

# STABILIZING YOUR SHORELINE TO PREVENT EROSION

## SHORELINE BEST MANAGEMENT PRACTICES

### Recognizing Erosion Problems

With more shoreline than California, Florida, and Hawaii combined, Minnesota is bound to have areas where shoreland erosion is a problem. It is obvious that wave-pounded properties lose soil and ultimately their value. What is not as obvious is that this erosion process can be accelerated or slowed by the practices you adopt, and that sediment going into the lake or river is a pollutant. Erosion is a natural process and, therefore, some sediment does end up in surface water. Clearing shoreland vegetation and beach rocks, and increasing runoff to the shore will accelerate shoreland erosion.

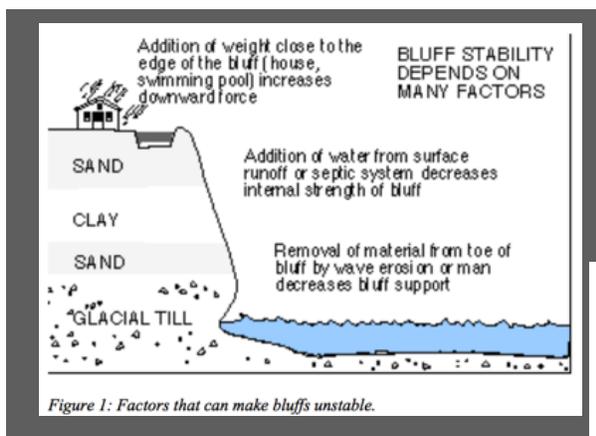


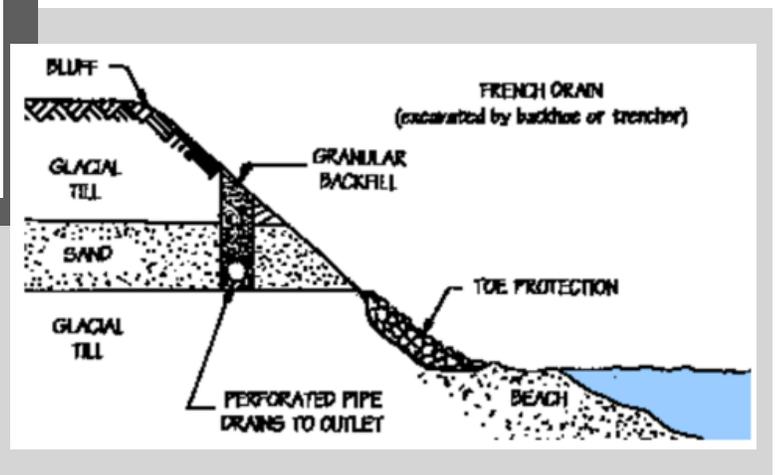
Figure 2: French drains intercept surface water and increase soil stability. Deeper drains will intercept more ground water, but shallower drains are effective also and may cause less disturbance on the bluff. The maximum depth for French drains is 15 to 20 feet.

### Bluff Stabilization

Increased runoff is especially detrimental to high bluffs. Slumping of waterfront bluffs results from unstable soil, usually because surface or ground water is reaching the bluff. On lakes, waves can erode supporting soil at the bottom of the bluff and cause slumping. Along river bluffs, river currents may erode the supporting soil.

On property with steep slopes or bluffs, reducing the amount of water reaching the bluff will help with stabilization. If diverting water away from the bluff is impractical, it should be routed through a nonperforated plastic drain pipe that outlets at the very bottom of the bluff.

Rock should be placed around the outlet to prevent erosion at the bottom of the drain. Surface water and some ground water can be intercepted before it reaches the bluff by installing a "French drain"(Figure 2).



A French drain is a narrow trench set back from, but parallel to, the top of the bluff and filled with free-draining sand or gravel. A perforated, corrugated plastic pipe at the bottom collects water and should drain away from the bluff. The entire perforated length of pipe must be wrapped with fabric or a filter sock. Installing deeper drains will intercept more ground water and provide better protection for the bluff.

