



BEST PRACTICES IN GREAT LAKES SHORELINE MANAGEMENT:

A Guide for Michigan Municipalities



Developed by Michigan Sea Grant
and University of Michigan
Sustainability Law Clinic

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This guide is meant to assist Michigan's coastal municipalities in developing policies that protect assets from the effects of shoreline erosion, lake level fluctuations, and flooding with a particular focus on the damaging impacts of private shoreline armoring. In addition, it describes policy approaches to shoreline management and summarizes example ordinances currently in place.

0. Choosing How to Respond

0.1. Acknowledging Trade-Offs

This guide describes different approaches and lists various examples of how to address the issue of private shoreline armoring along Michigan's coastline. It is important to note, however, that any armoring is, at best, a temporary and partial solution to one property owner's problem, and it will inevitably negatively impact nearby property owners as well as local governments and the coastal ecology.

Great Lakes coastal shorelines are naturally dynamic and go through cycles during which they move landward and lakeward. Over time, as each cycle is complete, much of Michigan's Great Lakes shorelines are slowly but surely receding landward. Both the American and Canadian governments have said that coastal shorelines contain "particularly diverse and valuable habitat" with ecological communities that can only be protected by "preserving the processes that sustain them."¹ Seawalls, revetments, and other armoring structures disrupt those natural processes and harm the ecology. Additionally, these structures:

[A]ccelerate erosion of shorelines on neighboring shoreland properties not similarly armored; scour and move sediments into deep water away from the armoring, such that the natural, walkable, and ecologically productive beaches and dunes lakeward of the structure are ultimately lost so long as the structure is maintained; ultimately fail unless periodically maintained at substantial, ongoing, long-term expense; and finally

¹ Referenced in Ron Reid & Karen Holland, *The Land by the Lakes: Nearshore Terrestrial Ecosystems* 2-3 (1997).

leave debris in nearshore waters when they fail if not fully removed, threatening safety and navigation.²

Some communities will want to prohibit future armoring and phase out any existing armoring. Others will decide that, for political, social, or other reasons, they will adopt an approach that limits armoring, prescribes its location, or otherwise regulates it, even if this decision results in harm to the natural system. If communities understand the impacts of armoring and the tradeoffs of allowing any form or amount of it, then they can make informed decisions about which policy tools to apply.

0.2. Determining Level of Response

As a very first step, given the variation in development and armoring along the shoreline, identifying the level of armoring or development for the area in question will help guide the policy response. Four general categories found along naturally receding shorelines and potential management policies include:

1. **Substantially developed and armored** – where development meets public trust interests (e.g., dense urban development, critical public facilities).
 - Possible Response: Allow to maintain armoring.
2. **Partially developed and/or armored** – where development meets public trust interests (e.g., dense urban development critical facilities).
 - Possible Response: Allow new and maintained armoring.
3. **Partially developed with partial to limited existing armoring** – where development primarily serves private interests with little public trust interest (no critical public facilities, primarily shorefront residential development).
 - Possible Response: Prohibit new armoring and require removal of existing armoring as it fails; require relocation (perhaps facilitate) as structures become threatened.
4. **Minimally to partially developed with no armoring** – where development primarily serves private interests with little public trust interest (no critical public facilities, primarily shorefront residential development).
 - Possible Response: Prohibit armoring; allow only truly moveable structures within moving shoreline setbacks (i.e., that move landward as shorelines recede); require relocation as structures become threatened.

0.3. Engaged Decision-Making

Determining a suitable policy option for long-term management should include community engagement focused on education about the long-term implications of various choices, especially more protective measures, and may require consultation of experts. Communities can use available online tools and consult with experts to determine the level of armoring and

² Richard K. Norton et al, *Armor or Withdraw? Likely Litigation and Potential Adjudication of Shoreland Conflicts Along Michigan's Shifting Great Lake Coasts*, 12 Mich. J. Env'tl. & Admin. L. 153, 160 (2023) ("Norton article") (citations and references omitted here but available in the article).

development along the coastline, the rate of erosion, and future shoreline scenarios for different management approaches. [Michigan Sea Grant's Extension Educators](#) can help connect communities with experts and provide support throughout the process. [Michigan's Coastlines Through Time](#) also may be a helpful tool.

Deciding the future of the shoreline should not be taken lightly and should include extensive education and input from community members. Community engagement events (meetings, educational webinars, field trips, etc.) can be held to share information about coastal erosion, management, and long-term implications. It is recommended that community engagement exceed the required notice of public hearing before voting. An overview of policy-making steps may be found in [Section 5](#).

1. Ban Shoreline Armoring

In areas with shorelines that are of relatively high public trust value, banning new shoreline armoring can be a clear and effective strategy for maintaining ecological function and accessible, natural beaches. This section outlines variations and examples of such a strategy.

1.1. Draft an ordinance prohibiting shoreline armoring.

Ideal shoreline armoring programs involve four elements:

1. Considering the shoreline types and tradeoffs noted above, prohibit the installation of permanent hard shoreline armoring (e.g., seawalls, revetments) where public interests would not be served by armoring and could cause substantial harm to natural features, and prohibit the installation of temporary "soft" shoreline armoring (e.g., geotextile tubes), mandating the removal of those soft structures when no longer necessary or if and when they begin to cause substantial damage to natural shoreline features.
2. If a locality decides not to prohibit shoreline armoring altogether, either jurisdiction-wide or along given stretches of shoreline, then implementing living shoreline systems where feasible and public trust interests are served is an option;
3. Similarly, implementing accommodation for armoring only where feasible and public trust interests are served; and
4. Similarly, implementing shoreline nourishment only where public trust interests are served and where sand sources for nourishment can be obtained at reasonable cost and without causing ecological harms.

