Fact Sheet
Commonwealth of Pennsylvania • Department of Environmental Protection

Bluff Recession: A Lake Erie Coastal Hazard

Introduction

Coastal hazards are a constant threat to our nation's coastal resources. In the Great Lakes, flooding and fluctuating lake levels cause serious property damage, endanger public safety and degrade environmental quality.

The Pennsylvania portion of the Lake Erie coastline is at risk from two coastal hazards: bluff recession and shoreline erosion. This fact sheet looks at the causes and cures of bluff recession.

The Lake Erie Shoreline

Pennsylvania’s Lake Erie shoreline extends along the northern boundary of Erie County in the northwest corner of the state. The coast consists mainly of bluffs ranging in height from five to 180 feet.

The glaciers that carved out the Great Lakes basin are also responsible for the majority of sediments that make up the bluffs. These unconsolidated (loose) glacial sediments and later stage lacustrine sands and gravels are very vulnerable to water-induced erosion. In some areas along the Erie coast, the bluffs also have a bottom layer of exposed bedrock.

Bluff Profile and Terminology

What is Bluff Recession?

Bluff recession is the landward retreat of the bluff caused by erosive forces along the lake. The average rate of bluff recession along Lake Erie is approximately one foot per year.

What Causes Bluff Recession?

Bluff recession is caused by waves, groundwater seepage, surface water runoff and human activity. One of these forces alone may or may not significantly weaken a bluff, but a combination of these forces will likely start the process of recession in motion.

- **Wave contact** with the bluffs is especially damaging when combined with high lake levels. High lake levels in Lake Erie are primarily caused by increased precipitation in the upper Great Lakes Watershed. During periods of storm events and high lake levels, waves break farther inshore and make contact with the base of the bluff, an erosion process known as undercutting. Once the base area is eroded, upper bluff soils and vegetation lose their support and collapse downward causing the bluff to recede landward.

- **Groundwater seepage** is the flow of underground water through the bluff face. As the water flows out of the bluff, it pulls soil particles with it, causing erosion. This action leads to slumping, which is a type of landslide. Groundwater comes from natural inland water sources and from human-induced water sources such as sprinkler systems, downspouts and leaking swimming pools and septic systems.
• **Surface water runoff** is the result of natural and human induced water flows over the bluff face. Flows are an erosive force, causing sediment to be dislodged and carried to the base of the bluff. Over time, flows across an unprotected bluff produce deep gullies. Surface water includes rain, snow melt and stormwater.

• **Human activity**, such as construction of roads and walking paths, increases the possibility of erosion and bluff instability. Also, dumping trash and yard waste on the bluff accelerates recession by discouraging vegetation growth and putting added weight on the bluff face.

Erosional Phenomena Affecting Bluff Stability

How Can Bluff Recession Be Prevented?

The Erie bluffs are reshaped daily by the natural forces of gravity, water and wind. However, through proper land-use management practices, bluff recession can be slowed, if not prevented. Since the majority of bluff recession-related problems start at the base of the bluff as a result of wave damage, it is recommended to stabilize the shoreline first before undertaking any of the following practices.

• **Biotechnical slope protection** combines the use of biodegradable wood cribbing and appropriate vegetation. The structure provides support for the bluff at a groundwater seepage area, while the vegetation absorbs the groundwater, eventually stabilizing the bluff face. Biotechnical systems are usually placed in the middle of the bluff face, so installation can be difficult and extremely labor intensive. This method is not recommended for shoreline protection against direct wave contact.

• **Dewatering** intercepts groundwater before it reaches the bluff face. Wells and groundwater trenches collect groundwater and rechannel it through pipes over the bluff face to the base of the bluff. Note: This is not a commonly recommended option because of limited beneficial or successful results.

• **Vegetation** naturally and inexpensively protects the bluffs. Root systems absorb groundwater and hold the soil together. Leaves intercept the impact of raindrops and transfer water absorbed by the root systems into the atmosphere through evapotranspiration.

How Does the Coastal Zone Management Program Address the Problem?

Pennsylvania’s Coastal Zone Management Program (CZM) is a federal/state partnership with the National Oceanic and Atmospheric Administration (NOAA). State administration is the responsibility of the Pennsylvania Department of Environmental Protection. CZM strives to create and maintain a balance between environmental protection and economic development in the state’s two coastal zones: Lake Erie and the Delaware Estuary.

Some of the services that CZM provides to property owners along Lake Erie are listed below:
• **CZM** provides financial and technical assistance for local administration and enforcement of the Bluff Recession and Setback Act (BRSA). The BRSA regulates the location of new structures and improvements to existing structures that are located in the bluff recession hazard area. The bluff recession hazard area is the zone where the bluff recession rate creates a substantial threat to existing or future structures.

• **CZM** offers a free Technical Advisory Service (TAS) to property owners affected by shoreline erosion and bluff recession. The TAS consists of on-site inspections and verbal and written recommendations for shoreline protection, surface and groundwater control, bluff stabilization and use of vegetation.
For more information, please contact:

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This fact sheet and related environmental information are available electronically via Internet. For more information, visit through the PA PowerPort at http://www.state.pa.us or visit DEP directly at http://www.dep.state.pa.us (directLINK “River Basins”).

www.GreenWorks.tv - A web space dedicated to helping you learn how to protect and improve the environment. The site features the largest collection of environmental videos available on the Internet and is produced by the nonprofit Environmental Fund for Pennsylvania, with financial support from the Pennsylvania Department of Environmental Protection, 877-PA-GREEN.