

OUR SHORE Coastal Erosion Assessments and Site Reports: Cliff Island



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The Maine Department of Environmental Protection (DEP) is currently developing OUR SHORE, a program that seeks to support homeowners, contractors, and communities who want to integrate nature-based strategies (NbS) into their plans for coastal resilience. The program provides informational tools in the form of a Quick Assessment to identify erosion hazards and a longer guide on how to apply NbS techniques, as well as outreach and training events for homeowners and shoreline stabilization practitioners.

In partnership with the Maine Conservation Corps, the OUR SHORE Program provides direct technical assistance on NbS to property owners and communities by placing Shore Corps Stewards with nonprofits across the state of Maine. Each Shore Corps Steward receives specialized training from the OUR SHORE program and state partners. From May 2025–May 2026, Island Institute is hosting a Shore Corps Steward, Emma Polhemus, to support the Casco Bay islands as they expand NbS opportunities for public and private properties.

Alongside community partners and Island Institute staff, the Shore Corps Steward visited coastal sites on Cliff Island in March 2026 to complete OUR SHORE Assessments of coastal erosion. The following report documents the results of these assessments along with recommended erosion management actions that align with OUR SHORE guidelines and prioritize nature-based and hybrid strategies.

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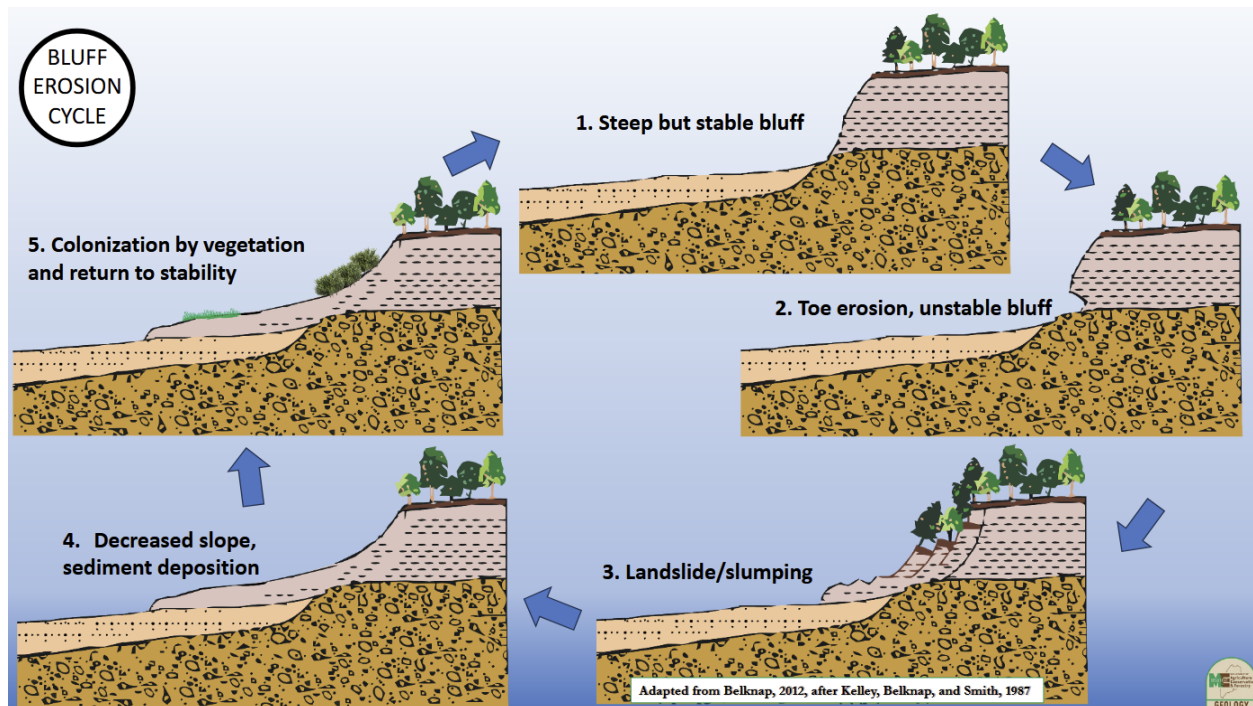
Contents

Key Terms.....	3
Mapping Tools.....	4
The OUR SHORE Quick Assessment.....	5
OURSHORE Quick Assessment: Griffin's Cove.....	6
OURSHORE Quick Assessment: Private Properties.....	13
References.....	21

Key Terms

Coastal bluff: A type of coastal shoreline where unconsolidated sediment (e.g. sand or clay) forms a steep slope 3 feet or taller. Coastal bluffs are located above the high tide line, and can be adjacent to different habitats like salt marshes or mud flats. The top of a bluff where flat land meets the slope is called the crest and the base of the bluff is called the toe. The slope in between the crest and toe is called the bluff face.

