protecting coastal investments

Examples of Regulations for Wisconsin's Coastal Communities

illustration credits

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preface

Wisconsin's Great Lakes coastal communities have been attempting to address coastal hazards for decades. In 1981 the Wisconsin Coastal Management Program published *Regulations to Reduce Coastal Erosion Losses* by Doug Yanggen of the University of Wisconsin-Extension. The report included erosion hazard provisions that could be included in local zoning and subdivision ordinances based on geologic and engineering studies available at the time. A recent inventory of coastal ordinances in Wisconsin's coastal communities showed that Wisconsin communities have taken a variety of approaches to address coastal hazards. Racine County's ordinance includes variations of the Yanggen model ordinance that conform closely to the intent of the model. A number of other local ordinances reflect at least some of the concepts of the report, indicating that the report did influence the evolution of local approaches used by local governments to address coastal issues. A summary of the inventory appears in the Appendix.

This publication seeks to provide some "best practices" for addressing coastal hazards in Wisconsin. Many of the best practices are based on ordinances that are currently in place in Wisconsin coastal communities. Some of the best practices build off approaches followed in other coastal states. This publication is intended to serve as a resource guide for coastal communities that are evaluating different approaches to dealing with coastal erosion. The publication includes ordinance language that can be included in local ordinances to address locally identified needs. The ordinance provisions are accompanied by explanatory commentary. The Appendix also allows coastal communities to examine the approaches followed by other Wisconsin communities.

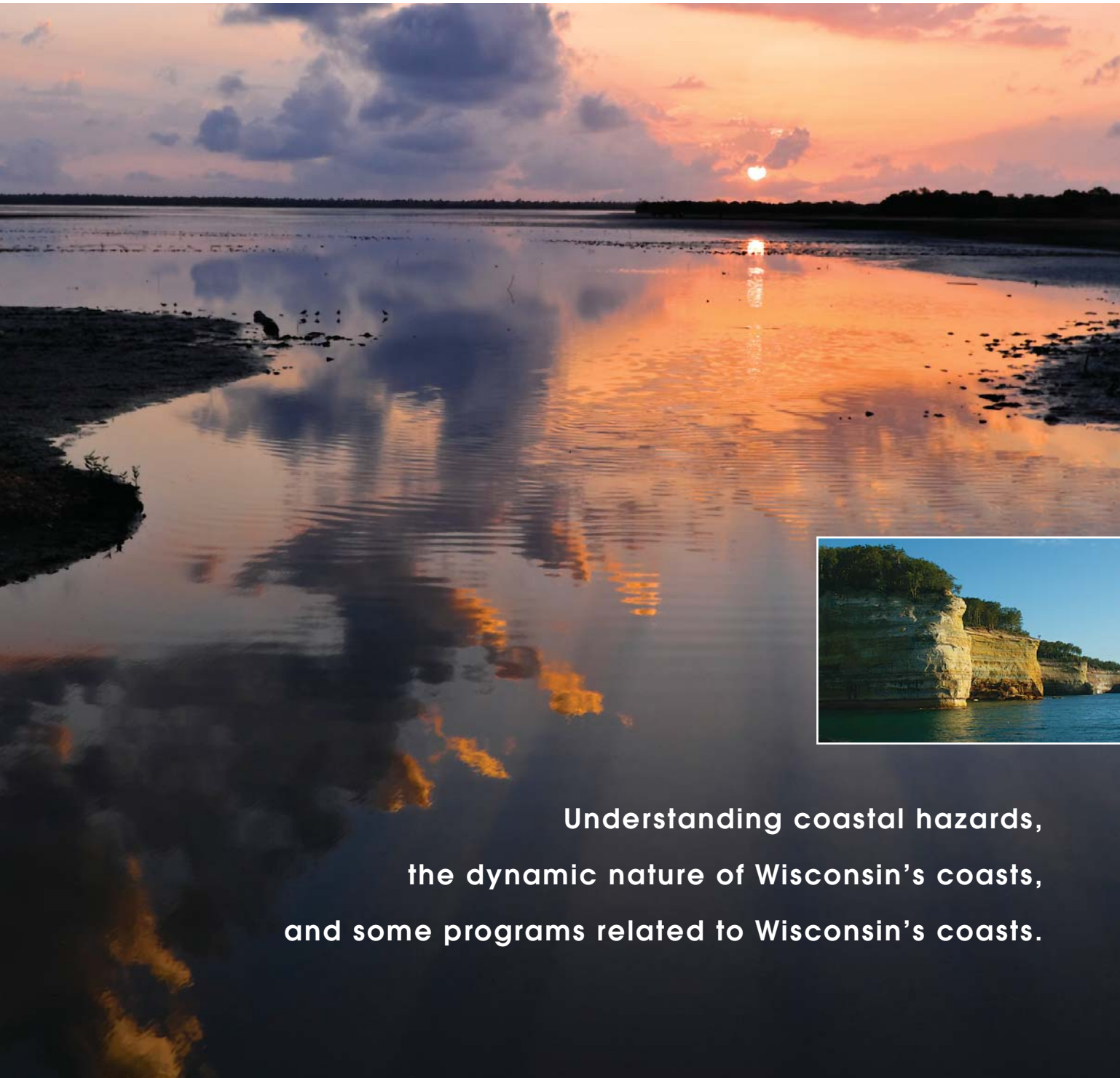
acknowledgements

Brian W. Ohm, Land Use Law Specialist, Department of Urban & Regional Planning, University of Wisconsin-Madison/Extension, is the primary author of this publication. David Hart, Geographic Information Systems Specialist, University of Wisconsin Sea Grant Institute, generated the idea for this publication and provided critical contributions throughout the project. Tanya Krzeminski (M.S. 2008 Urban & Regional Planning, UW-Madison) provided invaluable research for this publication.

THE FOLLOWING INDIVIDUALS PROVIDED IMPORTANT INSIGHTS into the issues facing Wisconsin's coastal communities and helped to define the scope of this publication: Phil Keillor, Coastal Engineering Specialist; Alan Lulloff, PE CFM; Kenneth W. Potter, Professor of Civil and Environmental Engineering, University of Wisconsin-Madison; David Mickelson, Senior Scientist and Emeritus Professor, Quaternary and Glacial Geology, University of Wisconsin-Madison; Andy Holschbach, Director, Planning, Resources, and Land Management Department, Ozaukee County; Frank Risler, Manager, Planning and Development Department, Racine County; Greg Schnell, County Board Advisor, Sheboygan County; Steve Sokolowski, Manager, Planning and Zoning Department, City of Sheboygan; Paulette S. Enders, Director, Planning and Development Department, City of Sheboygan; Randy Tetzlaff, Director, Department of Planning and Development, City of Port Washington; Pete Tarnowski, Code Administrator, Manitowoc County; Mark Walter, Executive Director, Bay-Lake Regional Planning Commission; Steve Rannenberg, Administrator, Planning and Zoning Department, Douglas County; Karl Kastrosky, Administrator, Zoning Department, Bayfield County; Lisa David, Program Assistant for Bayfield County Planning & Zoning Department; Kathryn Ten Haken, Neighborhood Preservation Officer/Planning and Development Department Assistant, City of Ashland; and Alyssa Core, Environmental Projects Coordinator, City of Ashland.

THE FOLLOWING INDIVIDUALS PROVIDED HELPFUL COMMENTS ON THE FINAL DRAFT OF THIS PUBLICATION: Phil Keillor, Coastal Engineering Specialist; Alan Lulloff, PE CFM; Kenneth W. Potter, Professor of Civil and Environmental Engineering, University of Wisconsin-Madison; David Mickelson, Senior Scientist and Emeritus Professor, Quaternary and Glacial Geology, University of Wisconsin-Madison; Sally Kefer, Land Use Team Leader, Wisconsin Department of Natural Resources; Kate Barrett, Water Resources Specialist and GIS Analyst, Office of Great Lakes, Wisconsin Department of Natural Resources; Kate Angel, Program and Planning Analyst, Wisconsin Coastal Management Program; and Gene Clark, Coastal Engineer, University of Wisconsin Sea Grant.

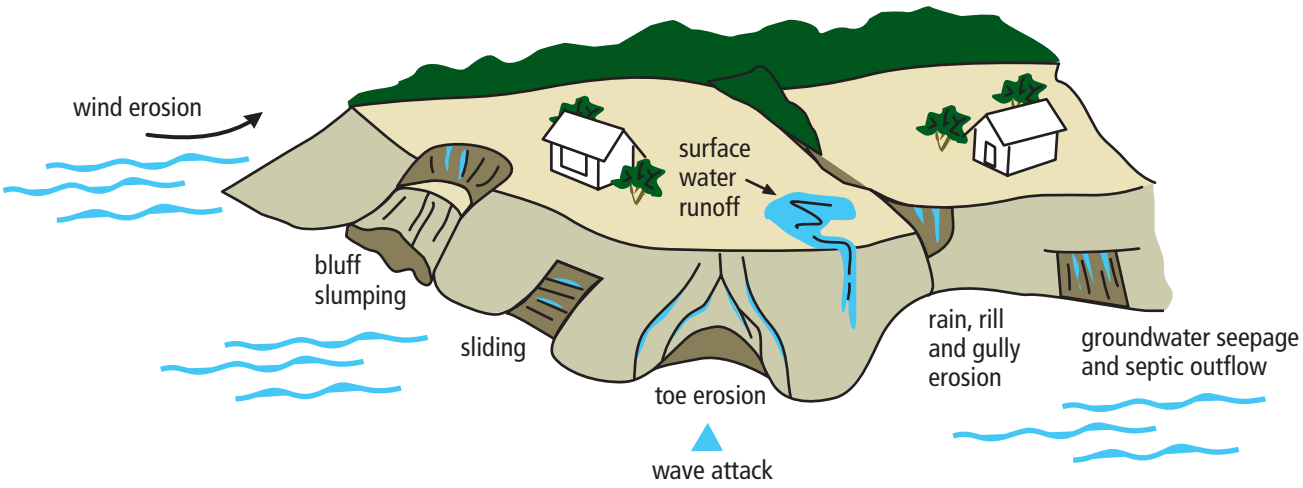
introduction



Understanding coastal hazards,
the dynamic nature of Wisconsin's coasts,
and some programs related to Wisconsin's coasts.

Understanding Coastal Hazards

The coastline of the Great Lakes is dynamic. While the movement is not always visible to the human eye, the bluffs along the coast are continuously changing due to coastal erosion and bluff instability. The forces that created the stunning vistas and breathtaking bluffs have not stopped. Wind, waves, and rainfall continue to shape the coast today. Although the bluffs are constantly changing, that change may be episodic. Years and even decades can pass without any major loss, and then, in one large event, a section of bluff-top 50 feet deep and 100 feet wide can fall into the lake. Bluff erosion and failure, in the form of slumps, can potentially occur any time the bluff is unstable. As a bluff grows steeper, it becomes more unstable. Coastal erosion is a serious issue affecting coastal communities in Wisconsin. The processes of bluff instability and coastal erosion are often complex and pose educational challenges for potential lakefront property developers and owners.



Causes and Effects of Coastal Erosion

Land along the Great Lakes has a history of erosion. Nearly 80% of Wisconsin's erodible coastline suffers from bluff erosion and recession problems. Wisconsin's coast consists of sandy beach and erodible bluffs along the Lake Michigan coastline from the Illinois border to the Sturgeon Bay Canal. From the Sturgeon Bay Canal to the tip of Door County and down through Green Bay, the coast includes wetlands, limestone outcrops, bays and clay banks. High short-term erosion rates from 3-15 feet per year have been recorded for decades along sand plains and 2-6 feet per year along high bluff lines.[1] Much of Wisconsin's Lake Superior coastline is also susceptible to erosion. The red clay found across the Lake Superior Basin, especially along the coast, is highly erodible and unstable.[2]

Flooding is a hazard to developments in low-lying areas, replacing coastal erosion as the primary natural hazard in some areas along the Great Lakes. Studies have shown that areas along the Lake Michigan coastline from Green Bay to the Michigan border and Kenosha County are prone to flooding. Along Lake Superior a high risk of flooding can be found on the coast of the city of Superior, Bark Bay, and Chequamegon Bay.[3] The risk of flood-

ing increases during intense storm events, which are predicted to increase in frequency and severity due to climate change.

There has been a recent heightened interest in planning by coastal communities in Wisconsin. Enactment of local comprehensive planning legislation in 1999, increasing development along the Great Lakes, concern over the impacts of global climate change, and recent high-profile disasters such as Hurricane Katrina contribute to the realization that action must be taken to reduce coastal hazards. As communities examine their existing ordinances, many look for ways to better address the coastal hazards present along the Great Lakes coastline.

Understanding the Dynamic Nature of Wisconsin's Coasts

How Does Erosion Happen?

Living along the coast requires an understanding of how bluff failures and coastal erosion work so that people and buildings are not located in dangerous areas. There are two primary types of coastal erosion at work along Wisconsin's coast: shoreline erosion and lakebed erosion. Shoreline erosion is characterized by events like bluff slumping, sliding and beach loss that can be witnessed over time. Lakebed erosion can lead to bluff toe erosion and nearshore sediment loss and is more challenging to document. Both shoreline and lakebed erosion can lead to bluff failure.

Shoreline Erosion

Shoreline erosion occurs along all parts of the Great Lakes coastline, but some areas erode faster than others. Shores that have cohesive materials like clay, till, and bedrock erode at a slower rate than noncohesive materials like sand and gravel. Bluffs composed of noncohesive materials constitute much of the coastline along the Great Lakes. Coastal slopes primarily erode due to storm waves attacking the slope toes, rising groundwater combined with instability in slope soils, and surface-water runoff. Other factors that can affect shoreline erosion include weathering due to freezing/thawing; lake levels; slope steepness; storm wave energy, height, and duration; amount of precipitation; shoreline ice cover; beach composition, width, and slope; presence or absence of shore protection structure, soil composition and type of shore protection technique.

Lakebed Erosion

Lakebed erosion — also referred to as downcutting — occurs when sediments in the water act like an abrasive against the lake bottom over time. This is common along much of the Great Lakes coastline. Erosion rates tend to be higher closer to shore, where waves break and cause turbulence. Erosion rates decrease further from shore but can still affect lakebeds into water depths greater than 33 feet.[6] Lakebed erosion is a two-fold hazard. First, this is a natural, irreversible process that cannot be 'fixed' by beach nourishment and other sediment-recapturing techniques. Once the lakebed has been downcut, the sediments drift out and settle in deep water basins. Second, lakebed erosion leads to bluff toe failure. Toe failure is the result of waves undermining sediments from the base of a bluff. Toe failure is a critical indicator of a future bluff failure event that can affect buildings and private property.

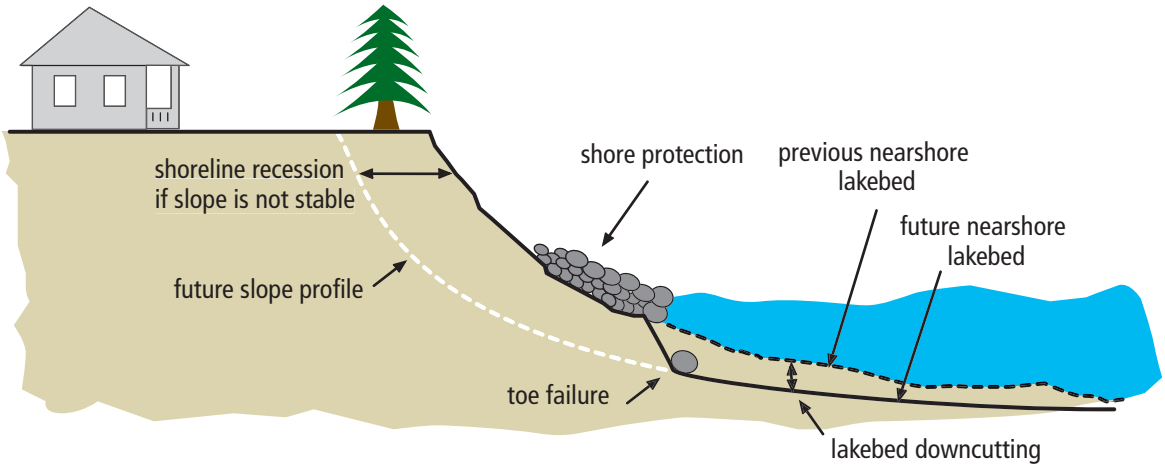
THE GEOLOGY OF THE COASTS

Glaciers once covered the entire coastline of Wisconsin. The geological features that the massive ice sheets left behind are diverse across a small area. Bluffs, dunes, sandy plains, and till are the major geological features along the Lake Michigan coast. Heading north from the Illinois border, the bluffs generally increase in elevation from less than 5 feet to as high as 100 feet. The highest point on the coast is 140 feet near Virmond Park in southern Ozaukee County. From the Sturgeon Bay Canal to the most northern part of the Door Peninsula and along the Green Bay coastline, the geology changes to clay banks.[4] High bluff erosion and shoreline recession rates have been recorded along parts of the Lake Michigan coast.[5]

The geology also varies along the Lake Superior coast. The mainland shore consists of beaches and bluffs of bedrock, clay, silt, and sand. Half of the coastline is composed of clay bluffs. On the northern coast, the highest point is over 200 feet near Port Wing in Bayfield County. Along the Apostle Islands the coast is limited to sandstone bluffs and rocky beaches.

Changing lake levels have a large effect on lakebed erosion and slope stability. During periods of low lake levels, the bluff toe is subject to less erosion. The zone where waves break and cause greater erosion is further off shore. When higher water levels return, the water depth closer to shore is now deeper. As a result, the wave impact increases along the bluff toe, creating more erosion.

Lakebed erosion can be mitigated by properly placed shore protection, but it cannot be completely stopped. Cobblestones and boulders, mimicking natural bedrock, form a protective lag deposit over the cohesive lakebed, developing an almost horizontal platform and reducing the recession rate of the bluff toe.



Lakebed Erosion with Slope Recession and Failure of Shore Protection Structure

Lakebed and Shoreline Erosion Working Together

Studies of Ozaukee County, along Lake Michigan north of Milwaukee, show that bluff failure and erosion is continuous and can generally be described by six phases. These phases describe the process of erosion along many parts of the Wisconsin shoreline.

Phase 1: High bluffs (100 ft +) are common along the coast in southern and mid-Ozaukee County and are composed of clay till and lake sediment. Bluffs like this are called "cohesive bluffs" and are prone to infrequent, large scale (150–200-ft wide), deep-seated slumps.

Phase 2: Every bluff has its own point of failure. When it passes that threshold, failure occurs and causes up to 50 feet or more of bluff-top recession. Saturated soils are very heavy and can lead to bluff failure.

Phase 3: The single largest cause of bluff failure is wave action coming into contact with the bottom of the bluff, due to high lake levels, large storms, or lakebed erosion. Wave action removes the newly slumped sediment away from the base of the bluff, starting the process of steepening the bluff again.

Phase 4: Since wave action at the bluff toe occurs during high lake levels or storms (especially storms during high lake levels), tons of material can be transported away from the bluff or along the shore.

Phase 5: Very typical of the bluffs in Ozaukee County, there is a 'lag period' for bluff movement between the bluff toe and the top. At this point,

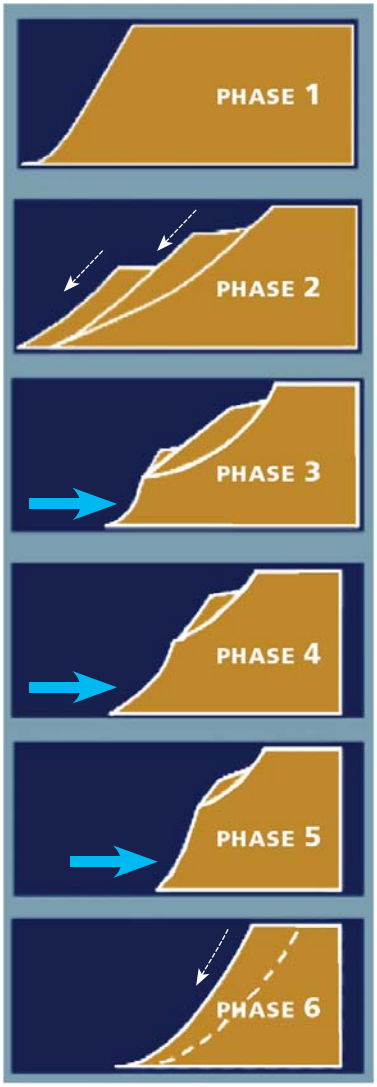


Illustration by Jeff Stone, based on a graphic published by the U.S. Geological Survey in *Formation, Evolution, and Stability* of Coastal Cliffs — Status and Trends, chapter "Erosion of Coastal Bluffs in the Great Lakes" by David M. Mickelson, Tuncer B. Edil, and Donald E. Guy.

even if wave action at the base of the bluff was removed, slopes on the bluff would continue to fail for years.

Phase 6: Eventually original steep conditions return and start the cycle again. It is important to note that this cycle sometimes takes decades to complete, something that land use planners must keep in mind when establishing rules for setback ordinances and other building guidelines.[7]

Surface Water Runoff and Shallow Groundwater-Induced Bluff Failures

Natural events and human activities combine to increase the effects of surface erosion on coastal land. Wind generates storm waves that attack the coast and erode or deposit material on sandy shores. Heavy rains soak into the ground, saturating and adding stress to coastal slopes and can run over the surface, washing away exposed soil. Soil freezing and thawing weakens coastal slopes and makes them more susceptible to failure. Soils disturbed by construction are vulnerable to erosion and may no longer be able to handle surface water flow adequately. Disturbed soils can also increase groundwater infiltration and migration to coastal slopes, leading to increased soil and bluff instability and erosion.[8] Global climate change may also lead to an increase in storm intensity and frequency, which could cause an increase in surface erosion.

Coastal Wetlands

Wetlands ecosystems are an important, unique, and fragile part of the coast. Each of the 15 coastal counties in Wisconsin contain or border coastal wetlands. Coastal wetlands can help manage stormwater, filter runoff, and maintain water quality in the Great Lakes. Wetlands also help protect against flooding — destruction of coastal wetlands decreases the land's natural ability to mitigate flood waters.

WISCONSIN'S COASTAL WETLANDS

In Kenosha County, the Chiwaukee — Illinois Beach Shoreline is the most floristically rich coastal plain prairie intact in southern Wisconsin. Just north of the Racine County border, in Southern Milwaukee County, the Root Riverine Forest contains mesic hardwoods and floodplain forest. In Milwaukee County, the Warnimont Park Fens site consists of spring seepages, a narrow sand beach, a spring run, and maple-beech forest. The Harrington Beach Lacustrine Forest found in the Harrington Beach State Park of northern Ozaukee County contains good-quality mature second-growth northern wet-mesic forest, which is rare, and is heavily used by migratory birds.

In the 1,800-acre wetland complex of Point Beach Great Lake beaches and dunes, interdunal wetlands, forested ridges and swales, northern and southern sedge meadows, white cedar swamp and hardwood swamp can be found. Other identified coastal wetlands are the Cleveland Hardwood Swamp, the Fischer-Centerville Creeks Area, Point Creek, Silver-Calvin Creek, and Little Manitowoc River in Manitowoc County.

