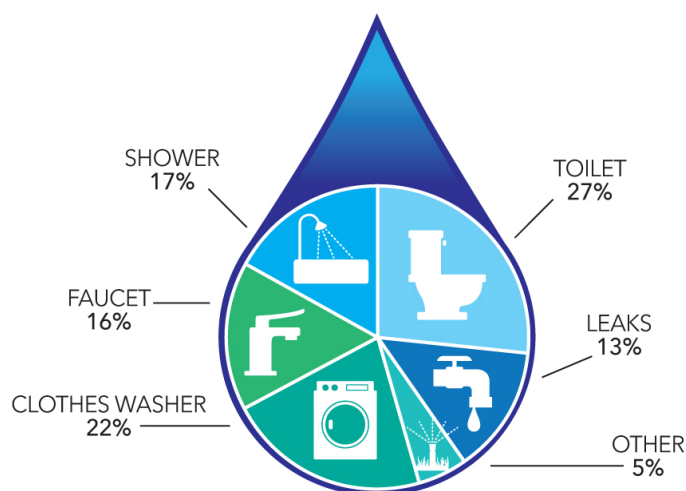


Figure 31. Average water used in a home. Illustration by Gerald Steffen, CAHNRS Communications.

Here are some tips to get started:

- Fix leaky faucets. Even a small drip can easily waste 20 gallons of water each day.

In the kitchen and laundry:

- Use a high efficiency washing machine and save up to 16 gallons of water per load.
- Run full loads. Fill your dishwashers and washing machines before you run them.

In the bathroom:

- Turn off the water while brushing your teeth.
- Install a water-efficient showerhead and take shorter showers.
- Check your toilet for leaks by placing two or three drops of food coloring in the toilet reservoir and checking the bowl (without flushing) for the appearance of color. Fix leaks when you find them.
- Install low flow or ultra-low flow toilets, saving 13,000 gallons per year for a family of four.
- Modify older toilets that use more than 1.6 gallons per flush by placing a half-gallon plastic bottle filled with pebbles in the toilet tank. Be sure the bottle doesn't interfere with the flushing mechanism. Don't use a brick in the tank as it could break down and pieces could get caught in the mechanical parts of the toilet.

Conserving Water in Your Yard and Garden

A lot of the water we use is in the yard or garden. A few changes in your habits could go a long way toward reducing your use and your water bill.

Here are some ideas to try:

Use a broom rather than a hose or pressure washer to clean walks, patios, and driveways.

Harvest rainwater for your outdoor watering needs by installing a few rain barrels or other rainwater catchment systems.

Use commercial car washes where water is reused.

Watering Tips

Water in early morning or evening, and avoid watering when it is windy to decrease water loss from evaporation.

Use a soaker hose or drip irrigation system for garden beds because they reduce and regulate the amount of water used.

Water less frequently but for a longer duration. Light watering encourages shallow root growth, making plants less drought tolerant.

Apply no more than a half inch of water per hour on your lawn. Lawns west of the Cascades only need about one inch of water per week during hot, dry weather, depending on type of soil and its absorption rate.

Water weekly, which should be sufficient for most plants in the ground during the summer.

Arrange sprinklers carefully so that they don't water the street, driveway, or sidewalks, and monitor your watering to prevent runoff.

Use hoses with a shutoff nozzle, and turn off the water when you don't need it.

Reducing Water Loss

Place two to four inches of mulch around plants and trees to reduce evaporation and minimize watering requirements. However, keep mulch from directly contacting stems and trunks to avoid damaging the plants.

Retain native plants and soil because the undisturbed soils retain water better and established native plants won't need to be watered as much as new plants.

Use native plants because they typically require less care and water after they are established.

TIP: Water conservation is a great way to save money and water. Through your water provider you might be eligible for rebates or discounts on water-saving toilets, free leak detection kits, free showerheads, and other incentives.