New York State drafted model ordinances showcasing different methods of restricting shoreline armoring. See Section 3.4.2 of the [model code](#). Note that language may need to be adapted to fit the local administrative structure and municipal deference to Michigan's Department of the Environment, Great Lakes, and Energy (EGLE) under Michigan's Natural Resources and

Environmental Protection Act (NREPA). Adopters should also consider adding clear language prohibiting seawalls and other hardened armoring.

Considerations³: Expressly prohibiting shoreline armoring provides the greatest protection for the coastal environment and natural habitats. Although new ordinances may apply prospectively to new projects, they may require special language to apply retroactively and permit condemnation of preexisting, non-compliant structures. If preexisting structures are allowed to remain intact, then unarmored adjacent properties may suffer accelerated shoreline degradation, and property owners may protest the ordinances restricting their protective action.

1.1.1. Ban permanent private shoreline armoring but allow temporary methods.

[Chikaming, MI](#): In the Beach Overlay District (Ordinance 147 [list](#) and [static page](#)), permanent shoreline armoring structures are prohibited. Geotextile tubes or sandbags are allowed with a one-year permit if the property owner establishes that a primary shoreland structure is endangered by shoreline erosion and such measures would slow erosion or flooding. The permits renew automatically for five years unless the township declares the temporary structures hazardous or unnecessary. Property owners must restore any damage caused to the shoreline by the sandbags or geotextile tubes.

[Grand Haven, MI](#)⁴: In the Beach Overlay District, permanent shoreline armoring structures are prohibited. Only temporary fencing, geotextile tubes, or sandbags are permitted to prevent erosion during extreme high water periods, but they must be dismantled when the water recedes below the ordinary high water mark. Property owners can seek a variance if the ban creates unnecessary hardship for or effectively prevents the use of the lot, though this kind of variance can undermine the prohibition if construed broadly.

1.1.2. Ban private “hard” shoreline armoring but allow methods of “soft” armoring.

Soft armoring may involve living shorelines, which could include vegetation, low rock fills or oyster reefs, sediment bluffs with logs, and gravel beaches. The National Oceanic and Atmospheric Administration (NOAA) has [helped](#) three Great Lakes communities implement living shoreline projects using vegetation and/or biodegradable materials.

It is worth noting that in high-energy systems, such as much of Michigan’s Great Lakes shoreline, soft armoring may not provide protection for an extended period of time; expecting soft armoring to effectively withstand all wave energy is likely unrealistic. Augmenting soft armoring to withstand these natural dynamics can effectively convert soft armoring to hard armoring.

[Sanibel, FL](#): Unless expressly permitted in specific zones, construction of rigid structures that redirect wave action or impede accretion are prohibited. Ecological alternative shoreline stabilization projects are permitted along natural waterbodies other than the Gulf of Mexico; they are prohibited in the Bay Beach Zone unless the design encourages shoreline accretion.

³ See the Norton article generally for a detailed description of legal considerations.

⁴ The Beach Overlay District ordinances are complemented by the following general land/environmental ordinances in Sec. [16-2](#), [37-167](#), [40-116](#), and [40-422](#) of Grand Haven’s Code.

Stabilization projects must be designed to protect existing shoreline vegetation, and new native vegetation must be planted where none previously existed.

1.2. Draft a general ordinance *effectively* prohibiting shoreline armoring.

Some communities have not explicitly addressed shoreline armoring in their codes, but their preexisting zoning or police ordinances effectively restrict or regulate the construction or maintenance of shoreline armoring structures.

Considerations: Owners may protest the validity of structure condemnation by claiming that the ordinances were not foreseeably applicable to such constructions. Additionally, in the case of public nuisance laws, municipalities may only be able to enforce the law *after* construction via expensive legal action.

1.2.1. Establish shoreline setback rules applicable to armoring structures.

Shoreline setback rules may take the form of fixed setbacks, tiered setbacks, erosion-based setbacks, or erosion and lot depth-based setbacks.

[Fort Gratiot, MI](#): Construction of permanent structures on high-risk erosion areas requires a shoreline setback permit from the building inspector.

Considerations: Along a stretch of shoreline that is naturally receding landward over time, establishment of a fixed setback will eventually fail to provide protection of the shoreline, as the shifting shoreline meets the setback. In such settings, use of some kind of erosion-based setback, where the setback moves landward along with the corresponding shoreline, should be considered.

1.2.2. Establish public nuisance laws applicable to armoring structures.

The City of Del Mar, California, has [ordained](#) that nonconforming structures within the Beach Overlay Zone constitute a public nuisance subject to abatement. Accordingly, it has [declared](#) certain seawalls and rip rap to be public nuisances due to their encroachment on and obstruction of public beach and has exercised its power of eminent domain to condemn the structures.

The City of Pacifica, California, maintains an [ordinance](#) declaring the following a public nuisance:

Land, the topography, geology or configuration of which whether in natural state or as a result of the grading operations, excavation or fill, causes erosion, subsidence, or surface water drainage problems of such magnitude as to be injurious or potentially injurious to the public health, safety and welfare or to adjacent properties.

It does not appear to have relied on this ordinance yet to condemn private seawalls, but the scenario of one property owner's seawall injuring adjacent properties (e.g., via accelerated erosion and flooding) is not inconceivable.