In Kewaunee, Door, Brown, Oconto, and Marinette Counties there are over twenty identified coastal wetland networks and areas. A large portion of the Door County Lake Michigan coastline is protected by coastal wetlands, and a majority of Oconto County's coast consists of wetlands that are inundated during periods of high precipitation and lake levels. Much of Marinette County's coast is made up of the swamp and wetlands of the Lower Peshtigo River.

In northern Wisconsin, the majority of wetlands lie in the western half of Douglas County and include the Red River Breaks — St. Louis River Marshes, Oliver Marsh, Superior Municipal Forest, Pokegama-Carnegie Wetlands, Superior Airport — Hill Avenue Wetlands — South Superior Triangle, Nemadji River Marshes, and Allouez Bay-Wisconsin Point. The mouth of the Brule River empties into Lake Superior on the eastern edge of the county and creates a wetland there. In Bayfield County, the wetland complex in Port Wing, Bark Bay, Lost Creek, Raspberry Bay, Sultz Swamp, Bayview Beach-Sioux River Slough, and Fish Creek Slough can be found. The Bad River — Kakagon Sloughs run along the mainland coast of Ashland County up to the border of Iron County, forming one of the most significant wetland complexes in the Great Lakes.

TERMINOLOGY

In order to understand coastal hazards fully, it will be useful to define several terms. The interplay of these terms is shaping the fields of hazards planning and disaster management.[9]

HAZARD

A hazard is an act or phenomenon that has the potential to produce harm or other undesirable consequences to some person or thing. Hazards can be natural or man-made or a combination of both. The Great Lakes coast can be the location of hazardous conditions independent of the presence of people.

VULNERABILITY

Vulnerability is the tendency for an entity to be damaged. It represents the interface between exposure to the physical threats to human well-being and the capacity of people and communities to cope with those threats. Introducing human settlements along the Great Lakes coasts increases their vulnerability to hazards. Elderly and poor populations are more vulnerable to damage from hazards.

RISK

The risk of a system may be defined as the possibility of an adverse and unwanted event. It can be thought of as the intersection of exposure to a hazard and the vulnerability of the system.

RESILIENCE

Resilience refers to the ability of an entity to resist or recover from damage. Vulnerability and resilience are opposites. Something is vulnerable to the extent that it is not resilient. Building resilience to hazards in coastal communities is an emerging priority of the National Oceanic and Atmospheric Administration and coastal states.

Understanding Some Programs Related to Wisconsin's Coasts

Ordinary High Water Mark

Under the Public Trust Doctrine, the state of Wisconsin holds (owns) the lake bed beginning at the ordinary high water mark. The Wisconsin Department of Natural Resources (WDNR) is entrusted with administering the Public Trust Doctrine. As codified in section 115.03(6) of the Wisconsin Administrative Code, the ordinary high water mark is "the point on the bank or shore up to which the presence and action of surface water is so continuous as to leave a distinctive mark such as by erosion, destruction or prevention of terrestrial vegetation, predominance of aquatic vegetation, or other easily recognized characteristic." This point may not be the same as the water's edge.

The ordinary high water mark is an important reference point used in a number of state programs related to the Great Lakes, such as the Shoreland Management Program discussed below and the Chapter 30 requirements discussed later under shore protection structures.

Shoreland Management Program

Counties in Wisconsin are required to enforce shoreland zoning around waterbodies within the unincorporated (towns) areas of the county. The standards counties must follow are outlined in Chapter NR 115 of the Wisconsin Administrative Code. The shoreland management program applies to land within 1,000 feet of the ordinary high water mark of lakes, including Lake Michigan or Lake Superior. The standards include: minimum lot sizes, building setbacks, tree and shrubbery cutting, filling, grading, lagooning, dredging, ditching and excavating, land division review, sanitary use provision, and a variety of agricultural uses and standards. One of the most significant regulations in the law is the requirement of a minimum 75-foot setback for all buildings from the ordinary high water mark except for piers, boat hoists and boathouses. Individual county shoreland zoning regulations may be more restrictive than the state minimum requirements.

Generally, cities and villages are not required to follow the requirements of Chapter NR 115. However, under section 59.692(7) of the Wisconsin Statutes, the provisions of the county zoning ordinance continue to be in effect for land that is annexed to a city or village or when a town incorporates as a city or village. The provisions are enforced by the city or village, or the city/village can request that the county continue to enforce the ordinance.

Cities and villages are required to adopt wetland zoning ordinances under Chapter NR 117 of the Wisconsin Administrative Code. These are important tools for protecting coastal wetlands.

Coastal Zone Management — Wisconsin Coastal Management Program

The National Coastal Zone Management Program is a voluntary partnership between the federal government and coastal states authorized by the Coastal Zone Management Act of 1972. At the federal level, the act is administered by the Coastal Program Division's Office of Ocean and Coastal Resource Management, a part of the National Oceanic and Atmospheric Administration (NOAA). NOAA cooperates with states that have Coastal Zone Management programs to balance coastal development with resource conservation.

Wisconsin established a coastal management program in 1978.[10] The Wisconsin Coastal Management Program (WCMP) is administered by the Department of Administration and is advised by a governor-appointed council. The WCMP works with state, local, and tribal governments and non-profit organizations to preserve and improve access to Wisconsin's Great Lakes resources. Wisconsin's coastal zone includes the 15 counties that border Lake Superior, Lake Michigan, and Green Bay.

Bulkhead Line

A bulkhead line is an officially set line that is meant to establish a regular shoreline. Local governments have the authority under section 30.11 of the Wisconsin Statues to adopt an ordinance establishing a bulkhead line. The ordinance must be approved by the WDNR and must be in the public interest. Often structures are built along the bulkhead line to create a marina, harbor, or other public facilities. Many of the coastal communities along the Great Lakes have bulkhead line ordinances. Most of these were approved before the 1960s, when standards were not as strict and did not consider the impact of human development on the dynamic coastal processes. Douglas County, Sheboygan County, the cities of Ashland and Bayfield, and the village of Howard are some of the coastal communities that have bulkhead line ordinances.

The Coastal Floodplain

Pursuant to section 87.30 of the Wisconsin Statutes and Chapter NR 116 of the Wisconsin Administrative Code, cities, villages, and counties are required to adopt floodplain zoning ordinances to protect property from flooding hazards in flood-prone areas of the state, including along the coasts. NR 116 defines the coastal floodplain as the "area along the coast of Lake Michigan or Lake Superior which is inundated by the regional flood and which is also subject to additional hazards due to wave runup." Floodplain zoning prohibits development in the floodway; local ordinances may impose additional limitations on development within the flood fringe area. The floodway generally pertains to the area where there is a one percent probability of inundation in any given year, also referred to as the 100-year flood. The flood fringe is the area landward of the floodway, where excess water from the floodway would be stored. Floodplain zoning is required for communities to be eligible to participate in the Federal Emergency Management Agency's (FEMA) National Flood Insurance Program.

The mapping of the floodplain is critical. Floodplain zoning is based on maps either produced by or approved by the WDNR or FEMA. Flood Hazard Boundary Maps depict where flooding hazards may occur. Flood Boundary Floodway Maps delineate the floodway and supplement the Flood Hazard Boundary maps. Flood Insurance Rate Maps (FIRMs) are based on detailed studies, include determined base flood elevations and depict both the floodway and the flood fringe on one map.[11]

coastal ordinance provisions

Coastal hazard setback,
alternative approaches to coastal hazard setback requirements,
stormwater management and erosion control, site planning,
and disclosure of coastal hazards.

ORDINANCE LANGUAGE

An important component of every ordinance is the purpose statement. Some possible language for a purpose statement follows.

PURPOSE

The coastal area regulations are established with the following intent:

- *To protect the natural environment and the integrity of the coastal area that is a distinctive and valuable natural feature of the Lake Michigan/ Superior shoreline.*
- *To recognize the potential for hazards to affect health and safety to persons and property from bluff development.*
- *To protect the stability of the coastal bluffs and thereby reduce the risks of coastal erosion, undermining, slumping, or collapse of the bluffs, and to protect the waters of Lake Michigan/Superior from unnatural sedimentation.*
- *To promote the recommendations of the [name of local government]'s Comprehensive Plan relative to the constraints that should be considered in developments that impact coastal environments.*

The following sections provide an overview of different ordinance provisions that local governments may use to address a variety of issues unique to Wisconsin's coasts. The sections include a commentary that explains the purpose of the ordinance provisions and examples of ordinance language that local governments may insert into their ordinances. The ordinance language is in *italics*. Ordinance language appearing in brackets [ ] indicates information that needs to be filled in by the local unit of government or indicates options available to local governments. The issues explored below include methods for determining coastal setbacks, shore protection practices, and the disclosure of coastal hazards to inform current and prospective purchasers of coastal property.

Coastal Hazard Setback

Perhaps the most fundamental element for all Great Lakes coastal communities to consider in their ordinances is a setback requirement to protect development from the potential coastal hazards relevant to the community, primarily bluff stability, erosion, and flooding. The setback establishes an area a certain distance from the edge of the water or bluff top within which certain land disturbing activities (such as the placement of structures) are limited.

Local governments have several options for where to include setback requirements in their local ordinances. Counties could include these setback requirements in their shoreland zoning ordinances as a special provision for coastal shoreland areas (which generally includes all land in unincorporated areas located within 1000 feet of the ordinary high water mark of Lake Michigan or Lake Superior). Counties, cities, villages, and towns with general zoning authority could also create a separate coastal protection zoning district in which special setback requirements apply to parcels adjacent to Lake Michigan or Lake Superior. Finally, counties, cities, villages, and towns could include special provisions for coastal setbacks in their land division or subdivision ordinances. Under Wisconsin law, local subdivision regulations are meant to prevent the division of land for development when that land is not suitable for development. Incorporating coastal setback requirements in local subdivision ordinances can help identify those coastal areas that are not suitable for development because of factors like bluff instability and shoreline recession. However, no matter the approach used, the setback requirements cannot be less than the requirements of Chapter NR 115 of the Wisconsin Administrative Code, which applies in the unincorporated areas and within land annexed to cities and villages after 1982. Also, in coastal areas where flooding presents a potential hazard, local floodplain ordinances include setback requirements. Conversely, setback requirements must also incorporate the requirements of local floodplain ordinances. Stormwater also needs to be managed further inland; this can be addressed more comprehensively in local stormwater management ordinances.

A review of existing local ordinances in Wisconsin's coastal communities reveals a range of approaches used by local governments to protect structures from coastal hazards through the use of setbacks. (The ordinance language for these communities is included in the Appendix.) Some communities require that structures must be set back a fixed distance from the water but do not expressly account for coastal hazards. Other communities require setbacks that take into account the dynamic nature of the coasts — setbacks that account for the future recession of the coastline and/or the stabil-

ity of the bluffs along the coast. The following sections review the different approaches used by Wisconsin coastal communities and provide examples of ordinance language that incorporate those approaches.

Fixed Distance Facility Setback — the 75-foot Setback Standard

Many coastal communities apply a setback that requires that new facilities (e.g., houses, infrastructure) not be located within a predetermined fixed distance from the ordinary high water mark or the edge of a bluff. The community applies the same setback along the entire coastline within the community. Most counties that use a predetermined distance setback follow the 75-foot minimum setback from the ordinary high water mark required by Wisconsin's Shoreland Management Program for County Shoreland Zoning Ordinances.

While a fixed distance setback is often easier to understand and administer, a 75-foot setback distance may not be sufficient for development along the Great Lakes. This standard, dating from the 1960s, was developed for the inland lakes in Wisconsin and does not address many of the unique coastal hazards found along the Great Lakes. In areas with unstable bluffs, a 75-foot setback from the ordinary high water mark is likely to result in the placement of a structure too close to the edge of the unstable bluff. In fact, for very tall bluffs, a simple 75-foot setback could still allow a structure to be built on the bluff front slope itself because the actual bluff top is more than 75 feet inland from the ordinary high water mark! If the bluff slumps in 15 years, the structure could be damaged beyond repair. In areas with low sandy banks and a moderate recession rate of two feet per year, following a 75-foot setback from the ordinary high water mark will mean that within just 7 years (the average amount of time that many people own a home) a house would be within 61 feet of the ordinary high water mark. Depending on the interpretation of the local ordinance, the house could become a nonconforming structure subject to complex nonconformity rules. What was once an easy standard to administer becomes more complex.

Many communities also allow setbacks to be modified based on the lot averaging method. Under this method, if adjacent structures are closer than the 75-foot setback, new structures can be built following a setback based on the average setback of the adjacent structures. Following the previous example, the property owners who originally built seven years ago needed to follow the 75-foot setback, but the property owner building today does not. The property owners who built seven years ago may wonder why they are being treated differently. Again, approaches to regulating the shoreline along inland lakes, which are more stable, are not effective when dealing with protecting properties along the more dynamic coastal areas.

Setbacks that Acknowledge the Dynamic Nature of the Coasts

As an alternative to relying on the fixed facility setback alone, a number of Great lakes coastal communities have adapted ordinances that account for the natural processes of coastal erosion. Since the 1930s, many studies have been completed that provide a better understanding of the recession rates and stability of the bluffs along the coasts.[12] Setbacks developed using these studies require distances that are based on a determination of the stability of

STABLE SLOPE SETBACK

WHAT IS A BLUFF?

Wisconsin Administrative Code NR 51.32 defines a "bluff" as "a hill, ridge or similar landform significantly elevated above the surrounding landscape, having a broad, steep face or cliff, and adjoining the shoreline or coastal lowlands of Lake Michigan or Lake Superior."

STABLE SLOPE PRINCIPLE

In order to accommodate the stable bluff slope principle alone, a structure on a 50-foot-high bluff along Lake Michigan would need to follow a 125-foot setback from the ordinary high water mark: 2.5ft (stable slope angle) x 50 ft (bluff height) = 125ft setback.

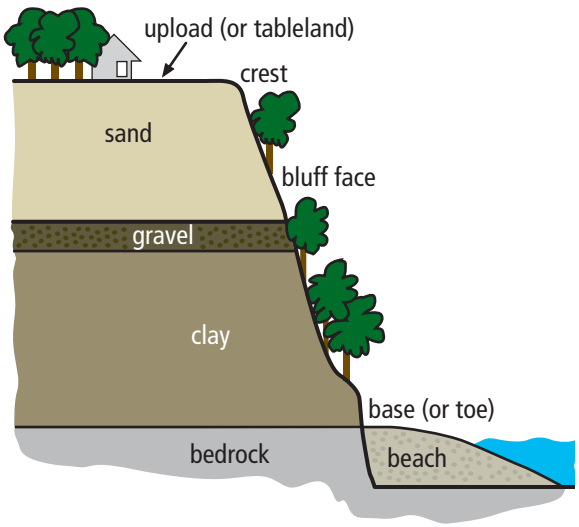
the slope and an estimate of the rate of shoreline recession for an area. Often an objective of these approaches is to develop a setback for buildings that takes natural processes into account, thereby exposing them to the lowest risk. Locating buildings in stable, non-hazardous areas, outside of floodplains, and away from bluff edges and coastal slopes is a way to minimize the impact of failing bluffs and coastal erosion on coastal properties. Building in areas away from coastal hazards allows the natural erosion process to continue without placing human development in danger.

A number of current ordinances adopted by Wisconsin coastal communities are based upon efforts to evaluate recession rates and/or bluff stability based on either site-specific or more general studies of certain areas (or "reaches") along the coast. These studies are geotechnical engineering studies that assess a number of variables influencing bluff stability and shoreline recession rates. Based on this information, local communities attempt to identify appropriate places for development to occur. The different approaches are explored below. Many of these ordinances reflect concepts that originated in the 1981 model ordinance prepared by Doug Yanggen of UW-Extension.

Slope Stability: Determining the Stable Slope Angle Setback

Many of the bluffs along Lake Superior and Lake Michigan are unstable. Communities in these areas should consider using a setback that accounts for this instability. One approach is to include a setback based on a calculation that includes a determination of the stable slope angle (or angle of repose). Even when lake levels are low, bluffs along the coast will continue to fail or slump until a stable slope angle is reached. Setbacks based on the stable slope angle attempt to determine the horizontal distance necessary for a bluff face to recede to a stable slope. The stable slope angle is a calculation that assumes no further shoreline erosion will occur.

Engineering studies have documented ways of estimating the stable slope angle. Actual bluff failure at a particular site depends on a number of variables, including the soil profile and properties, groundwater conditions, vegetative cover, surface drainage, and other factors. Engineering studies can provide a reasonable estimate of slope stability based on the height of a bluff, its slope angle, likely maximum groundwater elevation, and the predominant material of which it is composed. Older studies provided the basis for a generalized stable slope angle for bluffs along Lake Michigan of 21.8 degrees. This translates into an equation of 2.5 feet horizontal distance for every one foot of vertical distance. Studies of the bluffs along Lake Superior developed a generalized



Bluff Profile and Terminology

Illustration based on an original by Shamus Malone, Pennsylvania Department of Environmental Protection, Coastal Zone Management.

stable slope angle of 18.4 degrees, or three feet horizontal distance to one foot vertical distance. These stable slope angles are followed in a number of local ordinances. However, more recent research calls into question the continued reliance on these angles, citing the need for more current studies.[13]

Examples of Stable Slope Setback Application in Wisconsin

The following are examples of Wisconsin communities that apply a setback based on the stable slope angle alone as the determining factor.

- Manitowoc County follows the minimum 75-foot setback but adds a greater setback based on the stable slope angle of 2.5 feet to one for bluffs of ten feet or more in height. Both setbacks are measured from the ordinary high water mark.
- Ozaukee County requires a stable slope setback along the coast following the stable slope estimated angle of 2.5 feet to one. It is measured from the toe of the bluff. At a minimum, the county requires a setback of 75 feet from the edge of the bluff. For ravines, the County applies a stable slope angle of 3 feet to one.
- The City of Mequon, in Ozaukee County, requires a stable slope setback angle of 2 feet to one measured from the toe of the bluff and a minimum 75-foot setback measured from the edge of the bluff.
- While Kewaunee County applies a minimum 75-foot setback for bluffs 10 feet or less, the County requires a 125-foot setback from the ordinary high water mark for bluffs higher than 10 feet. The County uses this fixed setback of an additional 50 feet and does not base it on a calculation of the stable slope angle.

Receding Shoreline: Determining the Recession Rate Setback

Coastal communities that have bluffs and/or dunes and beaches may want to follow a setback that includes a calculation based on the projected recession rate of the shoreline. A setback based on the estimated recession rate attempts to account for the horizontal distance the shore is expected to recede during the useful life of a structure. Several studies over the years have attempted to discern the average annual recession rate of coastal lands due to wind and wave-induced erosion.[14] These studies captured the current state of bluff stability, beach width, and bluff recession rates by breaking the coastline into a series of reaches that were based on relatively uniform beach and bluff characteristics.

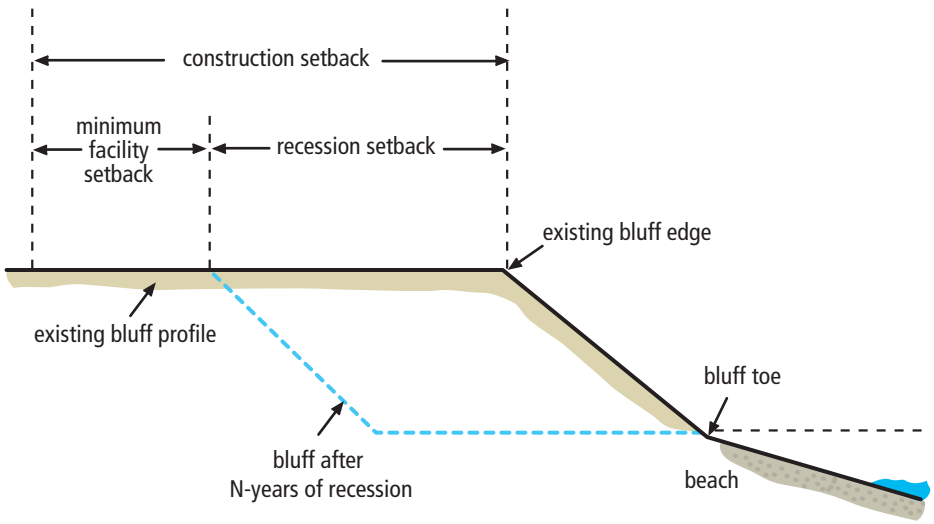
There are portions of the coastline for which no recession rate data are available. Another limitation is the inaccuracies in estimating recession rates from aerial photos. Early aerial photos were made for agricultural planning purposes and are not optimum for measuring coastal bluff edges. The episodic nature of massive bluff failure events that may occur decades apart also makes this information unreliable. Additionally, recession rate studies measure past erosion rates. These rates are then projected into the future. Perhaps the greatest limitation is the uncertainty of future climate change, its impact on coastal erosion, lake levels, and the likelihood of abrupt climatic surprises such as shifting storm tracks. These historic rates are not likely to predict future erosion rates because Wisconsin's climate is changing, and future change may be surprising.[15] It is therefore critically important to occasionally update the bluff recession studies and to measure both short-term and long-term recession rates.

RECESSION RATE SETBACK

Based on a long-term recession rate of 2 feet per year and a 50-year life of a typical residence, using a setback based on the recession rate alone would require a 100 foot setback : 2 x 50 = 100.

Recession rates can change over time and are constantly being affected by lake levels, surface and groundwater flow, vegetative cover on coastal slopes, wave impact height, and shore protection structures. When lake levels are high, coastal erosion from waves affects the bluff recession rate and the coastal recession rate. When lake levels are low, lakebed erosion primarily occurs on the beach in the nearshore zone, just off the coast. Then when the lake level rises again, there is more area for the water to fill in the nearshore zone because erosion in that area carved out the lake bottom. Therefore, there is deeper water at that location at the 'new' high lake level, allowing higher-than-previous storm waves to initiate more wave erosion at the base of the bluff.

In addition to the estimated annual recession rate, the other key variable for determining the recession rate setback is the useful life of the structure. A number of communities in Wisconsin use a 50-year time period for calculating the setback. In Wisconsin, as well as elsewhere in the country, there are an increasing number of well-built homes approaching 90 years of age with indefinite remaining useful lives. As more expensive structures are built along the coasts — often with brick construction replacing smaller wood frame cabins — it is likely the structures are intended to last much longer than 50 years. Local communities should consider using a longer structure life when calculating the recession rate setback.