No additional weight such as a building, garage slab, or vehicle should be placed near the top of the bluff. Septic systems and swimming pools are especially inappropriate near the top of a bluff because they add weight and water. For most property that slopes toward water, leaving the natural shoreland undisturbed is often the best and least expensive protection against erosion. A filter strip of thriving vegetation on and near the shore binds the soil and minimizes soil loss from surface runoff and waves, and from use by people. Existing vegetation can be enhanced by planting woody or aquatic plants.

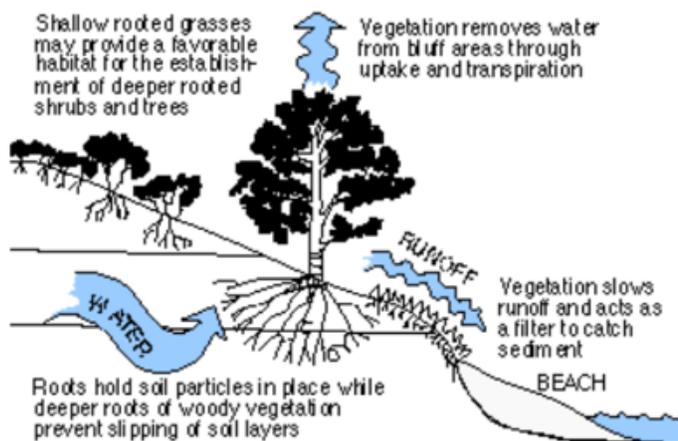


Figure 3: Well-established vegetation on the shore stabilizes the soil and helps remove water.

Natural shoreline features provide natural protection. While swimmers may not enjoy walking on cobblestones, and an ice-pushed ridge may block some of the view from your lawn chair, these features help "nourish" your beach by reducing erosion and trapping sand. Even driftwood absorbs a certain amount of wave energy that otherwise erodes soil.



## Best Management Practices

Erosion of higher shoreline bluff areas can be prevented by:

- Retaining moisture-absorbing vegetation on the bluff
- Outletting rain gutters and diverting surface runoff away from the bluff
- Reducing runoff rate toward the bluff
- Minimizing paved areas that increase runoff
- Limiting ground water flow toward the bluff
- Installing septic systems and drainfields away from the bluff
- Avoiding additional weight on the bluff edge, such as pools, buildings, or storage sheds

## Shore Protection

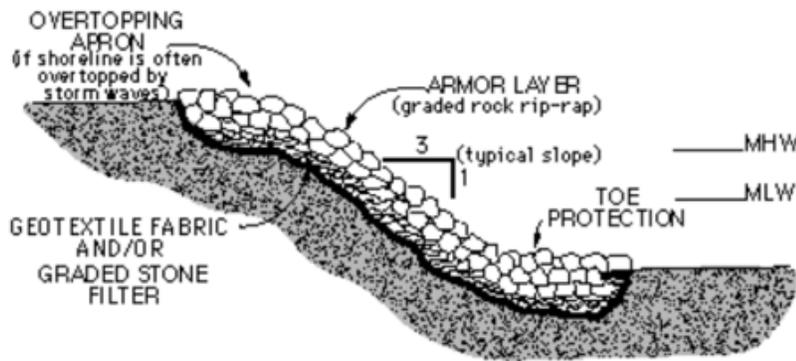
Regardless of the natural protection on your shore, the right combination of conditions (such as high lake level and wind direction) can result in a severe wave pounding, and shoreland soil may need additional protection.

Placement of large rock, usually referred to as rip-rap, is the preferred and most common form of shore protection (see Figure 4). Technical methods are available to determine rock size, placement geometry, and elevations to ensure the best protection.