2. Regulate Shoreline Armoring

For coastlines that are partially developed/armored, the menu of regulatory options is vast and municipalities can: require nonstructural erosion control techniques before any structural controls are permitted; develop a permit system with conditions on approval; or control the height, length, thickness, composition, shoreline setback distance, and distance from neighboring property lines of hard armoring structures.

Considerations: These permissive options will ultimately lead to long-term shoreline degradation and destruction of the surrounding environment by disrupting sediment transport and reducing species habitats. The unavoidable result is a miles-long seawall separating the municipality from the Great Lakes: when one neighbor erects a structure, they accelerate the erosion of neighboring shores, and neighbors see no choice but to erect their own protection, triggering a domino effect.

[Norton Shores, MI](#): Construction of seawalls, revetments, and groins requires a building permit. All structures must be of a height, color, and material that does not detract from the “natural beauty of the shoreline.” Removal of natural shore cover is prohibited.

[Seattle, WA](#): Non-structural measures are required unless insufficient or infeasible, under which conditions soft stabilization is required over hard stabilization, unless insufficient or infeasible. Soft shoreline stabilization is allowed with a permit. Hard shoreline stabilization is subject to a shoreline conditional use permit or special use permit depending on the zone. Homeowners in geologically hazardous areas must demonstrate that no alternatives, including reconstruction or relocation, are feasible and less expensive. Soft stabilization measures must be of minimum size necessary, and they may extend waterward of the ordinary high water mark if they do not move that mark waterward. Hard stabilization is banned, unless it is of minimum size necessary and a geotechnical report shows that the existing structure is in imminent danger of erosion damage; upland conditions are not causing the erosion; nonstructural measures or soft stabilization measures would be insufficient or infeasible; hard stabilization would mitigate or prevent structural damage; and hard stabilization will not adversely impact adjacent properties. While this ordinance bans most hardened armoring, permits for hardened shorelines that meet all the above exceptions are not uncommon.

3. Limit Future Shoreline Development

In addition to banning shoreline armoring, one of the first defensive mechanisms that municipalities can take is preventing permanent, not-readily-moveable near-shore development where it has not yet occurred. If residents and businesses cannot place themselves in danger of near-term erosion, then they will have no future need to armor the shoreline. Note that restricting high-hazard development settings requires planning and zoning regulation, which in turn requires notice, comment, and other procedures dictated by the Michigan Planning and Zoning Enabling Acts.

Coastal communities face risk from a minimum of three water-related sources during a storm event: (1) inundation from Great Lakes waters (i.e., storm surge); (2) wave action damage from Great Lakes waters; and (3) inundation from upstream waters draining into the Great Lakes. Limiting shoreline development can reduce these negative impacts. While the elevation requirements mentioned in the ordinances below were developed via FEMA for riverine and inland lake flooding, nothing prohibits coastal communities from adopting stricter elevation standards to further protect from Great Lakes' storm surge. Future updates to these elevation standards may come with improved mapping of FEMA's [Great Lakes Coastal Flood Study](#).

Considerations: While buffer requirements may be imposed retroactively to existing homes, setback and elevation requirements are relevant only for *new* developments. Existing homes remain endangered by rising lake levels and naturally landward receding shorelines, and homeowners may seek armoring methods to protect their assets. As such, shoreline development restrictions may yield the best results when paired with shoreline armoring restrictions.

3.1. Implement setback or buffer requirements.

The University of Wisconsin Sea Grant Program developed a [model setback ordinance](#) for bluffs along Lake Michigan, which may be adaptable to Michigan beaches. Communities developing setback requirements should consider using the flexible natural ordinary high water mark (OHWM) as a reference point rather than the more rigid elevation OHWM.⁵

[Hayes Township, MI:](#) No structures other than docks, patios, and retaining walls are allowed within one hundred feet of the Lake Michigan shoreline. Property owners must maintain Shoreland Protection Strips including all land located within fifty feet of the ordinary high water mark, and natural vegetation must be maintained on at least 80% of lake frontage in the shoreland protection strip.

[Manistee, MI:](#) No structures other than walkways, docks, launches, and boat houses may be placed within 100 feet of the ordinary high water mark.

[South Haven Township, MI:](#) No principal structures are allowed within fifty feet of the ordinary high water mark, and all must be set back 100 feet from the 1986 High Water Mark.

[Charlevoix, MI:](#) Principal land uses must be set back at least 50 feet from the ordinary high water mark.

[Michigan City, IN:](#) Only docks, seawalls, retaining walls, sidewalks, boardwalks, and patios may be constructed within the minimum waterway setback.

[Torch Lake Township, MI:](#) No structure except for stairways and ground-level walkways may be located within fifty feet of the Ordinary High Water Mark of Lake Michigan.

⁵ See discussion of the distinction between these two high water marks in Norton, et al., 2013. The deceptively complicated "elevation ordinary high water mark" and the problem with using it on a Laurentian Great Lakes shore. *Journal of Great Lakes Research* 39 (2013): 527-535.

3.2. Require future developments to meet elevation requirements.

Ordinances regulating development elevation appear common in floodplain codes. The State of Michigan's [building code](#) "requires that new construction or substantially improved buildings within the 100-year floodplain have the lowest floor, elevated at least 1 foot above the 100-year flood elevation. Basements that are below grade on all four sides must be 1 foot above the 100-year floodplain elevation." A local government may impose more stringent requirements along shorelines, as the state's requirements do not consider the impacts of seiches, storm surges, and lake level rise. The below examples highlight more stringent floodplain management ordinances.

