Stabilizing the Edge: Southeastern and Mid-Atlantic Shorescapes Facing Sea-level Rise

Shana Jones and J. Scott Pippin*

Ecologically fragile coasts face increasing pressures from economic development, population growth, hurricanes, extreme weather events, and sea-level rise. This Article addresses the last of these threats, focusing on shoreline stabilization law and policy. "Living shorelines" and similar nature-based approaches are often better alternatives to stabilize shorelines and reduce dangerous erosion than traditional hard "armoring" practices such as bulkheads and seawalls. Shoreline armoring is also closely associated with habitat loss in intertidal and subtidal areas, affecting fisheries' production, water quality, and other valuable ecosystem services. Adapting shoreline stabilization infrastructure and approaches to sea-level rise will require measures that improve federal, state, and local governance mechanisms; promote nature-based management practices; and change property owner behavior that affects coastal areas.

This Article analyzes ocean-facing and estuarine protection laws in the Southeast and Mid-Atlantic states to identify how governance mechanisms could better integrate sea-level rise into coastal management practices and decision-making, concentrating in particular on policies designed to reduce erosion and flooding. Our research revealed important distinctions

* Shana Campbell Jones, Esq., is Associate Public Service Faculty at the Carl Vinson Institute of Government at the University of Georgia and Director of the Georgia Sea Grant Legal Program. *J. Scott Pippin, Esq., is Associate Public Service Faculty at the Carl Vinson Institute of Government at the University of Georgia.* This material is based upon work supported by the National Science Foundation under Grant Number 1600273. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation. The authors wish to thank their project partners at the Center for Coastal Resources Management at the Virginia Institute of Marine Science at William & Mary. We also thank Georgia Sea Grant Law Fellows Julia Mueller Shelburne and Varad Dabke for their exceptional research assistance. We are also grateful to the natural resources managers who provided important feedback on this work.

between how we manage ocean-facing and estuarine-facing shorelines, as well as a wide variety of values and interests driving these differences. A regulatory system more strongly connected by science to the applicable natural systems is possible and desirable. To our knowledge, no such comprehensive overview or comparison of these shorescape protection, setback, and stabilization laws currently exists. Ultimately, the Article fills an important research gap in the existing climate change and coastal management literature, as it sets the stage for incorporating interdisciplinary findings from coastal science and social science research with legal and policy mechanisms to inform coastal zone management.

I. INTRODUCTION

Shoreline management is a thorny area of environmental management. Ecologically fragile coasts face increasing pressures from economic development, population growth, hurricanes, extreme weather events, and sea-level rise. Adapting shoreline-stabilization infrastructure to meet these pressures will require measures that improve federal, state, and local governance mechanisms; contemporary management practices; and coastal property owner behavior. Thus, shoreline management involves not only the convergence of land and water in an era of rising sea levels, but also the actions of multiple individual property owners who have varied and sometimes opposing goals for and expectations of their

property.[1] Both being inherently dynamic, human and natural shoreline systems interact in complex ways with numerous factors—including varying spatial and temporal scales and social norms—influencing the coastal system's overall sustainability. Efforts to understand shoreline's nature-human linkages in order to achieve a sustainable outcome have progressed from assumptions that the managed system would remain relatively constant over time to assumptions that the system inevitably changes. Generally, society's goal has been to maintain the extraction of goods or flow of services from the natural system indefinitely through informed management of human pressures by defining the spatial extent of the system to be managed and then focusing on the processes and process rates within that space. An extensive and growing literature has developed to describe and catalog these efforts and the search for effective guiding principles in this area is ongoing.

This Article developed as part of a larger project investigating shoreline interactions between human and natural systems. Funded by the National Science Foundation (NSF) and led by the Virginia Institute of Marine Science, the project, *Sustainability in Chesapeake Shorescapes: Climate Change, Management Decisions, and Ecological Functions*, is an interdisciplinary research project investigating the links between the human and natural components of Chesapeake Bay. As legal experts involved with the research, our roles included analyzing ocean-facing and estuarine protection laws in the Southeast and Mid-Atlantic states. We also incorporated project findings into proposals for identifying how to better integrate sea-level rise into coastal management practices and decision-making, focusing in particular on policies designed to reduce erosion and flooding. The long-term research goal of the *Sustainability in Chesapeake Shorescapes* project is to develop an advanced modeling framework that integrates physical,

1. *See* Dave Owen, *Mapping, Modeling and the Fragmentation of Environmental Law*, 1 UTAH L. REV. 220, 221 (2013) [hereinafter Owen, *Mapping, Modeling and Fragmentation*]; William L. Andreen, *Developing a More Holistic Approach to Water Management in the United States*, 36 ENVTL. L. REP. 10277, 10279 (2006) ("We have spent decades creating specialized disciplines and separate legal systems to govern land use, water use, and water pollution, and it will take considerable effort to demonstrate to voters, economic interests, and decisionmakers at all levels of government precisely how land use and water are inextricably connected….").

biogeochemical, and human components in order to simulate and select climate change adaptation strategies that will support a sustainable human and natural system, focusing on tidal shoreline management.

To investigate this intersystem dynamic in the Chesapeake Bay region, the project team used a social-ecological-systems approach developed by Nobel Laureate Elinor Ostrom and others. Social-ecological systems (SESs) acknowledge humans and their societies, technologies, and economies as elements of a broader ecology within the biosphere. Humans and their resources are entwined within complex SESs, which themselves contain subsystems and various internal variables that inform each other and the larger system.[2] As an organizing framework, Professor Ostrom offers four SES subsystems for analyzing how and whether social-ecological systems are sustainable: (1) resource systems (e.g., a watershed, a designated park, a fishing area); (2) resource units (e.g., plants, wildlife, water quantity and flow); (3) governance systems (e.g., management organizations, specific rules); and (4) users (individuals who use the resource in various ways for support, recreation, cultural, or economic purposes).[3] By focusing on the interactions between the system, the targeted resources in the system, the users of those resources, and the governance of that usage, researchers can identify the factors that contribute to or detract from the sustainability of the system.[4]

To understand what factors promote sustainable SESs, interdisciplinary research and collaboration is required. The SES approach has the potential to complicate more simplistic models utilized by legal scholars to conceptualize theories of property and natural resource management research.[5] In addition, the SES model supports an interdisciplinary

2. *See* BENJAMIN J. RICHARDSON, TIME AND ENVIRONMENTAL LAW: TELLING NATURE'S TIME 91, 419 (Cambridge 2017); Elinor Ostrom, *A General Framework for Analyzing Sustainability of Social-Ecological Systems*, 325 SCIENCE 420 (July 24, 2009) [hereinafter Ostrom].