Bluff erosion cycle: Coastal bluffs follow a predictable geologic cycle of erosion and stability. In the bluff erosion cycle, the toe of a stable bluff is eroded, creating instability. The unstable bluff slumps, meaning that sediment from higher up the bluff falls or slides to the toe. The fallen sediment creates a more gradual slope and provides habitat for intertidal and upland vegetation, which protects and restabilizes the bluff, returning to the beginning of the cycle. The diagram below, created by the Maine Geological Survey, illustrates this cycle.



(Slovinsky, 2025)

Shoreline stabilization: Often called shoreline hardening or armoring, this typically refers to building hard, manufactured structures (like seawalls, bulkheads, and/or riprap) along a coast or water's edge to attempt to stop erosion and protect private property. Shoreline stabilization can also refer to plants and natural materials used for the same purpose.

Nature-based strategies: Strategies that utilize natural processes and ecosystems to address environmental challenges. For shoreline erosion, several nature-based solutions can be

employed to manage and mitigate erosion while also providing additional benefits to the ecosystem

End-effect erosion: Worsened coastal erosion that happens at the ends of protective structures like seawalls or riprap, causing increased damage to neighboring properties by disrupting natural sediment flow, essentially pushing the erosion problem next door in a domino effect

Scouring: An effect that occurs when waves hit a hard, vertical wall. That wave energy is not absorbed; instead, it is reflected downward and sideways. This redirected, high-energy flow "scoops out" and carries away the sediment (sand, soil, and/or sea bottom) at the base of the structure and in adjacent areas. Consequences of scouring include deepening the water in front of the structure and creating more intense wave energy, degrading habitat, and the undercutting of the foundation of the hardened structure leading to failure of the structure

Fetch: The distance that wind can blow over water towards a shoreline without interruption by a land mass or structure. Shorelines with a high fetch are very exposed to wind, and therefore experience bigger waves, while shorelines with a low fetch are sheltered from wind, storms, and waves. The exposure level of a coastal site is sometimes expressed as *annualized fetch*, which combines the fetch from different directions with how often the wind was blowing in each direction during a year.

Mapping Tools

The following maps and mapping tools are referenced throughout this report:

Living Shorelines Decision Support Tool: Created by the Maine Geological Survey (MGS), this mapping tool rates stretches of shoreline from probably not suitable to highly suitable for a living shoreline design (i.e., using nature-based strategies). Suitability ratings are based on environmental factors like the shoreline geology, annualized fetch, and height and angle of the slope. This tool is a helpful starting point for deciding whether to build a living shoreline, but any site should be assessed on the ground and in detail before choosing a shoreline stabilization strategy.

Coastal Bluff Maps: The MGS Coastal Bluff Maps classify coastal bluffs as stable, unstable, or highly unstable. Stable bluffs have dense vegetation cover, gentler slopes, and no signs of erosion. Unstable and highly unstable bluffs have exposed soil on the bluff face, steeper slopes, and signs of erosion like fallen trees and displaced blocks of soil. Data for the Coastal Bluff Maps was last collected in 2020, so some bluffs mapped as stable might be unstable at present, and some unstable bluffs might have stabilized. New Coastal Bluff Maps of Casco Bay are expected in 2026.

Beginning with Habitat Maps: Beginning with Habitat is a program created by the Maine Department of Inland Fisheries & Wildlife (IF&W) to share information on plant and wildlife habitats and conservation. Since any shoreline stabilization project, whether nature-based or a hardened structure, will impact the surrounding environment, these maps can help decision-makers and project designers understand what habitats and wildlife are in the area and how to minimize negative impacts. Some of the data included in Beginning with Habitat maps also affect the permitting process. For example, shoreline stabilization permits have to undergo additional review by IF&W if the project will occur near protected habitats like high-value waterfowl and wading bird habitat.