[Nashville, TN](#): Structures built on floodplains and intended for human occupancy must rest at least four feet above the flood protection elevation.

[Waverly, MN](#): Structures built on floodplains must have their lowest floors placed at least three feet above the ordinary high water level or highest known water level, whichever is greater.

3.3. Combine elevation and setback requirements.

[Norton Shores, MI](#): All structures must stand at least 1 foot above the ordinary high-water mark, and all accessory buildings must be set back at least 50 feet from the high water mark. Additionally, no structure can be built closer to the lake than any adjacent principal structure.

[St. Joseph, MI](#): In the Edgewater Beach Overlay District, development of any structures, including shoreline protective measures but excluding temporary fencing installed from October to May, is prohibited. See case studies [here](#) and [here](#). Development of principal structures is prohibited within the Areas of Special Flood Hazard in the Floodplain Overlay District, and eligible accessory structures must be constructed so that their lowest occupied level is 1 foot above the base flood elevation. Property owners may apply for variances.

4. Facilitate Managed Retreat

4.1. Expressly allow, require, or create incentives for private managed retreat efforts.

Developments already located in high-hazard energy settings may be candidates for removal or relocation. Municipalities could permit and encourage managed retreat wherever and whenever possible, taking into account environmental implications and pre-existing setback restrictions.

Considerations: Structural relocation is expensive, although not necessarily more so than the installation of an extensive shoreline revetment, and the enacting municipality must decide whether to bear the cost itself or impose the burden on private owners. Eligibility for federal financing may require municipal implementation of protective and price-mitigating policies, such as hazard mitigation plans.

4.1.1. Development permit conditions.

One approach is to require owners of new developments to [agree to permit conditions](#) stating that they will relocate the structures following the occurrence of a particular hazard. These conditions can be written into zoning or land-use ordinances, administrative regulations, or individual permits.

Manhattan Beach, CA: Coastal Development Permits are subject to conditions necessary to ensure implementation of the Local Coastal Program. (Notably, this [program](#) appears to have been developed by administrative [regulation](#) rather than ordinance.)

4.1.2. Publicly financed structure elevation and retrofitting and infrastructure relocation.

In addition to ordinances facilitating managed retreat, local governments can use [FEMA Hazard Mitigation Grant Program](#) (HMGP) funds to elevate properties, retrofit existing structures, and complete structural flood control projects after a Presidential disaster declaration. Municipalities must have a hazard mitigation plan in place to be eligible for HMGP funds; funding may also require a presidentially declared disaster.

[Saugatuck Township, MI:](#) Allegan County Road Commission began the process of investigating options to move Lakeshore Drive away from the bluff's edge by hiring a firm to conduct a feasibility study and site investigation. Options include acquiring easements on the landside of existing property parcels to build a new road away from the eroding bluff. As of 2024, the Township was still considering engineering and funding options.

4.2. Establish an administrative program to convert private shoreland property to public ownership.

Conversion of shoreland to public ownership would eliminate any claim of rights to armor the shoreline and preserve upland property. Public ownership may be achieved through administrative programs or eminent domain proceedings. FEMA's [Hazard Mitigation Grant Program](#) may be used to relocate structures to non-hazard-prone areas while leaving the hazard-prone land for open space.⁶

Considerations: Conversion of property is expensive and administratively complex. Additionally, eminent domain proceedings may be time- and resource-intensive, and they may require proactive codification of supporting nuisance law to succeed. This approach also risks creating an expectation in other property owners that the government will also condemn their properties down the line, essentially indemnifying private shoreland property owners with public funds rather than requiring that they bear some or all of the burden from imprudent nearshore development decisions they made in the past.

⁶ [B.1. Property Acquisition for Open Space](#) FEMA

4.2.1. Transferable Development Rights and Purchase of Development Rights.

Some communities have established a transfer of development rights (TDR) program to protect environmentally sensitive lands. Creation of a [TDR program](#) involves updating the zoning code to include: (1) designation of a sending area or preservation zone; (2) designation of a receiving area or urban growth zone; and (3) definition of TDR procedures and a transfer ratio. The municipal government may establish a TDR bank to administer the program and facilitate the exchange of TDRs. A purchase of development rights (PDR) program usually involves a local government or conservation land trust acquiring the development rights on a parcel of property, typically in the form of a conservation easement, for the purpose of retiring those development rights. As such, the underlying property owner retains some rights to use the parcel but not the right to fully develop it (i.e., according to whatever development rights were conveyed). Property owners who sell development rights receive the revenue from the conveyance of those rights and may enjoy tax benefits. Note that, according to the [Michigan Association of Planning](#), “the Michigan Zoning Enabling Act does not specifically envision Transfer of Development Rights. However, public Purchase of Development Rights is specifically envisioned, as are Planned Unit Developments, and communities can combine those tools into a TDR program.”

[Mequon, WI](#): Any property owner may submit a proposal for a TDR transaction resulting in a conservation easement held by the city. Sending and receiving parcels and districts are approved on a case-by-case basis by the park and open space board, the planning commission, and the common council. Use of TDRs on the receiving land are subject to underlying zoning requirements.

[Milton, GA](#): Property owners may convert eligible properties to Open Space TDR Sending Sites or Park/Greenway TDR Sending Sites in exchange for a fixed number of TDRs, which can be transferred for use at approved TDR Receiving Sites.