Potential shore protection alternatives include:

- Bulkheads (retaining walls)
- Gabions (rock-filled wire baskets)
- Articulating blocks (cable-connected concrete blocks)
- Geoweb matrix (thick, open-cell plastic grid)

Figure 4: Proper rip-rap placement (MHW=mean high water, MLW=mean low water).



## Regulations that Apply

All erosion protection projects that alter the lake- or riverbed require a protected waters permit from the Department of Natural Resources (DNR).

Contact the DNR Area Hydrologist for permit guidelines, which other agencies might require a permit, and for assistance in planning your erosion prevention project.

Some rip-rap projects may not need a permit. For those projects requiring a permit, the fee is \$75 (1996). Permit fees for projects other than rip-rap are a minimum of \$75 (1996).

A few of the alternatives can be placed by hand. Some other alternatives, such as railroad ties, are often tried but rarely work. If you have your own idea for a solution, you should seek technical advice first. If rip-rap is used, crushed or blasted rock locks together better than rounded boulders, but can be very expensive unless it is readily available.

Geotextile fabric is usually placed beneath the rock rip-rap to prevent soil loss through the rip-rap openings. It is easy to place and provides an excellent filter barrier (Figure 4). In order to prevent punctures, plenty of slack should be provided over protruding objects that cannot be removed.

A layer of sand or fine gravel can be placed on the fabric for extra protection against puncture. Enough fabric should be laid out so that the rip-rap periphery can be "wrapped" by bringing the fabric up and back down into the rip-rap. This will help hold the rip-rap together as one structural unit. Keep in mind that sunlight will degrade exposed fabric. As an alternative to the fabric, a graded filter layer can be used beneath rip-rap to prevent soil loss through the rip-rap openings. Sufficient rock must be placed at the base of the rip-rap for toe protection. Excavated toe material must be removed from the lakebed and placed in a non-wetland area.

## Costs

The price of rip-rap placement depends on local contractors, distance to the nearest rock source, and access to the project site. It also depends on how much other work, such as clearing or earthwork, is required. Inquire at the county SWCD office about cost-share assistance. A project cost can also be estimated by calling earthwork contractors in your area. A big savings can be realized if you can install these items yourself. If you want to stabilize a slumping bluff, find out about soil types and ground water level.

The record from when your well was drilled may be a good information source and can be obtained from the state or county health department or from your well driller. Contact your county SWCD for information on soils. Effective bluff stabilization will require technical assistance. Request an engineer from the BWSR, SWCD, or NRCS to inspect your site, or consider hiring a geotechnical engineering firm to take soil borings, analyze soil properties, and recommend a remedy.

# MINIMIZING RUNOFF FROM SHORELINE PROPERTY

## SHORELINE BEST MANAGEMENT PRACTICES

### Why is Runoff a Problem?

When an area is developed or altered, the way water flows is also changed. As land surfaces are covered with roads, driveways, or impervious surfaces (rooftops, decks, sidewalks, and parking lots), less water can seep into the soil, so runoff increases. This increased runoff is usually channeled into ditches, drainageways, storm sewers, or road gutters and often ends up in nearby lakes and streams. High flows of water can cause flooding or erosion, as well as increasing sediment in streams and lakes. Fine sediment can also transport nutrients such as nitrate or phosphorus, and pollutants such as sands or salts from icy roads. All of these processes have an adverse effect on water quality.

### Preventing Runoff

Planning ahead is the first and most important step in preventing or minimizing erosion due to runoff. An easy way to do this is to pretend that you are a raindrop. In looking at the landscape or any impervious surfaces, which route would you travel?

Obviously, you would want to take the easiest path downhill. Keeping that in mind, note any areas that runoff would choose to travel. Evaluate your property before you begin your landscape design. Consider slope, soil type, and existing vegetation as you plan your development.