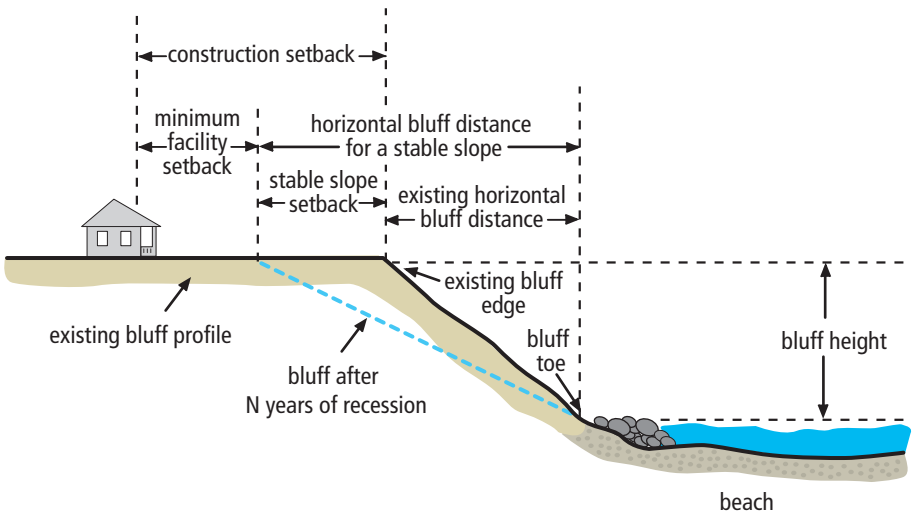
Examples of Recession Rate Setback Approaches in Wisconsin Communities

- Bayfield County uses the minimum 75-foot setback measured from the top edge of the bluff along Lake Superior and requires a greater setback in areas of active or potential erosion based on projected shoreland recession rates. The ordinance does not include a specific recession rate or number of years to calculate the setback.
- Manitowoc County uses the minimum 75-foot setback from the ordinary high water mark but will apply a greater setback based on the recession setback for all receding shorelines, applying a 2-foot annual recession rate times a structural design life of 50 years for principal uses and a design life of 25 years for accessory uses.
- Sheboygan County requires a 100-foot setback from the ordinary high water mark for structures located in the county south of the City of

Sheboygan where the coast consists primarily of low dunes and beaches. The 100-foot setback is based on a long-term recession rate of 2 feet per year over a 50-year structural design life.

Combining the Stable Slope Setback and the Recession Rate Setback

Several communities that have areas of high bluffs along the Great Lakes use a setback that combines the stable slope setback calculation discussed above with the recession rate setback, also discussed above. This approach adds greater protection for areas of the coasts that have bluffs and are experiencing shoreline recession.

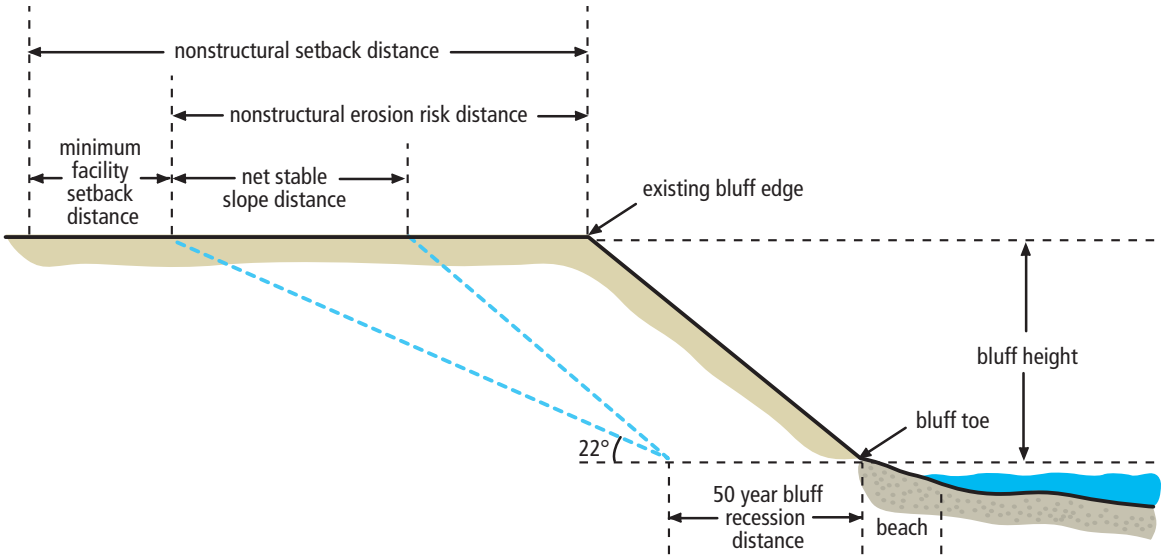


Examples from Wisconsin Communities

- Under Sheboygan County's ordinances, for the coast north of the City of Sheboygan, which consists almost entirely of steep bluffs 50 feet in height, the building setback is based on the 2-foot long-term recession rate plus the estimated stable slope setback of 2.5 feet for every 1-foot increase in height. As a result, if the recession setback is 100 feet (2-foot recession rate/year times 50 years) and the stable slope angle setback is 125 feet, the total setback for structures will be 225 feet. The setback is measured from lot lines or the ordinary high water mark. As referenced below, Sheboygan County follows an ordinary high water mark based on elevation, not the mark left by erosion or vegetation.
- Manitowoc County ordinances allow the zoning administrator to establish a setback based on combining the stable slope angle setback distance (2.5 feet of horizontal distance to every one foot of vertical distance) to the recession rate setback distance (2 feet per year for 50 years) in those areas where there is shoreline recession and there are bluffs of at least 10 feet.
- In Douglas County, for example, setbacks along Lake Superior are set based on a scale that combines the stable slope angle with a 3-foot per year recession rate. The scale is based on the study prepared by UW-Extension and the Red Clay Interagency Committee in 1972 entitled "Erosion and Sedimentation in the Lake Superior Basin."

Adding a Facility Setback to the Stable Slope/Recession Rate Setbacks

Adding the estimated stable slope and the estimated recession rate calculations provides an estimate of where the edge of the bluff will be at a projected future time, often 50 years. To ensure that a structure is not at the edge of the bluff in 50 years and to provide some room for error in case the generalized calculations prove to be incorrect, Racine County adds a minimum facility setback to the stable slope and recession rate setbacks. This approach would provide the greatest long-term protection from coastal hazards to structures located along the coast.



Procedure used to estimate nonstructural setback distance for management option of mitigating bluff recession impacts (from Southeast Wisconsin Regional Planning Commission, 1989), as published in Formation, Evolution, and Stability of Coastal Cliffs—Status and Trends, chapter "Erosion of Coastal Bluffs in the Great Lakes," by David M. Mickelson, Tuncer B. Edil, and Donald E. Guy.

Example from Wisconsin

- Racine County uses two setback overlay districts that are not part of the County Shoreland Zoning Ordinance. For the southern part of the county, the setback is based on the stable slope angle and a minimum facility setback of 100 feet for public utilities, public recreational facilities, and single-family residences and 200 feet for other structures. It does not include a recession rate setback because the county requires that all new development be protected by shore protection structures. These shore protection structures minimize the recession of the shore line. The stable slope setback is measured from the existing bluff edge. The slope is regraded to form the stable slope. The facility setback distance is measured from the edge of the regarded bluff.

For other parts of the county, the setback is based on the estimated stable slope of 2.5 to one, plus the estimated recession rate based on a study prepared for Racine County by the Southeastern Wisconsin Regional Planning Commission, plus a minimum facility setback of 100 feet for public utilities, public recreational facilities, and single-family residences and 200 feet for other structures. This setback is measured from the bluff edge.

Incorporating More Detailed Information

A limitation of the generalized approach followed in the ordinances discussed above for determining the stable slope setback and recession rates is that they may not be accurate given some of the variations that exist along the coast. Recession studies along Wisconsin's coasts have shown recession rates that vary from less than 1 foot per year to over 5 feet per year, depending on the area. The average estimated 2-foot recession rate used by some communities therefore may overestimate the recession rate for some properties and underestimate the recession rate for others. Likewise, the 2.5 to 1 stable slope angle used by some communities is an average estimate. The stable slope angle will vary based on the geology of the bluffs and other factors. Depending on the soils and other conditions, the stable slope angle might actually be greater for some areas (requiring less of a setback) and smaller for other areas (requiring a greater setback).

ORDINANCE LANGUAGE

The following ordinance language builds off the language currently used in Racine County with modifications made for the evolving approach in Bayfield County.

COASTAL HAZARD SETBACK

All permanent structures erected or constructed on property that is contiguous to Lake [Michigan/Superior] shall be set back the required distance needed to form a stable slope, plus the distance of the expected shoreline recession over a [sixty-year] period, plus a minimum facility setback distance from the future expected bluff edge calculated as follows:

(a) ***Stable slope setback.*** *A stable slope angle shall be established for bluffs located on a parcel based on the predominant soil conditions of the bluff as set forth in the table below.*

Table _____

Red clay till	*14 degrees (a gradient of 4 feet horizontal distance to every 1 foot of vertical distance)*
Sandy till	*26 degrees (a gradient of 2.1 feet horizontal distance to every 1 foot of vertical distance)*
Sand & gravel	*30 degrees (a gradient of 1.7 feet horizontal distance to every 1 foot of vertical distance)*
Bedrock	*60 degrees (a gradient of .5 feet horizontal distance to every 1 foot of vertical distance)*

The setback will be the distance necessary to achieve the stable slope angle. Measurement of the height of the existing bluff and the corresponding stable slope setback shall be made from the toe of the existing bluff perpendicular to the shoreline. There shall be two such measurements made for every 100 feet of shoreline at points no less than 50 feet apart. The setback shall be made from the line connecting these two points, or such line extended. In cases of an irregular shoreline or where lots are not perpendicular to the shoreline, the Zoning Administrator may require that additional points of measurement be used to determine the setback.

(b) ***Recession rate setback.*** *A recession rate setback shall be established for all receding shorelines by multiplying the annual recession rates reported in [name of study] by a structural design life as follows:*

(1) Principle structures – 60 years

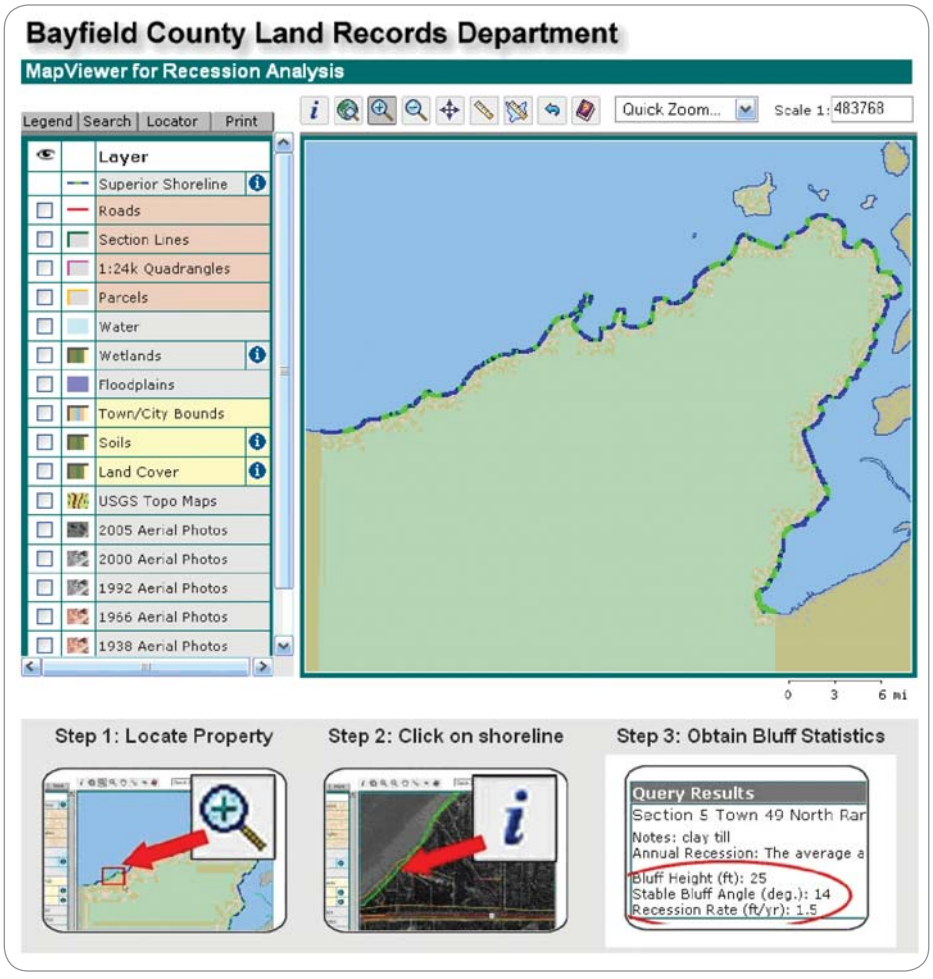
(2) Accessory structures – 30 years

The recession rate setback shall be measured from the stable slope setback.

(c) ***Minimum facility setback.*** *All principle structures shall be set back an additional 100 feet measured from the edge of the projected bluff edge (stable slope setback plus the recession rate setback).*

Technological advances and additional studies of Wisconsin's coasts can provide more refined parcel-specific information related to recession rates, bluff stability, and other factors related to coastal hazards. Bayfield County is currently in the process of updating the setback methodology used in its coastal ordinances by using information from the "Evaluation of Shoreline Erosion Extent and Process on Wisconsin's Lake Superior Shoreline" study.[16] This study provides more detailed data on slope angle, bluff soil composition, amount of water in the bluff, erosion trends, and amount and type of vegetation cover. This allows more accurate data to be used to estimate the recession rate and the stable slope angle.

For example, rather than using the average 2.5 stable slope angle followed by many communities, Bayfield County is exploring a stable slope angle based on the predominant soil conditions of a parcel. Bayfield's approach is based on studies that evaluate the geology of the coast and identify four general categories for determining the stable slope angle based on the soil type found on a particular parcel.[17] The estimate of a 14-degree stable slope angle (4:1) for areas of primarily red clay till, a 26-degree stable slope angle (2.1:1) for areas of predominantly sandy till, a 30-degree stable slope angle (1.7:1) for areas of predominately sand and gravel, and a stable slope angle of 60 degrees for areas of bed rock (.5:1). Applying the stable slope angle to a specific parcel will first require a measurement of the current angle of the bluff. This will allow the setback to account for the extent to which a parcel is already at its stable slope. For example, if a bluff composed of red clay till is currently at a 20-degree angle, the bluff only has 6 degrees left to erode before it reaches its stable slope. The existing slope angle can be measured by the Bayfield County zoning administrator or by the property owner. The county is also considering using a 60-year useful life for structures when calculating the recession rate and a minimum facility setback of 100 feet. (See ordinance language sidebar on page 21.)



http://www.bayfieldcounty.org/LandRecords/mapviewer/bcrv4101.asp

Bayfield County has taken advantage of some of the latest geographic information technologies to create a MapViewer for Recession Analysis that visually displays the setback requirements for parcels along the coast. The information and layout of this educational tool is set up so that land owners or other interested parties can

access the information at any time using the Internet to learn remotely about bluff stability, bluff height, recession rates, and stable slope angles for their parcels. Following the instructions on the Web page, a land owner can locate his/her property on the MapViewer. Once the property has been located, the user can click on the coastal parcel to obtain bluff statistics. Aerial photos of the coastline dating back over 50 years are also available on the MapViewer. The photos show the change along the coast over the years and can help current and potential land owners better understand the dynamic nature of the coasts and the need for the development setbacks.

Alternative Approaches to Coastal Hazard Setback Requirements

Local governments may decide not to follow a structure setback requirement that incorporates recession rates and a stable slope angle. Alternatives are explored below.

Site-Specific Studies

The ordinances in several communities allow site-specific studies to determine the appropriate location for structures along the coast. As an alternative to the more generalized formulas for estimating stable slope angles and recession rates, site-specific studies require a geotechnical engineering analysis of a site at the time development is proposed to evaluate slope stability and recession rates. Site-specific studies can be expensive and time consuming to prepare. The site-specific method is typically found in cities and villages that developed prior to the 1960s and the present understanding of the dynamic nature of the coastal areas in Wisconsin. As a result, many of these cities and villages have structures built very close to the edge of the bluffs along the Great Lakes, and developing a uniform setback for these areas now would likely create many nonconforming structures. Examples include the Villages of Bayside, Whitefish Bay, and Shorewood in Milwaukee County. Cities and villages are also not required to follow the minimum 75-foot setback requirements of the Shoreland Management Program, except for lands annexed to the city/village after May 7, 1982, and cities/villages incorporated after April 30, 1994. Nonetheless, in an effort to protect public health, safety, and welfare, these communities want to know that a bluff will actually be able to support a structure that is proposed to be built on a bluff along one of the Great Lakes. The site-specific approach allows the community to attempt to address coastal hazard issues as redevelopment and alterations occur in these developed areas on a site-by-site basis.

The site-specific approach is also authorized in some counties to provide an exception to a setback that is based on the stable slope angle or recession rate. In some cases, an examination of the unique characteristics of the site may result in a stable slope angle that is less than the 2.5 feet to one setback or a recession rate that is less than 2 feet per year, which translates into a smaller setback distance.

ORDINANCE PROVISIONS

Local communities that want to enable site-specific studies should include language in their ordinances that provides guidance for who needs to prepare the studies and what the studies need to include. The site-specific study method will also vary depending on the existing level of development in the community. At a minimum, new development in unincorporated areas and within city/village land annexed since 1982 must comply with the minimum requirements set forth in NR 115. The following ordinance language is based on the village of Whitefish Bay's ordinance. Whitefish Bay is a fully developed community.

BLUFF STABILITY STUDY

[For allowing an exception to other established setback distances] In the event that the property owner is seeking an exception to the requirements of this ordinance, the following must occur before any exception may be granted:

[or]

[For requiring a bluff stability study in developed areas] In the event that the property is on the bluff of Lake Michigan, the following requirements shall also apply before a building permit may be issued:

(a) A registered professional engineer, having a minimum of ten (l0) years of geotechnical experience involving foundation investigation/engineering and shoreline slope stability evaluation, and who is hired by the owner of the lot, shall certify to the [county/town/village/city] that the construction of any proposed building and structure(s) proposed to be built within the normal setback distance [l00' of the top edge of the bluff] will be safe [reasonably safe for a period of 60 years]. Specifically, the professional engineer shall certify that:

l. The design of any building or structure(s), the method of constructing such building or structure(s), and the materials used therefore are structurally adequate and will protect the public health and safety;

2. The proposed building and structure(s) will not in anyway adversely affect the structural integrity or safety of any building, or structure(s) located on adjoining or adjacent sites;

3. The proposed building and structure(s) will not adversely disturb ravine and bluff slopes, interfere with surface or subsurface drainage, or create new or exacerbate existing problems of erosion and recession;

4. The drainage system will not adversely affect the adjacent and adjoining properties;

5. There is no danger to the proposed or existing buildings or structures and its occupants from slippage of the slope above and/or below the proposed structure.

(b) The engineer shall make a technical report accompanying the certificate that shall include at a minimum:

l. Wave induced erosion based upon measured recession rates or wave energy calculations if no measured rates can be determined;

2. The stability of the slope before, during, and after construction;

3. Ground and surface water conditions on the stability of the bluffs and the effect of construction and post-construction activity on the natural drainage in the area including methods used to control stormwater runoff during and after construction;

4. The elevation of the 100-year flood and storm surges for areas subject to flooding;

5. Recommendations regarding site preparation, foundation design, lateral earth pressure and support of slabs on grade;

(c) The owner of the property shall certify to the[county/town/city/village] that he/she is aware of potential problems of lakeshore erosion, including but not limited to the possibility of adding fill of various types to stabilize the bluff area, is aware of the requirement for securing of a fill permit from the [county/town/city/village] for any such filling, is aware of the provisions of said fill permit ordinance, and is further aware of the potential cost involved.

(d) A memorandum of said certifications, including the legal description of the property, shall be recorded with the Register of Deeds of _____ County.

(e) [For counties and cities/villages incorporated since April 30, 1994] The minimum setback in all cases shall be 75 feet from the ordinary high water mark.

[For cities and villages] For lands annexed to the [city/village] since May 7, 1982, the minimum setback in all cases shall be 75 feet from the ordinary high water mark.

Which Structures Should be Set Back? Allowing Certain Structures within the Setback

A key component of any setback ordinance is determining which structures need to be set back. Certainly any structure that is intended to last for a long time, such as a house or commercial building, should be subject to the setback requirement. Ordinances will often make exceptions for structures that are movable, temporary structures such as stairways leading down to the lake, and shore protection structures. Shore protection structures are discussed later in this publication.

What is the Starting Point of the Setback?

The shoreland zoning setback is measured from the ordinary high water mark. Many coastal setbacks also use the ordinary high water mark as the point of reference. In areas of unstable bluffs, the top of the bluff is sometimes used as the point of reference for measuring the setback. The ordinary high water mark may be hard to define, especially in times when the lake level is fluctuating. An alternative reference point may be a bulkhead line (whether or not a community has constructed a bulkhead facility) or a set elevation.

ORDINANCE LANGUAGE

Sheboygan County is an example of a community that uses an elevation approach to establish the ordinary high water mark. The county ordinance reads:

ORDINARY HIGH WATER MARK. *For zoning purposes only, the Ordinary High Water Mark (OHWM) for the coastal reach of Lake [Michigan/Superior] shall be determined by an elevation at 582.7 feet NGVD (National Geodetic Vertical Datum, also known as MSL, Mean Sea Level), an elevation equivalent to 581.4 feet IGLD (International Great Lakes Datum), as determined by the Bureau of Water Regulation & Zoning, Wisconsin Department of Natural Resources. Elevations shall be determined by a registered professional surveyor, employing not less than five (5) uniformly distributed points of elevation, tied to a fixed reference point. The OHWM shall be a line connecting these points.*

Moveable Structures

If development is going to occur within an area that is subject to coastal hazards due to recession and bluff instability, the local government could require that new structures are built with relocation in mind. Depending on the location, this might include requiring that the property include a site for relocating the structure on the parcel. Planning for moveable structures is also a reason for including a "facility setback" which would allow for additional land to be available for structure-moving equipment. Local governments should consult with local builders regarding appropriate types of construction for movable structures. (See ordinance language sidebar on page 26.)

ORDINANCE LANGUAGE

The following language is from the Sheboygan County ordinance related to allowing certain structures within the setbacks.

EXCEPTIONS

STAIRWAYS, WALKWAYS, PIERS, AND WHARVES. *Stairways and walkways and that portion of piers and wharves landward of the ordinary high water mark (OHWM) are exempted from the shoreland setback requirements provided that the structure is necessary to access the shoreline because of steep slopes, impending turf destruction and erosion, or wet, unstable soils. Further, the structure shall be located so as to minimize earth-disturbing activities and shoreland vegetation removal during construction and to be visually inconspicuous and screened by vegetation as viewed from the adjacent waterway and public thoroughfares. The structure shall conform with all applicable handicapped accessibility requirements and unless inconsistent therewith, shall not be more than four feet (4') wide (outside dimension) for single- and two-family residential uses. For multi-family residential, commercial, industrial, institutional, and recreational uses, the four feet (4') standard may be exceeded only upon the granting of a Conditional Use Permit. Open railings are permitted only where required by safety concerns; canopies, roofs, and closed railings/walls on such structures are prohibited; stairways shall be supported on piles or footings rather than being excavated from erodible soils on steep slopes or a bluff face; and, landings are permitted only where required by safety concerns and shall not exceed forty (40) square feet in area for single- and two-family residential uses. For multi-family residential, commercial, industrial, institutional, and recreational uses, the forty (40) square feet standard may be exceeded only upon the granting of a Conditional Use Permit.*

RETAINING WALLS. *Retaining walls and terracing shall only be allowed in the shoreline setback area where the applicant demonstrates that there is a current erosion problem that cannot be remedied by resloping and revegetation of the area or other means consistent with natural shoreline aesthetics. Walls and terracing shall only be permitted to the extent that they resolve a continuing erosion problem and shall not be used to provide level outdoor living space in the near-shore area. Elevated stairs or walkways shall be employed to provide shoreline access rather than terracing, as set forth above.*

ORDINANCE

Racine County's ordinance includes a section on relocatable structures. The following ordinance language builds off the language found in the Racine County ordinance.