[Ocean City, MD](#): Properties in the Beach Transfer Sending Overlay District may receive one development right for every 500 square feet of land, to be used in the Beach Transfer Receiving District. Use of the TDRs are restricted to projects in conformity with zoning regulations, but density requirements may be exceeded.

4.2.2. Voluntary buy-backs.

Many municipalities take advantage of the Federal Emergency Management Agency’s (FEMA) post-disaster funding to conduct [voluntary buyouts](#). These include [Nashville, Tennessee](#); [Birmingham, Alabama](#); [Des Moines, Iowa](#); [Fort Wayne, Indiana](#); [Lumberton, North Carolina](#); [Pacific, Missouri](#); [Minot, North Dakota](#); and [Beatrice, Nebraska](#). FEMA’s programs (four categories of Hazard Mitigation Assistance grants) require acquired property to be converted into permanent open space or other approved uses. (See [4.1.2.](#) and [4.2](#) for more information on Hazard Mitigation Grant Programs). Other [sources of buyout funding](#) include the National Flood Insurance Program, FEMA’s Public Assistance, the Department of Housing and Urban Development’s Community Development Block Grant Disaster Recovery program, the Department of Interior’s Voluntary Community-Driven Relocation Program, the Army Corps of Engineers’ flood risk reduction projects, and NOAA’s land acquisition projects. Municipal

buyback programs do not appear to be established by ordinance but are approved by municipal leadership as administrative or budgetary issues. Note that community enrollment in the National Flood Insurance Program (NFIP) may be required to access buyout funding from [certain programs](#). Michigan municipalities currently participating in the NFIP are listed in FEMA's [Community Status Book Report](#).

4.2.3. Eminent domain.

The City of [Pacifica, California](#), has used its powers of eminent domain to seize shoreline properties endangered by coastal erosion and convert the space to public land. It had established legal grounds to declare the properties a public nuisance by codifying its [nuisance law](#). It has also used [emergency powers](#) to condemn an apartment complex endangered by erosion.

5. Preliminary Policy-Making Steps

Implementation of new shoreline management policies requires consultation with legal and coastal experts and the community. This section outlines the general steps from identifying a policy solution to receiving approval from EGLE.

Step 1. Educate citizens on the effects of coastal erosion and shoreline armoring to mitigate political opposition.

Step 2. Collaborate with upshore and downshore municipalities to negotiate an agreement, as appropriate given development activities near jurisdictional boundaries and predominant nearshore sediment transport patterns.

Step 3. Consider whether the policy may be enacted legally and most efficiently by general police power ordinance, zoning ordinance, or administrative regulation.

Note that some of the above strategies — shoreline setback, managed retreat, and shoreline armoring regulations — can be embedded in existing zoning ordinances with application explicitly relevant only to shoreline properties.⁷ Municipalities can also simplify the code by establishing a **shoreline overlay district** that imposes additional regulations on specified areas within an existing zone.

⁷ See, e.g., the Norton article reference above.

Step 4. Submit ordinance language to EGLE for review and approval.

Note that any adoptions and adaptations affecting soil and sedimentation control, critical dune areas, or high-risk erosion areas should be submitted to EGLE for approval.

Step 5. Enact ordinance at local government level.

Refer to the Michigan Municipal League's *Handbook for Municipal Officials'* [chapter on Local Ordinances](#) for more information.

Appendix

Additional examples of limitations on private shoreline armoring, and/or its reconstruction (1.1).

[Port Aransas, TX](#): Construction of an erosion response structure is prohibited, with the exception of retaining walls at least 200 feet landward of the line of vegetation. No existing erosion response structures on the public beach can be maintained or repaired. Any new development approved seaward of the sixty-year erosion line must be designed for feasible relocation.

[Port Arthur, TX](#): Construction of an erosion response structure is prohibited, with the exception of retaining walls at least 200 feet landward of the line of vegetation. No existing erosion response structures on the public beach can be maintained or repaired. All construction must be located as landward as practicable. Construction for flood protection may not cause erosion to adjacent properties, the public beach, or critical dune areas. Construction or maintenance of any obstruction on a public beach or accessway is prohibited.

[Quintana, TX](#): Construction of an erosion response structure is prohibited, with the exception of retaining walls at least 200 feet landward of the line of vegetation. No existing erosion response structures on the public beach can be maintained or repaired. All construction must be located as landward as practicable. Construction for flood protection may not cause erosion to adjacent properties, the public beach, or critical dune areas. Construction or maintenance of any obstruction on a public beach or accessway is prohibited.

[Rancho Palos Verdes, CA](#): In the Natural Overlay Control District, land activities cannot alter or create erosion on the shoreline or alter the intertidal marine environment.

[St. Joseph, MI](#): Within a specific zone, shore protection measures are banned with the exception of temporary, seasonally-placed fencing lower than four feet high and constructed with open slats. No variances are permitted, but property owners can apply for a Hardship Planned Unit Development if the regulation renders the land undevelopable.

Additional examples of permitting erosion control structures as a last resort after nonstructural erosion control (2).

A common response by coastal communities to risks posed by sea level rise and increasing hazard events (ocean coasts) and natural shoreline recession and hazard events (Great Lakes coasts) is to allow for the installation of hard shoreline armoring to protect beach structures like homes, but only as a last resort (typically phrased as as something like only when “no feasible alternative exists”). It is important to recognize that, along shorelines moving landward naturally over time, that approach amounts to making the decision to armor the shoreline, one that simply delays that occurrence as long as possible but does not mitigate the harms that hard shoreline armoring will ultimately cause.