### IDENTIFYING PROBLEMS CAUSED BY RUNOFF

Problem	Possible Cause
Is the water near shore cloudy?	Excess sediment reaching water
Is there an oily rainbow film on the water?	Possible petroleum contamination
Are there algal blooms, green scum, or abundant plant growth in the water?	Excess nutrients such as nitrate or phosphorus reaching the water
Are washouts, trenches, small piles of sediment, leaves, or debris found at the bottom of slopes?	Excessive runoff across the property

## Drainage Ways

- Use existing natural drainage systems such as valleys or low areas instead of digging new ditches.
- Design culverts and drainage structures to handle excessive amounts of runoff; assistance is available from your county Soil and Water Conservation District (SWCD) or the Natural Resources Conservation Service (NRCS).
- Protect storm sewers from sedimentation so they are able to carry storm water as intended.



### Best Management Practices

Follow these long-term BMPs to minimize runoff and prevent erosion:

- Limit paved and covered areas that prevent water from seeping into the ground. Invest in permanent stabilization practices for long-term protection of your shoreland property by planting new vegetation, installing erosion control structures, and diverting drainage.
- Retain trees and shrubs; trees provide a natural umbrella by shedding water and can reduce runoff by as much as 50%;
- Plan and complete an annual maintenance schedule to make sure that your runoff and erosion control plan is working to protect your property.
- Limit clearing and grading on slopes and minimize cutting and filling for roads, sidewalks, and footpaths to reduce erosion and still provide access.
- Avoid damaging adjacent property with temporary erosion control methods, because water does not stop flowing at your property line.

## Roads, Driveways, and Sidewalks

Minimize pavements and impervious surfaces.

- Use gravel driveways instead of pavement.
- Where paved areas are necessary, locate them as close to the main road as possible to minimize the length of paved driveway.
- Do not pave wasted space such as corners near buildings that are not large enough for parking or driving. Locate driveways, sidewalks, stairways, and footpaths away from slopes because steeper slopes have greater erosion potential; if you must cross a hillside, follow the contour of the slope.
- Use steps when a walkway must go directly up and down a slope, particularly near the waterfront.
- Minimize road crossings over waterways and cross at a right angle to the stream if possible. Sweep driveways or sidewalks instead of washing them down with a hose, to prevent sediment, salt, and petroleum products from washing into storm sewers; cover stockpiles of salt and sand with a tarp or store them in a building.
- Use shallow grassed areas by roadsides instead of curb and gutter runoff and storage for snow.
- Install water bars on sloping roadways to slow and divert runoff.
- Use paving stones instead of solid concrete for walkways; this allows water to seep around the stones instead of running off. Avoid shortcutting down slopes because shortcutting causes erosion; compacted soil on footpaths also promotes excessive runoff.

## Landscaping and Construction

- When landscaping, stage construction so one area is stabilized before another area is disturbed. Avoid construction in areas with: -- little vegetative cover; preserve existing cover -- erodible soils (sands, or soils that appear fluffy when dry) --mainly bedrock with a thin covering of soil --steep slopes of greater than 10%; to picture a 10% slope, imagine putting the bottom end of a board 10 feet out from the wall and the

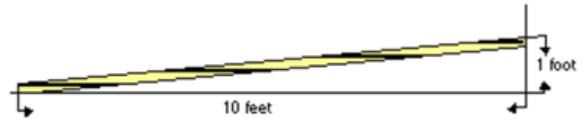
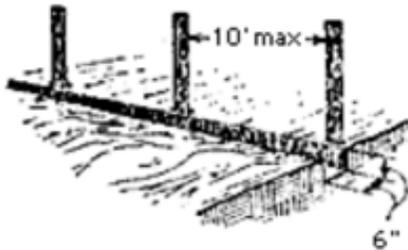


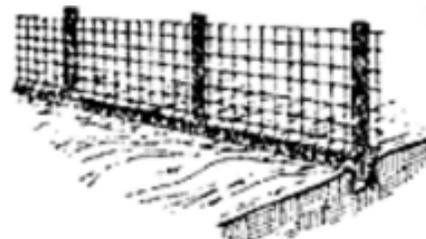
Figure 1: A 10% slope is represented by leaning a board against the wall with the top at 1 foot and the base set 10 feet away from the wall.