3. Ostrom, *supra* note 2 at 420.

4. *See* Ostrom, *supra* note 2, at 420–22.

5. Pammela Quinn Saunders, *A Sea Change Off the Coast of Maine: Common Pool Resources as Cultural Property*, 60 EMORY L.J. 1323, 1370–71 (2011) (citing Daniel H. Cole & Elinor Ostrom, *The Variety of Property Systems and Rights in Natural Resources*, in PROPERTY IN LAND AND OTHER RESOURCES 37 (Daniel H. Cole & Elinor Ostrom eds., 2011).

framework designed to allow for research across disciplines to integrate, as well as to ultimately improve, natural resource and overall system-management policies.[6] Until we understand the variables informing a system, Ostrom maintains, we will not develop rules that are "congruent with local conditions," inhibiting our ability to promote and attain lasting sustainability.[7]

The system in question for this project is the shoreline, or "shorescape," a somewhat novel term that conceptualizes the various human and natural components of a coastal interface with the water's edge. This includes beaches and other sea-front landscapes, river systems, and estuarine shorelines, as well as their connected intertidal zones. Each of these environments have different human and natural environmental forces that impact the entire coastal zone. Among numerous physical factors, we know that human management of the shoreline affects these resources through destruction and shoreline restoration activities. Moreover, examining the governance systems—one of Ostrom's four core SES sub-systems—is crucial because they create the regulatory structure and decision-making framework for shoreline armoring actions.

In SES approaches, representing the human dimension has been challenging, particularly for network scientists using computational modeling techniques such as agent-based and system dynamics modeling.[8] Policies and laws, however, are often identified as potential "social nodes" for SES-related network modeling.[9] Thus, one means of addressing these challenges is to incorporate policy choices that are embedded within or built upon existing legal rules within SES modeling frameworks. While the project modeling and science is focused on the Chesapeake, the project investigators have determined that it would be useful to understand the broader range of possible governance approaches that inform shoreline management. To this end, we have reviewed state statutes and

6. Ostrom, *supra* note 2, at 422.

7. *See* RICHARDSON, *supra* note 2, at 421.

8. Sondass Elsawah et al., *Eight Grand Challenges in Socio-environmental Systems Modeling*, 2 SOCIO-ENVTL. SYS. MODELING 16226 (2020).

9. J.S. Sayles et al., *Social-Ecological Network Analysis for Sustainability Sciences: A Systematic Review and Innovative Research Agenda for the Future*, 14 ENVTL. RES. LETTERS 093003 (2019).

regulations affecting both ocean-facing shorelines as well as estuarine tidal wetlands/marsh management practices from Florida to Delaware.

Our research indicates that new governance approaches are necessary to manage human activity in coastal areas. In this Article, we call for a shorescape approach to coastal zone management. Working from the term as conceptualized by our NSF project partners, "shorescape management" is modeled on landscape management theories and SES approaches, where "landscape" serves as a concept encompassing both natural and human systems.[10]

We, therefore, begin with an overview of how rising sea levels affect coastal areas in the Southeast and Mid-Atlantic, and then turn to examine existing shore-protection laws and policies, including both ocean-facing and estuarine areas from Florida to Delaware. The analysis focuses on how coastal edges are managed, with an emphasis on setbacks (areas designating where structures such as homes may not be built) and shoreline stabilization approaches (e.g., seawalls, bulkheads, and living shorelines). To the authors' knowledge, no such comprehensive overview or comparison of these shorescape protection, setback, and stabilization laws exists. These regulations must be understood within their respective frameworks for necessary adaptation to occur. Integrating boundaries established to guide coastal construction with science-based modeling efforts—efforts that incorporate factors such as shoreline characteristics, shoreline change, sea-level rise projections, marsh migration projections, population projections, and demographics—will further the understanding of how existing regulatory frameworks will need to adapt to protect habitat, property, and human life.[11]

10. *See* J.B. Ruhl & James Salzman, *Gaming the Past: The Theory and Practice of Historic Baselines in the Administrative State*, 64 VAND. L. REV. 1, 46 (2011) (explaining how a landscape management approach is often focused on adaptation strategies designed to address climate change impacts); Ann M. Eisenberg, *Alienation and Reconciliation in Social-Ecological Systems*, 47 ENVTL. L. 127, 167 (2017) (describing landscape management involving the integration of ranchers in ecosystem protection efforts).

11. Indeed, the NSF project is designed to set the stage for incorporating jurisdictional boundaries into such modeling and also into the setback and shoreline stabilization approaches that these boundaries authorize or encourage.

After this background, the Article examines the commonalities and distinctions among these laws in both ocean-facing and estuarine areas and the policies that drive them. Our findings include:

- *Jurisdictional Lines:* The majority of ocean-facing shore-protection laws in our study area have established jurisdictional lines designed to control the location of structures based on erosion rates, allowing for a more adaptive management approach driven by scientific data as sea-levels rise. However, a more explicit acknowledgement of and accounting for sea-level rise will be necessary in many areas.

- *Freezing Ocean-Facing Baselines:* We discovered a governance trend towards "freezing" the most oceanward jurisdictional baselines, suggesting that rising sea-levels and increased flooding may create pressure to simply "hold the line" when more dynamic and adaptive responses are needed. Estuarine managers should be aware of pressures in ocean-facing areas to establish set baselines.

- *Pre-Determined Estuarine Baselines:* In contrast to ocean-facing laws, all of the estuarine protection laws in the study area use jurisdictional lines that measure pre-determined buffer widths from natural features. Because sea-level rise will affect estuarine areas as much as—and, at times, even more than—ocean-facing areas, estuarine shoreline management should incorporate boundary markers more dynamic than natural features, using data such as erosion rates or a method based on rates of local relative sea-level rise.

- *Unequal Approval Processes:* Throughout our study area, armored shorelines are almost always held to a lesser standard than nature-based living shorelines under approval processes.[12] Living shoreline projects often

12. Shoreline armoring is the practice of using physical structures such as bulkheads and sea walls to protect shorelines from coastal erosion. *See What is Shoreline*

must prove that the location is appropriate for nature-based projects, using structural suitability data and scientific considerations such as fetch, bank elevation, erosion, and tides. Armoring does not typically require such justifications. A question for policy-makers going forward should be why "hard" armoring approaches such as bulkheads are not subject to the more comprehensive and specific science-based requirements applied to living shorelines.