The OUR SHORE Quick Assessment

The OUR SHORE Quick Assessment is a tool used to quickly analyze the causes and impacts of erosion at a shoreline site. The assessor ranks the site as lower, moderate, or higher instability risk based on a variety of criteria in the following categories.

Criterion	Characteristics of Lower Instability Risk	Characteristics of Moderate Instability Risk	Characteristics of Higher Instability Risk
Example: Bank Height	Low bank (less than 3 feet)	Moderate bank (3-6 feet)	High bank/bluff (over 6 feet)

Source & Severity of Erosion – Assess the locations & sources of of instability

Height & Slope Risk – Assess contributions of height, slope, and soil to instability risk

Overland Water from Land Use – Assess how property use affects stability through overland flow and groundwater

Revegetate/reconnect shoreline buffer – Assess levels of buffer vegetation for stability and habitat connection

The Quick Assessment then provides a list of possible management options based on the instability risk in each category. A complete erosion management plan is created by combining practices to address each source of instability. The Quick Assessment was designed to provide a starting point from which homeowners, contractors, municipal officials, and others can begin to consider nature-based strategies for managing erosion. It does not represent a complete environmental assessment or provide detailed erosion management plans. The complete OUR SHORE Guide and practitioner trainings provided by DEP are available to supplement the Quick Assessment when more detailed assessment or technical guidance is needed.

OURSHORE Quick Assessment: Griffin's Cove
19 Church Rd, Cliff Island, ME

Existing Site Conditions:

Location:

Griffin's Cove is a 0.75 acre property owned by the Cliff Island Corporation for Athletics, Conservation, and Education (ACE) with an easement held by the Oceanside Conservation Trust of Casco Bay (Fig. 1). The property is open to the public for recreational uses and water access. In the winter, docks, boats, and fishing gear are stored on the shoreline.

Environmental Characteristics:

The site assessed is named for the sheltered, shallow cove area where it is located. Most of the shoreline consists of a gravel beach that transitions into a gradually sloping grassy bank. The property also includes a ledge outcropping that defines the northern end of the cove. There are no mapped significant wildlife habitats or natural resources in the area.

Erosion:

The toe of the bank shows signs of erosion just above the high tide line. Stones have been placed along the bank to control erosion, but the edge of the bank has continued to recede.

Based on site characteristics including the sheltered location, shallow beach, and gradual slope, Griffin's Cove is mapped as Highly Suitable for living shoreline approaches in the Maine Geological Survey's Living Shorelines Decision Support Tool (Fig. 4).



Figure 1: Map of the Griffin's Cove property owned by ACE with an easement held by Oceanside Conservation Trust of Casco Bay (OCT, 2024).



Figure 2: Photograph of the beach and lawn area of Griffin's Cove. Larger stones placed for erosion control are visible along the upper beach edge.



Figure 3: Photograph of Griffin's Cove facing east.



Figure 4: MGS Living Shoreline Decision Support Tool map of Griffin's Cove. Dark green points indicate Highly Suitable locations for living shoreline approaches and light green points indicate Moderately Suitable locations.

OUR SHORE Quick Assessment:

Source & Severity of Erosion:

Overland Erosion	Low - No recent bank erosion or loss from overland flows
Groundwater	Low - No evidence of groundwater seepage
Toe Erosion	Moderate - Moderate toe erosion, beginning to slump
Wave Erosion	Moderate - Site receives some wave action, but only large storms cause erosion. Only toe is affected

Height & Slope Risk:

Bank Height	Low Bank (less than 3 feet)
Slope Severity	Moderate Slope (between 3L:1H—1L:1H)
Current Slope	High - Less than half of surface has vegetation and duff layer
Soils	Low - Soils contain mix of sediments and stone; fairly stable soil condition

Overland Water from Land Use:

Surface Water Flow to Bank	Low - No concentrated or channelized flow from adjacent land use
Lawn or Bare Ground Near Bank	High - Lawn area or bare ground is located within 25 feet of the shoreline
Impervious Surface Near Bank	Moderate - No roads, driveways, houses, or other impervious surfaces are within 25 feet of shoreline
Overall Impact of Surface Flow	Moderate - Moderate Overland Impact from surface water

Revegetate/Reconnect Shoreline Buffer:

Vegetation Within 250 Feet	Average vegetation (20-70% coverage)
Vegetation Within 25 Feet	Sparse vegetation (less than 20%)
How Natural is the Shoreline Habitat	Low - Bank is hardened and/or no vegetation present

Proposed Management Actions:

Living shoreline and nature-based techniques will likely be highly successful at Griffin's Cove based environmental conditions at the site. The addition of deeply-rooted native plants along the upper edge of the beach will help stabilize the bank and hold soil in place, supplementing the current stone protection. If suitable growing conditions are present and vegetation spreads into the riprap area of the upper beach, this will also help hold the riprap stones in place and enhance overall shoreline resilience. A vegetated buffer width of 10-15' is recommended at minimum to provide shoreline stability. This buffer should be made up of a variety of densely planted native plants including both woody plants like shrubs or trees and herbaceous plants like grasses, flowers, and groundcover plants.

Vegetated buffers for shoreline stabilization can be designed to fit well into existing recreational uses of the site. Low-growing shrubs like creeping juniper can be selected to preserve a view of the shoreline, and gaps in the buffer can be maintained to preserve shoreline access. In public spaces, vegetated buffers can be tailored to community interests to provide additional benefits, like providing habitat for pollinators or a space to use as an outdoor classroom.



Figure 5: Recommended buffer planting area for shoreline stabilization at Griffin's Cove.

OURSHORE Quick Assessment: Private Properties
Church Rd, Cliff Island, ME

Existing Site Conditions:

Location:

This report describes two private residential properties on Church Road on Cliff Island. Combined, the two properties have approximately 320 linear feet of shoreline.

Environmental Characteristics:

The shoreline of the site is primarily a rocky cliff with small, flat areas of gravel and sand. Above the highest astronomical tide line, the ledge transitions to soil and lawn areas. Across most of the shoreline, the soil bank is gently sloped and no more than three feet tall, but a small section to the southwest has a deeper soil layer that has eroded to form a steep bank 5-6 ft tall.

A drainage ditch passes between the two properties, fed by a culvert passing under Church Rd. A small freshwater wetland is located inland of the house on one of the properties. A groundwater seep was noted exiting the bank just above the bedrock layer.

The southwest section of the shoreline is included in National Wetland Inventory maps. There are no mapped areas of significant habitat within or near the site assessed.

Erosion:

Both properties have installed or are in the process of installing structural stabilization to prevent shoreline erosion. One property is using gabions, wire mesh baskets filled with stones and anchored to the shoreline. The other property is installing large stone riprap. This report provides recommendations on integrating OUR SHORE principles into these stabilization designs to increase resilience and longevity of the structures, minimize end-effect erosion on neighboring properties, and improve coastal habitat quality.



Figures 1 & 2: Photographs of one of two private properties including the stones being installed for shoreline stabilization.



Figure 3: Photograph of the second property including gabions installed for shoreline stabilization.



Figure 4: Photograph of the groundwater seep observed on the shoreline.



Figure 5: Erosion has formed a steep slope with bare soil on this section of shoreline.



Figure 6: The drainage ditch that runs between the two properties.



Figure 7: The wetland area upland of one of the houses.