Some ordinances allow armoring in any setting if no feasible alternative exists, while others place limits on that option, such as by allowing armoring as a last resort — but not in locations that support coastal wetlands, or where armoring would harm neighboring properties, and so on. In other cases, ordinances allow armoring as a last resort, but only when the petitioner can show that the structure will not cause one more adverse effects such as increased erosion, restricted water flow, and so on.

For these latter approaches, it is important to recognize that allowing armoring but imposing such restrictions will necessitate having the administrative capacity (and political will) to evaluate proposals, reject those not meeting a burden proof, impose conditions if possible and as needed to ensure compliance, and monitor installation and maintenance activities post permit approval. Not having that administrative capacity or political will to faithfully impose conditions or deny armoring applications will ultimately result in extensive shoreline armoring, again merely delaying its installation and increasing the burden on property owners and local government to reach that outcome.

With that observation, the following list provides a collection of local ordinances that allow shoreline armoring only as a last resort under a variety of conditions and with a variety of provisions, for purposes of illustration.

[Belleair, FL](#): The county water and navigation control authority must issue a permit before seawall construction, and the applicant must show that shoreline hardening is necessary because stabilization by vegetation is not viable. Seawalls cannot be installed on a shoreline that supports wetland vegetation.

[Carrabelle, FL](#): Erosion control structures must be 20 feet from the inland water boundary unless the applicant demonstrates hardship, and flexible shoreline protection measures (e.g. beach nourishment, dune construction and stabilization, sand fencing, and native vegetation planting) are required before hard stabilization structures are permitted. Vertical seawalls cannot be constructed without armoring on natural waterways. In coastal high hazard zones, seawalls and similar erosion control structures must be approved by the local authority, and design professionals must provide analysis showing that the structure would not result in diversion of floodwaters or wave reflection that would increase damage to adjacent structures and buildings.

[Coupeville, WA](#): Shoreline stabilization structures are only allowed when necessary and are prohibited for new developments. Shoreline modification projects require state and federal permits. Applicants must show that nonstructural measures (e.g. increased setbacks, relocation, bioengineering, alternative site designs) cannot achieve the purpose of structural shoreline modifications. Bulkheads that are exempt require approval of the shoreline administrator; bulkheads must be constructed landward of the OHWM and are forbidden for new developments when practical alternatives exist. Bulkheads are prohibited altogether in aquatic and urban aquatic environments and are subject to additional restrictions in urban conservancy environments.

[Daphne, AL](#): Nonstructural erosion control methods (e.g., dune preservation and restoration, shoreline restoration, beach nourishment) are required as practicable. Structural erosion control devices are permitted only when nonstructural alternatives are not available. The applicant must submit state and federal permits to the city before construction.

[Fort Myers Beach, FL](#): The Comprehensive Plan bans new or expanded seawalls along natural waterbodies (more permissive policies exist for artificial waterbodies). On the Gulf of Mexico, existing seawalls can be maintained but cannot be rebuilt; instead, the building can be moved landward, emergency renourishment is permitted, and temporary riprap revetments are allowed as a last resort. On other natural waterbodies, seawalls can be maintained but cannot be rebuilt if rebuilding would threaten wetlands or could endanger or cause excessive erosion to the shorelines of adjacent properties. In general, the town “encourages” seawall owners to convert the structure into a riprap revetment or planted mangroves, and it requires seawalls to be built landward of the mean high-water line and wetland vegetation (unless the administrator deems no reasonable alternative). Replacement and repair of seawalls require development of shallow swale, a linear drain, or shallow-water habitats.

[Gulf Breeze, FL](#): Along the coast, hard shoreline armoring structures are not allowed within 20 feet of the seaward property boundary unless they are deemed the only feasible means of protecting an existing structure or there are rigid coastal protection structures flanking the property. Beach nourishment, natural vegetation enhancement, sloping revetment and other flexible measures are encouraged over construction of hard structures. Approved rigid structures must be designed to minimize scour or erosive effects. New structures must have a 10-foot buffer from both sides of the structure to the adjacent properties or rise to the property line at a 45-degree angle. Groins are prohibited.

[Indian River Shores, FL](#): Shoreline stabilization must first be attempted by native wetland vegetation. Shoreline hardening is permitted only when erosion seriously threatens life or property, and such structures are only allowed when nonstructural alternatives are insufficient and they are part of a comprehensive beach restoration plan. Riprap, filter mats, pervious brick systems, and other methods must be used instead of vertical seawalls when feasible, and bulkheading is permitted waterward of the mean high water line unless the public interest deems otherwise. Shoreline erosion control structures must be necessary; cannot obstruct water flow, increase erosion, restrict public use below the mean high water line, or affect the

natural sand transport system; and cannot adversely impact the natural habitat, adjacent shore areas, or water quality.

[Indian Shores, FL](#): Construction seaward of the coastal construction control line is prohibited. When practicable, sand dunes and native vegetation must be used for shoreline stabilization. Seawalls may be constructed when necessary, but they must be placed landward of the high-water line and be compatible with the heights and setbacks of seawalls on adjacent properties. The city encourages planting of native vegetation in front of seawalls.