Determining How Much Water We Use

In this country, the in-home use of water averages about 80 to 100 gallons per day, per person. That's 29,200 to 36,500 gallons per year, per person. This is for personal use and does not include lawn, garden, and other outdoor uses of water. Table 2 shows where the water goes.

Table 2. Water use by gallons.

Activity	Gallons
Flushing low flow or ultra-low flow toilet	1.3-1.6
Flushing conventional toilet, per flush	3.6
Showering, per shower	17.2
Bathing, per bath	24
Brushing teeth, per brush	1
Washing dishes by hand, per load	30
Dishwashing, per load	9.3
Washing machine, per load	40
Cooking meal, per person	3
Washing car, per car	20
Water lawn/garden for 30 minutes	240

Understanding the Hydrologic Cycle

The amount of fresh water on earth is only 2.5% and the rest is salt water. While the amount of water on earth does not change much, it does change its form, from vapor to rain, snow, or ice. This continuous movement of water between earth and the atmosphere is called the hydrologic cycle (Figure 32). When development occurs, the hydrologic cycle is altered and water moves differently, resulting in more runoff and less infiltration (Figure 32). See Guideline 4 for more information on low-impact development techniques that can help.

How the Cycle Works:

When precipitation, in the form of rain or snow, reaches land, it percolates down through the soil to recharge our aquifers (i.e., underground reservoirs). Some of this precipitation first gathers in the form of ponds, lakes, streams, or rivers before soaking into the ground or flowing out into the sea.

Much of the water that does not soak in evaporates, condensing in the atmosphere in the form of clouds, and then falls to the earth again as precipitation. Plants and trees take up groundwater through their root system, using it to survive, and then release it back into the atmosphere. This process is referred to as evapotranspiration.

Besides providing water to animals, plants, and people, this cycle also helps transport nutrients, sediment, and other substances into and out of aquatic ecosystems.

Learning Where Your Water Comes From

It's fun and informative to learn where your water comes from. In Port Townsend, most residents know their water is piped from the Big Quilcene River, about 30 miles away! If you don't already know where your water comes from, call your water provider (the number on your monthly bill) and ask.

In Puget Sound, most large cities rely on rain and snowmelt that flows from the mountains into creeks and streams, and from there into major rivers. Seattle, for instance, receives its drinking water from the Cedar and Tolt Rivers, whereas the water source for Everett and some other parts of Snohomish County is the Sultan River, which flows into the Spada Lake Reservoir.

