



Addressing Erosion and  
Enhancing Resilience of Yarmouth's

# Coastal Bluffs

---

Resident Toolkit



August 2025

# Table of Contents

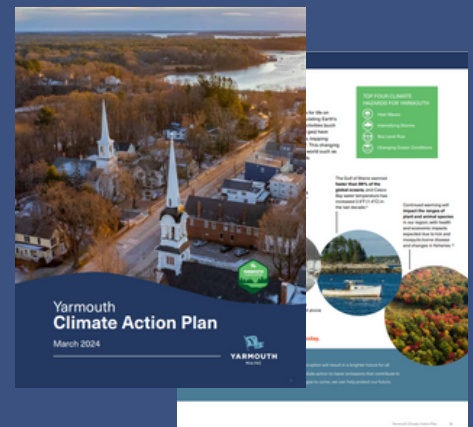
<b>Coastal Bluff 101</b> .....	4
Bluffs in Yarmouth .....	5
Value of Coastal Bluffs .....	6
Climate Impacts .....	7
Bluff Erosion Cycle and Erosion Factors .....	8
Stages of Bluff Stability.....	11
<b>Mitigating Erosion</b> .....	12
<b>Bluff Assessment</b> .....	14
<b>Decision Matrix</b> .....	15
<b>Solution Toolbox: Resilient Land Management</b> .....	16
Reducing Runoff.....	17
Capturing Water in Rain Gardens.....	18
Vegetative Buffers .....	19
<b>Conclusion</b> .....	20
<b>Resources</b> .....	21
<b>Sources</b> .....	22

\*Endnotes are included in the text for primary sources

## Coastal Resilience as Local Climate Action

This toolkit is intended to support implementation of the Town of Yarmouth’s Climate Action Plan, which includes:

- Action 2.3.3: Promote guidance for protection/restoration of erodible bluffs, steep slopes, and shorelines using nature-based solutions for both private and Town-owned lands.



### ABOUT THE AUTHOR

Sydney Ranalletti was a local AmeriCorps (ResilienceCorps) member and joined the Town of Yarmouth for her service term as Climate Action Fellow with the Sustainability Department. Sydney has a BS in Environmental Studies from Salve Regina University and is working towards a MA in Planning, Policy and Management with a concentration in Sustainability from University of Southern Maine.



# IN THIS TOOLKIT, YOU WILL LEARN ABOUT...



**What coastal bluffs are and where they are found in Yarmouth**

---



**Types and causes of coastal bluff erosion**

---



**Risks to coastal property and bluffs from climate change**

---



**Possible solutions to minimize or slow erosion and increase bluff stability**



# COASTAL BLUFF 101

Coastal bluffs are steep shoreline slopes made of sediments such as clay, sand, and gravel. These slopes typically rise more than three feet vertically above the high tide line. Cliffs or slopes comprised of bedrock (i.e., ledge) are not bluffs and are not subject to significant erosion.<sup>1</sup>



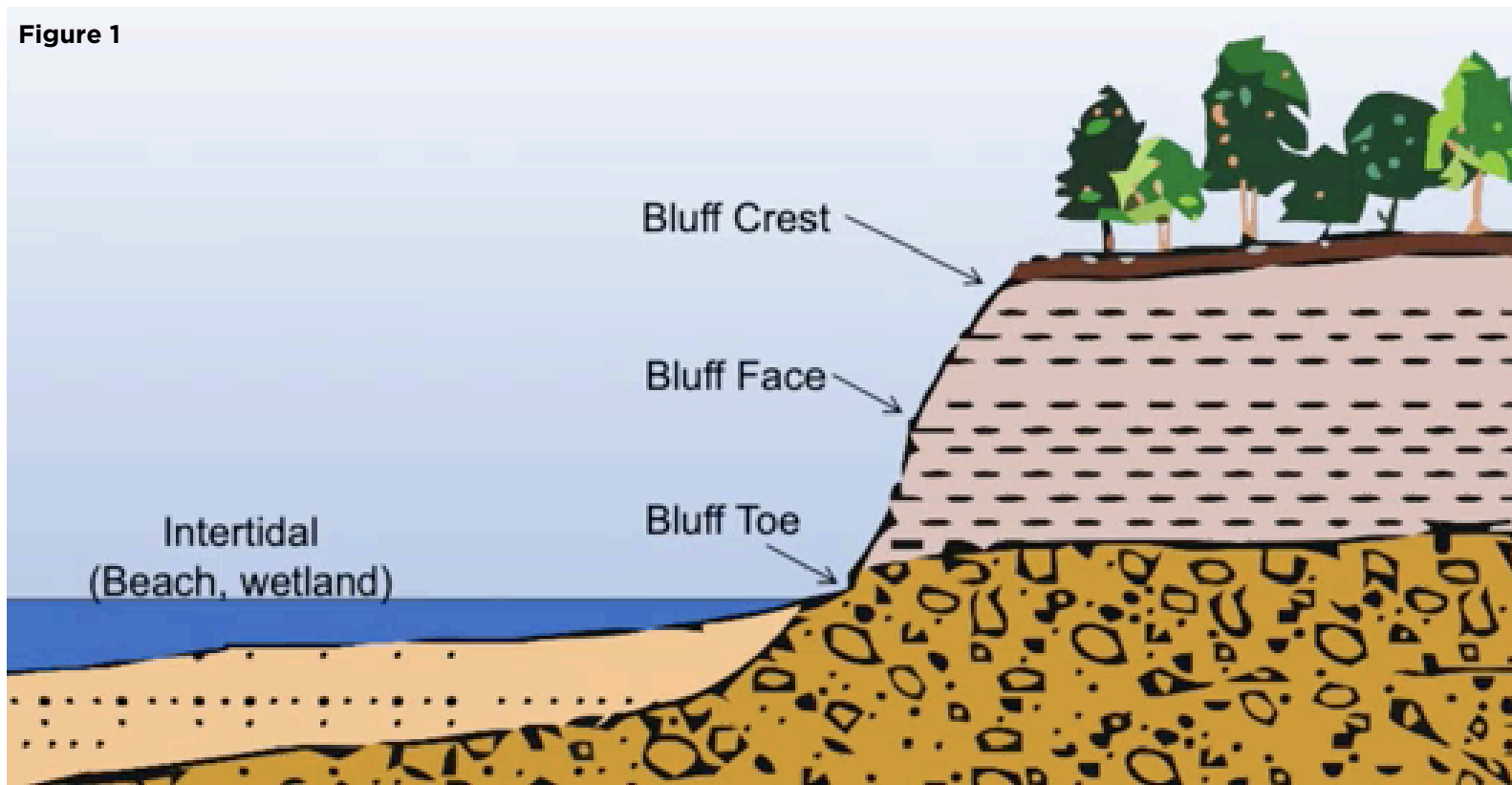
## KEY TERMS

Figure 1 shows the structure of a coastal bluff. The top of the bluff is referred to as the 'crest', the middle of the bluff is the 'face', and the bottom of the bluff is referred to as the 'toe', similar to terminology used for a wave.