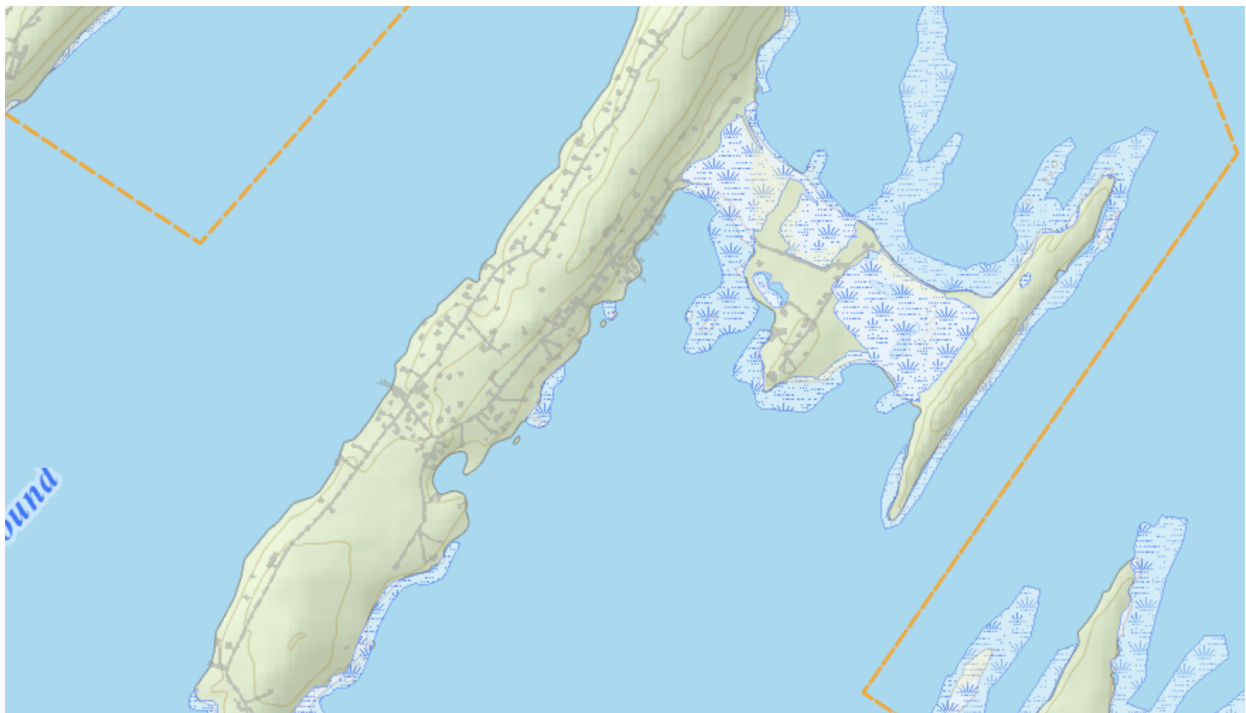


Figure 8: Beginning with Habitat map of the site showing National Wetland Inventory areas (white and blue pattern).

OUR SHORE Quick Assessment:

Source & Severity of Erosion:

Overland Erosion	High - Bank erosion is occurring with measurable change from overland flows
Groundwater	Moderate - Evidence of limited or seasonal groundwater seepage or impacts to slope
Toe Erosion	Moderate - Moderate toe erosion, beginning to slump
Wave Erosion	High - Site is exposed to wave action and increased impacts from severe storms. Waves erode toe and bank

Height & Slope Risk:

Bank Height	Moderate Bank (3-6 feet)
Slope Severity	High Slope (> 1L:1V)
Current Slope	High - Less than half of surface has vegetation and duff layer
Soils	Low - Soils contain mix of sediments and stone; fairly stable soil condition

Overland Water from Land Use:

Surface Water Flow to Bank	Moderate - Some concentrated or channelized flow is directed toward the eroding bank resulting in minimal sheet or rill erosion
Lawn or Bare Ground Near Bank	High - Lawn area or bare ground is located within 25 feet of the shoreline
Impervious Surface Near Bank	High - Roads, driveways, houses, or other impervious surfaces are within 25 feet of the shoreline
Overall Impact of Surface Flow	High - Overland flow of water is a significant contributor to instability

Revegetate/Reconnect Shoreline Buffer:

Vegetation Within 250 Feet	Average vegetation (20-70% coverage)
Vegetation Within 25 Feet	Sparse vegetation (less than 20%)
How Natural is the Shoreline Habitat	Low - Bank is hardened and/or no vegetation present

Proposed Management Actions:

Establish Vegetated Buffers:

When structural stabilization like gabions or riprap is installed on a shoreline, creating a vegetated buffer inland of the structure is still important to improve the structure's long-term durability and manage groundwater and surface runoff contributions to erosion. Shoreline armoring techniques do not address upland water contributions to erosion, and continued groundwater and surface runoff interactions can pull soil out from under a structure and lead to increased maintenance needs. Maintaining a healthy buffer of native vegetation helps reduce groundwater saturation and slow the movement of surface water. The root systems of a vegetated buffer also help to lock soil in place behind the structure for additional stabilization.

A minimum buffer width of 10-15 ft from the edge of the riprap or gabion inward is recommended when possible. An effective vegetated buffer will include a diverse mix of native shrubs and herbaceous plants like ornamental grasses and groundcovers. Lawn grass is not considered a buffer, as it has shallow roots that cannot take up water or stabilize soil as effectively.