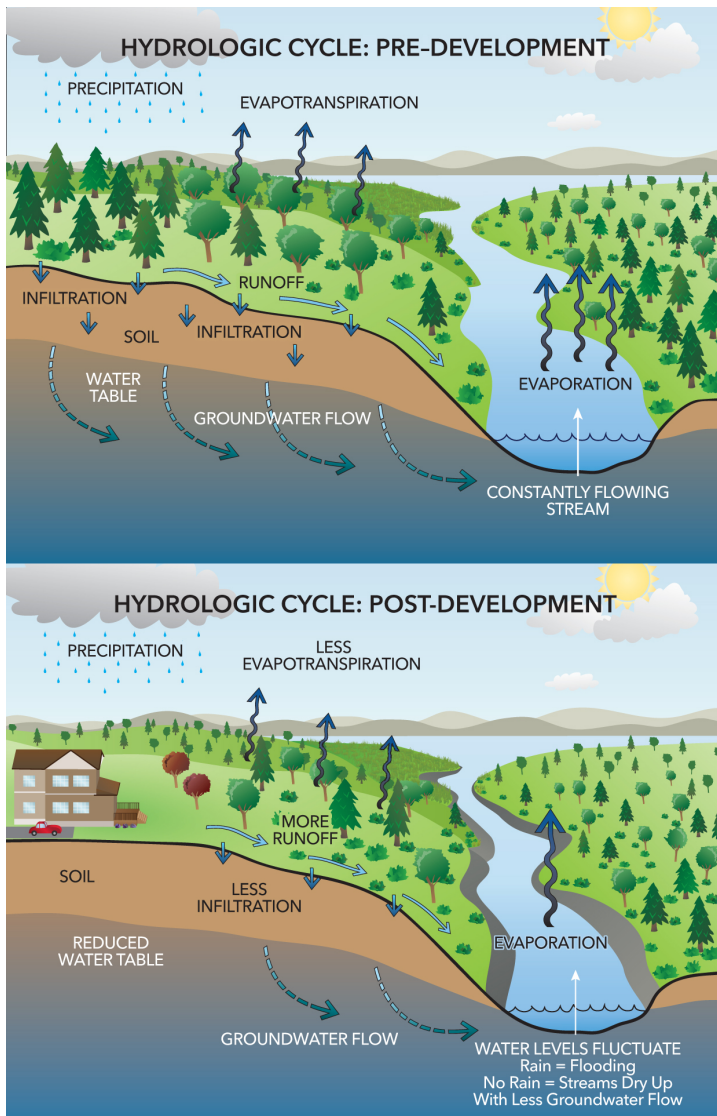


Figure 32. Top: Natural hydrologic cycle. Bottom: Hydrologic cycle altered by development. Illustration by Shelby Ruiz, CAHNRS Communications.

Other communities, such as Olympia, receive their drinking water from groundwater springs as well as from wells that are supplied by aquifers. If you live in a rural area, you might depend on a well, which may be private, community owned, or part of a public system.

Understanding Salt Water Intrusion

Salt water intrusion is the movement of saline (or salty) water into an aquifer that previously held freshwater. If we know the source of the salt water is marine seawater, it is often referred to as seawater intrusion. Seawater intrusion occurs when an aquifer is connected to (outcrops into) a marine water body and the pressure in the aquifer falls low enough to allow the movement of salt water into the aquifer. Areas immediately adjacent to marine shorelines are at the greatest risk for seawater intrusion. Some aquifers have a higher susceptibility to seawater intrusion than others.

Factors that increase an aquifer’s susceptibility include:

- Low amounts of water soaking into the ground.
- High permeability of the aquifer formation.
- Large groundwater withdrawals (pumping) from the aquifer.

Although we cannot generally influence the permeability of an aquifer, we can (and do) influence the recharge area (impermeable surfaces) and pumping rates. Practices such as low-impact developments that allow water to soak into the ground and water conservation can both aid in reducing the amount of seawater intrusion.

Words to Know:

surface water. Water on the land surface, such as in creeks, rivers, lakes, and wetlands.

groundwater. Water that exists below the ground.

aquifer. A saturated geologic formation that can hold and produce useable quantities of water.

ecosystem. A community of living and non-living things that work together.

permeability. The state or quality of a material (e.g., soil, rock, silt, and clay) that causes it to allow liquids to pass through it.

Guideline 9: Having Fun on Your Beach

Beaches not only provide great recreation for humans but are also homes for many creatures. As a Shore Steward, it is important to learn how to enjoy the beach in a way that allows others to enjoy the sea’s bounty for generations to come.

Respecting Intertidal Life

Being a polite guest at the beach is your best approach to keeping intertidal creatures alive and well.

Here are tips on how to be a good visitor while at the beach:

Walking carefully around tide pools and barnacle-covered rocks. Barnacles are living animals and your weight can crush them. Tide pools are important nurseries and safety zones for marine life, so stomping around in one—even if you don’t see anything—can also harm living things.

Using wet and gentle hands. If you pick up any sea creatures, wet your hands in seawater before you touch or handle them. You have oils on your skin that are foreign and may be harmful to sea life. Lifting them from their home may cause stress or wreck their home, making it impossible for them to protect themselves or hide from predators. Don't pry creatures off of rocks, as it may kill them.