- Control erosion during construction by using temporary methods such as diversions to carry water away from the construction site to where it can be safely dispersed or silt fences or hay bales to trap sediments before they enter the water; a combination of methods may be the best solution (see Figures 2 and 3).
- Use only clean fill (free from debris and dirt) such as rock, sand, or gravel near lakes and streams. Use only solid concrete forms such as interlocking blocks or slabs; do not use liquid concrete and avoid treated timbers or railroad ties.

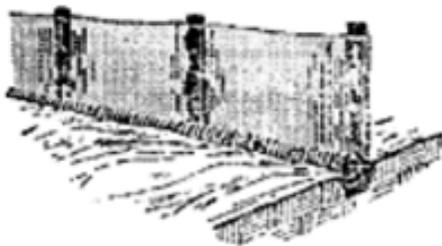
1. Set posts and excavate a 6"x6" trench upslope along the line of posts.



2. Staple wire fencing to the posts.



3. Attach the filter fabric to the wire fence and extend it into the trench.



4. Backfill and compact the excavated soil.

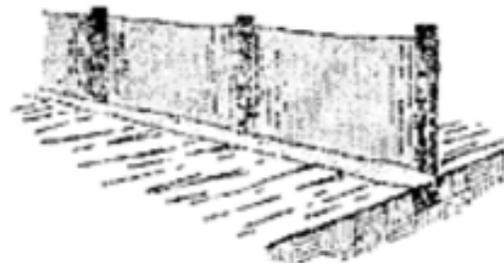


Figure 2: Constructing a silt fence to slow runoff and prevent erosion

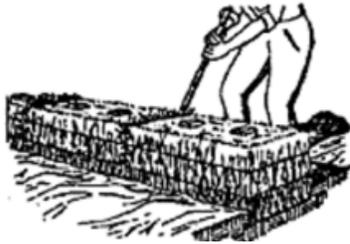
1. Excavate the trench.



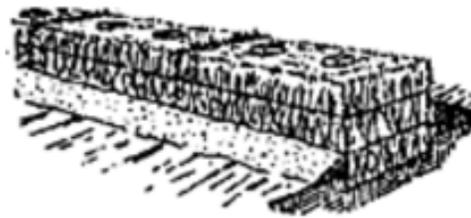
2. Place and stake straw bales.



3. Wedge loose straw between bales.



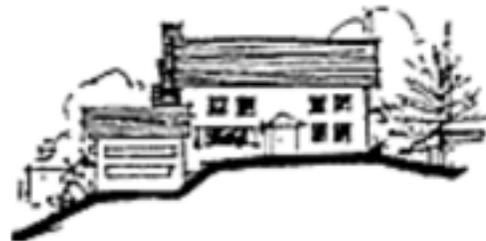
4. Backfill and compact the excavated soil.



### Buildings and Runoff

- Install rain gutters along the edge of rooftops to help carry water off of the roof and away from the building to areas where soil won't be eroded; make sure there is erosion protection where the gutters outlet onto soil.
- Keep gutters free from debris and draining properly. Keep rooftops free of snow and ice buildup to help control the magnitude of runoff in the spring and protect your roof from damage.
- Pave patios with flagstones or decay-resistant wood blocks instead of solid material to permit some water to seep around the stones or blocks.
- Position rooftops so they are perpendicular to the slope, instead of parallel, to slow down runoff (Figure 4).

Figure 4: Build rooflines perpendicular to slopes



roofline perpendicular to slope slows down runoff



roofline parallel to slope increases

### Regulations that Apply

Most zoning ordinances restrict the amount of impermeable surface allowed in the shoreland area; check with your local zoning officials for more information. Alteration or filling of wetlands is strictly regulated; check with your county Soil and Water Conservation District before beginning any projects that impact wetlands. For any development along waterways or lakeshores, contact the Department of Natural Resources, Division of Waters for any necessary permits.