RELOCATABLE STRUCTURES.

(a) The placement of relocatable structures or buildings within the coastal hazard setback (calculated by adding the recession rate setback, the stable slope setback, and the facility setback) may be permitted as a conditional use subject to the following conditions:

(b) The property owner shall submit a report from a professional building moving contractor certifying that the structure can be feasibly moved at a cost not to exceed thirty (30) percent of the equalized value of the structure.

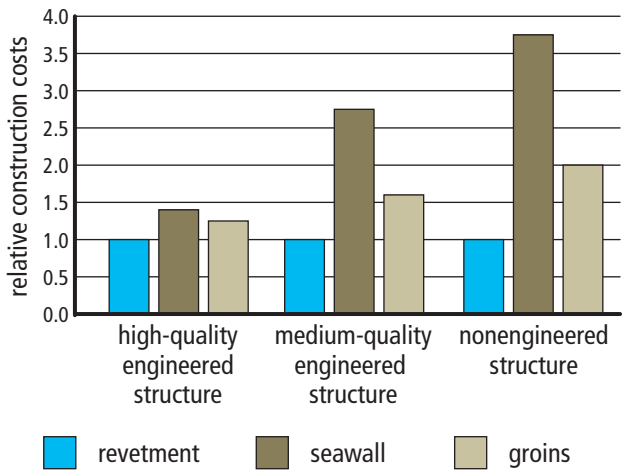
(c) The parcel shall extend sufficiently outside the coastal hazard setback so that the structure can be relocated in the future outside the setback.

(d) The property owner must certify that the structure will be moved before any part of the structure is within 50 feet of the receding edge of the bluff. The certification must be recorded with the Register of Deeds for _____ County. The certification must also state that the last owner of record, as shown of the latest assessment roll, is responsible for removing the structure, its foundation, and all costs associated with the move.

Shore Protection Practices

A coastal hazard setback that includes a recession rate setback plus a stable slope setback and a generous facility setback allow the parcel to adapt to the natural erosion processes. In an attempt to mitigate erosion problems, property owners along the coast often explore different techniques in an effort to slow coastal erosion. While these techniques can reduce erosion and slow recession rates on individual sites, they will not permanently stop erosion from occurring and may transfer increased erosion to adjacent properties.

Most shore protection structures will require a permit from the WDNR under Chapters 30 and 31 of the Wisconsin Statutes. Pursuant to those statutes, the WDNR has adopted administrative rules to guide the permit process. Chapter NR 328 of the Wisconsin Administrative Code addresses the rules for shore erosion control structures in navigable waterways. Chapter NR 329 of the Wisconsin Administrative Code addresses any regulations about miscellaneous structures in navigable waterways. Certain nearshore construction may also be regulated by the United States Army Corps of Engineers. Even though many shore protection structures are regulated by the WDNR, coastal communities may want to develop their own ordinances to ensure that property owners have received any necessary permits from the WDNR, that all structures are regulated (including structures above the ordinary high water mark that may not be permitted by the WDNR), and that property owners address certain issues unique to the coasts that the WDNR may not address in its processes.



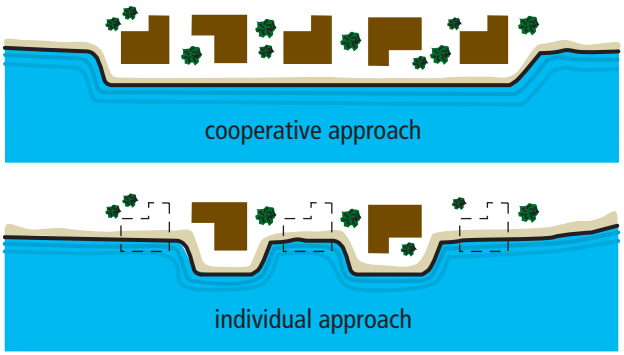
Relative Construction Costs of Shore Protection Structures

There are many approaches to shore protection, including restoring the natural coastline by nourishing beaches, restoring and constructing dunes and beach ridges, and creating or restoring coastal wetlands. Other approaches include shore armoring that can include the construction of hard erosion structures like riprap revetments, seawalls, and groins.

For more detailed information on shore protection along the Great Lakes, see the publication *Living on the Coast*.[18] Hard erosion structures can have a negative impact on the coastal processes of adjacent proper-

ties along the coast. A community may want to discourage the use of these hard structures or at least exercise caution in allowing these structures. Any structures need to be designed and built by coastal engineers familiar with the Great Lakes erosion processes.

In the Great Lakes, the littoral transport system carries sand and other sediments along the coast by waves and currents and is often referred to as longshore drift. This is a natural process that is necessary for naturally replenishing the coastline and should not be stopped. Shore protection structures can deprive the littoral transport system of sediments that replenish areas that are down current, causing them to lose land because there are no sediments left to restore those removed by the longshore drift. Since armoring the coast can have significant negative impacts to down-drift areas, care should be taken when approving an erosion mitigation plan. Several property owners may want to collaborate to design an approach that protects the coast regionally instead of individually.



Protecting Your Coastal Investments

Another issue that arises with shore protection structures is long-term maintenance costs and the ultimate failure of these structures. Environmental factors such as the frequency and intensity of storms and lake levels can affect the long-term integrity of these structures. Local governments need assurances that they will not be left with the maintenance or repair costs or with the costs of removing hazardous remnants of shore protection structures. Concordia University in Ozaukee County is a recent example of the problems with shore protection structures. Concordia University spent millions of dollars to stabilize the shoreline along its campus only to have the structure begin to fail within six months.

Local ordinances should require that the approval of shore protection structures include the following:

1. A site investigation of slope stability and coastal erosion
2. A site investigation of nearshore lakebed erosion
3. An analysis that shows no adverse affect for all new erosion protection applications
4. A plan for ensuring the quality control of materials used in the structure
5. Plans for site and structure monitoring and maintenance

Property owners responsible for carrying out the construction of shore protection structures should follow the guidelines in the University of Wisconsin Sea Grant Institute publication "Working with Engineers and Contractors on Shore Protection Projects."[19] (See ordinance language sidebar on page 28.)

ORDINANCE LANGUAGE

The following is based on coastal ordinances from the Town of Huron, NY, and Shoreham, NY.

SHORE PROTECTION STRUCTURES

The following requirements apply to the construction, modification or restoration of erosion protection structures:

A. No prudent alternative. The applicant must first establish that there is no feasible and prudent alternative to the need to construct the proposed shore protection structure, including the inability to relocate any building threatened because of coastal erosion on the applicant's lot of record.

B. All necessary permits have been received from the Wisconsin Department of Natural Resources and the U.S. Army Corps of Engineers

C. The construction, modification or restoration of erosion protection structures must:

1. Not be likely to cause a measurable increase in erosion, including lakebed erosion, at the development site or at other locations along the coast.

2. Minimize and, if possible, prevent adverse effects upon natural protective features, existing erosion-protection structures and natural resources, such as significant wildlife habitats This includes the impact of the structure on the movement of sand along the shore.

D. All erosion protection structures must be designed and constructed according to generally accepted engineering principles. The design and construction shall be certified by a professional engineer as having a reasonable probability of controlling erosion on the immediate site for at least [30, 50] years.

E. All materials used in such structures must be durable and capable of withstanding inundation, wave impacts, weathering and other effects of storm conditions for a minimum of [30, 50] years. Individual component materials may have a working life of less than [30, 50] years only when a maintenance program ensures that they will be regularly maintained and replaced as necessary to attain the required [30, 50] years of erosion protection.

F. A long-term maintenance program must be included. The maintenance program must include specifications for normal maintenance of degradable materials including repairs necessary to maintain the integrity of the shore protection structure. To ensure compliance with the proposed maintenance programs, a bond or other financial security may be required.

G. There is a minimum of [75] feet from the coastal protection structure to any permanent structure. If the bluff or dune is unstable due to height, slope, wind, erosion, or groundwater seepage, a greater setback may be required. There shall be sufficient access to permit the maintenance and repair of the shore protection structure.

H. Excavating, grading, mining, or dredging that diminishes the erosion protection afforded by the nearshore area is prohibited, except construction or maintenance of navigation channels, bypassing sand around natural and man-made obstructions and artificial beach nourishment in accordance with the permit requirements of the Wisconsin Department of Natural Resources.

I. Before approving any shore protection structure, the [county, city, village, town] shall hold a public hearing on the proposed structure. Notice shall be send to all riparian owners within [300] feet of the proposed shore protection structure.

Stormwater Management and Erosion Control

Runoff from rainstorms and snowmelt can present some unique issues for properties located along Wisconsin's coasts. Not only are coastal properties subject to erosion from high water, wave action, and winds coming off the lakes, they are also subject to erosion from stormwater runoff. For parts of the coast with highly erodible soils, this can be a major problem. Runoff along the bluffs can create channels in coastal bluffs that change size, shape, and depth during storm events and over time. Efforts to infiltrate runoff too close to shoreland can also increase bluff erosion and failure. Because runoff picks up pollutants as it flows over the ground, runoff can adversely affect the quality of the lakes, rivers, and coastal wetlands that ultimately receive the runoff.

The following discussion focuses on three issues related to erosion control and stormwater runoff that may be of importance to coastal communities — channel erosion, stormwater infiltration, and coastal wetlands. As communities throughout the state work to address runoff in response to federal and state laws as well as in response to local problems caused by runoff, they should consider different approaches for addressing the unique issues of the coasts. The WDNR has developed a Model Post Construction Storm Water Management Zoning Ordinance that is published as Chapter NR 152 of the Wisconsin Administrative Code. That model ordinance is intended to help implement the post-construction performance standards for new development and redevelopment contained in subchapters III and IV of Chapter NR 151 of the Wisconsin Administrative Code, one of the main stormwater management laws of the state. The following are additional provisions that coastal communities could include in their adaption of the state's Model Post Construction Storm Water Management Zoning Ordinance to address some of the stormwater management issues that are unique to the coast.

Channel Erosion

As stormwater runs off the land it eventually concentrates in channels. The introduction of impervious surface increases the volume of runoff and the frequency of "channel-forming" events[20] This leads to enlargement of existing channels and creation of new channels. As channel erosion occurs along the coastal areas, it can negatively affect the stability of the bluffs. Climate changes may also affect the volume and frequency of these events.

In Wisconsin, structures and techniques employed to avoid or minimize channel erosion are normally designed to meet a peak discharge standard. Chapter NR 151 of the Wisconsin Administrative Code follows the commonly used performance standard that aims to maintain or reduce post development peak discharge rates as compared to pre-development levels based on a 2-year, 24-hour design storm. NR 151.12(5)(b). However, research suggests that channel protection measures based on the 2-year, 24-hour storm event do not reduce channel erosion and may actually increase the amount of time a channel is exposed to erosive flows.[21] Recognizing the limitations of the peak discharge standard, other areas of the country use a flow duration standard to design stormwater management practices. A flow duration standard seeks to maintain the post-development duration of all discharges at predevelopment levels.

FLOW DURATION

For general information about the flow duration standard see <http://water.oregonstate.edu/streamflow/analysis/flow/index.htm>.

Information about HSPF is a vailable from the United States Environmental Protection Agency at <http://www.epa.gov/athens/research/modeling/hspf.html.> The software to run HSPF is available for download from the USEPA at <http://www.epa.gov/ceampubl/swater/hspf/>.

ORDINANCE LANGUAGE

Possible ordinance language, making some modifications to the WDNR's Model Post Construction Storm Water Management Zoning Ordinance, could read:

STORMWATER MANAGEMENT IN COASTAL AREAS

The peak run off discharge rate will not be used to design Best Management Practices (BMPs) in the coastal area. By design, BMPs shall be employed to maintain the post-development duration of all discharges greater than or equal to the channel-forming discharge at predevelopment levels to the maximum extent practicable. The duration of all discharges shall be determined using a continuous hydrologic simulation model, such as the Hydrologic Simulation Program-FORTRAN (HSPF). Pre-development conditions shall assume "good hydrologic conditions" for appropriate land covers as identified in TR-55 or an equivalent methodology. However, when pre-development land cover is cropland, instead of using TR-55 values, the runoff curve numbers in Table 1 shall be used. [See WDNR's Model Post Construction Storm Water Management Zoning ordinance for Table 1.]

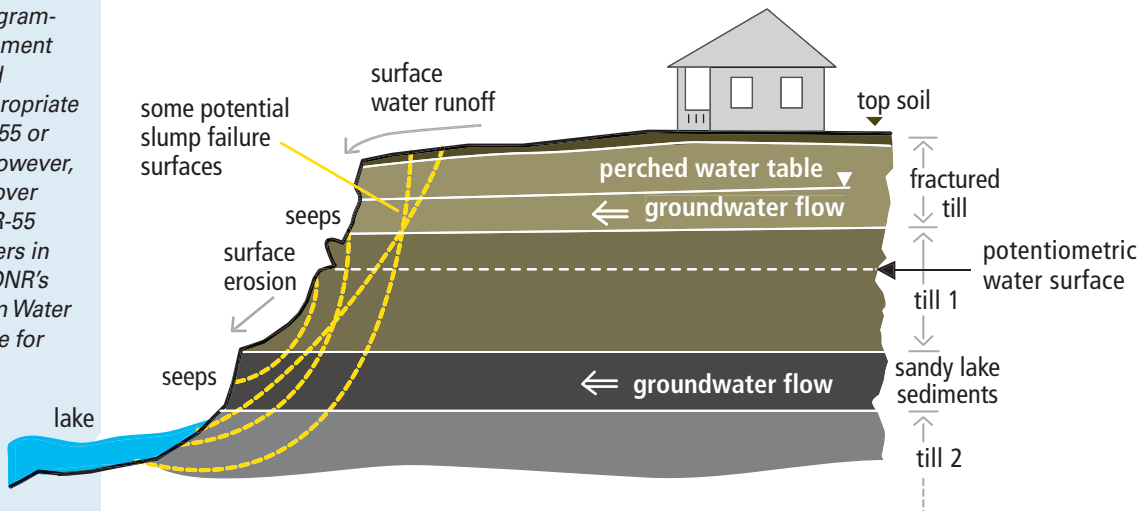
To meet flow duration standards, stormwater detention and retention facilities must be designed using continuous hydrologic models, such as the Hydrologic Simulation Program-FORTRAN (HSPF). Stormwater detention and retention facilities designed using this approach will generally be larger than those designed to meet peak discharge standards. The facilities will exceed the performance standards required under Chapter NR 151, thereby providing greater protection for coastal properties and resources.

Infiltration

Infiltration means the entry and movement of precipitation or runoff into or through soil. NR 151.002(19). The amount and rate at which precipitation or runoff is absorbed into the soil is called permeability. The permeability of the glacial till soils that constitute a majority of Wisconsin's coastal bluffs is generally high. (Part of the Karst formation — limestone subsurface with very high permeability — has been found in parts of Door and Kewaunee County, but it is unclear how this formation affects coastal waters.) Statewide recommended infiltration systems include devices or practices such as a basin, trench, rain garden, or swale designed specifically to encourage infiltration (NR 151.002(20)).

Wisconsin Administrative Code Chapter NR 151 includes performance standards that require infiltration of part of the runoff volume on site. For example, for residential development, 90% of predevelopment infiltration volume or 25% of the 2-year 24-hour design storm must be infiltrated on site. However, not more than 1% of the project site needs to be dedicated to active infiltration (NR 151.12(5)(c)(1)). For commercial development, not more than 2% of the site needs to be dedicated to active infiltration. Since March 10, 2003, NR 151 has applied to construction and post-construction sites of one acre or more. Prior to that, it was a five-acre threshold. In developing local ordinances governing erosion control and stormwater management, local governments are allowed to adopt regulations for areas smaller than one acre, going beyond state requirements.

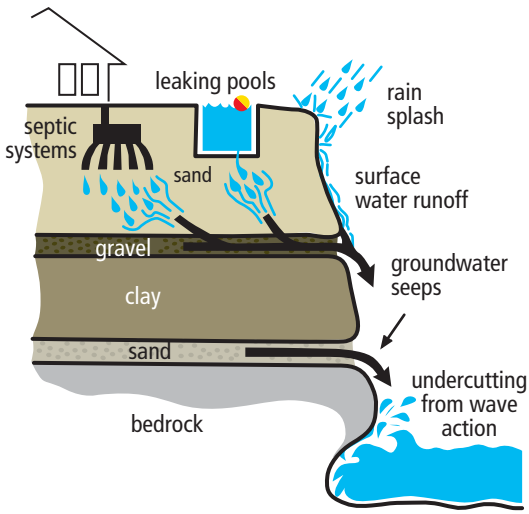
Bluffs, like any other part of the land, have a pre-existing water table level where groundwater resides. Groundwater flows through the coastal bluffs as a part of the natural Great Lakes watershed. Infiltration of precipita-



Bluff Problems: Instability & Erosion
Surface Water Runoff Groundwater Seepage

tion and runoff near the shore can increase the amount of groundwater in a bluff and cause instability, seepage, and bluff failure. This presents a problem for land owners along the Great Lakes.

Seepage occurs when underlying layers force water out the ground. In areas of coastal bluffs, water can be seen pouring out the slope face. This has two implications: 1) Water along the slope of the bluff can contribute to bluff face surface erosion, washing away sediments that maintain the bluff stability. 2) Seepage may be a sign of too much water inside the bluff adding to the load on bluff soils. This may lead to a future bluff failure event like slumping, which happens when the saturated soil becomes too heavy for the bluff to support, and a large portion of the bluff suddenly falls or slumps to the land below.[22] Slumping tends to occur suddenly, without warning, and can cause large amounts of the bluff to slide away.



Erosional phenomena affecting bluff stability

Illustration based on an original by Shamus Malone, Pennsylvania Department of Environmental Protection, Coastal Zone Management.

For properties located along the coasts, it is extremely important that all infiltration systems are located in appropriate locations so they do not encourage bluff instability or increase groundwater in the bluff. A way to discourage the oversaturization of the soils on and near bluffs is to not permit infiltration systems, such as rain gardens, on coastal property. Redirecting rooftop downspouts so they keep the flow of excess water away from the edge of bluffs can also help protect against bluff erosion.

There are, however, other stormwater management techniques that are appropriate along the coastal bluffs. One technique is the use of "green roofs." A green roof is a roof that is partially or completely covered with some kind of vegetation and soil, or growing medium, planted over a waterproof cover. There are different types of green roofs: intensive, semi-intensive, and extensive, depending on the depth of planting medium and the amount of maintenance they need. Green roofs are designed to retain stormwater on-site, decreasing the amount of impervious surface on a site and mitigating erosion by helping to reduce the volume and velocity of stormwater runoff flow.

ORDINANCE LANGUAGE

It might be advisable to include a section in local erosion control and stormwater management ordinances, or other ordinances that address stormwater and/or erosion, to prohibit the location of infiltration systems along the bluffs.

An example of such language might be: *"No infiltration systems shall be located within [1000] feet of the top of erodible bluffs along the Lake [Michigan/Superior] shoreline."*

Communities also need to seriously consider setbacks for special facilities such as on-site private sewage disposal systems. The placement of the system too close to the edge of a bluff can have the effect of accelerating the instability of that bluff. On-site private sewage disposal systems should follow the same setback requirements for a house or other principal structure built on a lakeshore lot. These setbacks could be in the community's zoning code or in the community's sanitary code. Possible language could read:

On-Site Private Sewage Disposal Systems. On-site private sewage disposal systems shall not be located between the principal structure and the shoreline.

GREEN ROOFS

For more information on green roofs, see http://www.epa.gov/ORD/NRMRL/news/news042006.html

NATIVE PLANTS

Photo: U.S. Environmental Protection Agency Great Lakes National Program

For information on plants native to the Great Lakes see *Guide to Great Lakes Coastal Plants* by Ellen Elliott Weatherbee. Published by Michigan Sea Grant and the University of Michigan Press (2006)

Coastal Wetlands

Extensive coastal wetlands are found primarily along the shores of Brown, Oconto, Marinette, Douglas, Bayfield, and Ashland counties, and they serve many important functions. They trap soil sediments, retain and remove nutrients, and reduce pollution and siltation in the Great Lakes. Yet excess nitrates, sediments, and other pollutants from urban and agricultural run-off lead to wetland degradation. As pollutants increase in wetlands, invasive species also increase, degrading the quality of the wetlands. To protect the quality of coastal wetlands, local governments should consider stormwater management approaches that trap pollutants before they reach wetlands.

Maintaining native vegetation along the coast is important for erosion control and stormwater management. It can help minimize the amount of impervious surface area, which has been linked to increasing water velocity, erosion, and water pollution. Maintaining native vegetation, especially forest cover, can also help slow down the velocity of runoff, thereby minimizing erosion, and remove sediments and other pollutants in the runoff. Native vegetation can also help stabilize bluffs in some cases.

Site Planning

The above sections have identified the need to address the setback distances for structures, management of stormwater, plans for possible future relocation of structures, the need to maintain native vegetation, etc. Each site along the coast is unique. The site planning process can provide opportunities for local officials and landowners to engage each other in discussions on possible problems on a site. Site plans prepared by trained professionals can incorporate strategies to minimize environmental impacts along the coast.

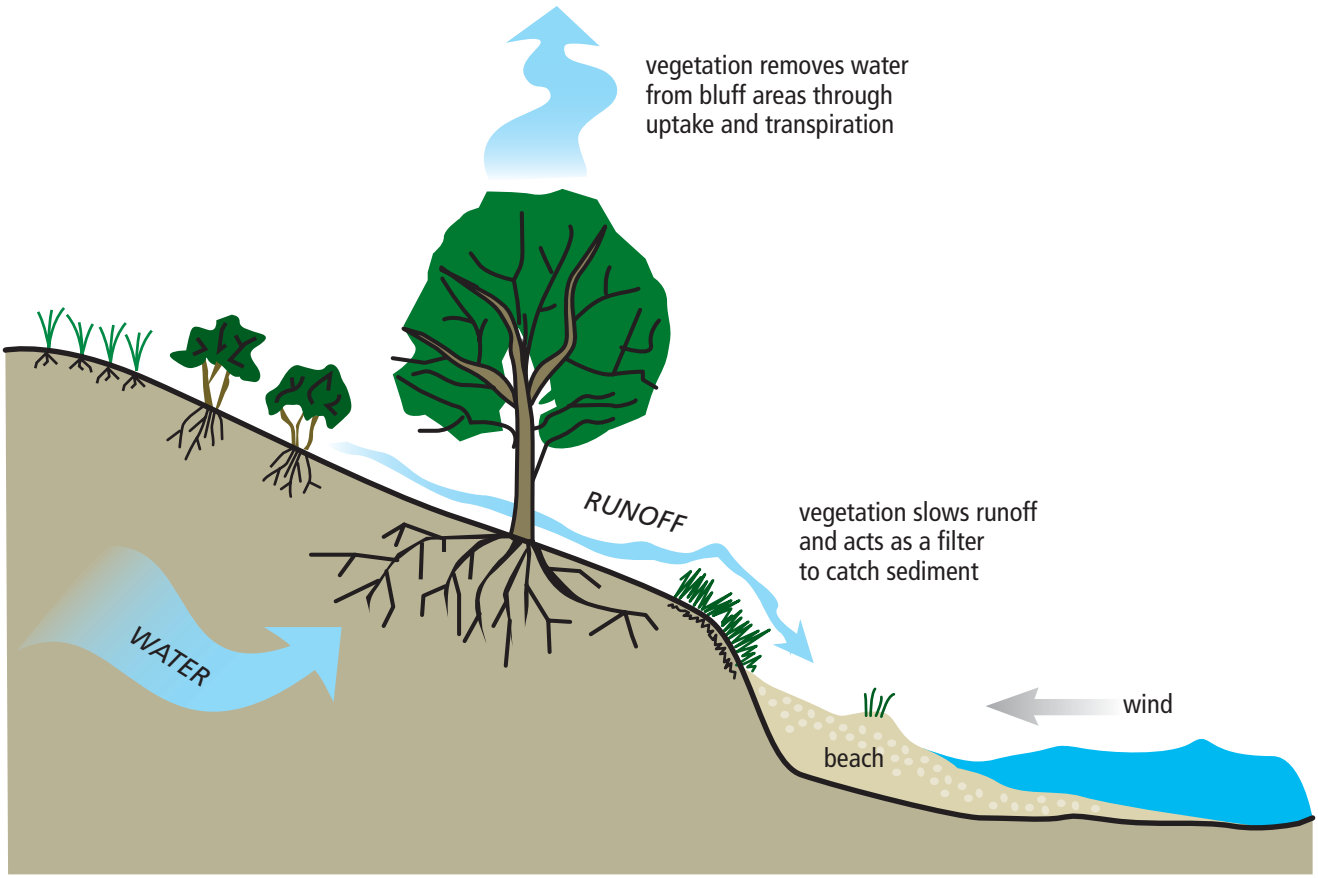
Site planning is particularly important along the coast and on land near the coast where alterations in surface water runoff and infiltration patterns could increase slope failure. Development can alter the hydrology, expediting bluff instability and coastal erosion. The size and location of structures can negatively affect erosion rates and bluff stability. The location of septic tanks, wells, and landscaping can also disturb the land.