### **Already familiar with bluffs and erosion factors?**

*Skip to page 13 to dive into how coastal property owners can make their shorelines for resilient.*

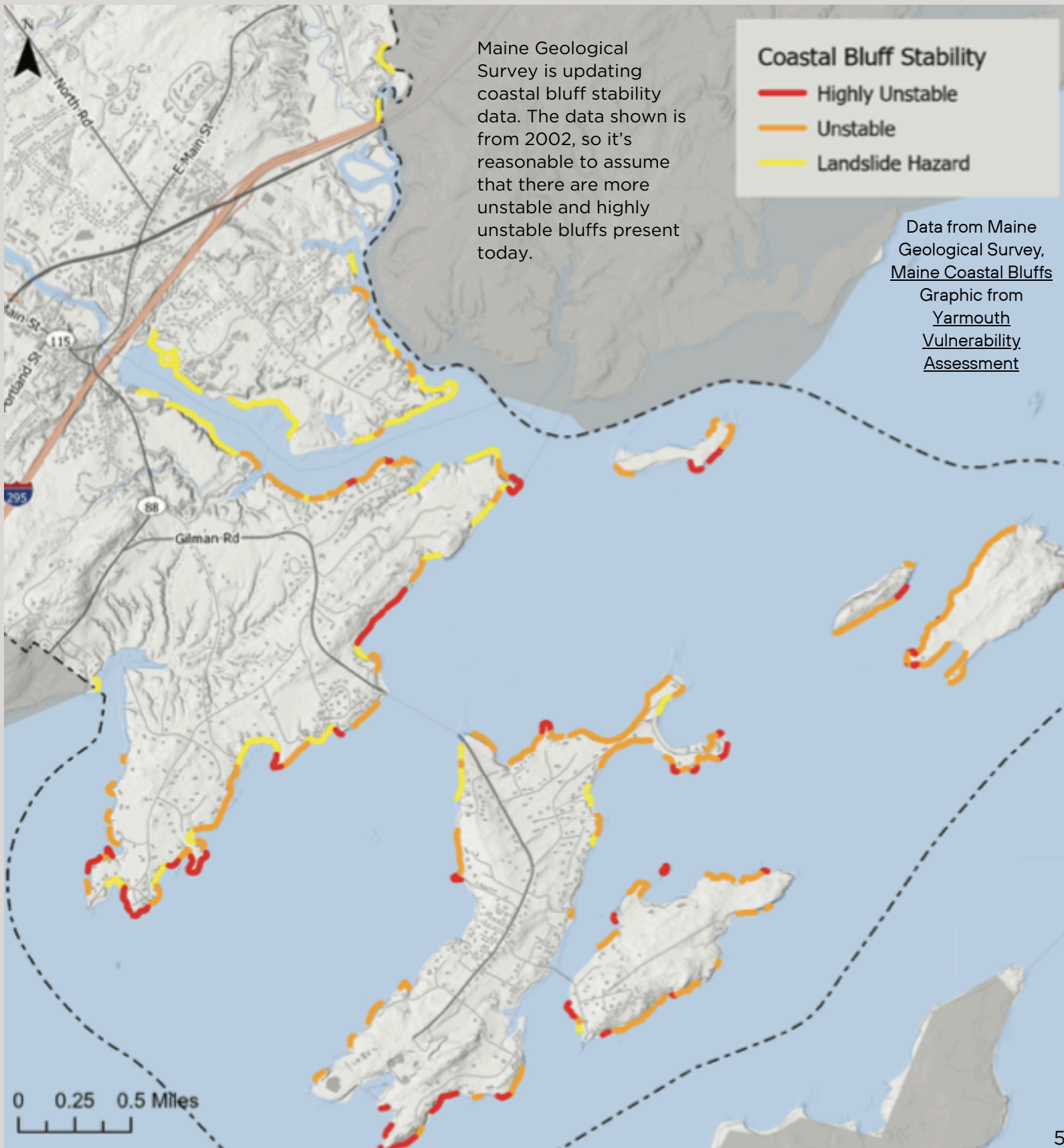
Figure 1



Graphic from Great Diamond Island Sea Level Rise Partnership, [Anatomy and Life Cycle of a Bluff](#)

# BLUFFS IN YARMOUTH

Bluffs are common along Yarmouth's coastal shoreline. Bluffs can also be found along other waterbodies such as rivers, streams, and lakes.



# VALUE OF COASTAL BLUFFS

Coastal bluffs serve as a natural barrier that protects habitats and properties from coastal threats. They are also vital to Maine's coastal, intertidal, and upland ecosystems, offering a variety of environmental functions that support biodiversity.<sup>2</sup>

---

## ECOSYSTEM

Coastal bluffs are essential to the ecosystems they support. As they naturally erode, sediments flow into ecosystems below - mudflats, sandflats, beaches, wetlands, and salt marshes - helping replenish and sustain intertidal environments. These unique ecosystems foster habitats for native flora and fauna, each playing a role in the broader coastal ecosystem. When erosion is uncontrolled or controlled too much (such as gray infrastructure), it disrupts these habitats, accelerates sedimentation in nearshore waters, and damages coastal vegetation.

Bluffs also serve as natural barriers, protecting upland ecosystems from threats - storm surge, sea level rise, flooding, salt spray, and wind - maintaining the delicate balance of coastal ecosystems. Protecting bluffs helps support a healthy, diverse, and resilient coastal environments.

## PRIVATE PROPERTY

Just as bluffs are a natural 'armor' to protect upland habitats, they also protect homes, properties, and recreational areas from the damage of storm surge and rising sea levels. When erosion undermines bluff stability, the shoreline retreats, leading to land loss and potential property damage. Investing in bluff restoration helps stabilize these formations, slowing shoreline erosion and preserving their role as a protective coastal bluff.

Approximately  
**88%**  
of Maine's coastline is privately owned. That means property owners are responsible for restoring and stabilizing coastal bluffs for the future.<sup>3</sup>

## CLIMATE CHANGE

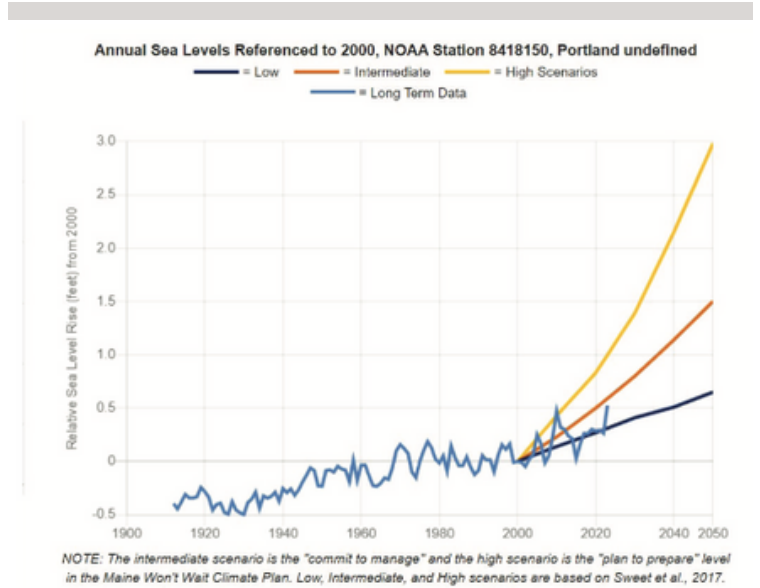
Coastal bluffs, like other natural shoreline features such as dunes and wetlands, provide important protection against sea level rise, erosion, and increasingly intense storms. However, this protection is limited. As climate change accelerates, bluffs are exposed to more severe conditions that increase erosion and gradually reduce their ability to safeguard the coastline.