There are many plant selection guides that can help in choosing native plants that will be successful under the sun, water, and soil conditions of the shoreline. Buffer plants can be added as potted plants, seeds, or live stakes, and a buffer can be created over several years to spread out planting costs and maintenance.

Adding Vegetation to Riprap and Gabions:

When structural stabilization measures using stones or non-biodegradable materials are used, OUR SHORE recommends incorporating vegetation in and over the structure in addition to maintaining a vegetated buffer. Similarly to the buffer, vegetation planted in riprap or gabions creates a root network that helps hold soil in place. This root system also acts as a natural filter layer, allowing groundwater to pass through and drain out of the structure while filtering out soil that might otherwise be washed out. Additionally, using vegetation in combination with a structural stabilization practice achieves the OUR SHORE principles of restoring natural functions like habitat connectivity and water quality protection to a stabilized shoreline.

Vegetation can easily be added to existing riprap through a planting technique called live staking. Live stakes are cuttings of certain shrubs that will re-root and grow when pushed into the soil. Live stakes can be planted directly into the soil between the large riprap stones. If a plastic geotextile fabric was installed underneath the riprap, a piece of rebar can be used to create a pilot hole for the live stake to be planted into.

Retrofitting gabions that are already installed is more difficult, but if additional gabions are installed they can be vegetated with a similar live staking method. As the gabions are placed and filled, live stakes are planted horizontally into the soil as layers between the stones. Live stakes can also be layered between subsequent layers of gabions, as long as they have enough soil contact to form root systems. Soil and seed mixes wrapped in biodegradable fabrics such as coconut coir can also be layered into gabions during construction to provide a growing media and encourage revegetation.

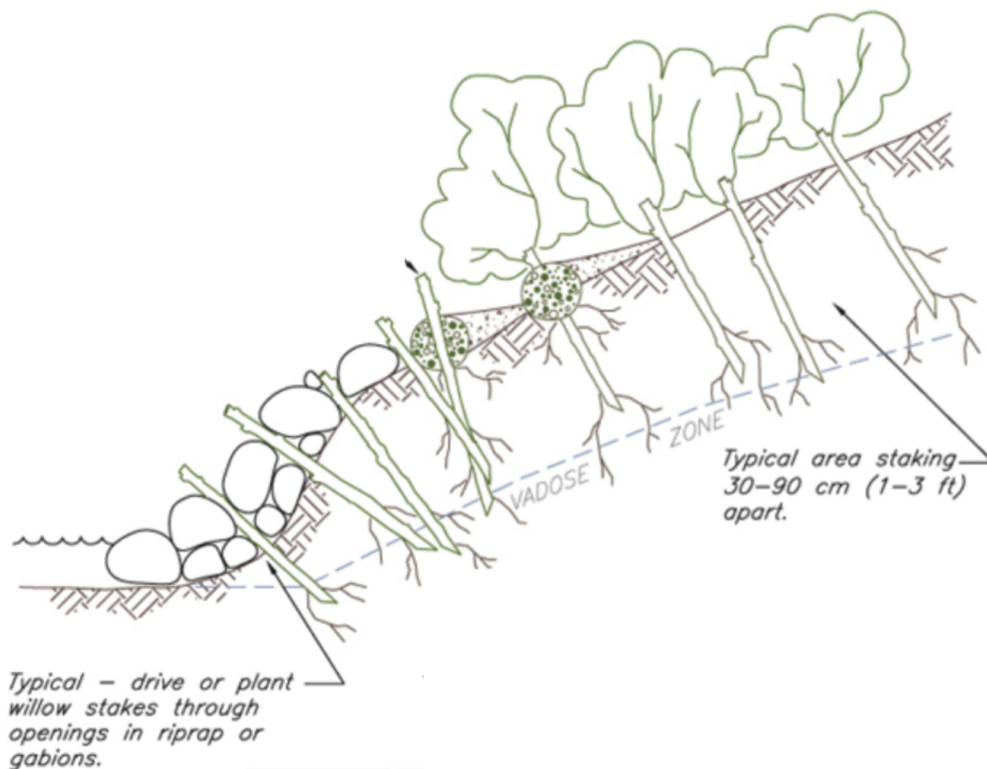


Figure 9: Example placement of live stakes into riprap (Virginia Department of Transportation).

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