Site plans can be general, including the location and size of building foot-prints and on-site improvements, or detailed, including descriptions of building materials, vegetation choices, and coastal erosion mitigation or shoreline protection plans. Site plans should provide a basic understanding of bluff stability, past recession rates, and drainage patterns on a property.[23] This information can help make better decisions on property development. Having different standardized requirements for site plans for properties along the coast may be necessary to assess the development and environmental impact. Some of the things a site plan may include are details or sketches of:

- structure dimensions and design
- paved surfaces (driveways, parking lots, etc.)
- the location of the ordinary high water mark
- existing natural resources
- bluff height and stability
- rates of erosion and recession
- shoreline erosion control program or structures
- viewsheds
- existing or neighboring structures

- a grading or fill plan
- building relocation plans
- the location of near-by natural resources like wetlands, bluffs, dunes
- on-site wastewater treatment facilities
- the location and type of outdoor lighting
- stormwater runoff controls
- plans for foot traffic to the lakefront, including footpaths, boardwalks, or stairways
- plans to protect and restore native vegetation

A vegetation plan can help ensure that the right type of planting occurs in the right places. Some plants are better suited to absorb surface moisture, reducing the amount of water that would enter the groundwater. These types of plants would be ideal on the surface of the bluff. Other plants would be better suited to a slope crest or edge, providing added resistance to bluff slumping or sliding. Vegetation on the face of a slope should be light, but strong and deep rooted. Plants here should be able to handle some degree of stress because the slope's face will change over time.



Revegetated Coastal Slope

ORDINANCE

The site planning requirements can be placed within a subdivision or land division ordinance to ensure site planning occurs as part of the land division process. The site planning requirements can also apply to any development if a local community makes development and redevelopment along the coast a conditional use under a local zoning ordinance. The following ordinance language is for treating development along the coast as a conditional use.

SITE PLAN APPROVAL STANDARDS[24]

Any development on property adjacent to Lake [Superior/Michigan] will require a conditional use permit. Development conditions will be determined based on a site plan that meets the following standards, subject to the review by the [Zoning Administrator or Plan Commission]:

1. *The site plan shall demonstrate that the impact to fish, birds, wildlife and native vegetation is minimized by preserving natural habitat;*
2. *The site plan shall demonstrate that erosion and sedimentation shall be prevented, and that the risk of structural loss due to future changes in lake levels is minimized;*
3. *The site plan shall demonstrate that the natural character and aesthetic values of the coast are maintained by minimizing the visual impact of the development from neighboring properties;*
4. *Site development shall be fitted to the topography and soil so as to create the least potential for vegetation loss and site disturbance;*
5. *All structures shall be located to maintain an open and unobstructed view to the waterfront from adjacent properties, roadways and pedestrian ways, to the maximum extent possible.*

SITE PLAN CONTENT

Submitted site plans must be prepared by a licensed landscape architect and include all pertinent site plan information, including the following:

a. *All lake shorelines, streams, wetlands, groundwater seeps, springs, soil types, soil strata and groundwater table at the site.*
b. *All existing roads, driveways, structures, culverts, and other pertinent features on the site or within 100' of the area of site disturbance.*
c. *Existing ground contour lines and proposed ground contour lines at five (5) foot intervals encompassing the area of site disturbance and in the immediate area of influence of the disturbed areas, e.g., within 15 feet.*
d. *All proposed construction activities on the site, including the installation of sanitary sewage disposal systems, stormwater management systems, including outflow or outlet facilities, power lines, and communication installations.*
e. *An inventory of existing vegetation and individual trees measuring three (3) inches or more in diameter (caliper) proposed to be disturbed/removed.*
f. *Slope stability analysis of existing slopes and of proposed excavations and embankments.*
g. *Construction staging and progress schedule.*

Disclosure of Coastal Hazards

Coastal hazard information is important. Local governments should explore different ways of informing coastal property owners and prospective buyers of coastal properties of the potential hazards that might exist in a particular area along the coast. Local governments with identified erosion hazard areas should consider ordinance provisions that help inform current and prospective property owners about those risks.

While, as a matter of law, people are on notice of what is contained in local ordinances, whether they actually read them or not, the reality is that most people will not actually read the notice. A more effective way of informing current and future owners/users of coastal properties is through the use of disclosure statements. Disclosure statements are written documents that identify certain issues related to property. They often function as a consumer protection tool for future purchasers of property so they are better informed about the condition of the property they are buying. This is important because under the law it is "buyers beware." Owners of residential properties are currently required to disclose information they have about the condition of their property to prospective purchasers under Chapter 709 of the Wisconsin Statutes, including whether the property is located in a floodplain. The following suggestions go beyond these requirements to better inform current and future property owners about the dynamic nature of the coastal areas.

Disclosure statements can help ensure that current property owners are aware of the risks inherent in building on or making changes to coastal lands. For local governments, disclosure statements can help ensure that property owners know they are proceeding at their own risk when they make changes to their properties. This is important for local governments so property owners do not expect local governments to bear the cost of fixing problems that might occur later related to the property owner's development.

Since there are many activities that could occur in the coastal areas, another option would be to have a more encompassing disclosure requirement that would cover things like additions to existing structures, fill activities, and the construction of shore protection structures. Depending on size and location, fill and the construction of shore protection structures might also require a permit from the WDNR under Chapter 30 of the Wisconsin Statutes. Property owners should be put on notice that these structures might fail or that they may need to be modified if they cause damage to the bluffs or shorelines of adjacent properties.

By providing a disclosure statement, the local government can tailor the document to the issues present along the coast in that community. Also, since the disclosure statement is separate from the ordinance, the local government can more easily keep the disclosure form up to date since it does not need to follow the ordinance adoption process.

ORDINANCE LANGUAGE

Local ordinances should be upfront about the risks inherent in building along coastal areas. Local governments should include general language in their ordinances about the risks of coastal development such as:

Lands along the coast may be unstable. The provisions of the ordinance are considered the minimum necessary for reducing but not eliminating impacts due to coastal hazards and property loss for the [50, 60] year period of recession based upon current engineering and scientific methods of study. Faster or slower rates of erosion may occur. Bluff instability or coastal erosion rates may be increased by natural causes such as high lake levels, climate change, major storms, or by man-made causes such as the construction of erosion control devices or by increasing runoff. Placing a structure landward of the required setback distance is not a guarantee or warranty of safety from bluff failure or coastal erosion damage.

ORDINANCE LANGUAGE

The Village of Whitefish Bay, for example, requires that the property owner certify that he/she is aware of the potential problems of lake shore erosion for any building or structure proposed to be located within 100 feet of the top edge of the bluff. The following ordinance language is adapted from the Village of Whitefish Bay ordinances:

The owner of the property shall certify to the [County/City/Village/Town] that he/she is aware of potential problems of lake shore erosion, including but not limited to the possibility of adding fill of various types to stabilize the bluff area, is aware of the requirement for securing of a fill permit from the [County/City/Village/Town] for any such filling, is aware of the provisions of said fill permit ordinance, and is further aware of the potential cost involved.

A memorandum of said certifications, including the legal description of the property, shall be recorded with the Register of Deeds of _____ County.

ORDINANCE LANGUAGE

The following is some possible ordinance language to require a disclosure statement:

Prior to the issuance of any permit for the use of real property or the construction or alteration of any structure located within the Coastal Hazard Zone, the owner of the property shall sign a Coastal Hazards Disclosure Statement. The statement shall be on a form provided by the [zoning administrator/planning department/clerk] and shall be filed with the Register of Deeds of _____ County.

SAMPLE DISCLOSURE STATEMENT

The real property located at _____ [street address] _____, [City/ Village/Town] of _____, County of _____, Wisconsin, legally described as _____ _____, is located in a Coastal Hazards area. Lands along the coast may be unstable. Faster or slower rates of erosion may occur. Bluff instability or coastal erosion rates may be increased by natural causes such as high lake levels, climate change, or major storms, or by man-made causes such as the construction of erosion control devices or by increasing runoff. Placing a structure landward of the required setback distance required by Ordinance No. _____ is not a guarantee or warranty of safety from bluff failure or coastal erosion damage.

I certify to the [County/City/Village/Town] that I am aware of potential problems of lake shore erosion, including but not limited to the possibility of adding fill of various types to stabilize the bluff area, am aware of the requirement for securing of a fill permit from the [County/City/Village/Town] for any such filling, am aware of the provisions of said fill permit ordinance, and am further aware of the potential cost involved. I agree to pay the costs involved. I further agree to hold the [County/ City/Village/Town] harmless for any and all costs associated with damages to my property caused by erosion and/or bluff failure.

Owner: _____ Date: _____

Owner: _____ Date: _____

_____

ORDINANCE LANGUAGE

While subsequent purchasers of real property will have legal notice of these disclosures that are filed against the property, most purchasers will probably not read them. It is therefore advisable to include a requirement to ensure that future purchasers of coastal properties are aware of the risks involved.

POSSIBLE ORDINANCE LANGUAGE FOLLOWS:

Upon any transfer of real property by sale, exchange, or lease, including a condominium unit, as defined under Wis. Stat. §703.2(15), and timeshare property, as defined under Wis. Stat. §707.02(32), the transferor shall deliver to the prospective transferee a Coastal Hazards Disclosure statement signed by the transferee and filed with the Register of Deeds of ___ _____ County. The statement shall be on a form provided by the [zoning administrator/planning department/clerk] and shall be filed with the Register of Deeds of _____ County.

SAMPLE DISCLOSURE STATEMENT

The real property located at _____ [street address] _____, [City/ Village/Town] of _____, County of _____, Wisconsin, legally described as _____ _____, is located in a Coastal Hazards area. As purchasers of this property, we have read the publication "Living on the Coast" and viewed the information contained on the www. XXXXXXX. We are aware of potential problems of lakeshore erosion and bluff instability on the property. We are aware we will need to relocate any and all structures currently located on the property when the edge of the bluff is within [xx] feet of the structure. We agree to pay all costs associated with relocating the structure and follow all applicable laws related to moving the structure to its new location.

Seller: _____ Date: _____

Seller: _____ Date: _____

Purchaser: _____ Date: _____

Purchaser: _____ Date: _____

conclusion

Photo: U.S. Environmental Protection Agency, Wisconsin Division of Tourism

Since the development of the Yanggen model ordinance in 1981, several significant developments have occurred.[25] 1) The Yanggen model ordinance encouraged the use of shore protection structures. Since the 1980s, there has been an increased awareness of the negative influence of shore protection structures on neighboring properties and the failure of such structures without monitoring and maintenance. 2) A changing Wisconsin climate that brings warmer winters with more frequent freeze/thaw of coastal slopes will lead to a greater risk of slope failures, and more intense rainfall events that contribute to greater shore erosion. 3) More intense lakebed erosion will deepen nearshore lakebed areas, allowing more storm wave energy to reach the shore, thereby increasing the rate of shoreline erosion and shortening the useful life of shore protection structures. 4) An increasing number of larger, well-built homes have been constructed along the coast that will be difficult and costly to relocate.

Because of these developments, it is time for local governments to reexamine their coastal management ordinances. Local governments have a number of different options for protecting property along the coast. When considering these options, it is important to remember that the coasts present a unique set of challenges. Approaches modeled after the inland lakes are not sufficient. Information is critical to helping people understand the unique coastal issues and selecting an approach that protects property along the coast and the community interests.

endnotes

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7 Mickelson, D.M., Edil, T.B., and Guy, D.E., 2004. Erosion of coastal bluffs in the Great Lakes, U.S.G.S. Professional Paper 1693, p. 107-123.

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10 For further information about the Wisconsin Coastal Management Program, see the program's Web site at http://coastal.wisconsin.gov.

11 Wisconsin Department of Natural Resources. 2005. *Floodplain and Shoreland Zoning: A Guidebook for Local Officials, Dam Safety, Floodplain and Shoreland Management*. Available at http://dnr.wi.gov/org/water/wm/dsfm/Documents/FloodplainShorelandZoningGuidebook.pdf.

12 Lulloff, Alan, and Philip Keillor. Dec. 2007 [Draft Report]. Managing Land Use in Wisconsin's Coastal Erosion Hazard Areas.

13 Id.

14 Southeastern Wisconsin Regional Planning Commission, Bay-Lake Regional Planning Commission, supra note 5; Anderson, Lindsay. 2003. "Evaluation of shoreline erosion extent and processes on Wisconsin's Lake Superior shoreline." Madison, Wisconsin, M.S. Thesis. University of Wisconsin-Madison.

15 Lulloff and Keillor, supra note 12.

16 Anderson, supra note 14.

17 Id.; Swenson, Mike. 2005. "Spatial variation of bluff recession rates along the Wisconsin coastline of Lake Superior." Madison, Wisconsin M.S. Thesis. University of Wisconsin-Madison. Need, E.A. 1980. "Till stratigraphy and glacial history of Wisconsin's Lake Superior shoreline: Wisconsin Point to Bark River." Madison, Wisconsin M.S. Thesis. University of Wisconsin-Madison. Need, E., M. Johnson, M. Schultz, S. Pulley, D. Mickelson, T. Edil, R. DeGroot, and A. Bagchi A. 1980. "Shoreline erosion and bluff stability along Lake Michigan and Lake Superior shorelines of Wisconsin: Appendix 9, Douglas and Western Bayfield Counties, Wisconsin Point to Bark Bay," Wisconsin Coastal Management Program, Shore Erosion Study Technical Report.

18 Keillor, supra note 8.

19 Clark, Gene, Matthew Clark, Philip Keillor. Working with Engineers and Contractors on Shore Protection Projects. University of Wisconsin Sea Grant. Available at http://www.aqua.wisc.edu/publications/PDFs/WorkingwithEC.pdf.

20 Booth, D. B. 1990. "Stream-Channel Incision Following Drainage Basin Urbanization." *Water Resources Bulletin* 26:407-417.

21 McCuen, R. H. and G. E. Moglen. 1988. "Mulitcriterion Storm-water Management Methods." *Journal of Water Resources Planning and Management*. ASCE, 114:4, pp. 414-431; MacRea, C.R. 1996. "Experience from morphological research on Canadian streams: Is control of the two year frequency runoff event the best basis for stream channel protection?" in L. Roesner. *Effects of Watershed Development and Management on Aquatic Ecosystems*, Engineering Foundation, ASCE, New York.

22 Chase, et al., supra note 6.

23 State of Washington Department of Ecology. Understanding Your Property. Available at http://www.ecy.wa.gov/programs/sea/pubs/93-30/under01.html.

24 Wyckoff, Mark A. 2003. *Site Plan Review: A Guidebook for Planning and Zoning Commissions*. Michigan Association of Planning. Fourth Printing.

25 These observations are from Phil Keillor, a retired coastal engineer with the University of Wisconsin Sea Grant Program, and a long time observer of the dynamic coastal process.

appendix

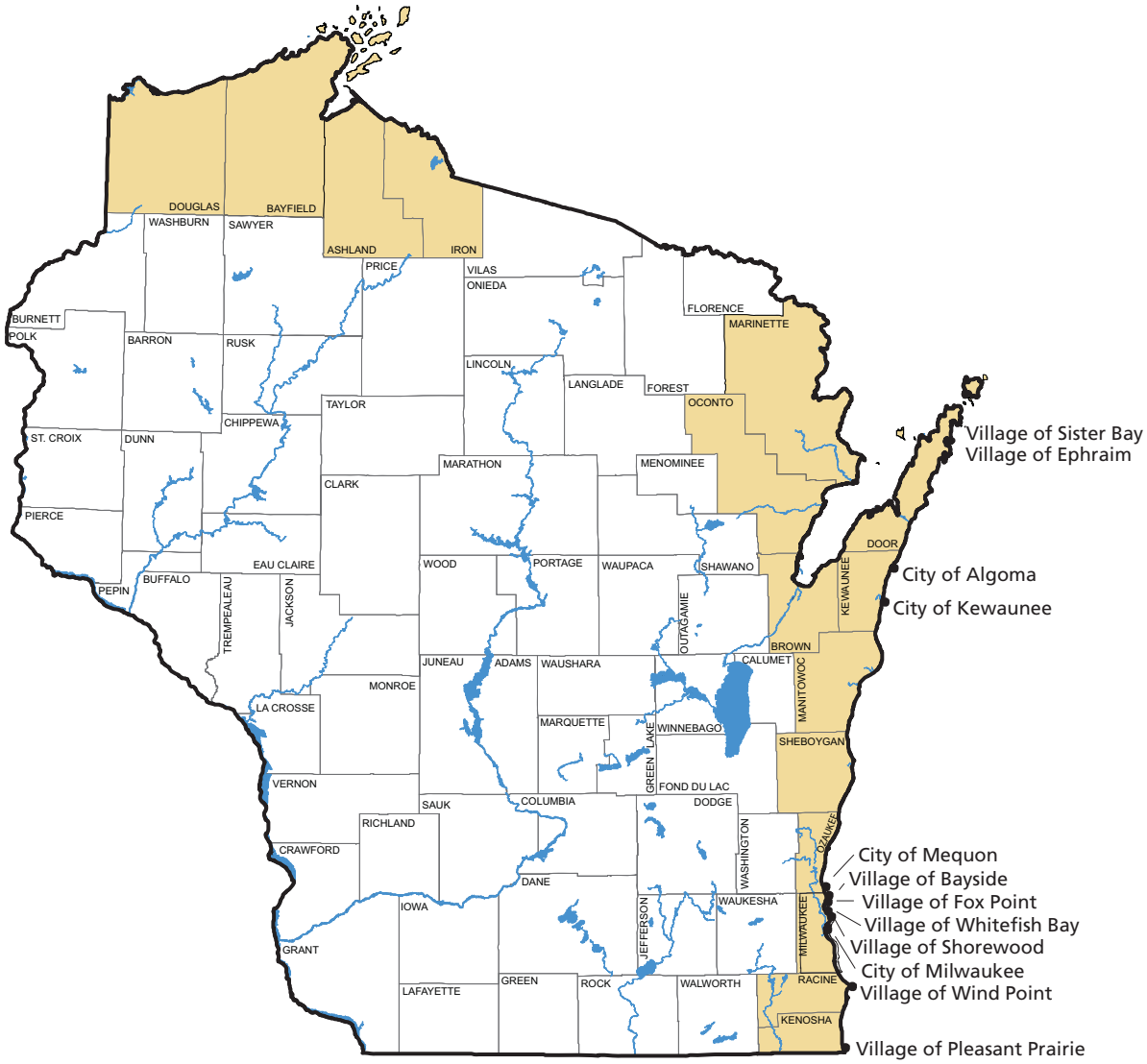
An inventory of current coastal setback provisions found in local ordinances in Wisconsin.

Large Photo: U.S. Environmental Protection Agency, Karen Holland • Small Photo: U.S. Environmental Protection Agency, Karen Rodriguez

An Inventory of Current Coastal Setback Provisions Found in Local Ordinances in Wisconsin

The following excerpts include language specifically related to the coasts found in county, city, village, and town ordinances in Wisconsin as of March 31, 2008. General ordinance language found in many communities limiting the development of land in areas where land is not suitable for development due to soil conditions, steep slopes, etc., is not included. Floodplain zoning ordinances are also not included.

The inventory is separated into Lake Superior communities and Lake Michigan communities. The Lake Superior communities are listed in the order they are found along the coast from West to East. The Lake Michigan communities are listed in the order they are found along the coast from North to South.



Lake Superior Communities

Douglas County

Chapter 8.0, Zoning Ordinance

Section IV. Regulations...

4.4 Shoreland Regulations...

1. Lake Class Development Standards for Waterfront Property on Navigable Waters...

7. Lake Superior Coastal Waters

1. Setback.

For lots that abut on navigable waters the following setback regulation shall apply:

(a) All permanent installations including soil absorption system, seepage pits and holding tanks; but not including piers and boathouses, shall be setback from all points along the bluff edge by the distance shown on the Lake Superior Shoreland Setback Table. Boathouses or similar structures which require waterfront location shall not be used for habitation nor extend toward the water beyond the ordinary high water elevation. The Zoning Administrator or his representative, shall determine the setback for those cases not shown on the Setback Table, but in no case shall the setback be less than 75 feet from all points along the bluff edge.

(b) A setback equal to the average setback of existing principal buildings within 500 feet of a proposed building site shall be permitted where such existing buildings do not conform with the appropriate setback line. A minimum setback of 75 feet from all points along the bluff edge shall be required in all such cases.

(c) Private sewage disposal systems shall conform to subparagraph 4.42.1.a of this ordinance and the applicable rules, regulations and laws as set forth in the Wisconsin Statutes and the Wisconsin Administrative Code.

(d) The County Zoning Administrator, or his representative, shall determine the bluff edge.