# CLIMATE IMPACTS

Among other hazards, climate change effects sea level rise and precipitation intensity. In Casco Bay, Water levels have risen 7.5 inches since 1912. The State of Maine has recommended communities “commit to manage” 1.5 feet of sea level rise by 2050 and 4 feet by 2100, while preparing for higher scenarios.<sup>4</sup>

Yarmouth has experienced slightly more warming than the state average and is projected to have annual temperatures 3.5-4 degrees Fahrenheit higher than 1895 by 2050. Yarmouth is also likely to see a 5% increase in precipitation. However, this rainfall is projected to be concentrated in more intense storms with periods of increased drought in between.<sup>5</sup>



## Annual Sea Level, NOAA Station, Portland, Maine

*“The December 2023 and January 2024 storms were estimated to cause \$90 million in damage to public infrastructure alone, and untold damage to private property.”(Maine Won’t Wait, p 31).*

## IMPACTS TO COASTAL BLUFFS

Coastal bluff erosion will accelerate as the impacts of climate change amplify and compound over time. These impacts will effect different features of bluffs:

- Sea level rise will increase the intensity and reach of wave action that erodes bluff toes.
- Intensifying storms (more rain in shorter periods) increase surface runoff and overly saturate bluffs, causing erosion to bluffs crests and faces.
- Increasing wind intensity will move sediment in larger quantities that erodes bluff faces.

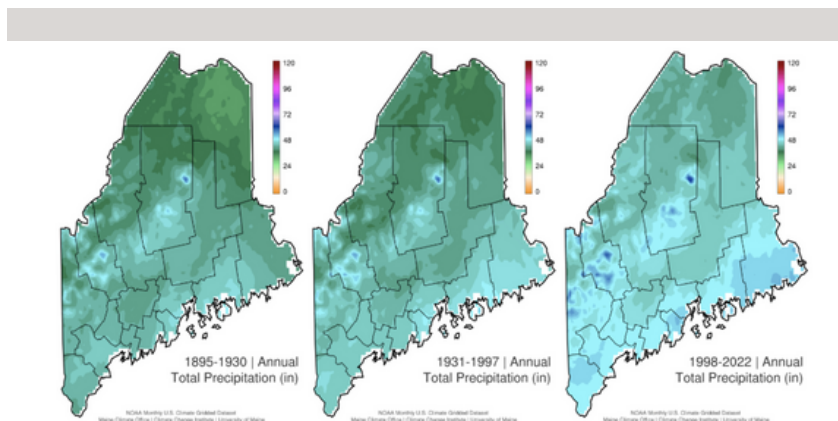


Figure 3. Maine statewide total annual precipitation 1895–2022. Maps show three period means for comparison: 1895–1930, 1931–1997, 1998–2022. Data from the NOAA Climate Divisional Database.

As erosion intensifies due to climate change, more coastal owners may ‘armor’ their shoreline with walls, riprap, or other gray infrastructure to prevent further damage. Hard armor alters wave dynamics, causing waves to deflect and increase erosion on adjacent shorelines. This ripple effect could further accelerate erosion.

Maine Annual Precipitation Comparisons from 1895 to 2022,  
Maine Climate Council

# BLUFF EROSION CYCLE

Bluff erosion is a natural process, but it has already intensified—and will continue to do so—as climate change accelerates. While some erosion is expected and beneficial to help replenish beaches and other shoreline areas, increasing rates of erosion pose growing challenges for coastal resilience.

**Figure 2**

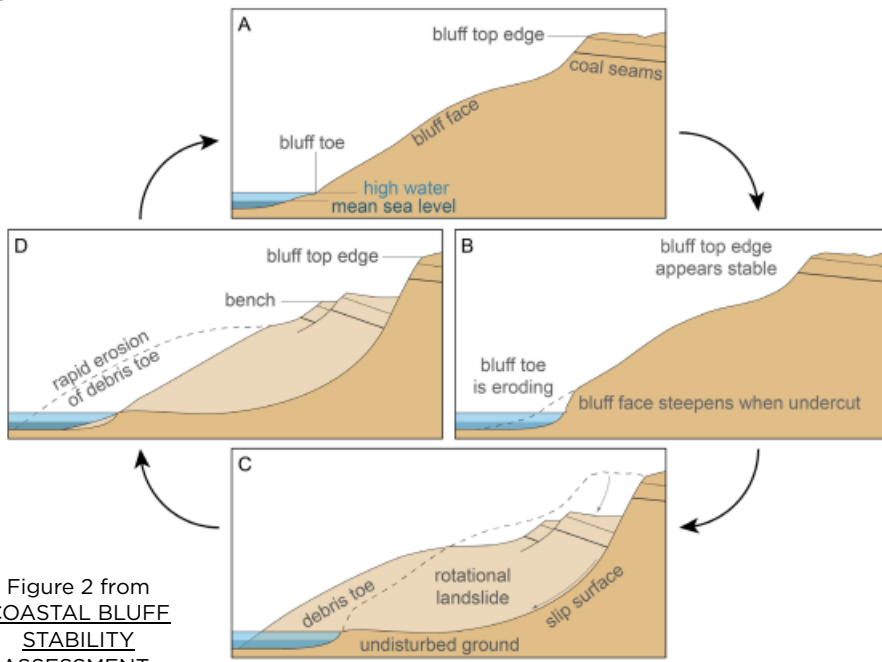


Figure 2 from  
COASTAL BLUFF  
STABILITY  
ASSESSMENT

Figure 2 shows how the bluff erosion cycle works. Graphic A is what would seem to be a stable bluff, as that bluff becomes more unstable, the toe of the bluff begins to erode causing undermining. This undermining makes the face of the bluff highly unstable leading towards a landslide (also known as ‘slumping’, shown in graphic C). As the bluff weathers, it then becomes stable again. As this cycle repeats, the shoreline continues to retreat.<sup>6</sup>



This is an example of a small landslide on Cousins Island at Camp SOCI.

This bluff has experienced a landslide, but has weathered into a more stable slope.