Replacing rocks. Looking under rocks and seaweed is part of the surprise and mystery of being at the beach. Be sure to lift rocks carefully, so you don't crush anything underneath. Replace rocks exactly the way you found them, since many small organisms live under rocks and seaweed to protect themselves from air, sun, and predators. Leaving them uncovered destroys their home and possibly them, too.

Leaving plants where you find them. Seaweed, eelgrass, and other plants in the water and on the beach provide erosion control, food, shelter, places to spawn and lay eggs, and protection from heat and cold. When walking on the beach, wading along the shoreline, or dragging your boat or kayak into the water, try not to disturb or squash plants.

Protecting forage fish habitats. Forage fish are small fish like herring, sardines, and anchovies that provide food for other fish, birds, and marine mammals. They fill a critically important role in the food web and are important to the stability of salmon populations. We have six kinds of forage fish, and three depend on local beaches for their survival. Surf smelt and sand lance actually spawn and lay their eggs on the upper parts of the beach during the higher tides experienced at full moon. Pacific herring rely on eelgrass beds to spawn in. Learn more about protecting eelgrass in Guideline 7.

Leaving seal pups alone. In the summer, Harbor seal mothers usually give birth to one pup. She will leave the pup alone on the beach while she looks for food. She returns when she has finished her meal to nurse her pup with rich milk. While she is hunting, you may find the pup on the beach looking like it's abandoned, looking at you with big, sad eyes and often crying for its mother with a sheep-like "ma-a-a." If you find a seal pup, stay at least 100 yards away and make sure your dogs are leashed and do not harass the pup.

The shy mother may not return to the beach if she sees people or dogs near her baby. She might be forced to nurse the pup at night if people are around during the day. If you think the pup is abandoned, a minimum observation period of 24 to 48 hours is recommended before contacting National Oceanic and Atmospheric Administration's Marine Mammal Stranding Network (866-767-6114).

Harbor seals and all marine mammals are protected from harassment by federal law under the Marine Mammal Protection Act.

Harvesting Fish and Shellfish

Before you head out to clam, crab, fish, or collect seaweed for personal consumption, you must have the correct license with the appropriate catch cards. These are available at your local authorized license sales location, or directly from [WDFW](#). There are different annual licenses for freshwater and saltwater fishing, shellfish and seaweed (which includes crab), combination fishing and shellfish, and razor clams. Be sure to also obtain your free copy of the "Fishing in Washington Sport Fishing Rules" pamphlet where you buy your license, or find it online.

Shellfish Licensing

Anyone 15 years of age or over needs an annual license to harvest shellfish, such as clams and oysters, unless you are harvesting from your own private beach. You can be fined if you harvest shellfish over the allowable limit, or under the legal minimum size (Figure 33). You can purchase an inexpensive plastic gauge at most sporting goods stores to measure your clams, shrimp, and crabs.

Following beach closure recommendations: Before you head to the beach to dig for shellfish, always check to see if a beach is approved and open for recreational harvest. Check for closures just before you leave by calling the 24-hour Shellfish Safety Hotline at 1-800-562-5632, or check the DOH's [Shellfish Safety Information Shellfish Safety website](#).

The DOH classifies recreational shellfish harvest beaches as to whether they are safe for gathering shellfish. They can be closed to harvest for a number of reasons, including pollution, harmful algal blooms, or biotoxins in the shellfish. The classifications are open, conditionally open, emergency closure, closed, and unclassified. Note that open classifications don't always mean you can harvest. The WDFW sets limits and harvest seasons to prevent overharvesting. Check the WDFW's website to make sure you can legally harvest at the location you plan to harvest. Because harvest limits, seasons, and even shellfish consumption safety depends on the type of shellfish you harvest, knowing how to identify the different shellfish types is important. The WDFW's website also includes identification guides for common shellfish species in our region.