<http://www.douglascountywi.org/ordinances/Chapter%20VIII%20Zoning%20and%20Planning/8%200%20Current%20Zoning%20Ordinance%20as%20amended%20form%20original%20dated%201934(4.08).pdf>

SETBACK TABLE @ 3.0 FEET/YEAR EROSION RATE – SLOPE HEIGHT (FEET)

SLOPE ANGLE DEGREES	5	10	15	20	25	30	35	40	45	50	55	60	65	70
16	170	183	184	186	187	189	191	192	193	194	195	196	197	199
18	172	187	190	195	198	201	205	209	212	215	218	221	224	227
20	174	191	195	201	206	212	217	223	227	232	236	241	245	252
22	175	193	198	206	212	219	226	232	238	244	250	255	260	270
24	175	195	201	211	218	226	234	242	248	256	263	270	275	285
26	175	197	205	215	223	232	241	250	258	266	274	282	290	300
28	175	199	207	218	227	237	246	256	265	274	283	291	300	311
30	175	200	209	221	231	241	251	262	271	281	290	300	309	321
32	175	202	211	224	234	245	256	267	277	288	298	308	318	331
34	176	203	212	226	237	249	260	272	282	294	304	315	325	339
36	176	203	213	228	240	252	264	276	287	299	310	321	332	346
38	176	204	214	230	242	255	268	280	291	304	316	327	339	353
40	176	204	214	232	244	257	271	284	295	308	320	332	344	359
42	176	205	215	232	246	259	274	287	299	312	325	338	349	364
44	176	205	216	234	250	261	277	290	302	316	329	342	354	369
46	176	206	217	236	252	263	279	293	305	320	333	347	359	374
48	177	206	218	238	253	265	281	295	308	323	336	351	363	379
50	177	207	219	240	254	267	283	297	311	326	339	355	367	383
52	177	208	220	240	255	269	285	299	314	329	342	359	371	387
54	177	209	221	241	256	271	287	301	316	332	345	363	375	391
56	177	210	222	242	257	272	289	303	318	335	348	366	379	394
58	177	211	223	243	258	274	291	305	320	337	351	368	381	397
60	177	212	224	244	259	275	292	308	323	339	354	369	384	399

Bayfield County

Zoning Code

Title 13, Chapter 1, Article B

Sec. 13-1-32 Inland Lake Classification and Shoreland Development Requirements.

(c) Lake Superior Lot Requirements. Lots having frontage on Lake Superior and any improvements thereon shall be subject to the requirements applicable to lots on Class 1 lakes, [Class 1 lakes are the most developed lakes and require a 75 foot setback from the ordinary high water mark] except that if a lot has a bank or a bluff fronting the lake, the top of which is discernible due to evidence of erosion, (including but not limited to exposed rock), the required shoreline setback shall be 75 feet back from the top edge of the bank or bluff, and if a lot is located in an area of active or potential erosion designated on a map entitled Erosion Hazard Areas—Bayfield County, a greater setback may be required as determined by the Zoning Committee or its duly designated agent, based on projected shoreland recession rates.

[Bayfield County also has special provisions for Multiple Unit Developments built along the shoreline. The County requires a 200 foot setback.]

<http://www.bayfieldcounty.org/ordinance/PDF/Section13/sec13-artB-13-1-20-to-13-1-39.pdf>

Ashland County

Shoreland Amendatory Ordinance…

5.0 Setbacks From Water.

5.1 All permanent structures except legally erected piers shall be set back a minimum distance of 75 feet from the ordinary high water mark of any navigable water.

<http://www.co.ashland.wi.us/departments/zoning/AshlandCountyZoningOrdinances2005.pdf >

Iron County

Title 9, Land Use, Chapter 1, Land Use and Shoreland Protection…

Sec. 9-1-70 Shoreland Regulations

(a) Setback. For lots that abut on navigable waters the following setback regulations shall apply:

(1) All permanent structures, except piers, boat hoists and boathouses shall be set back seventy five feet from the ordinary high water mark of navigable waters.…

Lake Michigan Communities

Marinette County

Chapter 21 Shoreland-Wetland Zoning…

21.06 Setbacks and Structures

(1) Setbacks from Navigable Waters. All buildings and structures, except piers, boat hoists, boathouses and satellite dishes that are one meter or less in diameter, which may require a lesser setback, shall be setback as specified in the table of water class development standards in Section 21.09(1). [Green Bay waters are classified as a Class III water (highly developed) and follow a 75 foot setback.] All distances, unless otherwise specified, shall be measured horizontally. The measurement shall be taken from the ordinary high water mark to the closest point of a building or structure including, but not limited to, steps, decks, overhangs, eaves or landings.

(a) The County shall grant special zoning permission (via a zoning permit) for the construction or placement of a structure on property in a shoreland setback area if all of the following apply:

(1) The part of a structure that is nearest to the water is located at least thirty-five feet landward from the ordinary high water mark.

(2) The total floor area of all structures in the shoreland setback on the property shall not exceed two hundred square feet (in calculating this square footage, boathouses shall be excluded).

(3) The maximum height of the structure will not exceed fifteen feet.

(4) The structure that is the subject of the request for special zoning permission has no sides or has open or screened sides.

(5) The Zoning Administrator or the County Zoning Agency approve a plan that will be implemented by the owner of the property to preserve or establish a vegetative buffer zone that covers at least 70% of the half of the shoreland setback area that is nearest to the water. For the purpose of this section, applicable provisions of the table of water class development standards in Section 21.09(1) shall determine the extent of the shoreline setback area. Such plan shall…include an implementation schedule.

(6) Any permit issued under this section shall not be valid until notice of its conditions is recorded by affidavit with the County Register of Deeds.

<http://www.marinettecounty.com/i_marinette/d/chapter_21.pdf>

Oconto County

Chapter 14, Oconto County Zoning Ordinance…

14.500 Zoning Standards for use of shorelands along navigable waters…

14.505 Setbacks of Buildings and Structures from the Water

1. Basic setback rule: No building or structure, except as provided in section 14.410 3. or section 14.50 shall be located closer than 75 feet from the ordinary high-water mark.

2. Averaging to reflect existing development patterns — The basic setback rule of 75 feet may be subject to modification to reflect existing development patterns as provided in section 14.410 4.

3. Special regulations for boathouses, marinas, boat liveries or similar structures. A county zoning permit shall be required for these structures and the following standards shall apply:

a. All structures and uses shall comply with the standards of Chapter 30, Wisconsin Statutes and of other state and federal laws or regulations, where applicable.

b. No structure shall be allowed to impede the free movement of water or to cause formation of land upon the bed of a water body.

c. Erosion, sedimentation or impairment of fish or wildlife habitat shall be prevented.

d. All structures and activities shall be designed, constructed and located so as to preserve natural beauty of the shoreland area.

e. Boathouses: Boathouses shall not exceed 12 feet wide, 24 feet long and 10 feet in height or extend closer than 3 feet to the ordinary high-watermark. Boathouses roofs shall not be used as a deck. Boathouse shall not include plumbing or sanitary fixtures, patio doors or any similar feature, and shall not be used for human habitation.…

<http://www.co.oconto.wi.us/i_oconto/d/zoning_ordinance_2007.pdf>

Brown County

Chapter 22, Shoreland-Wetland Ordinance…

22.16 Lots that Abut Navigable Waters. All buildings and structures, which also include decks, patios, fences, gazebos and screen houses shall be set back at least 75 feet from the ordinary high water mark of navigable water.…

22.18 Critical Slope Setback. All residential, commercial or industrial structures shall be set back a minimum of 20 feet from the top ridgeline of a 20% or greater slope measured to the foundation. Elevation change will be analyzed to determine how steep or significant the slope is to decide the applicability of this section. Decks, patios, stairways, fences, gazebos, screen houses, pools, boathouses and storage sheds can be located within the 20 foot setback but must not exceed a building footprint of 500 square feet. If a geotechnical study is completed for the proposed area, a shoreland permit may be issued for a structure within the 20 foot setback subject to being constructed following the recommendations of the study. A certificate of compliance will need to be completed by the responsible architect or engineer after construction and prior to occupancy. This certificate must be returned to the Zoning Office within 60 days of completion of the project. Special exceptions. A special exception permit shall be required for the following: (a) For any proposed encroachment into the critical slope setback not identified in 22.18…

22.20 Shoreland Permit – Special. As authorized under s. 59.692(1v), Wis. Stats, a special shoreland permit can be issued for a structure within the shoreland setback area if all of the following conditions are met:

(1) The part of the structure that is nearest the water is located at least 35 feet landward from the ordinary high-water mark.

(2) The total floor area of all the structures existing and proposed in or extending into the shoreland setback area of the property shall not exceed 200 square feet. In calculating this square footage, boathouses, boat hoists, piers, wharves, stair and landing shall be excluded.

(3) The structure that is the subject of the request for a special shoreland permit has no sides or has open or

screened sides, and has a maximum height from the lowest grade to the highest point of any structure of 15 feet. Any permitted roof shall not be designed or used as a deck, observation platform, or for other similar uses. The color of the structure or the use of the structure must not be prohibited by other zoning regulations or deed restrictions (e.g. floodplain regulations). Retaining walls are not included in this classification since they have solid, not open sides.

(4) The owner(s) or their agent must submit a plan that will be implemented by the owner of the property to establish, preserve, enhance and/or restore a vegetative buffer zone that covers 70% of the half of the shoreland setback area that is nearest the water. The plan must be approved by the Department.

(a) The shoreland setback for the purpose of this section shall be 75 feet or a lesser setback that has been approved by setback averaging, variance, or is a preexisting non-conforming setback.

(b) For the plan to be approved, it must be binding on the owner, his/her heirs, successors, and assignees, and must authorize entrance onto the property by zoning staff for inspections to assure compliance with the plan. The agreement shall be written and recordable on forms provided by the Zoning Office and recorded with the Register of Deeds. This also applies to preservation of an existing natural buffer.

(c) Failure to comply with the plan and/or subsequent removal of vegetation from the vegetative buffer zone will cause the Zoning Office to revoke the special shoreland permit and order the removal of any structure(s) authorized by a special shoreland permit.

(d) To be considered for approval, a plan to establish, preserve, enhance and/or restore a vegetative buffer zone shall, at minimum, contain:

1. A description of how the landowner intends to carry out the project, including methods, materials and equipment to be used;

2. A proposed schedule and sequence of work activities;

3. The names, descriptions and densities of native species to be utilized in the restoration work, including ground cover, shrubs and tree layers;

4. A description of the site before the project begins and a description of the proposed site once the buffer is completed; and

5. The erosion control measures that will be used during construction of the permitted structure and vegetative buffer zone to control sediment, runoff and protect water quality.

(e) To be considered for approval, a plan to establish, preserve, enhance, and/or restore an existing native vegetative buffer zone shall, at a minimum, contain:

1. A description of how the homeowner intends to maintain the buffer including “mowing” plans;

2. Supplemental plantings of native species;

3. Removal of non-native species (e.g. purple loosestrife); and

4. The erosion control measures that will be used during construction of the permitted structure and any disturbance in the vegetative buffer zone due to planting or removal of non-natives to control sediment, runoff and protect water quality.

(f) The plan must be implemented and the vegetative buffer planted and vegetation must be in viable, growing condition for at least one growing season before a special shoreland permit to build a structure is granted or approval must be obtained from the Department based on a field onsite of the property.

(g) A shoreland grading permit may be required to implement a vegetative buffer zone plan.

(h) Removal of the shore yard structure will not relinquish the recorded agreement or permit the removal, destruction, degradation and/or reduction in size of the shoreland vegetative buffer.

<http://www.co.brown.wi.us/zoning/Chapter22.htm>

City of Green Bay

Chapter 13, Zoning Ordinance...

Chapter 13-1100. Conservancy District...

13-1103. Dimensional Standards. Because the permitted and conditional uses in the Conservancy District are generally not conducted in buildings, no minimum lot area is specified. The following setbacks and coverage limits shall be required:

(a) Waterway setback. All buildings and structures, except for road, bridge and utility crossings, docks, piers, boat landings, or drainage structures, shall be set back a minimum of 50 feet from the bulkhead line or ordinary high water mark, whichever provides the greater landward distances, of all navigable waterways, including, but not limited to: 1. Green Bay shore and islands....

(b) Impervious coverage. Impervious coverage within the Conservancy District shall be limited to 35% of any parcel.

<http://www.ci.green-bay.wi.us/forms/Code_Book/chp13.pdf>

Door County

Zoning Ordinance...

Chapter 3, General Requirements...

3.07 Setback from navigable waters

(1) ...[T]he required setback from all navigable water shall be 75 feet from the ordinary high water mark. The setback shall be measured from the nearest portion of a structure.

<http://map.co.door.wi.us/planning/ORDINANCE/Zoning/CHAPTER%2003.pdf>

[Door County also has additional ordinances to protect certain natural features including the Niagara Escarpment, dunes, ridges, and shoreland vegetation. The provisions for the escarpment are similar to those for the Village of Ephraim included below. The provisions do not provide setback requirements.]

<http://map.co.door.wi.us/planning/ORDINANCE/Zoning/CHAPTER%2005.pdf>

Village of Ephraim

Chapter 17, Zoning Code...

17.15 Site and Development Standards...

(11) Setbacks from Navigational Waters.

(a) Unless otherwise specified, all structures, except piers, wharves, boat hoists and boathouses, shall be set back at least 75' from all points along the normal high water mark of navigable waters. Boathouses shall not project waterward of the high watermark. (b) The PW district navigable water setbacks for principal structures from the shoreline of Green Bay shall be 40' or the setback determined by averaging, whichever is greater.

(c) Setback averaging applying the principles and the policies set forth in the par. (8)(c) may be applied to shoreline setbacks, subject to a minimum limit of 40'. Rental cabins shall not qualify as principal structures on parcels sitting or lying within 75' of the shoreline of Green Bay....

17.20 Protected Waterfront (PW) District

(1) INTENT. Recognizing that the open shoreline is one of Ephraim's most distinctive features, the intent of this ordinance is to provide for as much open viewing space along our shoreline as possible. As an important contributing component of the Ephraim Historic District owners of residences in the PW district are encouraged to use and maintain their existing residences.

The Village position is since most of the residential buildings in this district are sited on small non-conforming lots that would otherwise prohibit the erection of such structures under existing ordinances, residences shall be restricted to those in existence. Existing residences can be modified, or torn down and reproduced, subject to approved Plan committee "PW Design Review" whereas the individual footprints, lot coverage, and setbacks for this district are grandfathered....

http://www.ephraim-wisconsin.com/resources/17zoning.pdf

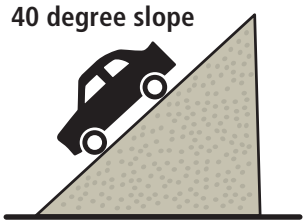
Chapter 16, Erosion Control…

16.02 Definition. Niagara Escarpment. The *Niagara Escarpment*, as a feature of geography, is a long escarpment or cuesta running from the area of Sault Ste. Marie into Wisconsin following the Door Peninsula and westerly coastline of Lake Michigan, ending near Chicago. Most commonly, an escarpment, also called a scarp, is a transition from one series of sedimentary rocks to another series of a different age and composition. In such cases, the Escarpment usually represents the line of erosional loss of the newer rock over the older.

16.03 Land Disturbing Activities Subject to Runoff and Erosion Control

(3) **Niagara Escarpment.** The intent of these regulations is to promote safe conditions, prevent erosion and runoff, and preserve escarpments as landmark features that contribute to the scenic diversity and attractiveness of the Village. The regulations recognize the geologic significance of the dolomite bluffs that constitute the Niagara Escarpment winding its way along Ephraim's shoreline. These bluffs are part of our natural heritage, and the intent of the language set forth below is to permit property owners to build on Escarpment land and, at the same time, preserve the natural features, such as steep slopes, rugged bluffs, rock outcroppings, and trees and other vegetation, that grace and stabilize the Escarpment. As a broad definition, we consider "Escarpment" as lengthy slopes of 20% or greater that are associated with the crest of the formation, and that can be seen from the bay, as designated on the attached map.

(1) **Roads.** No roads or driveways shall be placed on slopes of 30–39 degrees unless the roads or driveways are placed parallel to the Escarpment face. No roads or driveways shall be placed on or parallel to slopes of 40 degrees or greater. In such cases property owners should join together to provide a single access road placed on a slope of less than 39 degrees and extending along the base of the Escarpment to access the several properties involved. For reference purposes, the diagram below shows a 40 degree slope:



(2) **Tree Removal For Site Preparation.** The clearing of trees located within an

Escarpment protection area shall be permitted for:

(a) Providing building footprints with approved erosion and runoff plans:

existing trees more than 12 inches in diameter shall be shown on the erosion control plan with trees to be removed for site preparation or landscaping also marked on the plan. Owner/Developer may be required by the Village to consult with an expert regarding tree removal and erosion control.

(b) Providing sites for wastewater disposal systems with approved erosion control and runoff plans;

(c) Driveways with limitations as set forth in (1) above.

(d) The area extending not more than 25 feet from the exterior walls of principal buildings and 15 feet from accessory buildings.

(3) Removal of Additional Trees. Within an area on a lot between 25 and 100 feet from the exterior walls of principal buildings, selective clearing is permitted provided that:

(a) No more than 30% of this area is cleared;

(b) The clearing of the 30% described shall not result in strips of cleared openings of more than 30 feet along the Escarpment protection area;

(c) In the remaining 70% of this area, cutting and pruning shall leave sufficient cover to screen vehicles, dwellings, and other structures.

(d) Special attention is paid to leaving trees between built structures and the shoreline such that, as seen from the bay, the visual impact of development in minimized.

(4) **Penalties.** If owner/developer removes trees within the escarpment protection area without prior approval, in addition to penalties provided for in Chapter 25 of this Ordinance, the owner/developer may be required to make reparation of the area by replanting the area with trees as close to the original number and size as is practicable.

<http://www.ephraim-wisconsin.com/resources/16erosioncontrol.pdf>

Village of Sister Bay

Chapter 66, Zoning Code…

Sec. 66.0304 Setback Requirements from the water. For lots that abut on navigable waters, there shall be setbacks from the ordinary high-water mark of such waters.

(a) Applicability in developed areas.

In areas with existing development patterns, structures close to the ordinary high water mark, except as provided in subsections (e) and (f) below, shall be set back at least 30 feet from all points along the ordinary high-water mark. The lowest floor level of all structures shall be elevated at least two feet above the ordinary high water mark. All structures, boathouses, accessory buildings allowed in (e) and structures not buildings shall comply with the applicable district side yard setbacks.

(b) Applicability in undeveloped areas.

In areas with no development pattern, structures close to the ordinary high-water mark, except as provided in subsections (e) and (f) below, shall be set back at least 75 feet from all points along the ordinary high-water mark. The lowest floor level of all structures shall be elevated at least two feet above the ordinary high-water mark. All structures, boathouses, accessory buildings allowed in (e) and structures not buildings shall comply with the applicable district side yard setbacks.…

(e) Exceptions.

(1) Decks are allowed provided they do not extend waterward more than 20 percent of the remaining setback.

(2) Boathouses shall not project beyond the ordinary high-water mark.

(3) Stairways, elevated walkways, ramps, lifts, fences, flagpoles, piers, boat hoists.

(4) Utility poles, lines and related equipment without permanent foundations.

(5) Structures not buildings as defined.

(6) Signs as permitted.

(f) Parking lots. Parking lots shall be set back at least 75 feet from all points along the ordinary high water mark. However, the Plan Commission may with a conditional use permit, grant modifications to a minimum of 35 feet from all points along the ordinary high-water mark for parking lots only.…

Sec. 66.0344 Bluff Protection Overlay District

The Bluff Protection Overlay district (BP) is hereby established as a district, which overlaps, and overlays existing base zoning districts, the extent and boundaries of which are as indicated on the official zoning map for the Village. Overlay districts provide for the possibility of superimposing certain additional requirements upon a basic zoning district without disturbing the requirements of the basic district. The uses of the underlying standard zoning district shall remain in force.

(a) Intent: (1) Promote safe conditions by preventing placement of roads on highly inclined surfaces. (2) Preserve escarpments as landmark features that contribute to the scenic diversity and attractiveness of the Village. (3) Preserve flora and fauna habitats.

(b) Location of requirements: The Bluff Protection Overlay district shall be identified on the Official Zoning map of the Village. The location of the bluff on a parcel shall be determined by a trained expert or geologist acceptable to the Plan Commission.

(c) Permitted uses: Principal Uses shall be those permitted in the underlying zoning district. Uses prohibited in the underlying zoning district are also prohibited in the Bluff Overlay district.

(d) Conditional uses: Conditional Uses shall be those permitted in the underlying zoning district.

(e) Site plan required: A site plan prepared in accordance with . . . this chapter is required for all uses.

(f) Setbacks: There shall be at least a 25-foot setback from the crest of the bluff. The crest shall be established by means of a site inspection by the Village, the location of which will be plotted by the applicant on the site plan based upon the zoning map.

(g) Special requirements:

(1) No roads or driveways shall be placed on slopes of 30–39 percent unless the roads or driveways are placed parallel to the bluff face. No roads or driveways shall be placed on slopes of 40 percent or greater.

(2) The clearing of trees, shrubbery, undergrowth, and other ground cover located within bluff protection areas shall be permitted for:

a. Building footprints.

b. Sites for wastewater disposal systems.

c. Driveways, not to exceed feet in width.

d. The area on a lot, excluding the bluff crest and face, extending not more than 15 feet from the exterior walls of principal buildings and ten feet from accessory buildings.

(3) Tree topping. Tree topping which is defined as tree cutting or sculpturing where only a portion of the tree is removed to improve the view is prohibited within the bluff protection overlay district.

(4) In the area on the balance of the lot, selective removal of trees, shrubbery, under growth and other ground cover is permitted provided that:

a. No more than 30 percent of this area on the lot shall be cleared.

b. The clearing of the 30 percent described above shall not result in strips of cleared openings of more than 30 feet in any 100-foot wide strip nor create a cleared opening strip greater than 30 feet wide.

c. In the remaining 70 percent of this area, cutting and pruning shall leave sufficient cover to screen vehicles, dwellings, and other structures. Even though vegetation removal is permitted by this Code, the Village strongly recommends that the existing vegetation, including trees, shrubbery, undergrowth and ground cover, be preserved to the greatest extent possible to protect the ecosystem of the bluff

(5) Pruning of trees is not permitted, except for the removal of dead, diseased or dying trees.

(6) Special cutting plan. A special cutting plan allowing greater cutting may be permitted by the Plan Commission by issuance of a conditional use permit. In applying for such a permit, the commission may require the lot owner to submit a drawing of his/her lot including the following information: location of all structures, location of parking, and gradient of the land, existing vegetation, proposed cutting and proposed replanting. The commission may grant such a permit only if it finds that such special cutting plans:

a. Will not cause undue erosion or destruction of scenic beauty.

b. Will provide substantial shielding from the water of dwellings, accessory structures and parking area. The commission may condition such a permit upon a guarantee of tree planting by the lot owner. Such an agreement shall be enforceable in court.

c. Is consistent with established forest management practices.

http://intranet.sisterbay.com/Shared%20Documents/Zoning%20Code/66a-Chapter%2066%20Zoning%20Code%20021208.pdf

Kewaunee County

Shoreland Zoning Ordinance…

5.0 Setbacks…

5.2 Setbacks From the Water…

5.22 Lots that Abut on Lake Michigan

(1) Finding of fact: Lake Michigan possesses unique ecological characteristics, water level fluctuations and erosion hazards not found on other surface waters in Kewaunee county. Storms and record high Great Lake water levels have caused shoreline erosion, flooding and property damage that have posed a threat to the health, safety and general welfare of Kewaunee County; therefore, setbacks from Lake Michigan shall be increased from that for inland waters and Green Bay.

(2) Required Minimum Setback. The minimum setback for all buildings and structures, except piers, boat hoists, decks, and boathouses which may require a lesser setback shall be set back at least 75 feet from the ordinary high water mark where the shore bluff height is 10 feet or less and 125 feet from the ordinary high water mark where the shore bluff height is greater than 10 feet.