- *"Gap-filling" Policies:* We found a high value on uniformity woven throughout shore protection law and policy in the study area. Florida, for example, exempts seawalls and riprap structures that connect other hard structures from the permitting process, and North Carolina and Delaware have laws promoting "aligned" shoreline stabilization. In addition, project findings indicate that neighbors tend to copy each other, especially when it comes to hard armoring. "Gap-filling" and "shoreline alignment" policies designed to promote contiguous hardened shorelines should be reconsidered as they run counter to beneficial efforts to reduce shoreline fragmentation as well as efforts to provide "habitat patches" that serve as important refuges for plants and wildlife between armored shorelines.

- *Incorporating New Data:* A significant amount of data is now available online through digital spatial formats related to erosion rates, projected rates of sea-level rise, ecosystem metrics, and habitat fragmentation, among other factors. Much of this data did not exist or was not readily available when current regulatory frameworks were established. A regulatory system more strongly connected by science to the applicable natural systems is possible and desirable.

- *Taking a Shorescape Approach:* A "shorescape approach" to managing our coastlines is needed. Analogous to

Armoring?, NAT'L OCEANIC ATMOSPHERIC ADMIN., *available at* https://perma.cc/X5A3-DEZC.

> watershed approaches that have been pursued throughout the country, this approach would rise above parcel-by-parcel management of the "edge" of the shoreline itself and produce a more holistic approach, allowing for better management of ever-increasing erosion and flooding impacts, for the restoration of coastal habitats to offset unavoidable habitat losses elsewhere, and for the creation of new areas of marsh as rising sea-level inundate existing marshlands. A shorescape approach informed by spatial analysis and modeling also would advance a more dynamic and cooperative federalism. It would allow for improved communication among different levels within jurisdictions, promote interjurisdictional coordination, and facilitate robust discussion and examination of trade-offs and competing goals.[13]

Finally, given the challenges that coastal development, rising sea-levels, and extreme weather events bring to coastal areas, the Article concludes with proposals for next steps in research, including calls for more research related to property-owner behavior and how regulatory frameworks should evolve to promote broader coastal resilience. The Article fills an important research gap in the existing climate change and coastal management literature, as it sets the stage for incorporating interdisciplinary findings from coastal science and social science research with legal and policy mechanisms to inform coastal zone management.[14]

Adapting shoreline stabilization infrastructure and shorescape approaches to sea-level rise will require measures that improve (i) federal, state, and local governance mechanisms; (ii) shoreline management practices; and (iii) property owner behavior that affects coastal areas. These improvements, in turn, will require a comprehensive understanding of the existing legal frameworks, as law is

13. *See* Owen, *Mapping, Modeling and Fragmentation*, *supra* note 1, at 274.

14. A companion article, *Property Owners on the Edge: Living Shorescapes in an Era of Sea Level Rise*, is currently being developed to discuss specific findings from the overall NSF project related to private property owner behavior surrounding shoreline stabilization decision-making.

notoriously path dependent, building upon past decisions and approaches. We can expect that future regulations will build on the existing frameworks we survey here.

II. BACKGROUND: BEACHES, MARSHES, AND SEA LEVEL RISE

Coastal systems are changing. Rising sea levels and expanding human development—including actions of shoreline property owners to combat erosion—are the primary drivers of these changes.[15] Focusing on the United States' Mid-Atlantic and southeastern coasts, this part first provides an overview of sea-level rise and "high tide" projections for coastal areas. It then turns to describing how sea-level rise affects tidal shorelines and compares armoring and nature-based shoreline management approaches, setting the stage for the law and policy analysis that follows.

A. Rising Sea Levels: Projections for Coastal Areas

The beaches, estuaries, and other coastal ecosystems in the Mid-Atlantic and Southeast are among the most vulnerable in the United States to sea-level rise.[16] This area covers seven states from Florida to Delaware, which includes 18,822 shoreline miles of both ocean-facing and estuarine areas.[17] Sea-level rise at a global scale comprises both increased water volume in the world's oceans, driven by melting land-based ice, and the thermal expansion of water due to higher temperatures. Through the twentieth century, global mean sea levels (GMSLs) rose approximately 1.4 millimeters per year (mm/year).[18] Between 2006 and 2015, that rate more than doubled to

15. U.S. GLOB. CHANGE RESEARCH PROGRAM, CLIMATE SCIENCE SPECIAL REPORT: FOURTH NATIONAL CLIMATE ASSESSMENT, VOLUME 1 333 (D.J. Wuebbles et al. eds., 2017), *available at* https://perma.cc/3CBY-M7WU [hereinafter FOURTH NATIONAL CLIMATE ASSESSMENT].

16. *Id.*

17. SHORELINE MILEAGE OF THE UNITED STATES, NAT'L OCEANIC ATMOSPHERIC ADMIN. OFF. COASTAL MGMT., *available at* https://perma.cc/3SR7-FVTU (last accessed Feb. 15, 2021).

18. Global Mean Sea Level (GMSL) is the average elevation of all the Earth's oceans measured from the center of the Earth. It is based on averages from a variety of data sources including satellites and tide stations around the world. Rebecca Lindsey, *Climate Change: Global Sea level*, NAT'L OCEANIC ATMOSPHERIC ADMIN. (Jan. 25, 2021), *available at* https://perma.cc/45J5-EXJC.

3.6 mm/year, and it continues to rise by about 3.2 mm/year.[19] Because of climate change and rising average global temperatures, GMSL will continue to rise throughout the twenty-first century.[20] The U.S. National Climate Assessment provides the likely range of sea-level rise by the year 2100 as between a "realistic" low of one foot and a "plausible" four feet.[21] This is similar to the range of sea-level rise projections (approximately 11 inches to 3.2 feet) published in the 2013 Intergovernmental Panel on Climate Change.[22]

More locally, the Mid-Atlantic and Southeast have experienced sea-level rise that generally exceeds the global rate.[23] While global projections are critical for resource management, scientific inquiry, and overall planning and policy-making, it is important to recognize that rates of sea-level rise vary from place to place and region to region. This is what scientists refer to as Relative Sea Level Rise (RSL). RSL reflects changes in local sea level in relation to the adjacent land. Measured by local or regional tide gauges, these rates may vary substantially from the global average.[24] For example, Norfolk, Virginia, is experiencing the highest rate of rise on the east coast: more than twice the rate as Jacksonville, Florida, and three times the rate as Portland, Maine.[25] Factors that affect rates of sea-level rise include shoreline elevation, land subsidence (i.e., sinking), groundwater withdrawal, and changes in mass, volume, and regional distribution of seawater.[26]

19. *Id.*

20. *Id.*

21. John Walsh et al., *Chapter 2: Our Changing Climate*, *in* U.S. GLOB. CHANGE. RESEARCH PROGRAM, CLIMATE CHANGE IMPACTS IN THE UNITED STATES: THE THIRD NATIONAL CLIMATE ASSESSMENT 45, 45 (Jerry M. Melillo et al. eds., 2014), *available at* https://perma.cc/W4WL-Z92V.