Figure 33. Clams that are too small are under the legal limit (left). Use a clam gauge to ensure you are taking legal shellfish (right). Photos by Scott Chase.

Digging for Dinner

Once you have checked the regulations, purchased a license, bought your equipment (gauge, shovel for digging, and five-gallon bucket or other container for your shellfish), and made sure that there are no closures on your beach, you are ready to go! Check the tide tables online, in newspapers, or in tide booklets, and plan to dig when the tide is low enough to access the beach. Only dig on your own beach or a beach open for public shellfish gathering. Dig carefully and try not to break or crush any shells with your shovel. Measure your catch to be sure it is legal. If any clams you dig are under the legal size, replace them in the harvest hole with the neck upwards, and cover them shallowly. When finished, fill in all your holes to protect shellfish and people. Wash your catch with clean salt water, cool your shellfish to keep them safe and fresh, and enjoy them using your favorite recipes!

Knowing When It's Safe to Eat

Contaminants, including marine biotoxins, bacteria, and viruses, can make you sick. Washing and cooking shellfish may kill some bacteria and viruses, but biotoxins and chemical contaminants are not removed by washing, cooking, or freezing. Shellfish safety also cannot be determined by the color of the shellfish or the water in the area.

All areas harvested by commercial shellfish companies are tested and approved by the DOH to make sure water quality in the area is safe. However, the DOH does not regularly test private tidelands and beaches. If you live near a public beach with shellfish harvest, or a commercial shellfish operation, you may be able to infer if and when shellfish from your beach are safe to eat. But caution is always advised.

Shellfish Harvesting Checklist:

- Check for closures just before you leave by calling the 24-hour Shellfish Safety Hotline at 1-800-562-5632 or visiting doh.wa.gov/CommunityandEnvironment/Shellfish.
- Harvest shellfish as soon as possible with the receding (outgoing) tide.
- Don't harvest shellfish that have been exposed to the sun for more than one hour (less in really hot weather).
- Keep shellfish cold after harvesting.

Biotoxins, such as paralytic shellfish poisoning (PSP or “red tide”), amnesic shellfish poisoning, and diarrhetic shellfish poisoning, are marine toxins that can concentrate in shellfish and make them unsafe to eat. Biotoxins are commonly found in our marine waters, and eating contaminated shellfish can result in severe illness or death.

Other non-chemical contaminants that can be found in shellfish include the norovirus and vibrio. Illness from either of these can be avoided by thoroughly cooking shellfish. Avoid eating raw shellfish after periods of hot weather or stick to farmed shellfish (which are regularly monitored) from reputable shellfish companies.

Seek medical attention if within minutes or several hours after eating shellfish, you experience:

- Numbness of the lips and tongue.
- Tingling in your toes and fingertips.
- Loss of muscular control.
- Difficulty breathing.

Protecting Your Beach from Contamination

Waste from humans, pets, livestock, and wildlife can make its way into the water and contaminate it with harmful bacteria and other pathogens. Shellfish such as clams, oysters, and mussels filter large amounts of water daily and help clean the water. A single oyster can filter up to 50 gallons of water per day. If the water is contaminated, the shellfish will take it in and likely concentrate the contaminants.

By taking the following steps, you can protect your beach and your family from land-based contamination:

- Knowing where your septic system is located and following the maintenance and pumping recommendations as described in Guideline 1.
- Bagging your pet's waste and putting it into the garbage.
- Managing your manure if you have livestock or horses. See Guideline 1.
- Minimizing the amount of pesticides and fertilizers you use. See Guideline 3.
- Planting trees, shrubs, flowers, and groundcovers to provide some filtration for stormwater runoff before it reaches your beach. See Guideline 3.