(3) Reduced Building Setback-Variance. The Board of Adjustment…may approve a modification of the setback to no less than 75 feet upon submittal of acceptable engineering studies prepared by a licensed or certified engineer documenting the recession rate and the stable slope distance for the property. The recession rate is the horizontal distance the bank bluff edge is expected to recede from the high water mark during the useful life of the structure, and the stable slope distance is the horizontal distance necessary for the bluff face to recede to a stable slope.

<http://www.kewauneeco.org/subpages/Departments/Zoning/Zoning.htm>

City of Algoma

[The city follows a 75 foot setback from the high water mark in various waterfront districts under the zoning ordinance.]

<http://www.algomacity.org/Adobe%20Files/ZONING2.pdf>

City of Kewaunee

Chapter 94, Zoning…

Sec. 94-207. WFD waterfront district.

(a) **Purpose.** The WFD waterfront district is intended to provide for the rational, well-planned, well-landscaped and orderly development of the city's waterfront. The city's waterfront is a limited and unique resource that provides recreational, commercial, industrial and residential values. Since space in the waterfront is limited, uses in the waterfront district should be restricted to those industrial, recreational, residential, or commercial uses that are marine related or have a distinct locational advantage by being in the district and to those that provide for public assess or visual access to the waterfront. Uses in the district should be consistent with the city's comprehensive plan, tax incremental financing program, waterfront recreation plan, and central business district improvement program.…

d) **Dimensional requirements.** Within the WFD district the following standards shall apply:

1. Lot area: Minimum 0 height

2. Lot width: Minimum 25 ft

3. Lot coverage: Maximum coverage 50%

4. Building height:

   For single-family residences: Maximum 40 feet so as to preserve views and vistas of the Kewaunee River and Lake Michigan.

   For all other buildings: Maximum 46 ft

5. Floor area: No minimum

6. Yard requirements:

Front Minimum 25 ft

Rear Minimum 30 feet as measured from the ordinary high-water mark

Side 15 feet minimum. Design and construction of new structures shall use side yards to preserve views or vistas of the Kewaunee River and Lake Michigan.

7. The rear yard of the property shall always face the lake or the Kewaunee River. The rear yard setback shall always be measured inland from the ordinary high-water mark. Side yards shall be perpendicular or nearly perpendicular to the rear yard. Side yards shall be utilized to maintain views or vistas of the water. Side yards shall not be used for parking or accessory buildings or other means to restrict views of the water. Front yards shall be on the opposite side of the lot from the rear side.

8. Structures built on outlots shall maintain setbacks of 15 feet from the side lot line; six feet from the road right-of-way; and two feet from the bulkhead line or harbor waters edge, whichever is closer to the structure. Structure height shall not exceed 12 feet, maximum square footage of any structure not to exceed 144 square feet, and the total square footage of all structures not to exceed 30 percent of the total square footage of the outlot. Structures on outlots are subject to the following conditions:

a. Architectural and exterior materials of any storage building must match what the principal structure on its corresponding lot is or will be.

b. No metal structures or pole buildings are permitted.

c. With the exception of docks for winter storage, no outside storage, including boats, on an outlot is permitted.

d. All structures must be firmly anchored to the foundation.

e. No fence shall be built on an outlot greater than 48 inches in height and such fence must meet all city ordinance fence requirements.

f. No outlot may be sold separately from its corresponding principal lot.

g. No structure shall be used as living or sleeping quarters, or contain kitchens, restrooms or the like.

h. No structure shall be used to garage cars, trucks, boats, or other automobiles.

i. Any violation of these outlot conditions or setback, height and use requirements shall cause any structure in violation to be removed at the expense of the property owner. If the structure is not removed by the property owner after 30 days' written notice, the structure shall be removed by the city and the cost of such removal shall be added to the real estate tax roll for the corresponding principal lot and outlot.…

<http://www.municode.com/resources/gateway.asp?pid=12627&sid=49>

Manitowoc County

Chapter 9, Shoreland/Floodplain Zoning…

9.05 General Regulations…

(5) The minimum setback for all structures, except piers, wharves, bridges, dams, and boathouses, patios, and walkways and stairways which are necessary to provide pedestrian access to the shoreline, from the ordinary high water mark shall be seventy-five feet. In addition, a greater setback for permanent principal structures and accessory uses shall be required in areas where the shoreline has been receding and/or where bluffs of ten feet or more in height which rise ten feet or more vertically for every twenty-five feet of horizontal distance exist. In these cases, the setback line shall be established by the Code Administrator by use of the following procedures:

(a) A stable slope angle setback shall be established for bluffs at a ratio of 2.5 feet of horizontal distance for every one foot of vertical distance. The measurement shall be made from the ordinary high water mark perpendicular to the shoreline. There shall be two such measurements made for every one hundred feet of shoreline at points not less than fifty feet apart. The stable slope angle setback shall be a line connecting these two points or such line extended. In cases of highly irregular shoreline, more than two measurement points per one hundred feet may be required by the Code Administrator.

(b) A recession rate setback shall be established for all receding shorelines by multiplying the average annual long term recession rate, which is two feet per year adjacent to Lake Michigan, by a structural design life of fifty years for principal or conditional uses or a structural design life of twenty-five years for accessory uses.

(c) In areas where both shoreline recession and bluffs exist, the stable slope angle setback shall be added to the recession rate setback to arrive at the required setback for permanent principal structures. In areas where only one condition exists, either shoreline recession in areas without bluff, or a bluff along shoreline, which is not receding, only the applicable setback shall apply. The seventy-five foot setback from the ordinary high water mark shall be the minimum in all cases.

(d) Notwithstanding any other provisions of this ordinance to the contrary, the Manitowoc County Board of Adjustment may permit a setback less than seventy-five feet but not less than the development pattern on adjacent lots on inland lakes of the County where an existing development pattern exists. (An existing development pattern shall be deemed to exist when all zoning lots within three hundred feet (300') of the property in question have been developed with a permitted principal use). The Board shall use the following criteria when considering the establishment of a setback less than seventy-five feet:

1. The subject property has unusual topography that significantly limits its development potential.

2. The lot dimensions are such as would significantly limit the lot's development potential.

3. Surface water drainage or ground water flow would be adversely affected if the reduced setback is not permitted.…

<http://www.manitowoc-county.com/Upload/8/Chapter%2009%20Current%20-%20REVISED.pdf>

Sheboygan County

Chapter 72, Shoreland Ordinance…

72.16 Setbacks

(1) SETBACKS FROM THE WATER. NOTE: Setbacks hereunder are to be measured at right angles from lot lines or the ordinary high water mark (OHWM), horizontally, to the closest projection of the structure or integral part thereof, including attached decks, porches, balconies, attached covered stairs and landings, chimneys, such architectural projections as sills, eaves, and belt courses, and attached garages.…

(b) Lake Michigan.

1. Findings of Fact. Lake Michigan possesses unique ecological characteristics, water level fluctuations, and erosion hazards, not found on other surface waters in Sheboygan County. The coast north of the City of Sheboygan consists almost entirely of steep bluffs ±50 feet in height; the coast south of the City consists almost entirely of low dunes and beaches. Despite this contrast, long-term recession (erosion) rates of ±2 feet per year have been recorded along both coastal reaches.

To protect property and life and minimize costly damage, the setback from

Lake Michigan shall be based upon the long-term recession rate of two feet per year and a fifty year period as the useful life of a typical residence. In addition, on steep bluffs it shall also be necessary to determine an additional setback distance based upon a stable slope angle of two and one-half feet horizontal distance for every one foot vertical distance.

[To illustrate, 50-year design life: 2 feet per year recession rate = 100-foot setback. If on the 50 foot high bluff; 2-1/2 feet (stable slope angle) 50 feet (bluff height) = 125-foot setback. TOTAL SETBACK = 225 feet (100 + 125).]

2. Required Setbacks. All structures, except playground apparatus, piers, wharves, boat hoists, boathouses, patios, open fences, bridges, dams, and walkways and stairways which are necessary to provide pedestrian access to the shoreline, shall be set back at least one hundred feet from the ordinary high water mark (OHWM) for the entire coastal reach extending from the North County Line to the South County Line. Additionally, to achieve the added degree of protection for major structural investments as described in Subsection (1)(b)1, above, all Principal Buildings as herein defined shall be set back two hundred twenty-five feet from the ordinary high water mark (OHWM) for the coastal reach extending from the City of Sheboygan north to the North County line. Structures which require authorization or permits from the DNR pursuant to Wis. Stat. chapters 30 and 31 or which are to be located below the ordinary high water mark (OHWM), namely bridges, dams, culverts, piers, wharves, navigational aids, and waterway crossings of transmission lines shall comply with all applicable federal, state, county, and local regulations, but shall not require the issuance of a Shoreland/Floodplain Zoning Permit where the standards of this Ordinance are complied with.

3. Procedure to Reduce Setback of Principal Buildings. For the coastal reach extending from the City of Sheboygan north to the North County line, a lesser setback may be achieved for the principal building on an individual site where it is determined by a registered professional engineer or surveyor that the height of the bluff is less than fifty feet and, therefore, that the stable slope angle setback (2-1/2:1) would be less than the one hundred twenty-five feet established above. Measurement of the stable slope angle setback shall be made from the ordinary high water mark (OHWM) perpendicular to the shoreline. There shall be two such measurements for every one hundred feet of shoreline at points not less than fifty feet apart. The setback shall be a line connecting these two points, or such line extended. The Board of Adjustments may approve, as a variance under the provisions of Section 72.26 of this Code, a modification of the erosion hazard setback upon presentation by the applicant of acceptable engineering studies documenting:

A. Lower recession rates;

B. More stable slope conditions;

C. Plans for structural protection against wave attack; and

D. Plans for stabilization of the bluff or shoreline.…

(f) Stairways, Walkways, Piers, and Wharves. Stairways and walkways and that portion of piers and wharves landward of the ordinary high water mark (OHWM) are exempted from the shoreland setback requirements provided that the structure is necessary to access the shoreline because of steep slopes, impending turf

destruction and erosion, or wet, unstable soils. Further, the structure shall be located so as to minimize earth disturbing activities and shoreland vegetation removal during construction and to be visually inconspicuous and screened by vegetation as viewed from the adjacent waterway and public thoroughfares. The structure shall conform with all applicable handicapped accessibility requirements and unless inconsistent therewith, shall not be more than four feet (4') wide (outside dimension) for single- and two-family residential uses. For multi-family residential, commercial, industrial, institutional, and recreational uses, the four feet (4') standard may be exceeded only upon the granting of a Conditional Use Permit pursuant to Section 72.12 of this Code. Open railings are permitted only where required by safety concerns; canopies, roofs, and closed railings/walls on such structures are prohibited; stairways shall be supported on piles or footings rather than being excavated from erodible soils on steep slopes or a bluff face; and, landings are permitted only where required by safety concerns and shall not exceed forty (40) square feet in area for single- and two-family residential uses. For multi-family residential, commercial, industrial, institutional, and recreational uses, the forty (40) square feet standard may be exceeded only upon the granting of a Conditional Use Permit pursuant to Section 72.12 of this Code.

(g) Retaining Walls. Retaining walls and terracing shall only be allowed in the shoreline setback area where the applicant demonstrates that there is a current erosion problem that cannot be remedied by resloping and revegetation of the area or other means consistent with natural shoreline aesthetics. Walls and terracing shall only be permitted to the extent that they resolve a continuing erosion problem and shall not be used to provide level outdoor living space in the near-shore area. Elevated stairs or walkways shall be employed to provide shoreline access rather than terracing, as set forth in Subsection (1)(f), above.

(h) On-Site Private Sewage Disposal Systems. On-site private sewage disposal systems shall be set back at least fifty feet (50') from the ordinary high water mark (OHWM) of navigable waters, and shall fully conform with the requirements of the SANITARY ORDINANCE, Chapter 70, of this Code....

72.27 Definitions....

(66) Ordinary High Water Mark.... [F]or zoning purposes only, the Ordinary High Water Mark (OHWM) for the coastal reach of Lake Michigan extending from the City of Sheboygan south to the South County line shall be determined by an elevation at 582.7 feet NGVD (National Geodetic Vertical Datum, also known as MSL, Mean Sea Level), an elevation equivalent to 581.4 feet IGLD (International Great Lakes Datum), as determined by the Bureau of Water Regulation & Zoning, Wisconsin Department of Natural Resources. Elevations shall be determined by a registered professional surveyor, employing not less than five (5) uniformly distributed points of elevation, tied to a fixed reference point. The OHWM shall be a line connecting these points.

<http://www.co.sheboygan.wi.us/county_depts/cnty_clerk/office/code-book/ch72.PDF>

Ozaukee County

Chapter 7, Shoreland and Floodplain Zoning Ordinance…

Section 7.0300 Lot, Site, and Setback Requirements…

7.0308 Erosion Hazard Setback from Bluffs.

A. All Buildings and Structures in the Lake Michigan bluff area shall be set back the greater of the following distances:

1. A distance equal to a slope ratio of 2.5 feet horizontal distance to every one foot vertical distance, measured horizontally from the toe of the bluff, calculated using the most severe angle of slope as determined by a registered professional engineer or a surveyor and approved by the Zoning Administrator, and based on the following graph (see Figure 1). Measurement of the stable slope angle setback shall be made from the toe of the bluff perpendicular to the shoreline. There shall be two such measurements for every 100 feet of shoreline at points not less than 50 feet apart. The setback shall be a line connecting these two points, or such line extended.

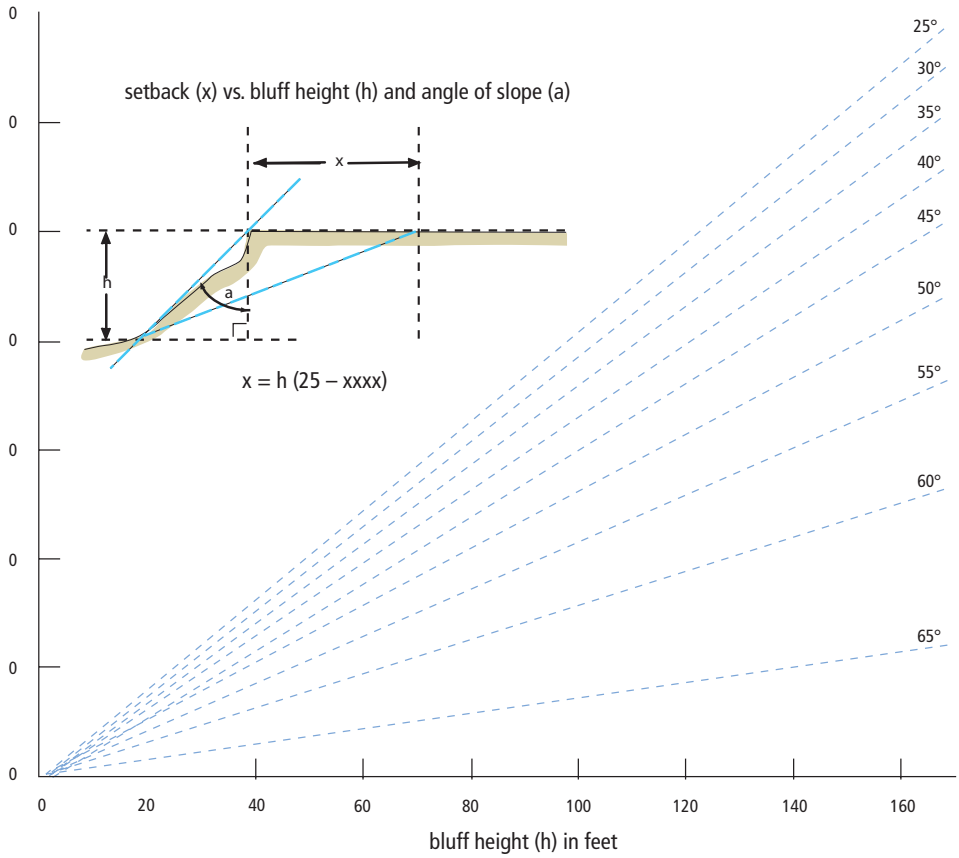
2. A minimum setback of 75 feet from the edge of any bluff.

B. Seepage Pits and Soil Absorption Fields in the Lake Michigan bluff area shall be set back a minimum of 75 feet from the edge of any bluff, unless a stipulated permit is granted in accordance with Section 7.0905 to allow a lesser setback.

7.0309 Erosion Setback from Ravines.

A. Except as set forth in Subsection B, all buildings, structures, seepage pits, and soil absorption fields shall be set back the greater of the following distances in the Lake Michigan ravine area:

1. A distance equal to a slope ratio of 2.5 feet horizontal distance to every one foot vertical distance measured horizontally from the toe of the ravine, calculated using the most severe angle of slope, as determined by a registered professional engineer or a surveyor and approved by the Zoning Administrator, and based on the following graph.



2. A minimum setback of 75 feet from the edge of any ravine.

3. When a detailed subsurface investigation report by a Wisconsin Registered Geotechnical Engineer indicates that a ravine is a stable formation; the setback shall be as recommended in the report, subject to a minimum setback of 40 feet from the edge of that particular ravine, and subject to the approval of the Board of Adjustment.

B. Setback from Shallow Ravines. In the case of shallow ravines in the Lake Michigan ravine area, all buildings, structures, seepage pits, and soil absorption fields shall be set back a minimum of 40 feet from the edge of the angle of repose based on a slope ratio of three feet horizontal distance to every one foot vertical distance. The vertical distance of a specific site is measured from the bottom of the ravine to the horizontal level of the land adjacent to the ravine.

<http://www.co.ozaukee.wi.us/PlanningResourcesLandManagement/PDF/CHAPTER7Zoning.pdf>

City of Mequon

Chapter 58, Planning and Development Regulations...

Article 4, Zoning...

Section 58-416, Building and structure location

(c) Setbacks.

(2) Setback from Lake Michigan Bluff. All permanent structures, including in-ground swimming pools erected or constructed after January 1, 1988, on property that is contiguous to Lake Michigan shall be set back from the top of the bluff a distance based on a slope ratio of two feet horizontal distance to every one foot vertical distance measured from the toe of the bluff. In no case, however, shall a building be set back less than 75 feet from the top edge of the bluff at the time of construction. Additions or alterations to structures that were erected or constructed prior to January 1, 1988, on property that is contiguous to Lake Michigan shall in no case reduce the existing setback from the edge of the top of the bluff to the existing structure.

All underground utilities including but not limited to sewer, water, gas, electric, or telephone shall be installed no closer than 75 feet from the top edge of the Lake Michigan bluff. Underground extensions of existing utilities shall not reduce the existing setback from the edge of the bluff if said utilities are closer than 75 feet to the top of the bluff. However, utilities located more than 75 feet from the top of the bluff may be extended underground to structures lacking the 75-foot setback from the top of the bluff. The city does not guarantee, warrant or represent that only those areas which lie within the required setback area from the top of the bluff will be subject to damage resulting from bluff erosion or instability and hereby asserts that there is no liability on the part of the common council, its agencies or employees for any damages that may occur as a result of reliance upon and conformance with this section.

<http://www.municode.com/Resources/gateway.asp?pid=13876&sid=49>

Milwaukee County

Village of Bayside

Chapter 14, Buildings and Building Regulations…

Sec. 14-5 Requirements for building on ravines and the bluff of Lake Michigan.

(a) **Purpose.** The regulations set forth in this section are established because of the danger of adding to the problem of erosion of the banks of the ravines and lake bluff and the possibility of disturbing the natural runoff of surface and percolating water; to promote the public health, safety and welfare; to preserve the natural beauty of ravines and bluffs, and to protect the ecological balance.

(b) **Basic restrictions.** Except as hereinafter provided, no building or structure shall be erected on or over the face or slope of ravines or of the lake bluff in the village.

(c) **Limitation of construction on bluff of lake lots.**

(1) All foundations or footings for any building or structure built on the lake bluff shall be on or below the surface of the flat area located at the top of the bluff.

(2) No building or structure may be built on the flat area of a lot at the top of the lake bluff unless a registered professional engineer has certified that in his or her opinion the footings and method of construction of the building and materials are adequate from an engineering standpoint so as not to disturb the natural runoff of surface and percolating water or create or add to a problem of erosion on the bank of the lake bluff and also so that any such excavation for the construction shall not adversely affect the structural integrity of any structure located on adjoining lots.

(3) The village manager or building inspector may require the applicant for a permit, as a condition of the granting of the building permit, specify that any structure or building shall be set back a specified number of feet from the edge of the bluff of the lake. Cantilever over the lake bluff is prohibited.…

(f) **Slope or foot of bluff or ravine.** Except for retaining walls, no structures or buildings (except for accessory buildings as defined in section 14-4) may be built wholly or partially on the slope, foot, plateau or level area below the bluff of Lake Michigan or any ravine in the village.

(g) **Retaining walls.** Retaining walls which are built solely and expressly for the purpose of preventing and retarding erosion and slippage of the lake bluff may be built. Application and plans for retaining walls must be prepared by a registered professional engineer. Before any such retaining wall is built, a building permit shall be obtained as for the construction of any other structure in the village. Plans for such retaining wall shall be submitted to the village manager. If in his or her opinion the footings and method of construction and materials are suitable to serve the purpose for which such retaining wall is being built and adequate provision is made for the flow of surface and percolating water, he or she shall notify the building inspector accordingly. No building permit shall be issued except in accordance with this subsection.

(h) **Restriction on cutting.** Wherever in the village the slope of the ravine or lake bluff averages 12 degrees or over, no one shall prune, cut, kill or remove any natural vegetation, including trees, shrubs, bushes, plants, flowers and grasses without first obtaining a permit as hereinafter provided.

(1) An application for the proposed pruning, cutting, killing or removing shall be filed with the village clerk, which application shall give the name of the owner and address of the property on which the work is proposed, and the name of the person, company or corporation who will do the work. The clerk shall refer the application to the village manager. The village manager shall examine the application and shall view the location of the proposed work. If after such viewing it is the opinion of the village manager that the proposed work is minor in nature and primarily for the improvement and care of the plant life involved, he or she shall issue the permit.

(2) If after the delivery of an application to the village manager and a view of the premises as above provided the village manager is of the opinion that subsection (1) above does not apply, he or she shall refer the matter to the architectural review committee. The architectural review committee shall consider the application at a duly called meeting; notice of the meeting shall be given to the applicant and to the owners of abutting lots. Such notice shall be in writing mailed not less than six days or delivered to a person on the premises not less than five days before the day of the meeting. Persons to whom notice is required to be given may attend the architectural review committee meeting and may be heard.

If upon the evidence produced at such meeting the architectural review committee is of the opinion that the proposed work will not increase erosion or slippage of soil or the danger thereof and will not unreasonably and unnecessarily damage or destroy the beauty of the natural vegetation, it shall direct that the requested permit be issued. Otherwise, it shall deny such permit or may modify the proposed work and authorize the issuance of a permit if the owner agrees to such modifications.

(3) The village manager may delegate his or her responsibility and authority under this section to the village building inspector.