22. JOHN A. CHURCH ET AL., CLIMATE CHANGE 2013: THE PHYSICAL SCIENCE BASIS: CONTRIBUTION OF WORKING GROUP I TO THE FIFTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 1140 (T.F. Stocker et al. eds., 2013).

23. *See* Jim Morrison, *Flooding Hot Spots: Why Seas Are Rising Faster on the U.S. East Coast*, YALE ENV'T 360 (Apr. 24, 2018), *available at* https://perma.cc/MJM6-7X8V.

24. *See, e.g.*, *U.S. Sea Level Trend Map*, NAT'L OCEANIC ATMOSPHERIC ADMIN.: TIDES AND CURRENTS, *available at* https://perma.cc/FMT3-255F (last accessed Feb. 15, 2021).

25. *U.S. East Coast Sea Level, Annual Values & Processes*, VA. INST. OF MARINE SCI., *available at* https://perma.cc/PEK8-T2EW (last accessed Feb. 15, 2021).

26. *Processes Affecting Sea-Level Trends*, VA. INST. OF MARINE SCI., *available at* (last accessed Feb. 24, 2021); WILLIAM V. SWEET ET AL., NAT'L OCEANIC ATMOSPHERIC ADMIN., NOAA TECHNICAL REPORT NOS CO-OPS 083: GLOBAL AND REGIONAL SEA-LEVEL RISE SCENARIOS FOR THE UNITED STATES, (2017), *available at* https://perma.cc/M5QT-GR94.

An important consequence of sea-level rise is "high tide" flooding, a relatively new term used to describe coastal flooding events caused by the tides and unrelated to storm events such as hurricanes, nor'easters, and storms with significant rainfall.[27] These flooding events are also called nuisance flooding, sunny day flooding, and recurrent tidal flooding.[28] While these high-tide events have always occurred, they occur more frequently now due to rising sea-levels, flooding roads and overwhelmed stormwater systems. In addition, areas that have a large tidal range, such as the Georgia and South Carolina coasts, regularly have tides that can be three feet or more above the local mean high tide during periods when the moon is full or at its perigee (closest to the Earth).[29] These areas are increasingly subject to flooding during these exceptional high-tide events, which are often referred to as spring tides or "king tides." Put simply, it no longer has to rain for it to flood.

High-tide events are more likely to cause significant impacts as compared to storm events because, unlike rainstorm and nor'easters, relatively small increases in the local sea level can significantly increase the frequency and severity of high-tide flooding. For most coastal communities, the National Oceanic and Atmospheric Administration (NOAA) estimates that a 0.35 meter (14 inch) rise in RSL will result in a 25-fold increase in the frequency of high-tide events. A high-tide flood that now occurs, on average, once every five years will become an event that occurs every two to three months by the year 2030, under NOAA's "Intermediate-High" scenario for sea-level rise projections.[30] For Norfolk, Virginia, NOAA projects between twenty and twenty-five high-tide flood days annually by 2030,[31] representing about one flood every two weeks.

27. Sweet, *supra* note 26.

28. *Id.*

29. *What Is a Perigean Spring Tide?*, NAT'L OCEANIC ATMOSPHERIC ADMIN.: NAT'L OCEAN SERV., *available at* https://perma.cc/Q94T-4HAJ (last accessed Feb. 15, 2021).

30. *Id.*

31. *The State of High Tide Flooding and Annual Outlook*, NAT'L OCEANIC ATMOSPHERIC ADMIN., *available at* https://perma.cc/4TNU-UYMY/.

B. Shoreline Management: Hard Armoring and Living Shorelines

Humans have modified ocean-facing and estuarine shorelines for centuries to protect property from erosion and promote shipping and commerce. Typically, the modifications consist of installing "hard" structures such as sea walls, bulkheads, and riprap revetments, described by scientists as "shoreline armoring."[32] Florida law, for example, defines "armoring" as follows:

> "Armoring" is a manmade structure designed to either prevent erosion of the upland property or protect structures from the effects of coastal wave and current action. Armoring includes certain rigid coastal structures such as geotextile bags or tubes, seawalls, revetments, bulkheads, retaining walls, or similar structures . . . .[33]

The presence of shoreline armoring is closely associated with habitat loss (e.g., wetlands, seagrasses) in intertidal and subtidal areas. This in turn affects fisheries' production, water quality, and other valuable ecosystem services. For example, beaches, wetlands, and marshes offer shoreline protection from wave-induced erosion to human infrastructure.[34] Shoreline armoring, however, prevents the landward migration of marshes and other coastal habitats pushed by sea-level rise.[35] In a phenomenon sometimes referred to as "coastal squeeze," coastal

32. Donna Marie Bilkovic et al., *A Primer to Living Shorelines*, *in* LIVING SHORELINES: THE SCIENCE AND MANAGEMENT OF NATURE-BASED COASTAL PROTECTION 3, 3 (Donna Marie Bikovic et al. eds., 2017) [hereinafter *A Primer to Living Shorelines*]; Donna Marie Bilkovic et al., *The Role of Living Shorelines as Estuarine Habitat Conservation Strategies,* 44 COASTAL MANAGEMENT (2016) [hereinafter *The Role of Living Shorelines*]. Riprap is the stone used to build a revetment, although frequently the structure itself is called riprap. *Living Shorelines — Coastal Structures Glossary*, CTR. FOR COASTAL RESOURCES MGMT., *available at* https://perma.cc/U23P-ELLM.

33. FLA. ADMIN. CODE ANN. R. 62B-33.002 (2020).

34. *A Primer to Living Shorelines*, *supra* note 32, at 4.

35. *The Role of Living Shorelines*, *supra* note 32; J.G. Titus et al., *State and Local Governments Plan for Development of Most Land Vulnerable to Rising Sea Level Along the U.S. Atlantic Coast*, 4 ENV'T RES. LETTERS (2009); K. E. Anderson et al., *Executive Summary*, *in* U.S. CLIMATE CHANGE SCI. PROGRAM & SUBCOMM. ON GLOB. CHANGE RESEARCH, COASTAL SENSITIVITY TO SEA-LEVEL RISE: A FOCUS ON THE MID-ATLANTIC REGION 21 (James G. Titus et al. eds., 2009), *available at* https://perma.cc/9GHM-6X9N.

marshes trapped between rising sea levels and hard armoring cannot relocate to higher elevations, often leading to their destruction.[36] Thus shoreline armoring often accelerates, rather than slows, the erosive effects of sea-level rise.