[Islamorada, FL](#): Shoreline hardening is only permitted when extreme erosion is demonstrated and the use of vegetation will not prevent further erosion. Vertical seawalls are not permitted. Riprap, bulkheads and non-vertical seawalls must include a landward retention swale, curb or berm. The design and installation must not accelerate erosion of adjacent properties and must include revegetation. Riprap must be placed at the waterward base of seawalls and bulkheads when feasible. Shoreline hardening is prohibited along stretches of shore that may be a nesting area for threatened or endangered species.

[Key West, FL](#): Shoreline hardening is permitted only when erosion critically imperils upland property and vegetation has failed to stabilize the shoreline. Riprap is the first allowable alternative. Vertical seawalls and bulkheads are not permitted, and methods such as pervious tile systems or filter mats must be used instead of vertical walls when feasible. The structure must be landward of the mean high water line unless in the public interest to be waterward of the line, and it must avoid a vertical slope that erodes adjacent properties. Shoreline vegetation must be included in the plan.

[Marathon, FL](#): Shoreline hardening is permitted on altered shorelines and residential canals only when the City Biologist determines that rip-rap or sloping rock revetments combined with geotextiles and biotechnical erosion control are insufficient. The structure must be landward of turtle nesting areas and include a landward six-inch retention swale, berm or curb. New bulkheads or vertical seawalls are banned on open water shorelines. Seawalls cannot be wider than two feet. Bulkheads must be at the average mean high water line of the property. These regulations are coupled with buffer, setback, and shoreline-access requirements.

[Ocean City, MD](#): Within the Atlantic Coastal Bays Critical Area, shoreline erosion control techniques require a permit. Structural measures are allowed only where nonstructural measures are impractical or ineffective. If structural measures are required, the measure most amenable to habitat conservation is required.

[Port St. Lucie, FL](#): Construction of shoreline protection structures requires a permit. Shorelines that are not already stabilized can be stabilized only with native wetland shoreline vegetation. If vegetation is not feasible, stabilization may occur through a combination of geogrids or geotextiles and native wetland vegetation. If the latter option is not feasible, shorelines may be stabilized with rock rip rap and native wetland vegetation. If still infeasible, seawalls or bulkheads are permitted. Structures cannot impact coastal natural resources or interfere with littoral processes.

Additional examples of allowing private shoreline armoring with a permit (2).

Finally, another common response by coastal communities to risks posed by sea level rise and increasing hazard events (ocean coasts) and natural shoreline recession and hazard events (Great Lakes coasts) is to allow for the installation of hard shoreline armoring to protect beach structures like homes, but only by permit (i.e., without specifying that armoring is allowed only as a last resort). Requiring a permit allows the government to constrain and possibly impose conditions on that installation, and potentially to deny a permit if certain conditions are not met. Again, however, it is important to recognize that, along shorelines moving landward naturally over time, allowing armoring by permit amounts to making the decision to armor the shoreline, typically imposing only minimal conditions to mitigate the harms that hard shoreline armoring will ultimately cause.

With that observation, the following list provides a collection of local ordinances that allow shoreline armoring only by permit under a variety of conditions and with a variety of provisions, for purposes of illustration.

[Anna Maria, FL](#): Seawalls and bulkheads along the Gulf of Mexico or Tampa Bay require permits. Along other shores, seawalls and bulkheads are allowed with a permit on property that abuts seawalls on either side, but otherwise new developments without existing seawalls or bulkheads can be stabilized only by native wetland shoreline vegetation or limestone riprap. Seawalls and bulkheads must be constructed landward of mangroves. Additional construction requirements apply.

[Annapolis, MD](#): Bulkheads and other modifications to the natural shoreline require a permit from the Port Warden, who must consider the structure's effects on the environment, navigation, and effects on other property owners. Bulkheads and shoreline protection structures cannot be constructed in the waterway without permits.

[Cape Charles, VA](#): Shoreline erosion control projects on tidal waters require a land disturbing permit issued upon the approval of an erosion and sediment control plan.

[Cocoa Beach, FL](#): Seawalls require a permit and must meet size specifications. Living shorelines require a city permit if land material is removed or added.

[Corpus Christi, TX](#): Permittees for concurrent dune protection permits and beachfront construction certificates cannot construct new erosion response structures other than a retaining wall at least 200 feet landward of the vegetation line. They must also design construction to prevent erosion to adjacent properties and critical dune areas and to minimize impacts on natural hydrology. Erosion response permits must meet specific requirements and be found not to significantly affect sand dunes and dune vegetation.

[Del Mar, CA](#): Shoreline Protection Permits from the City Council are required for the construction of protective structures in the Shoreline Protection Area. Permits are issued only upon findings that the structure is necessary to protect existing structures, the design mitigates adverse impacts to the sand supply, the structure will not create or exacerbate erosion or

instability of the surrounding area, there is no other feasible location or less environmentally harmful alternative, and environmental mitigation measures have been identified. A vertical wall cannot be constructed more than five feet west of the Shoreline Protection Area. Noncompliant structures must be abated as a public nuisance. Shoreline protective structures landward of the Shoreline Protection Area must also receive approval and be found (1) to protect existing principal structures or serve coastal-dependent uses; (2) not to exacerbate erosion or geologic instability of the surrounding area or alter natural landforms; and (3) to meet other conditions reasonably imposed by the Planning Commission.

[Destin, FL](#): Bulkheads and seawalls are only permitted for redevelopments if riprap is placed on the waterward side — unless the Board of Adjustment grants a special exception following proof of continued erosion. In coastal high hazard zones, erosion control structures are permitted only with evidence that it will not cause harmful diversion of floodwaters or wave reflection that would exacerbate damage to adjacent structures. All seawalls and bulkheads must be registered with the City. Seawalls are generally prohibited in coastal marsh vegetation areas with few exceptions.