(4) This subsection does not apply to the area on which a building or structure is authorized to be built, the perimeter of such area to be the outside of the foundation extended five feet in all directions, nor does it apply to the area reasonably required for a driveway.…

<http://www.municode.com/resources/gateway.asp?pid=13080&sid=49>

Village of Fox Point

Chapter 14, Zoning…

14.07 Accessory Uses and Structures…

(2) Permanent Structures…

4. Permanent Structures. Lake, Bluffs, Ravines. Where property abuts Lake Michigan, or is located on a bluff or a ravine in such a locale that construction of a fence, wall, architectural screening device, driveway gate or arbor would materially obstruct the aesthetic views of adjoining and surrounding property owners, the Building Inspector may deny a permit based upon his determination that there is a substantial negative impact upon the aesthetic enjoyment of surrounding properties. Any affected party may appeal the Building Inspector's determination to the Board of Appeals within thirty days of the Building Inspectors' determination. No fence, wall, architectural screening device, driveway gate or arbor shall be constructed on the side of a ravine or bluff in violation of … this Code.

<http://foxpoint.govoffice.com/vertical/Sites/%7B83EA0406-DD07-4114-A4A0-57078ECDDD72%7D/uploads/%7B64CD6E1D-702D-49AD-87AF-C39152B69C5F%7D.PDF>

Village of Whitefish Bay

Chapter 16, Zoning Code…

16.04 District 1 – Lake Shore Residence District…

(4) In the event that the property is on the bluff of Lake Michigan, the following requirements shall also apply:

(a) A registered professional engineer, having a minimum of ten (l0) years of geotechnical experience involving foundation investigation/engineering and shoreline slope stability evaluation, and who is hired by the owner of the lot, shall certify to the Village that the construction of any proposed building and structure(s) proposed to be located within l00' of the top edge of the bluff will be safe. Specifically, he shall certify that:

l. The design of any building or structure(s), the method of constructing such building or structure(s), and the materials used therefore are structurally adequate and will protect the public health and safety;

2. The proposed building and structure(s) will not in anyway adversely affect the structural integrity or safety of any building, or structure(s) located on adjoining or adjacent sites;

3. The proposed building and structure(s) will not adversely disturb ravine and bluff slopes, interfere with surface or subsurface drainage, or create new or exacerbate existing problems of erosion and recession;

4. The drainage system will not adversely affect the adjacent and adjoining properties;

5. There is no danger to the proposed or existing buildings or structures and its occupants from slippage of the slope above and/or below the proposed structure.

(b) The engineer shall make a technical report accompanying the certificate which shall include at a minimum:

l. Recommendations regarding site preparation, foundation design, lateral earth pressure and support of slabs on grade;

2. The stability of the slope before, during, and after construction;

3. The effect of the construction on the natural drainage in the areas including any measures, such as "weepers" which are designed to improve natural drainage in the area.

(c) The owner of the property shall certify to the Village that he/she is aware of potential problems of lake shore erosion, including but not limited to the possibility of adding fill of various types to stabilize the bluff area, is aware of the requirement for securing of a fill permit from the Village for any such filling, is aware of the provisions of said fill permit ordinance, and is further aware of the potential cost involved.

(d) A memorandum of said certifications, including the legal description of the property, shall be recorded with the Register of Deeds of Milwaukee County.

<http://www.village.whitefish-bay.wi.us/Zoning/Chapter16Zoning%20Code.pdf>

Village of Shorewood

Chapter 8, Land Divisions, Zoning and Planning…

Article 3, Zoning…

Section 8- 304 Zoning Districts…

1. R-1 Lake Drive Residence District No. 1

Principal Use: One-Family Dwellings

Conditional Uses: See Section 8-305

Lot: Width Minimum: 100 ft. (on N. Lake Drive)

Area Minimum: 24,000 square ft.

Building: Area Minimum: 1200 square ft.

Height Maximum: 30 ft.

Setback: Front Minimum: 100 ft.

Side Minimum: 10 ft.

Rear: See specific requirements for bluff areas which follow hereafter

Lot Coverage: Maximum: 30% of land area for principal structure plus up to 10% for accessory structure

Additional Requirements:

Land Divisions, Zoning and Planning. All land between the water's edge of Lake Michigan and elevation 680 ft. mean sea level, shall not be included as part of the required land area under Sec. 8-304F.3.b of the Village Code. The rear setback shall be at least such distance as to insure the stabilization of the bluff area; sufficient distance from the bluff area as to prevent injury or damage to adjacent property; sufficient distance from the bluff area to provide for the natural runoff of surface and percolating water or provide for an approved drainage according to applicable law. A registered professional engineer hired by the owner of the lot shall certify to the Village that the footings and method of constructing any building or structure and the materials used therein are adequate from an engineering standpoint so as not to adversely disturb the natural runoff of surface and percolating water or create or add to a problem of erosion on the bank of the lake bluff and shall not adversely affect the structural integrity of any structure located on adjoining or adjacent lots.…

R-4 Lake Drive Residence District No. 4

Principal Use One Family Dwellings

Conditional Uses: See Section 8-305

Lot: Width Minimum: 60 feet

Area Minimum: 18,000 square feet

Building: Area Minimum: 1200 square feet

Height Maximum: 30 feet

Setback: Front Minimum: 25 feet or the average of existing setbacks on the east side of N. Lake Drive as established between the two closest intersecting streets extended, whichever is greater.

Side Minimum: 5 feet

Rear: See specific requirements for bluff area which follow hereafter.

Lot Coverage: Maximum: 30% of lot for principal structure; plus up to 10% for accessory structure.

Additional Requirements:

All land between the water's edge of Lake Michigan and elevation 680.00 feet mean sea level shall not be included as part of the required land area under Sec. 8-304F.3.b of the Village Code.

The rear setback shall be at least such distance as to insure the stabilization of the bluff area; sufficient distance from the bluff area as to prevent injury or damage to adjacent property; sufficient distance from the bluff area to provide for the natural runoff of surface and percolating water or provide for an approved drainage according to applicable law. A registered professional engineer hired by the owner of the lot shall certify to the Village that the footings and method of constructing any building or structure and the materials used therein are adequate from an engineering standpoint so as not to adversely disturb the natural runoff of surface and percolating water or create or add to a problem of erosion on the bank of the lake bluff and shall not adversely affect the structural integrity of any structure located on adjoining or adjacent lots.

<http://villageofshorewood.org/vertical/Sites/%7B5230848F-4209-4497-9E80-89EC90BA64AE%7D/uploads/%7B3B04B327-E4D9-4F8F-930B-B0A4F98B8E23%7D.PDF>

City of Milwaukee

Chapter 295, Zoning Code…

Subchapter 10, Overlay Zones…

295-1015 Lakefront Overlay Zone (LF). 1. Purpose. The lakefront overlay zone is established to accommodate a wide variety of public and quasi-public facilities providing recreational and cultural opportunities and supporting services that require lakefront sites.…

<http://cc-codenew.milwaukee.gov/code/volume2/ch295-sub10.pdf>

Racine County

Chapter 20, Zoning…

Article 6 District Regulations…

Division 1 Generally…

20-217 Setback Overlay Districts…

(a) Boundaries of the structural and nonstructural setback overlay districts shall be determined as follows. The boundaries of the SSO structural setback overlay district shall be determined through the use of the following equation establishing a setback distance from the existing Lake Michigan bluff edge:

SSO structural setback overlay district distance = Horizontal distance required to achieve one on two and one-half stable bluff slope + Minimum facility setback distance

(b) The stable slope distance and the minimum facility setback distance are described in section 20-916 et seq.

(c) The boundaries of the NSO nonstructural setback overlay district shall be determined through the use of the following equation establishing a setback distance from the existing Lake Michigan bluff edge:

NSO nonstructural setback overlay district distance = Horizontal distance required to achieve one on two and one-half stable bluff slope + (Average annual bluff recession rate x 50 years) + Minimum facility setback distance…

Division 36 SSO Structural Setback Overlay District.

Sec. 20-916 Purpose: The SSO structural overlay district is intended to be used to protect people and property from shore erosion damage in Lake Michigan shoreland areas which are recommended to be protected by properly designed, constructed and maintained shore protection structures.

Sec. 20-917 Application: The SSO structural overlay district applies to those Lake Michigan shoreline areas which are located south of the northern one-half of Township 4 North, Range 23 East, Section 8, in the Town of Caledonia and Mt. Pleasant. In addition, the SSO district applies to the northernmost one thousand three hundred (1,300) feet of Lake Michigan shoreline in Section 6 of the Town of Caledonia, Township 4 North, Range 23 East, which is covered by fly ash deposits. All new development within this overlay district shall be adequately protected by properly designed, constructed, and maintained shore protection structures or measures. Such structural protection structures or measures shall meet the criteria established in Recommendations of the Racine County Technical Subcommittee on Shoreland Development Standards to the Racine County Land Use Committee, 1982.

Sec. 20-918 Stable slope: (a) In delineating the SSO structural setback overlay district, the required recession or regrading of the bluff needed to form a stable slope, plus a minimum facility setback distance, shall be computed. The provision of the stable slope provides protection against further major bluff recession, as long as the shore protective structures are effective. This stable slope distance is measured from the existing bluff edge. The minimum facility setback distance is then measured from the edge of the regraded bluff needed to form a stable slope. The minimum facility setback distance provides a safety factor against possible failure of the protective structures during extreme storm events or other natural occurrences, and provides a buffer area which helps protect the regraded bluff edge from excessive surface water runoff and from the potential bluff instability which could be caused by the additional weight of buildings being placed close to the bluff edge. In addition, the minimum facility setback distance provides an area which may be effectively utilized to facilitate surface water and subsurface water drainage and control.

(b) The distance required to achieve a one (1) on two and one-half (2 1/2) stable slope is set forth in Table 12, page 65, of SEWRPC Community Assistance Planning Report No. 86, A Lake Michigan Coastal Erosion Management Study for Racine County, Wisconsin, and shall be used to determine the stable slope distance. Minimum facility setback distances measured from the edge of the net stable slope distance shall be as follows:

(1) Two hundred (200) feet for all structures except public utilities, public recreational facilities and single-family residential units.

(2) One hundred (100) feet for public utilities, public recreational facilities, and single family residential units. The minimum setback distance may be reduced in areas of existing facility development to be at least the average distance from the edge of the net stable slope distance to adjacent principal structures located on abutting parcels (excluding public right-of-ways and easements), although the minimum setback distance shall not be less than fifty (50) feet from the edge of the net stable slope distance. If an abutting parcel is vacant, a setback of one hundred (100) feet will be assumed for purposes of averaging.

Sec. 20-919 Modification: The calculated SSO structural setback overlay district distance may be modified upon submittal by an applicant or property owner of acceptable engineering analyses which indicated that the required distance for a stable slope is different than as defined in SEWRPC Community Assistance Planning Report No. 86, or that the height of the bluff is different than the assumed height.

Sec. 20-920 Permitted uses: The following uses are permitted in the SSO structural setback overlay district:

(1) *Principal uses.* Surface and subsurface water drainage and control; general farming activities, not including the erection of structures; open space; outdoor recreation; yard; storage of portable equipment and supplies; accessory buildings such as storage sheds; and minor structures such as driveways, sidewalks, patios and fences.

(2) *Conditional uses.* Tree cutting and shrubbery clearing, land disturbance and earth movements, and shore protection structures. See section 20-1291.

Sec. 20-921 Structures prohibited: New, permanent or relocatable residential, institutional, commercial, industrial, and agricultural structures designed for human habitation or the confinement of animals are prohibited in the SSO structural setback overlay district.

Division 37 NSO Nonstructural Setback Overlay District.

30-941 Purpose: The NSO nonstructural setback overlay district is intended to be used to protect people and property from shore erosion damage in Lake Michigan shoreland areas which are not protected by properly designed, constructed, and maintained shore protection structures.

30-942 Application: The NSO nonstructural setback overlay district applies to those Lake Michigan shoreline areas which are located north of the southern one-half of Township 4 North, Range 23 East, Section 8, Town of Caledonia, except for the northernmost one thousand three hundred (1,300) feet of Lake Michigan shoreline in Section 6 of the Town of Caledonia, which is covered by fly ash deposits.

30-943 Stable slope: (a) In delineating the NSO nonstructural setback overlay district, the expected bluff recession over a fifty-year period, plus the required recession, or regrading the bluff needed to form a stable slope, plus a minimum facility setback distance from the regraded bluff edge, shall be computed. The NSO district thus includes those Lake Michigan shoreland areas which, based on historical bluff recession rates, are expected to be lost due to bluff recession, and the formation of a stable slope, over a fifty-year period, plus a minimum facility setback distance.

(b) The distance required to achieve a one (1) on two and one-half (2 1/2) stable slope is set forth in Table 12, page 65, of SEWRPC Community Assistance Planning Report No. 86, A Lake Michigan Coastal Erosion Management Study for Racine County, Wisconsin, and shall be used to determine the stable slope distance. Minimum facility setback distances measured from the edge of the net stable slope distance shall be as follows:

(1) Two hundred (200) feet for all structures except public utilities; public recreational facilities and single-family residential units.

(2) One hundred (100) feet for public utilities, public recreational facilities, and single-family residential units. The minimum setback distance shall be reduced in areas of existing facility development to the average distance from the regraded bluff edge to adjacent structures within one hundred (100) feet of the structure, although the minimum setback distance shall not be less than fifty (50) feet from the edge of the net stable slope distance.

30-944 Modifications: The calculated NSO nonstructural setback overlay district distance may be modified upon submittal by an applicant or property owner of acceptable engineering analyses which indicate that the actual bluff recession rate is different than as set forth in SEWRPC Community Assistance Planning Report No. 86, that the required distance for a stable slope is different, or that the height of the bluff is different than the height presented in the report.

30-945 Permitted uses: The following uses are permitted in the NSO nonstructural setback overlay district:

(1) *Principal uses.* General farming activities, not including the erection of structures; open space, outdoor recreation; yard; storage of portable equipment and supplies; accessory buildings such as storage sheds; and minor structures such as driveways, sidewalks, patios and fences.

(2) *Conditional uses.* Tree cutting and shrubbery clearing, land disturbance and earth movements, shore protection structures, and the placement of structures or buildings which may be relocated at a cost not to exceed 30 percent of the equalized value of the structure.

30-946 Structures prohibited: New, permanent residential, institutional, commercial, industrial and agricultural structures designed for human habitation or the confinement of animals are prohibited in the NSO nonstructural setback overlay district.…

Article 7 Supplementary District Regulations and Requirements…

Division 3. Shoreland…

Sec. 20-1041. Relocatable structures.

Within the NSO nonstructural setback overlay district, relocatable structures may be allowed as a conditional use provided that:

(1) The property extends sufficiently outside the NSO nonstructural setback overlay district so that the structure can be relocated outside the NSO district in the future; and

(2) The structure is certified by a professional building moving contractor as being relocatable at a cost not exceeding thirty (30) percent of the estimated equalized value of the structure.

This conditional use requires review, public hearing, and approval by the planning and development committee and approval by the zoning administrator in accordance with section 20-1141 et seq. Relocatable structures are not allowed as conditional uses within the SSO structural setback overlay district.…

Sec. 20-1045. No structure permitted within shoreland setback area.

Within the shoreland setback area in conformance with the regulations of the Wisconsin Department of Natural Resources, no structures are permitted. "Structures" includes fences, ice fishing shanties, accessory buildings other than boathouses, minor structures, and any retaining wall not approved by the Wisconsin Department of Natural Resources.

Sec. 20-1046. Mitigated shore yard structure.

Not withstanding section 20-1045 above, special zoning permission shall be granted for the construction or placement of a structure on property in a shore yard setback area if all of the following apply:

(1) The part of a structure that is nearest to the water is located at least thirty-five (35) feet landward from the ordinary highwater mark.

(2) The total floor area of all of the structures in the shore yard setback area of the property will not exceed two hundred (200) square feet. In calculating this square footage, boathouses shall be excluded.

(3) The structure that is the subject of the request for special zoning permission has no sides or has open or screened sides.

(4) Once the location of the structure is approved by the county, a plan must be submitted by the applicant(s) for county approval. The plan must be implemented by the owner of the property to preserve or establish a vegetative buffer zone that covers at least seventy (70) percent of the half of the shore yard setback area that is nearest to the water. The plan shall contain the following information:

a. Location of mitigated structure.

b. Location of vegetative buffer.

c. Number, type and size of proposed native vegetation to be installed or identification of existing plant/materials to be maintained.

d. Installation schedule/deadline.

e. Erosion control measures.

f. Maintenance plan to replace dead/diseased vegetation.

g. Before and after photographs of vegetative buffer area.

h. Description of how the project is to be implemented.

(5) The structure meets the height and street, side and rear yard setback requirements for the zoning district in which it is located.

(6) The structure shall not be used for principal or accessory uses not allowed in the district.

(7) Such structure shall be colored in earth tones to decrease the visual intrusion near the natural shoreline.

For purposes of this section, special zoning permission includes, but is not limited to the following: shoreland contract, conditional use, special exception, special permit, zoning variance, conditional permit and words of similar intent....

Article 8 Conditional Uses...

Division 8. Shoreland Uses...

Sec. 20-1294. Shore protection structures.

(a) Shore protection structures for the Lake Michigan shoreline include such items as groins, revetments, breakwaters, bulkheads, and piers, and may be permitted. All such structures shall meet the criteria set forth in recommendations of the Racine County Technical Subcommittee on Shoreland Development Standards to the Racine County Land Use Committee, 1982.

(b) The planning and development committee or the zoning administrator shall request a review of such shore protection structures by the county technical subcommittee on shoreland development standards and await their recommendations before taking final action, but not to exceed sixty (60) days.

Sec. 20-1295. Relocatable structures.

(a) The placement of relocatable structures or buildings within the NSO district may be permitted.

(b) The property owner shall submit a report from a professional building moving contractor certifying that the structure can be feasibly moved at a cost not to exceed thirty (30) percent of the equalized value of the structure. In addition, the property shall extend sufficiently outside the NSO district so that the structure can be relocated in the future outside the NSO district. Relocatable structures are not permitted within the SSO structural setback overlay district.

<http://www.municode.com/Resources/gateway.asp?pid=12370&sid=49>

Village of Wind Point

[The village's zoning ordinance includes shore yard setback requirements for each use district. Wind Point requires a minimum 100-foot setback for shore yards.]

http://www.windpointwi.us/dms/dm_browse.asp?pid=39

Kenosha County

Chapter 12. General Zoning and Shoreland/Flood Plain Zoning Ordinance.

[The shoreland setback requirements are contained in the standards for each use district. Kenosha County follows the minimum 75 foot setback for all uses other than for landfills and extraction uses which require greater setbacks.]

12.29-4 Conditional Uses. Application

(b)(4) For shoreland and floodland conditional uses, such description shall also include information that is necessary for the County Land Use Committee to determine whether the proposed development will hamper flood flows, impair floodplain storage capacity, or cause danger to human, animal or aquatic life. This additional information may include plans, certified by a registered professional engineer or land surveyor, showing existing and proposed elevations or contours of the ground; fill or storage elevation; basement and first floor elevations of structures; size, location, and spatial arrangement of all existing and proposed structures on the site; location and elevation of streets, water supply and sanitary facilities; aerial photographs, and photographs showing existing surrounding land uses and vegetation upstream and downstream; soil types and any other pertinent information required by either the Land Use Committee or the Office of Planning and Zoning Administration.

<http://www.co.kenosha.wi.us/corpc/ordinances/MCKC12.pdf>

Village of Pleasant Prairie

Chapter 420 Zoning Ordinance…

ARTICLE XV Shoreland Regulations

§ 420-91. Use, site and sanitary regulations.

All applicable use, site, or sanitary restrictions and regulations shall apply to shorelands in addition to those listed below.

§ 420-92. Tree cutting and shrubbery clearing.

Tree cutting and shrubbery clearing within 100 feet of the ordinary high-water mark of all navigable waters are prohibited except for home site development, as defined in this chapter, and park site development; access roads; path and trail construction; timber stand improvement; customary trimming; dead tree removal; and managed timber harvesting under a State District Forester's Plan. Such tree cutting and shrubbery clearing shall not involve the clear-cutting of more than 30 feet in any 100 feet, as measured along the ordinary high-water mark, and shall be so regulated as to prevent erosion and sedimentation, preserve and improve scenic qualities, and during foliation substantially screen any development from stream or lake users. Paths and trails shall not exceed 10 feet in width and shall be so designed and constructed as to result in the least removal and disruption of shoreland cover and the minimum impairment of natural beauty.

§ 420-93. Earth movements.

Earth movements, such as installing shore protection, altering or enlarging of waterways, removing stream or lake bed materials, channel clearing, dredging, lagooning, grading, removing topsoil, filling, road cutting, ditching, and installing soil and water conservation structures, shall require a stipulated shoreland permit.

§ 420-94. Structures.

All structures, except navigational aids, piers and boat launching facilities, shall not be closer than the shore yard distance as specified in each district of this chapter.

§ 420-95. Tillage and grazing.

Tillage, grazing, livestock watering and feeding and application of fertilizers shall be prohibited unless conducted in accordance with applicable county, state and federal laws and regulations and unless conducted in such a manner as to safeguard the health, safety and welfare of individuals and animal and aquatic life in the surrounding environment.

§ 420-96. Water withdrawal and diversion uses.

Surface water withdrawal, diversion, or discharge for irrigation, processing, cooling or other purposes shall require a stipulated shoreland permit.

§ 420-97. Crop production.

Crop production on lands with an erosion factor of three or more is prohibited, and such lands shall be planted with permanent vegetation.

§ 420-98. Wisconsin Shoreland Management Program.

The use of any parcel of land located within the county's designated shoreland-floodplain area shall be conducted in accordance with the provisions of Ch. NR 115, Wis. Adm. Code, Wisconsin's Shoreland Management Program, and in the case of conflict between this chapter and the Wisconsin Administrative Code (Ch. NR 115), the provision with the greater restriction shall apply.

§ 420-99. Stipulated shoreland permits.

Notwithstanding the other requirements set forth in this article, the Zoning Administrator shall issue a stipulated shoreland permit for those uses listed in §§ 420-93 and 420-96, provided that the use shall not be susceptible to flooding, concentrated runoff, inadequate drainage, adverse soil and topographic conditions or any other feature likely to be harmful to the environment or the public interest. Detailed plans and specifications shall be submitted with the required application, and the Village may require plans to be prepared and certified by a Wisconsin registered land surveyor and a professional engineer. The Zoning Administrator shall mail notice by first class mail to the last known address of the applicant, the owner of the subject lot or site, the owners of all

real property located within 300 feet of said property, and to the Wisconsin Department of Natural Resources. Failure of any person to receive actual notice of the request shall not invalidate any action taken by the Zoning Administrator. Written comments shall be submitted to the Zoning Administrator regarding the application within 20 days from the date that the written notice is mailed. In addition, the petitioner shall obtain all required permits from the Wisconsin Department of Natural Resources and the United States Army Corps of Engineers, if applicable, for the proposed project prior to the Zoning Administrator issuing the stipulated shoreland permit. The Zoning Administrator shall not issue the stipulated shoreland permit until the applicant agrees to the stipulations and such stipulated shoreland permit is filed and recorded in the Kenosha County Register of Deeds office. The Zoning Administrator shall notify the Wisconsin Department of Natural Resources prior to the issuance of all stipulated shoreland permits.

[Shore setbacks are established in each zoning district in the zoning ordinance. The Village follows the 75 foot setback.]

<http://www.e-codes.generalcode.com/codebook_frameset.asp>

Sea Grant
University of Wisconsin

UW Extension
University of Wisconsin–Extension