In the second half of the twentieth century, armored shorelines increased substantially.[37] Major cities often have more than 50% of their shorelines armored, and rural and suburban coastal areas facing development pressures may experience the fastest rates of armoring.[38] The Chesapeake Bay has seen 18% of its tidal shorelines armored, with urban sub-watersheds having more than 50% armoring.[39] As coastal populations continue to grow, development pressure on the beaches, estuaries, and other coastal ecosystems along the Mid-Atlantic and southeastern United States will only continue to increase.[40]

In contrast to hard armoring, "green," nature-based erosion management techniques are designed "not only to protect shorelines and infrastructure but also [to] conserve, create, or restore natural shoreline functions in estuarine, marine, and aquatic systems."[41] When conceived broadly to include both ocean-facing and estuarine shoreline nature-based stabilization approaches, specific techniques include:

- Vegetation only, where plant roots hold soil in place.
- Edging, where structures such as erosion control blankets, geotextile tubes, rock gabion baskets, or living reefs made of oysters or mussels hold the edge or "toe" of the existing shoreline or vegetated slope in place.
- Sills, where stones, sand, rock gabion baskets, or living reefs made of oysters or mussels are placed parallel to the shoreline or vegetated slope, often with a "gapped" approach to allow for greater tidal exchange and better waterfront access.

36. Nicole E. Peterson et al., *Socioeconomic and Environmental Predictors of Estuarine Shoreline Hard Armoring*, SCI. REP., Nov. 08, 2019, at 1.

37. *See The Role of Living Shorelines*, *supra* note 32.

38. *Id.*

39. *Id.* Watersheds are often divided into smaller units called "sub-watersheds." *Principles of Watershed Management*, EPA, *available at* https://perma.cc/589G-D9BT.

40. FOURTH NATIONAL CLIMATE ASSESSMENT, *supra* note 15, at 164, 167, 222, 294.

41. *See A Primer to Living Shorelines*, *supra* note 32.

- Beach nourishment only, where a large volume of sand from an outside source is added to an eroding beach, thus widening the beach and moving the shoreline seaward.
- Beach nourishment and vegetation on dune, where a large volume of sand is added and a vegetated buffer is created to anchor sand and protect inland areas.[42]

In many circumstances, such nature-based techniques can be a better management approach to addressing coastal erosion than can "hard" or "gray" structures such as groins, revetments, bulkheads, and sea walls.[43] Natural features provide a number of benefits to people that hard infrastructure does not, including creating or maintaining habitat that supports fisheries and livelihoods, providing more resilient storm protection to reduce risk to property, and promoting favorable water quality.[44]

Because green techniques are intended to mimic the complex and specific coastal ecosystems in which they are placed, they require a thorough understanding of the local terrestrial landscape (including both geomorphic features and human infrastructure) as well as the adjacent "seascapes," which encompass both intertidal and submerged marine features.[45]

Nature-based approaches for ocean-facing beaches, with their "unsheltered" shorelines, typically involve beach renourishment efforts. Estuarine areas such as bays and tributaries are often referred to as "sheltered" shorelines, with areas more appropriate for "softer" green techniques such as living shorelines.[46] A living shoreline is mostly made of native material, incorporating "vegetation or other living, natural 'soft' elements alone or in combination with some type of harder shoreline structure (e.g., oyster or mussel reefs or rock sills) for

42. *Id.*

43. *See* NAT'L OCEANIC ATMOSPHERIC ADMIN., NATURAL AND STRUCTURAL MEASURES FOR SHORELINE STABILIZATION (2015), *available at* https://perma.cc/C3GM-M265.

44. Katie K. Arkema et al., *Chapter 2: Living Shorelines for People and Nature*, *in* LIVING SHORELINES: THE SCIENCE AND MANAGEMENT OF NATURE-BASED COASTAL PROTECTION, *supra* note 32, at 11, 15–17 (2017).

45. Donna Marie Bilkovic & Molly Mitchell, *Chapter 15, Designing Living Shoreline Salt Marsh Ecosystems to Promote Coastal Resilience*, *in* LIVING SHORELINES: THE SCIENCE AND MANAGEMENT OF NATURE-BASED COASTAL PROTECTION 293, 295 (Donna Marie Bikovic et al. eds., 2017) [hereinafter *Designing Living Shoreline*].

46. *Living Shorelines*, NAT'L OCEANIC ATMOSPHERIC ADMIN.: HABITAT BLUEPRINT, *available at* https://perma.cc/9W5X-TPRV.

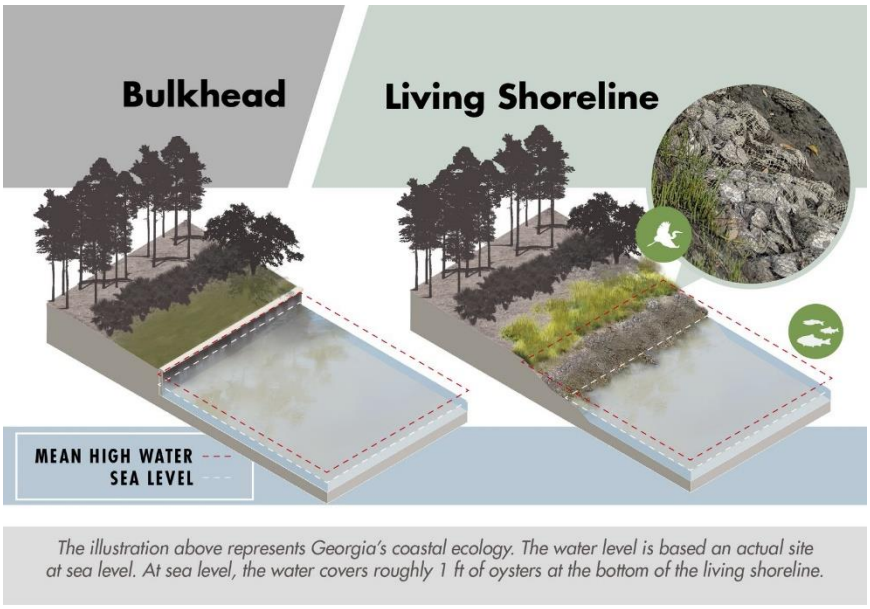

Figure 1: Bulkhead and Living Shoreline. Image courtesy of Kelsey Broich, Network for Engineering with Nature, University of Georgia

added protection and stability."[47] Living shorelines can promote coastal resilience in coastal marsh areas,[48] and have been shown to absorb floodwaters, attenuate waves, and provide erosion protection during storms.[49] Living shorelines also are more resilient and adaptive to sea-level rise than armored

47. Issuance and Reissuance of Nationwide Permits, 82 Fed. Reg. 1860-01 (Jan. 6, 2017). The Army Corps of Engineers defines living shorelines as occurring "along shores with small fetch and gentle slopes that are subject to low- to mid-energy waves." *Id.* Living shorelines should maintain the natural continuity of the land-water interface, retain or enhance shoreline ecological processes, and have a substantial biological component, either tidal or lacustrine fringe wetlands or oyster or mussel reef structures. *Id.*

48. *See Designing Living Shorelines, supra* note 45; Niki L. Pace & Nathan Morgan, *Living Shorelines: Eroding Regulatory Barriers to Coastal Resilience*, 31 NAT. RESOURCES & ENV'T 44–45 (2017).