Sandy Point, Cousins Island

# EROSION FACTORS

Erosion is a physical process that leads to the loss and degradation of land.<sup>7,8</sup>

## SURFACE WATER

Surface water, including precipitation and upland runoff, flow directly over the bluff face or down a gully. When surface water flows over the crest and down the face of the bluff, the water carries away sediment. This loss of sediment amplifies bluff erosion.



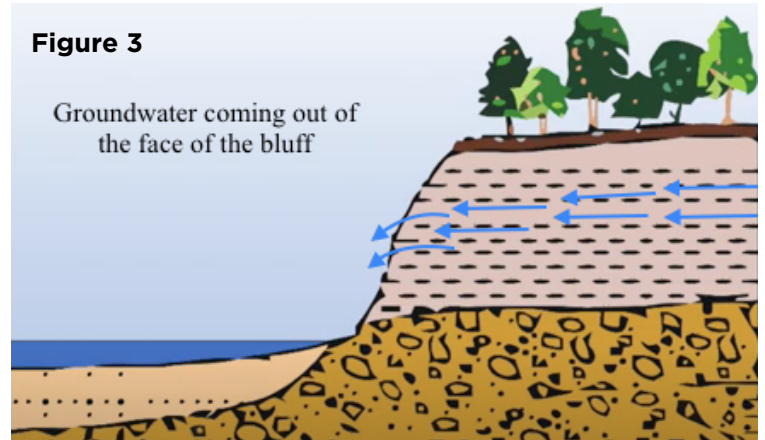
### KEY TERM

**Upland** refers to the land above the crest of the bluff.

## GROUNDWATER

Groundwater can seep through cracks in the bluff face that can create wet spots, which washes sediment down the bluff face.

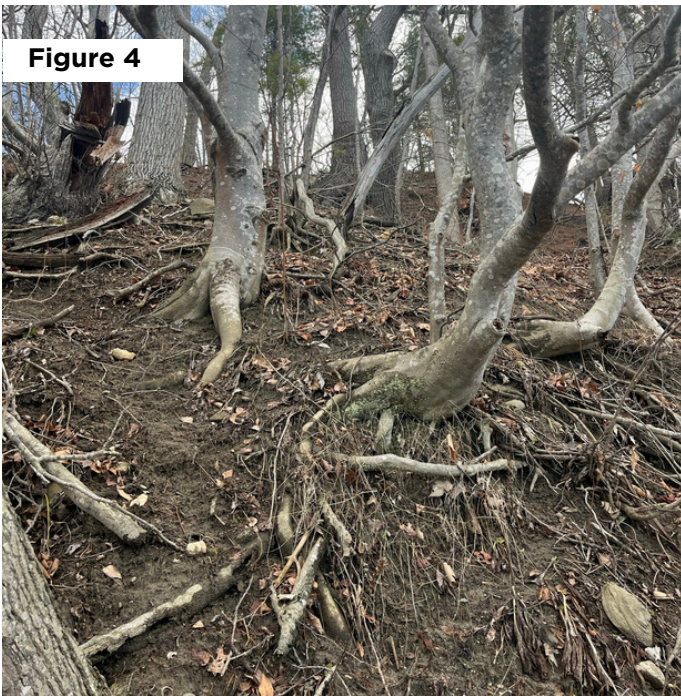
Figure 3



Groundwater coming out of the face of the bluff

Figure 3 from Great Diamond Island Sea Level Rise Partnership, [Anatomy and Life Cycle of a Bluff](#)

Figure 4



Camp SOCI, Cousins Island

Exposed tree roots are one indicator of surface water erosion. When the trees on the bluff face do not have enough sediment to cover or hold their roots down, erosion accelerates. This can cause trees to lean, as shown in Figure 4.

Figure 5



Camp SOCI, Cousins Island

Figure 5 highlightd the impacts of surface water/runoff to a bluff. There is evidence of missing topsoil and lack of vegetation to hold sediment in place.

# EROSION FACTORS

## Wave action

Wave action undercuts the bluff which erodes the base first. This leads to an excessively steep slope in the lower face of the bluff, causing the slope above to slide downward. Tidal cycles can influence wave action impacting erosion on different parts of the bluff face.

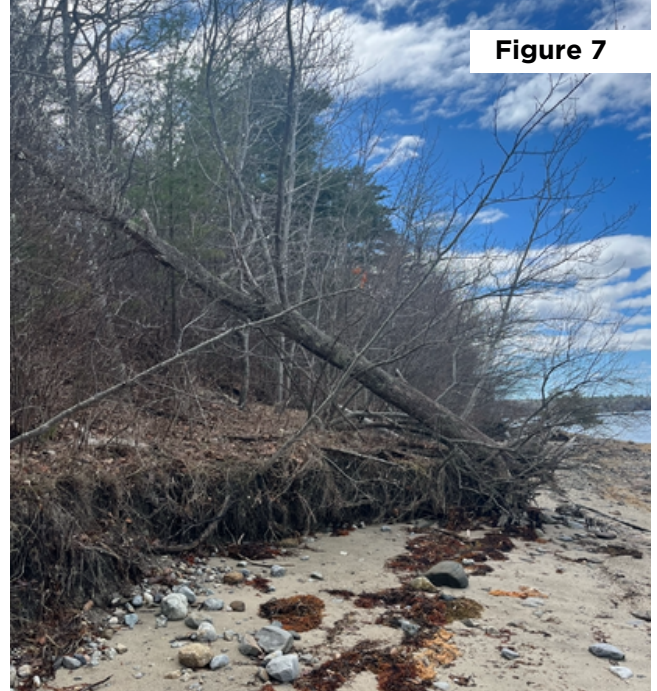


Figure 7



Figure 6

Figure 6 shows erosion impacts from wave action, causing slumping due to undermining. Undercutting is also visible. Figure 7 shows the initial erosion (undercutting) impacts from wave action.

Figures 6 & 7: Camp SOCI, Cousins Island

## Vegetation

Native plants protect the structural integrity of bluffs. Vegetation aids in stabilizing the soil, slowing and absorbing rainfall and water, acting as a wind barrier, and trapping moving sediment. With a lack of vegetation, the bluff is more likely to erode.

### Non-Vegetated Bluff



Camp SOCI, Cousins Island

### Vegetated Bluff



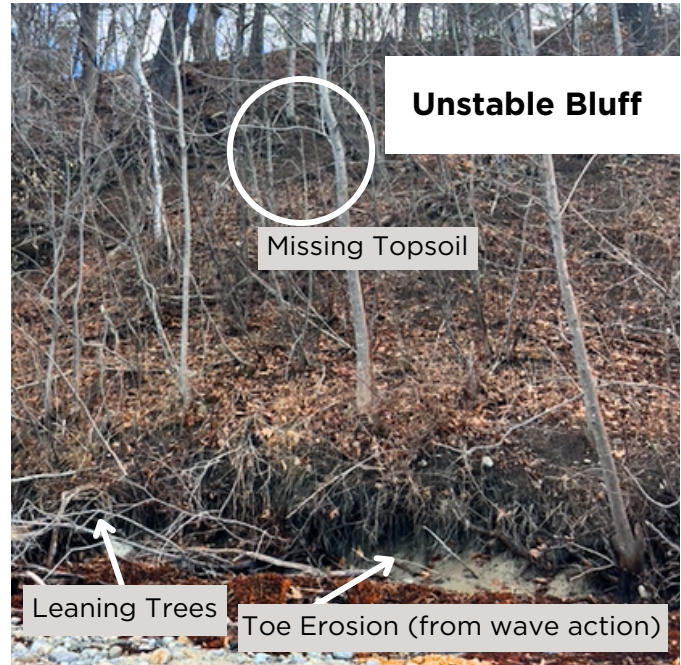
Photo: Maine Geological Survey, Peter Slovinsky

# STAGES OF BLUFF STABILITY

The stability of a bluff is categorized into three stages, Stable, Unstable, and Highly Unstable. Below are some examples of each and visible indicators of different erosion factors.