Growing Your Own Shellfish

Hundreds of shoreline landowners around Puget Sound grow their own clams, oysters, and geoducks on their beaches, or mussels from their docks. Seed and equipment are sold by commercial shellfish growers and other organizations in our region a few times each year. Do not buy shellfish seed from the internet, and never buy shellfish at the grocery store to transplant on your beach. These practices are prohibited by both federal and state regulations. The WDFW regulates the movement of shellfish to protect Washington waters from the spread of diseases and dangerous non-native pests, such as the Japanese Oyster Drill and the European Green Crab.

When purchasing seed, make sure it comes from a pest- and disease-free area and is unrestricted for planting in all areas of our state. WDFW guidelines for importing and transferring shellfish in Washington State, can be found on the WDFW website. Other resources for purchasing and planting seed include the Pacific Shellfish Institute, Washington Sea Grant, and the Puget Sound Restoration Fund, which holds an annual seed sale on Bainbridge Island.

Guideline 10: Building or Clearing Land Near the Shore

There are plenty of things to think about in any building project, and building along a shoreline can be especially complex. Whether you are just clearing a little land or building a dock, a staircase to the beach, or a dream home, you have a lot of decisions to make, regulations to follow, and safety issues to consider.

Working with Your Contractor and Planning Department

Check with your city or county building department whenever you are planning any clearing or development near the shoreline to see what their requirements are regarding setbacks, buffers, clearing, and grading. Most cities and counties require you to preserve natural vegetation along shorelines. There may also be additional restrictions placed by your homeowners' association, if you belong to one.

Whether you are hiring a general contractor or acting as your own general contractor and hiring subcontractors, you will need to obtain appropriate permits. It is important to make sure your contractor has experience with all steps in the shoreline permit process and you have checked references. If you are acting as your own general contractor, you may want to hire a consultant to guide you through the permit process. Check with your local planning department to see if they offer a pre-application conference, where you can meet with staff and discuss your development proposal before you submit your formal application. Most cities and counties in the Puget Sound area offer this, which may be free or may require a fee. Depending on the project, the meeting may allow you to ask questions of staff from the health, planning, and building departments. Other staff from federal, state, or city jurisdictions may be asked to attend to help with specific issues. There is likely a pre-application checklist that you will need to fill out prior to requesting a conference or meeting, which will include information about and maps of your proposed construction or clearing activity.

Shoreline Permit Process

The Shoreline Management Act (SMA) was adopted by voters in 1972 and covers more than 20,000 miles of Washington State saltwater, river, and lake shorelines. This includes more than 2,600 miles of saltwater shoreline. The SMA seeks to protect and preserve our shoreline resources, provide reasonable use of the state's shorelines, and to preserve the public's right to access the shorelines. Local governments have the responsibility to develop Shoreline Master Programs to carry out the policies of the SMA at the local level.

Most projects near the shoreline require a “substantial development permit” (Figure 34). Certain kinds of development are exempt from substantial development, conditional use, or variance permit requirements, and under certain circumstances local governments can allow deviations from Shoreline Master Program (SMP) provisions.

Existing structures may be “grandfathered in” and not subject to new regulations, but new changes must follow your county's SMP. Buffer widths vary based on the steepness and stability of your slope, wave action, fish and wildlife habitat needs, and how your area of shoreline has been designated by the city or county in the SMP. Check with your local planning department to find out how far from the water's edge you can build. Sheds, decks, and patios may require a different distance from the shoreline than a house.

After the pre-application conference or meeting, if you have one, you may file your application which should include: a detailed site plan, a vicinity map, text describing the location of proposed use, proposed and existing structures, utilities, fill, information on the natural shoreline environment, local shoreline designation information, and the location of the OHWM.



Figure 34. Development along the shoreline requires a permit. Photo by Bob Simmons.

A State Environmental Policy Act (SEPA) checklist is also often required. When a shoreline permit is required, the local jurisdiction will typically be the lead agency for SEPA, but not always. Your local government will conduct a technical review of your proposal and they will make a decision on your permit application. You may appeal the decision on your permit at the local level, if your government has an appeal process, as well as at the state level by the Shorelines Hearings Board.