49. Pace & Morgan, *supra* note 48, at 44-45; R.C. Holleman & M.T. Stacey, *Coupling of Sea Level Rise, Tidal Amplification, and Inundation*, 44 J. PHYSICAL OCEANOGRAPHY 1439, 1439–1455 (2014); E.B. Barbier et al., *The Value of Wetlands in Protecting Southeast Louisiana from Storm Surges*, 8 PLOS ONE e58715 1 (2013); R.K. Gittman et al., *Engineering Away Our Natural Defenses: An Analysis of Shoreline Hardening in the U.S.*, 13 FRONTIERS ECOLOGY & ENV'T. 301, 301–307 (2015), *available at* https://perma.cc/7A77-4XTA.

shorelines.[50] As sea-levels rise, hard armoring interferes with the ability of the marsh to migrate landward, contributing to "coastal squeeze."[51] Living shorelines, in contrast, better allow for marsh migration in the face of shoreline change.[52] Moreover, living shorelines have great potential for adoption. The majority of hardened shorelines in the United States have been constructed along sheltered seascapes, precisely the shoreline areas with suitable characteristics for nature-based approaches.[53] Armored shorelines in these areas could be replaced with living shorelines in many cases, and living shorelines could be installed instead of armored ones in areas where armoring has not yet occurred.

The appropriate shore stabilization technique is determined by the specific site's characteristics.[54] Green, nature-based solutions are preferred in most circumstances, but some areas may be best protected by hard armoring, particularly where few natural features will be disturbed by its implementation. It is also possible to use "hybrid" approaches for shore stabilization that include both gray and green techniques.[55] The Center for Coastal Resources Management at the Virginia Institute of Marine Science has developed a Shoreline Management Model to determine the best management practices for an estuarine shoreline and to identify both where living shorelines are suitable and where traditional armoring techniques may be more effective.[56]

III. SHORESCAPE PROTECTION ACTS IN THE SOUTHEAST AND MID-ATLANTIC

The following examination allows multi-jurisdictional comparison of specific provisions of shoreline management laws,

50. *See Designing Living Shorelines*, *supra* note 45; W. Vandenbruwaene et al., *Sedimentation and Response to Sea-level Rise of a Restored Marsh with Reduced Tidal Exchange: Comparison with a Natural Tidal Marsh*, 130 GEOMORPHOLOGY 115, 126 (2011).

51. Nicole E. Peterson et. al, *supra* note 36, at 2.

52. *Id.*

53. *See Designing Living Shorelines*, *supra* note 45, at 310.

54. *Id.*

55. *Id.*

56. *Shoreline Management Model*, VA. INST. OF MARINE SCI., *available at* https://perma.cc/4LL4-PGTZ.

the policy-drivers that inform them, and variation in characteristics of these laws across jurisdictions. Each law has its own complicated history, of course—indeed, a separate article could be written on each one of them. For the purposes of this Article, our examination is necessarily high-level, focusing on the structures of and policies inherent in the text of the statutes themselves. Such an analysis, we found, illuminated much: highlighting what we see as important trends and distinctions between how we manage ocean-facing shorelines and estuarine shorelines, which in turn raised important questions for how we will manage each of these shorelines in the future, as sea-levels rise. This section begins with Florida and works north to Delaware, examining first the ocean-facing and then the estuarine law and policies. Coastal management provisions cover a wide area, including local zoning and building regulations, regulatory takings, the public trust doctrine, and wetlands regulation.

The Article focuses on state statutes, rules, and policies related to shoreline stabilization. Because shoreline stabilization often occurs in intertidal waters or involves "navigable waters" and adjacent wetlands, the Army Corps of Engineers (the Corps) becomes involved through its authority under the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act.[57] Given this Article's primary focus, the most relevant Corps activities are its power to issue Nationwide Permit 13 (for armored shoreline stabilization structures) and Nationwide Permit 54 (for living shorelines).[58] Both fall within

57. 33 U.S.C. §§ 403, 1344 (2018). *See also* Niki Pace, *Permitting a Living Shoreline: A Look at the Legal Framework Governing Living Shoreline Projects at the Federal, State, and Local Level*, *in* LIVING SHORELINES: THE SCIENCE AND MANAGEMENT OF NATURE-BASED COASTAL PROTECTION, *supra* note 32, at 34, 34 (2017) (describing how federal, state, and even local government agencies may have regulatory authority over the construction of living shorelines and shoreline stabilization projects).

58. 33 U.S.C. § 1344(e)(1) (2018) (providing for a general permitting process); Issuance and Reissuance of Nationwide Permits, 82 Fed. Reg. 1860-01 (Jan. 6, 2017). Under Nationwide Permit (NWP) 13, "bank stabilization" projects such as seawalls, rip rap, and revetments no more than 500 feet in length are permitted. *Id.* Under Nationwide Permit 54, which was added in 2017, living shorelines are now authorized under the Corps' general permitting process. *Id.* A series of conditions must be met, including that the living shoreline may not extend into a waterbody more than 30 feet from the mean low water line in tidal waters, is no longer than 500 feet, have a substantial biological component and structural materials that prevent relocation in most wave action, utilize native plants, and be properly maintained. *Id.* Permittees must submit a pre-

the Corps' general permitting process, which is designed to streamline approvals for projects expected to have "minimal adverse environmental effects."[59]

Notably, nationwide permits must be certified by each state to officially apply within that state. A recent survey of Atlantic and Gulf Coast states found that six out of eighteen states surveyed had approved the living shorelines permit, Nationwide Permit 54; the twelve which denied certification concluded that the permit did not work well with the state's shorescape characteristics.[60] Ultimately, analyzing these general permits is beyond the scope of this Article, but such findings underline the importance of understanding each state's statutory shoreline management scheme when it comes to promoting living shorelines, given that most states also require state approval to stabilize shorelines.[61] The Article therefore notes when the states discussed have certified Nationwide Permit 54, as well as when they have developed a joint-permit application process with the Corps as part of their shoreline permitting process that typically involves armored shorelines.