Spear Farm Estuary Preserve



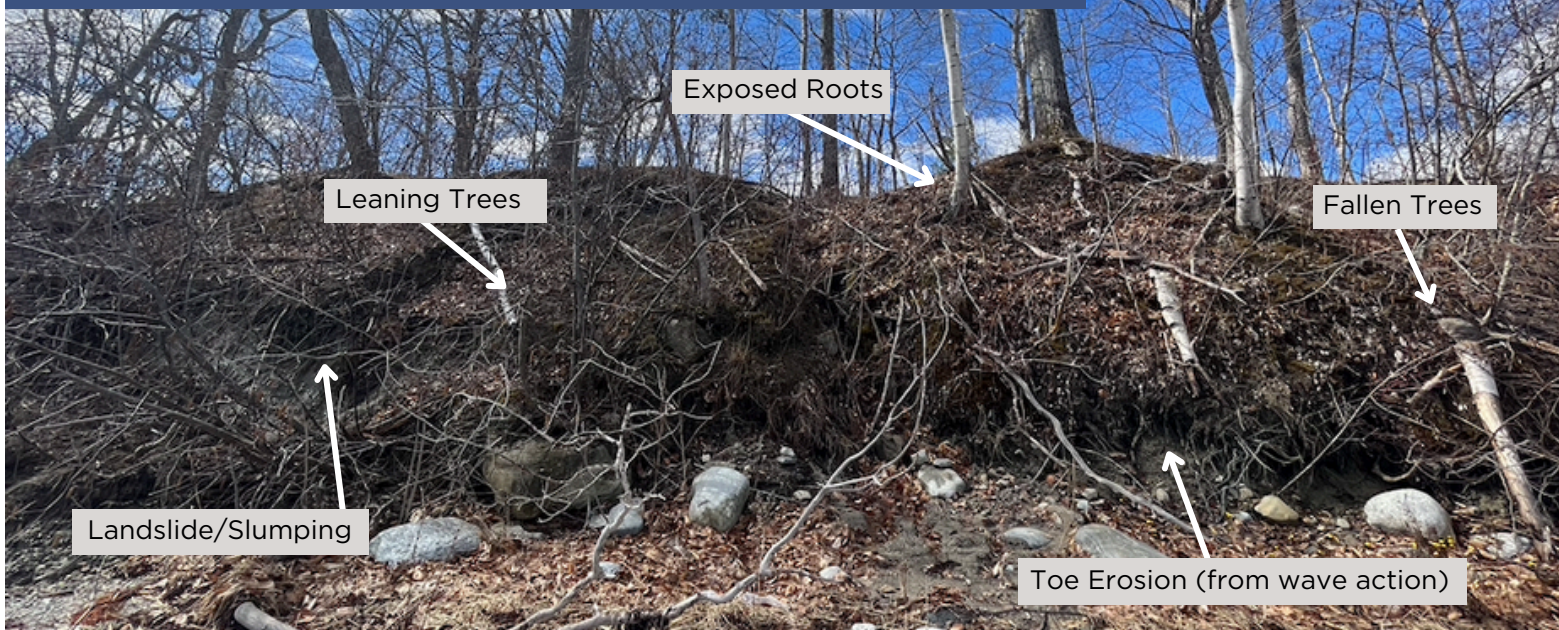
Camp SOCI, Cousins Island



## PRO TIPS

For more information on bluff stability stages, Maine Geological Survey has photos and [stability indicators](#).

To determine bluff stability more in depth use the [Instability Assessment Rating Form](#).



Sandy Point, Cousins Island

# MITIGATING EROSION

There are different pathways to protect coastal bluffs from extensive or accelerated erosion. Mitigation techniques depend on each site and what the primary causes of erosion are (wave action, surface water, groundwater, lack of vegetation).<sup>9</sup> Some types of solutions include:

- Implementing stabilizing infrastructure (Page 13),
- Increasing native vegetation on and above the bluff (Pages 17-19),
- Fostering resilient upland management (Pages 17-19).

Protecting coastal bluffs often involves choosing between gray (hard) and green (nature-based) infrastructure. Understanding the trade-offs is key to choosing the right solution for your property and the surrounding ecosystem.



## KEY TERM

Green infrastructure applies nature-based solutions (NBS)—like plants and soils—to protect and strengthen ecosystems. NBS, such as living shorelines, help manage erosion and support coastal resilience in a changing climate.<sup>10</sup>