Following the decision, your application is sent to Ecology. Ecology's role is to review permits with an emphasis on providing assistance to local government and insuring compliance with the Shoreline Management Act.

The following are examples of major types of activities that require HPA permits for either salt water or freshwater locations:

Freshwater

- Bank protection
- Construction of docks, piers, and floats
- Pile driving or removing
- Water-crossing structures (bridges and culverts)
- Channel change or realignment
- Conduit (pipeline) crossing
- Dredging or gravel removal
- Water outfall structures
- Pond construction
- Water diversions
- Mineral prospecting
- Aquatic plant removal
- Lake bulkheads
- Boat hoists, ramps, and launches
- Log, logjam, or debris removal

Salt Water

- Fill placement
- Non-single-family bulkheads or bank protection
- Single-family bulkheads
- Boat ramps and launches
- Piers, pilings, docks, floats, rafts, ramps, boathouses, dry docks, and houseboats
- Utility line placement
- Dredging
- Marinas
- Aquatic plant removal
- Anchor buoys
- Artificial reefs

Ecology will approve, approve with conditions, or deny each conditional use permit and variance. Ecology does not have direct approval authority over the more common permits; however, if they are found inconsistent with the local shoreline acts and plans, Ecology may file an appeal with the Shorelines Hearings Board. Each county also works with Ecology to coordinate with the WDFW, DNR, and the US Army Corps of Engineers. The DNR is a participant where state-owned tidelands and bedlands are involved.

When applying for a permit to do work along a shoreline, you may also need to go through the WDFW's HPA process, which is designed to protect fish. WDFW habitat biologists are available to help people and groups apply for an HPA and ensure their projects meet state conservation standards for aquatic life.

Any construction activity below the ordinary high water line requires a HPA permit, even if the activity is outside the water at the time it is undertaken. If you live on a freshwater lake or stream, see Guideline 6 for more information.

Additional Resources

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Guideline 10

Washington Department of Ecology. [Shoreline Master Programs Permits and Enforcement](#).

Online Resources

Find additional useful links and view the [“Shoreline Living” video](#)

[County Conservation Districts](#)

[Encyclopedia of Puget Sound](#)

[Hood Canal Coordinating Council](#)

[Northwest Indian Fisheries Commission](#)

[Northwest Straits Commission](#)

[Puget Sound Partnership](#)

[Washington Conservation Commission](#)

[Washington State Department of Ecology](#)

[Washington Department of Fish and Wildlife](#)

[Washington State Department of Health](#)

[Washington State Department of Natural Resources](#)

[Washington Sea Grant](#)

[Washington State Parks](#)

[Washington Stormwater Center](#)

[WSU Water Programs](#)

[U.S. Environmental Protection Agency](#)

[U.S. Geological Survey](#)

Oil Spill Reporting (Coast Guard; Best practice is to call both):

State: 1-800-424-8802 • Federal: 1-800-OILS911

WSU Extension Offices

[Island County WSU Extension](#): 360-240-5558

Whidbey Island: 360-679-7327, Camano Island: 360-387-3443, Ext. 258

[Jefferson County WSU Extension](#): 360-379-5610

[Kitsap County WSU Extension](#): 360-337-7157

[Mason County WSU Extension](#): 360-427-9670, Ext. 680

[Skagit County WSU Extension](#): 360-428-4270

Other important contact information can be found on the [WSU Shore Stewards website](#) and at [WSU’s water website](#).

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Anne Nelson, WA Sea Grant

Teri King, WA Sea Grant



Use pesticides with care. Apply them only to plants, animals, or sites as listed on the label. When mixing and applying pesticides, follow all label precautions to protect yourself and others around you. It is a violation of the law to disregard label directions. If pesticides are spilled on skin or clothing, remove clothing and wash skin thoroughly. Store pesticides in their original containers and keep them out of the reach of children, pets, and livestock.

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