A. Florida

With 11,000 miles of beach and estuarine coastline and an indisputable coastal identity, Florida is rightly world-renowned for its beaches and diverse coastal habitat. Florida boasts 825 miles of sandy beaches, home to shorebirds and sea turtles and attracting approximately 18.6 million tourists yearly.[62] Meanwhile, on its northwest shoreline on the Gulf of Mexico alone, Florida boasts approximately 60% of salt marshes found in the United States.[63] South Florida is home to the Everglades,

construction notification prior to construction, a requirement some have noted as delaying the permitting process.

59. 33 U.S.C. § 1344(e)(1)

60. NAT'L FISH & WILDLIFE FOUND., SOFTENING OUR SHORELINES 8 (2020) [hereinafter SOFTENING OUR SHORELINES].

61. For an in-depth analysis of the Corps' shoreline stabilization approaches, *see* Travis O. Brandon, *A Wall Impervious to Facts: Seawalls, Living Shorelines, and the U.S. Army Corps of Engineers' Continuing Authorization of Hard Coastal Armoring in the Face of Sea Level Rise*, 93 TUL. L. REV. 557, 559–61 (2019).

62. *Beaches*, FL. DEPT. OF ENVTL. PROTECTION, *available at* https://perma.cc/ZPJ3-WQ29.

63. *Marshes*, U.S. FISH & WILDLIFE SERV. (Sept. 19, 2017), *available at* https://perma.cc/CHW2-DYL3.

which includes huge expanses of freshwater marsh within its 1.5 million acres.[64] From the Ten Thousand Islands to the St. John's River, from Apalachicola Bay to the Biscayne, Florida encompasses a rich estuarine and wetlands environment.[65]

1. Ocean Edge: The Shore and Beach Preservation Act

Florida has an obligation to conserve and protect its beaches under both the public trust doctrine and its Constitution,[66] and it was one of the first states in the nation to establish a coastal setback line when it passed the Shore and Beach Preservation Act in 1961.[67] The values of public access, preventing erosion, and preserving dune system stability to protect property animates Florida's shore protection law.[68] Florida creates two distinct methods of creating jurisdictional areas of protection under the Act, depending on whether the purpose of the activity is for beach restoration or for the construction of structures.[69] This section focuses on the latter.

64. *Freshwater Marshes*, FLA. MUSEUM (Oct. 3, 2018), *available at* https://perma.cc/L3AJ-AQ8R.

65. FLA. FISH & WILDLIFE CONSERVATION COMMISSION, ESTUARIES, THE CRADLE OF THE OCEAN (2007), *available at* https://perma.cc/Z56W-MTYW.

66. Walton Cty. v. Stop the Beach Renourishment, Inc., 998 So. 2d 1102, 1110–11 (Fla. 2008), *aff'd sub nom.* Stop the Beach Renourishment, Inc. v. Fla. Dep't of Envtl. Prot., 560 U.S. 702 (2010).

67. Kenneth E. Spahn, *The Beach and Shore Preservation Act: Regulating Coastal Construction in Florida*, 24 STETSON L. REV. 353, 359–60 (1995) (noting also that serious efforts to protect the coast did not begin until the 1970s).

68. FLA. STAT. § 161.053(1)(a) (2020) (finding that beaches and dunes "represent one of the most valuable natural resources of Florida" and that it was "in the public interest to preserve and protect them from imprudent construction which can jeopardize the stability of the beach-dune system, accelerate erosion, provide inadequate protection to upland structures, endanger adjacent properties, or interfere with public beach access").

69. FLA. STAT. §§ 161.088, 161.101(1), 161.041(1) (2020) (providing for beach restoration and nourishment projects). *Stop the Beach Renourishment, Inc.*, 560 U.S. 702, 707 (2010), arose under Florida's beach restoration law. While it has been discussed extensively by commentators for its "judicial takings" theory, the core issue in the case revolved around whether the "fixing" of a once dynamic shoreline with the erosion control line violated the upland owners' littoral rights by divesting them of their right to receive accretions and severing their contact with the water. The U.S. Supreme Court upheld the Florida Supreme Court's determination that it did not. For in-depth discussion about how sea-level rise is likely to place pressure on common law doctrines of accretion and avulsion, *see* Alyson C. Flournoy, *Beach Law Cleanup: How Sea-Level Rise Has Eroded the Ambulatory Boundaries Legal Framework*, 42 VT. L. REV. 89, 101–02 (2017); *see also* E. Britt Bailey, *From Sea to Rising Sea: How Climate Change Challenges Coastal Land Use Laws*, 33 U. HAW. L. REV. 289, 310–11 (2010); Thomas K. Ruppert, *Eroding Long-Term Prospects for Florida's Beaches: Florida's Coastal Construction Control Line Program*, 1 SEA GRANT L. & POL'Y J. 65 (2008).

In Florida, structures are prohibited within 50 feet of the line of mean high water at any riparian coastal location fronting the Gulf of Mexico or Atlantic coast shoreline of the state.[70] This setback requirement excludes estuarine areas such as bays, inlets, rivers, bayous, and creeks. If an erosion control line has been established in an area, that line serves as the jurisdictional boundary if it is more landward than the existing mean high-water line.[71]

Structures may be built along Florida's beaches landward of the "Coastal Construction Control Line" (CCCL), which is developed by the Florida Department of Environmental Protection (DEP) on a county-by-county basis.[72] The CCCL marks the extent of "the beach-dune system subject to severe fluctuations based on a 100-year storm surge, storm waves, or other predictable weather conditions."[73] To establish the CCCL, a comprehensive engineering and topographical survey is required.[74] This survey, though, is not required to take into account future conditions such as sea level-rise projections.[75] Each survey depends instead on examining "30-year erosion projection procedures," including historical weather data such as past hurricanes, tide cycles, and erosion trends, among other

70. FLA. STAT. § 161.052 (2020).

71. *Id.*

72. *Id.* §§ 161.011; 161.053(1)(a)(2)(a) (2020); *Id* § 161.54(1). (providing that "[c]oastal building zone" means the land area from the seasonal high-water line landward to a line 1,500 feet landward from the coastal construction control line . . . ."); *Id* § 161.55 (providing that, on barrier islands, the coastal building zone extends from the seasonal high-water line to 5,000 feet landward from the CCCL or the entire island, whichever is less); *Id* § 161.54(1) (providing, when no line is established on a barrier island, the zone is the area seaward of the most landward velocity zone as determined by the Federal Emergency Management Agency (FEMA)). In 2020, Florida enacted a new law, which will be effective on July 1, 2021, requiring state-financed construction of structures in coastal areas to conduct a sea level impact project study before receiving approval to build by DEP. S.B. 1094, 26th Leg., 2d Reg. Sess. (Fla. 2020), FLA. STAT. § 163.3178(2)(f) (2020).