Figure 8

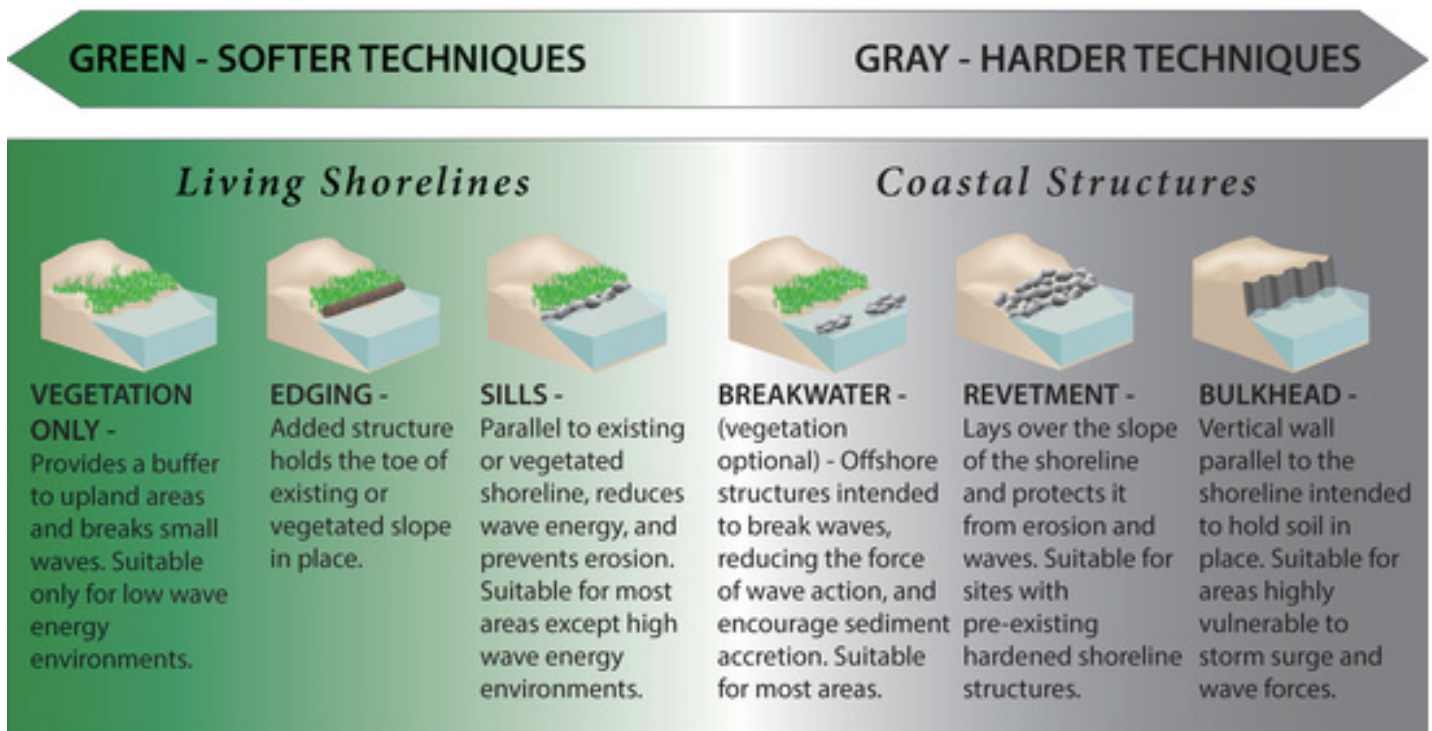


Figure 8 from Maine Geological Survey, [Introducing Green Infrastructure for Coastal Resilience Living Shorelines and Decision Support Tools](#), Pete Slovinsky

## PRO TIPS



When talking with a professional, discuss your options for including green infrastructure. Consider working with your neighbors to address erosion. Remember, erosion doesn't have property lines!

# GREEN INFRASTRUCTURE

Green infrastructure, or nature-based solutions (NBS), work with natural systems to protect existing features and structures. For coastal bluffs, NBS can include living shorelines, native plantings, and restoration of natural buffers.<sup>11</sup>

## Benefits

- Reduces erosion and supports natural sediment movement
- Improves habitat for fish, birds, and pollinators
- Stores carbon and improves water quality
- Adapts and grows over time, reducing long-term maintenance
- Can outperform gray infrastructure in long-term resilience

## Challenges

- Not ideal for high wave-energy sites or already hardened shorelines
- Takes longer to design, permit, and establish
- Still emerging in Maine—some contractors may lack experience
- Must be carefully tailored to each site



Living shoreline at Maquiot Bay Conservation Land, Brunswick, Maine

Photo from P. Slovinsky, MGS.

---

# GRAY INFRASTRUCTURE

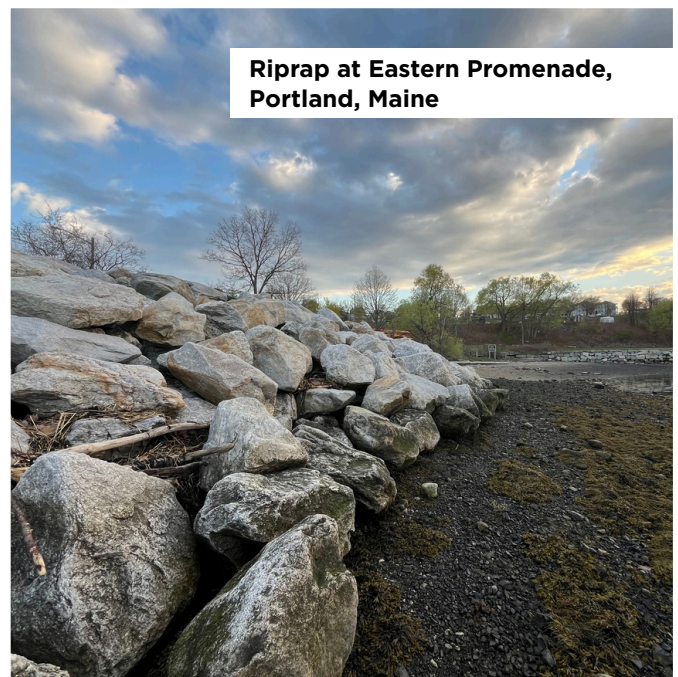
Gray infrastructure (also called hard armor) includes man-made structures like riprap, seawalls, or bulkheads. These are commonly used to stabilize bluffs and protect property.

## Benefits

- Provides strong, immediate protection from erosion
- Stabilizes upland areas
- Can reduce storm surge flooding in some settings

## Challenges

- Disrupts natural erosion and sediment flow
- Disrupts wave dynamics and increases erosion on adjacent shorelines
- Damages coastal habitats
- Expensive to install and maintain
- Not always a good long-term fit, especially as sea levels rise



Riprap at Eastern Promenade, Portland, Maine

# BLUFF ASSESSMENT

Did you know that 88% of Maine’s shoreline is privately owned and 40% are erodible bluffs? As a coastal property owner, there are steps you can take to reduce erosion impacts to bluffs on your shoreline, The first step is to assess the evident erosion factors! Use this page as a starting place to identify visible indicators bluff erosion.

---

## Questions to Answer:

### Look for evidence of surface runoff

- Is there is missing topsoil and/or exposed roots on the face of the bluff? (see page 9)

### Identify Bluff Stability

- Are there leaning or fallen trees on the crest, face, or toe of the bluff? (see page 11).
- Is there undermining at the toe where the top layer of soil is ‘hanging’? (see page 10).

### Observe How Water Moves Across your Property

- Is your property at the bottom of a hill?
- Where does water pool during rain/snow melt?

### Assess Existing Vegetation and Soils

- Is lawn up to the edge of the bluff?
- Is there a variety of plants and trees on the bluff face?
- Is there a path on the edge of the bluff or consistent soil compaction (such a mowing or walking)?

### Consider Other Conditions

- Do you have hard armor? Do your neighbors?
- How steep is the bluff? (A steeper slope is more unstable)



### Pro Tips

Collect photos and write down notes to document erosion process. This will help inform professionals about site-specific erosion factors. Google Earth has a historical bird’s-eye view. Compare current and past views to see how your property has changed over time. See [Google’s how-to guide](#).

Use the Cumberland Country Soil and Water Conservation District’s [Instability Assessment Form](#) to determine your bluffs stability.

ID your property on the [Coastal Bluff’s and Landslide Hazard Map](#).

# DECISION MATRIX

Due to the complexities of bluff erosion, it is only possible to do *some* restoration and mitigation techniques on your own. Different sources of erosion can require different solutions. For interventions located on the bluff or intertidal areas, professionals are best suited for the job.