[Elk Rapids, MI](#): Shoreline retaining walls require a permit from the village harbor commission and must be designed and placed to minimize adverse hydrological effects on adjacent property owners. Shoreline setback requirements must be observed.

[Evanston, IL](#): Construction of any structure on a watercourse in or connected to a floodplain requires a permit from the Floodplain Administrator. Flood control structures must not create or exacerbate flood heights or velocity, impair the natural hydraulic or hydrologic functions of the channel, or permanently harm the water quality or aquatic habitat.

[Gulf Stream, FL](#): Seawall and alternative shoreline protection methods require a permit. Seawalls are required along properties on tidal or brackish water but not those on the Atlantic Ocean.

[Highland Park, IL](#): Construction of any new structure along a specified area of Lake Michigan requires city permits.

[Hilton Head Island, SC](#): Building permits are required for the construction of new erosion control structures. The city favors natural features (e.g. sand fencing, dune vegetation) over artificial structures, and construction must be done during seasons when the impact on wildlife is minimized. Structures cannot interfere with public beach access unless equivalent access is provided.

[Jupiter, FL](#): Bulkheads and revetments require a permit. Bulkheads must be set back five feet from the mean high water line and must be faced with sloped riprap and mangroves on the waterward side.

[Layton, FL](#): In coastal high hazard zones, erosion control structures are permitted only with evidence that it will not cause harmful diversion of floodwaters or wave reflection that would exacerbate damage to adjacent structures.

[Miami, FL](#): Construction of bulkheads and seawalls requires a permit. Structures must be impermeable and meet minimum elevation requirements, although variances are available upon application.

[Miami Beach, FL](#): New seawalls must meet elevation minimums and be designed, as practicable, to adjoin immediately adjacent seawalls. Applicants are encouraged to consider alternatives that incorporate living shoreline features or biological forms. Property owners with permeable erosion barriers like living shorelines are responsible for preventing tidal waters entering their property to affect adjacent properties or the public right of way.

[Monroe, MI](#): Construction or modification of dikes require a dike ordinance compliance permit. Dikes must meet a minimum height to prevent wave runup and water overtopping, and they must be designed to resist wave action and hydrostatic pressure. The applicant must assure that a dike would not affect adjacent dikes or properties, including through undue erosion, water overtopping or splash caused under average storm conditions. Public hearings will be held for each application.

[Narragansett, RI](#): Special use permits are required to install structural or nonstructural shoreline protection measures and to perform beach nourishment with the coastal resources overlay district. The structure must not impede public access to the shoreline or waters, reduce the natural diversity along the shoreline, degrade the recreational or aesthetic value of the waters, degrade water quality or adversely affect circulation or shoreline habitats, or exacerbate potential shoreline erosion.

[New Orleans, LA](#): Shoreline modification projects require a special use permit. Shoreline stabilization structures must be designed to prevent downstream erosion and land loss.

[Oak Hill, FL](#): Erosion control structures are permitted only if design professionals assure they would not cause wave reflection or runup to accelerate damage to adjacent structures.

[Pacifica, CA](#): Construction of shoreline protection devices is not permitted unless the structure is designed to mitigate or eliminate adverse impacts on sand supply and the structure is necessary to protect existing development. Developments that require seawalls for protection are prohibited unless the property is rendered undevelopable without a seawall. The seawall must be designed to minimize water runoff, impact on beach scouring and sand replenishment, and impact on existing lateral and vertical public access. Structures must also be sited to minimize tree removal, grading, and natural topography and landforms, as well as to be screened from public view on the least visible area of the property hidden by native vegetation. They must also blend into the natural setting and incorporate natural materials.

[Port Orange, FL](#): New developments and improvements to developments on a shoreline require a wetlands alteration permit. Shoreline hardening stabilization can occur only on non-vegetated shorelines, and structures must be located landward of the mean high water line.

[Satellite Beach, FL](#): The construction of coquina revetment systems are permitted in the estuarine shoreline protection zone and ocean bluff protection zone, provided they meet certain dimensional requirements. The owners of such structures must maintain sufficient sand seaward of the armoring, and the sand must be vegetated. Property owners with unarmored shoreline embankments must stabilize the shorelines with native vegetation.

[Virginia Beach, VA](#): The construction of bulkheads and jetties requires a permit, which will be issued only if it is designed not to obstruct the water, not to encroach on the rights of others, and to conform to the area and best practices.

[St. Bernard Parish, LA](#): A permit is required to construct bulkheads or jetties unless the construction occurs at least five feet above mean sea level or in fastlands. Permits are only granted if the project will not perceptibly or measurably alter the hydrological, chemical, biological or physical characteristics of the waters.

[Michigan Sea Grant](#) is a cooperative program of the University of Michigan, Michigan State University, and the National Oceanic and Atmospheric Administration. We fund research, education, and outreach projects designed to foster science-based decisions about the use and conservation of Great Lakes resources.

The [Environmental Law and Sustainability Clinic](#), directed by Professor Oday Salim, provides an opportunity for students to learn how to practice environmental and related areas of law. Founded in 1983, the clinic regularly represents the National Wildlife Federation (NWF), its state affiliates, and other similar organizations. The focus is on water and wildlife resources, public lands, energy, and human health in the Great Lakes watershed.