## Primary Sources of Erosion

## Solutions

## Who Can Do the Work



### Lack of Bluff Vegetation

See Page 10 for reference



- On-bluff Planting
- Invasive Species Management
- Other Stabilizing Techniques



Contact a Professional Engineer, Landscape Architects, Environmental Consultants, Botanist

### Resources

[Licensed companies for Invasive species management](#)



### Surface Water

See Page 9 for reference



- Rain Gardens
- Limiting Runoff
- Vegetative Buffers
- Reducing Lawn
- Increasing Soil Health



You can do this yourself or hire a contractor!

See Pages 17-19 for resources and ideas.



### Wave Action

See Page 10 for reference



- Living Shorelines or other NBS
- Hard Armor
- A combination of green and gray infrastructure



Contact a Professional Engineer, Landscape Architects, Environmental Consultants, Botanist

### Resources

[Shoreline Management Decision Tree](#)

# WHAT YOU CAN DO

Coastal property owners can most readily address the erosion impacts of surface water compared to wave action or bluff vegetation. Even if there is no clear evidence of surface water erosion on your bluff, implementing the techniques on the following pages are best practices to prevent this source of erosion from impacting your bluff over time!

---

## REMEMBER...

Surface water includes any water above the ground's surface (rain and runoff). On a bluff, precipitation and upland runoff flow directly over the face, while water also pools in low spots and soaks into the ground. This combination increases groundwater levels and can oversaturate the bluff, leading to more erosion. Certain upland land management practices can make a bluff even more vulnerable and less able to handle heavy rain events or wave action.



## RESILIENT LAND MANAGEMENT

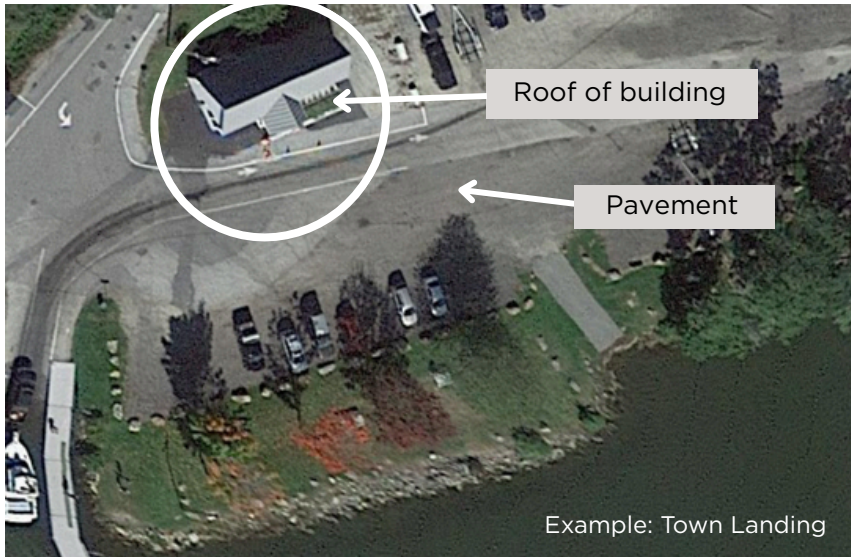
The most effective way to manage surface water is by controlling how much—and where—water flows on your property above the bluff. Fostering resilient land management techniques is a great place to start. This includes thoughtfully placed native plantings and small engineered solutions that reduce runoff. In addition to preventing erosion and drainage issues, these practices make your property more functional and offer many other benefits: they create a low-maintenance landscape that saves you money, time, and effort; improves resistance to pests and drought; attracts birds, butterflies, and other wildlife; and reduces water use.

**The following pages provide more detail on how to get started.**

- Step 1: Reducing and Navigating Runoff from your House and Impervious Surfaces
- Step 2: Capturing Water via Rain Gardens
- Step 3: Creating and Enhancing Vegetative Buffering

# RESILIENT LAND MANAGEMENT

## Step 1: Reducing and Navigating Runoff from your House and Impervious Surfaces



Water runoff from your house or other impervious structures and surfaces on your property (like driveways) may contribute to surface water erosion of nearby bluffs.



### KEY TERM

**Impervious surface** is any surface that does not readily absorb water and blocks the natural infiltration of water into the soil.

### Rain Barrels

Rain barrels are connected to gutters or downspouts and capture rainwater runoff from roofs. Water is stored and can be used later. This reduces the volume of water runoff at the source (the roof).



### Rubber Razor Bar

A rubber razor blade/bar is mainly used for seasonal gravel driveways to divert water off the road, towards a **stable vegetated area**.



### Dripline Trench and Infiltration Trenches

Dripline trenches can be used for roof runoff for buildings with no gutters. Infiltration trenches are used for impervious surfaces. A trench is dug, filled with crushed stone and geo-textile fabric. The water then flows into the soil. This can prevent topsoil erosion, but will increase groundwater towards the bluff if not directed properly.<sup>12</sup>



#### Avoid:

Paving large areas that increase runoff and overwhelm natural drainage.



#### DO:

**Consider permeable pavement or surfaces for patios and walkways.**

### Broad-based Dip

A broad-based dip is a shallow, angled dip in a gravel or dirt driveway that helps catch and redirect water off to the side towards **stable vegetation**.<sup>13</sup>

### Pro Tip



It is key that runoff is directed towards stable vegetation such as native water loving plants. Consider building a rain garden in low areas that flood frequently or receive runoff.

# RESILIENT LAND MANAGEMENT

## Step 2: Capturing Water via Rain Gardens



Identify pooling areas during rain storms! These may be good candidates for a rain garden to decrease runoff towards the shoreline.



### Lawns are not enough!

Grass lawns alone don't absorb enough water to significantly reduce runoff.

## Rain Gardens

A rain garden is a depression in the ground that is planted with water-loving native plants to collect, clean, and absorb stormwater. <sup>14</sup>

Rain gardens are a kind of upland green infrastructure and help prevent flooding and erosion, intercept pollutants, and provide habitat and food for pollinators.

Rain gardens can be easy and inexpensive to install and maintain.

Plant a rain garden where there is

- frequent pooling water in your lawn, or
- heavy runoff from impervious surfaces (see Page 18).

Check out this resource for an in depth how-to guide on rain gardens.

- [Landscapes for Maine: Adding a Rain Garden to your Landscape](#)



### PRO TIPS



Consider other ways to make your landscape more functional and resilient with 'Yardscaping'.

Check out these resources:

- [Cumberland County Soil and Water Conservation District - Yardscaping](#)
- [Maine Yardscaping Partnership](#)

# RESILIENT LAND MANAGEMENT

## Step 3: Creating and Enhancing Vegetative Buffering



### Vegetative Buffer

A vegetative buffer is made up of native trees, shrubs, and groundcover plants that work together to stabilize the soil. Their deep roots help hold the ground in place and reduce erosion by slowing the movement of water.

If you already have a natural buffer, it's important to protect it—avoid raking away the natural ground cover, as it plays a key role in shielding the soil and filtering stormwater runoff.

To maintain a strong buffer, plant in areas with sparse vegetation and prune or replace any dead or unhealthy plants.<sup>15</sup>



Lawn, patio, or compacted walking paths up to the edge of a bluff allow water runoff to flow straight down the bluff without being slowed down or absorbed. Without a substantial vegetative buffer, this runoff washes away sediment from the bluff face faster - increasing erosion impacts.

Trees alone are not enough as a vegetative buffer. Unlike grasses and shrubs, trees do not absorb enough surface water to aid in reducing erosion.

### ❌ Avoid:

Dumping yard waste, fill, or debris on or over the bluff. These materials don't aid in stabilization and block sunlight for vegetation growth.

### ✅ DO:

**Check with Code Enforcement to see if you need a permit to work in the shoreland zone.**

### PRO TIPS



Use the [Coastal Plant Guide](#) to determine what native plant species should be used as a vegetative buffer. CCSWCD has [checklist of native plants](#) that can be used for this purpose as well.

# CONCLUSION

---

## Caring for Your Bluff, Protecting Our Coast

Living on or near a coastal bluff comes with both opportunity and responsibility. The choices you make on your property have real impacts on the long-term health and stability of the bluff and shoreline.

As sea levels rise and weather becomes more extreme, bluff systems are under increasing pressure. But with thoughtful land management, residents can play an active role in supporting the natural processes that protect Maine's coast. Protecting bluffs is about working with nature—not against it. The more we preserve native vegetation, manage water wisely, and minimize disruption, the more we help ensure the long-term health of our coastline. This toolkit is meant to empower you with practical steps and helpful guidance for doing just that.

Whether you're ready to take on a full restoration project or simply start with a few native plantings, your actions matter. Small changes across many properties add up to big benefits—for your home, your neighbors, and the wider coastal ecosystem. To learn more, consult with local conservation groups, coastal restoration professionals, or connect with the resources listed in this guide.



# ADDITIONAL RESOURCES

---

## [Cumberland County Soil & Water Conservation District](#)

CCSWCD has a comprehensive toolkit explaining details relating to..

- [Coastal Bluff Toolkit](#)
- [Shoreline Management Assessment](#)
- [Shoreline Management Decision Tree](#)
- [Instability Assessment Rating Form](#)
- [Case Studies](#)
- [Coastal Planting Guide](#)

## [Maine Geologic Survey](#)

An in depth guide for [Maine Coastal Property Owner's for Erosion, Flooding, and Other Hazards](#)

## [OUR SHORE](#)

Currently in draft form, this guide compares various shoreline stabilization options for landowners, contractors, and designers.

## [Plants for the Maine Landscape](#)

Extensive resource on native plants from the UMaine Extension.

## [Climate Network, Living Shorelines](#)

More information on living shorelines throughout New England.

## [Coastal Bluff's and Landslide Hazard Map](#)

This is a general view of bluff stability. The data is from 2002, see if your bluff has changed.

## [Living Shorelines Decision Support Tool](#)

This State tool estimates where Living Shorelines could be appropriate for your property. The scale is green to red, green showing where living shorelines would work well.

## [Maine Sea Level Rise/ Storm Surge Scenarios Map](#)

This tool estimates sea level rise with various storm surge scenarios for the State of Maine.

## [NOAA, Sea Level Rise Calculator](#)

This tool estimates location-specific sea level rise.

## [Building Resilient Coastal Bluffs](#)

Casco Bay Regional Meeting, Presentation on Building Resiliency Along Maine's Coastline

# SOURCES

---

## ENDNOTES

- 1 [Maine Geological Survey, \*Reading Coastal Bluffs\*](#)
- 2 Maine Geological Survey, Pete Slovinsky, [Calling Your Bluff Symposium](#),
- 3 University of Maine, Sea grant, [Public Shoreline Access in Maine](#)
- 4 Maine Climate Council, [Maine Won't Wait](#), November 2024
- 5 GPCOG, Yarmouth [Vulnerability Assessment](#), 2024
- 6 Maine Geological Survey, [Sample Sidebar from Coastal Bluffs Map](#)
- 7 Maine Coastal Program (MCP)/Maine Department of Agriculture, Conservation and Forestry (DACF), Cumberland County Soil and Water Conservation District (CCSWCD), [Building Resiliency Along Maine's Bluff Coastline](#)
- 8 Maine Geological Survey, [Sample Sidebar from Coastal Bluffs Map](#)
- 9 DEPARTMENT OF AGRICULTURE, CONSERVATION AND FORESTRY Maine Geological Survey, [Maine Coastal Property Owner's Guide to Erosion, Flooding, and Other Hazards, 2nd edition](#), Peter A. Slovinsky
- 10 [Fact Sheet | Nature as Resilient Infrastructure - An Overview of Nature-Based Solutions](#)
- 11 [Understanding the Effectiveness of Coastal Nature-based Solutions: Practitioner-based Learning](#) Dr. Jessica Reilly-Moman, [Prof. Kathy Jacobs](#), [Dr. Glynis Lough](#), [Dr. Richard Moss](#)
- 12 Cumberland County Soil and Water Conservation District, [Addressing Roof Runoff](#)
- 13 Cumberland County Soil and Water Conservation District, [Addressing Driveway Runoff](#)
- 14 Cumberland County Soil and Water Conservation District, [Yardscaping, Rain Garden](#)
- 15 Cumberland County Soil and Water Conservation District, [Vegetative Buffer](#)

## SUPPORTING RESOURCES

[Controls on coastal bluff erosion of a drowned drumlin field: Boston Harbor, Massachusetts](#)  
Sarah K. Black, Zoe J. Hughes, Duncan M. FitzGerald

NOAA Fisheries, [Understanding Living Shorelines](#)

University of Minnesota Extension, [Stabilizing shoreland property to prevent erosion](#)

The Nature Conservancy, Land & Water Stories, [Conserving Our Ocean](#)

NOAA, Office for Coastal Management, [Stories from the Field](#)

Maine Geological Survey, [Sidebar from Coastal Landslide Hazards Map](#)

Portland Press Herald, [Greater Portland Council of Governments leads coastal erosion initiative](#), Sophie Burchell

New Jersey Department of Environmental Protection, [Living Shorelines Engineering Guidelines](#), Jon K. Miller, Andrew Rella, Amy Williams, and Erin Sproule

Urban Ocean Lab, [Resource Hub](#)

Southern & Midcoast Maine Resource Hub, [Resource Library](#)

East Coast Erosion Control, [Guide to Protecting Waterfront Property from Erosion](#)

NOAA, [Guidance for Considering the Use of Living Shorelines](#)

Resources for the Future, [Nature-Based Solutions 101](#)

Gouldsboro Shore, [Erosion Resources for Property Owners](#)

State Horticulturist, Gary Fish, [Vegetation Management on Coastal Bluffs](#)