73. FLA. STAT. § 161.053 (2020). A coastal county or municipality may establish its own coastal construction zone if approved to do so. *Id* § 161.053(3) (2020). *See also* Richard Grosso, *Planning and Permitting to Reduce and Respond to Global Warming and Sea Level Rise in Florida*, 30 J. LAND USE & ENVTL. L. 201, 237–38 (2015) (describing how many of the CCCL's are outdated); Ruppert, *supra* note 69.

74. FLA. STAT.§ 161.053(2)(a) (2020) (requiring also that the CCCL may not be set until a public hearing is held in the affected county).

75. Grosso, *supra* note 73, at 237–38.

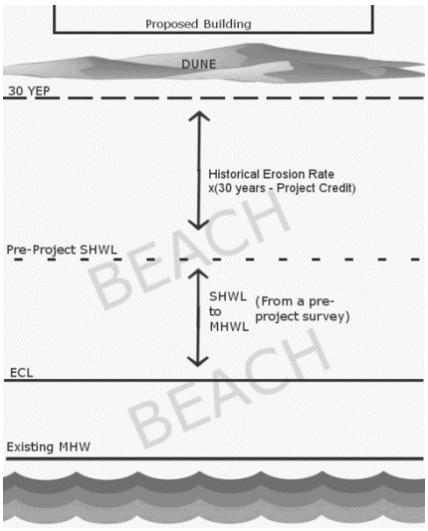

Figure 2: 30-YEP. Source: Fla. Admin. Code Ann. r. 62B-33.024

factors.[76] The CCCL is essentially a landward line established by adding a 30-year historical erosion rate projection (known as the "30-YEP") to an existing "seasonal high-water line,"[77] also known as the "spring tide."[78]

If the CCCL does not "extend beyond the landward toe of the coastal barrier dune structure that intercepts the 100-year storm surge," the DEP can shift the line further landward than the 100-year storm surge impact zone."[79] Once established, the CCCL is subject to review at the discretion of the Florida DEP under the following circumstances: after consideration of hydrographic and topographic data which indicate shoreline changes that render the CCCL "ineffective for purposes of the act"; at the written request of officials of affected counties or

76. FLA. ADMIN. CODE ANN. r. 62B-33.024 (2020); *see Frequently Asked Questions About the CCCL 2017*, FLA. DEP'T ENVTL. PROTECTION (Apr. 2020), *available at* https://perma.cc/4LWF-W4WN.

77. FLA. STAT. ANN. § 161.053(2)(b) (2020).

78. *Id.* § 161.053(5)(a)(2) (defining spring tide as "the line formed by the intersection of the rising shore and the elevation of 150 percent of the local mean tidal range above local mean high water").

79. *Id.* If there is not an established CCCL in the county, the jurisdictional line is set 50 feet from the erosion control lines or from the mean high-water line, whichever is more landward. *Id.* § 161.052.

municipalities; or when a riparian upland owner "feels that such line as established is unduly restrictive or prevents a legitimate use of the owner's property" and asks for review through a written request.[80]

In 2009, the Shore and Beach Preservation Act was amended to establish the state's policy on "rigid coastal armoring structures . . . for protection of private property and public infrastructure."[81] Permits may be issued for permanent or temporary armoring structures if it is determined that the areas where these structures are to be placed are "vulnerable to damage from frequent coastal storms."[82] Rigid armoring structures proposed for locations seaward of a CCCL are exempt from siting and design criteria outlined in the statute, "provided the armoring is capable of protecting the proposed construction from the effects of erosion from a 100-year storm surge."[83] Structures erected landward of the armoring must be: (1) sited a sufficient distance landward to allow for maintenance of the armoring; (2) located up to or landward of the established line of construction; (3) designed to comply with statutory windload requirements; and (4) sited and designed to protect marine turtles.[84]

Permits may be issued in response to a "present" situation or for "future installations," "contingent upon the occurrence of specified changes to the coastal system which would leave upland structures vulnerable to damage from frequent coastal storms."[85] Permits for "present" installations may connect existing armoring structures only if the result is a "continuous and uniform armoring structure construction line" no more than 250 feet in length.[86] This "gap-filling" provision has been criticized for promoting the armoring of important sea turtle nesting sites.[87] Armoring should not interfere with the protection of the beach dune system, adversely impact adjacent properties, interfere with public beach access, or harm native

80. *Id.* § 161.053 (2)(a).
81. *Id.* § 161.085(1).
82. *Id.* § 161.085(2). *See also* FLA. ADMIN. CODE ANN. r. 62B-33.0051 (2020) (outlining criteria for determining vulnerable structures).
83. FLA. STAT. ANN. § 161.053(b) (2020).
84. *Id.*
85. *Id.* § 161.085(2)(a)-(b).
86. *Id.* § 161.085(2)(c).
87. Grosso, *supra* note 73, at 246–50.

coastal vegetation, nesting marine turtles, or their hatchlings.[88] Alternative practices such as foundation modification, structure relocation, and dune restoration are encouraged but not required.[89]

2. Estuarine Edge: Environmental Resource Permits

In 1984, Florida passed the Warren S. Henderson Wetlands Protection Act, which made it illegal for anyone to "dredge or fill in, on, or over surface waters" without a permit. Studies indicated that, between 1850 and 1974, 60% of the state's wetlands—approximately 12 million acres—had been destroyed, with much of that destruction occurring between 1970 and 1973 in South Florida.[90]

Florida law provides that wetlands "generally include swamps, marshes, bayheads, bogs, cypress domes and strands, sloughs, wet prairies, riverine swamps and marshes, hydric seepage slopes, tidal marshes, mangrove swamps and other similar areas," with longleaf or slash pine flatwoods with an understory dominated by saw palmetto excluded.[91] To determine wetlands, Florida requires a "unified statewide methodology for the delineation of the extent of wetlands,"[92] working from a statutory baseline that defines wetlands as "areas that are inundated or saturated by surface water or groundwater at a frequency and a duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soils."[93] While Florida has a comprehensive wetlands protection program that goes above and beyond that under Section 404 of the Clean Water Act, it does not have a statewide buffer or setback

88. FLA. STAT. ANN. § 161.085(8) (2020).

89. Fla. Admin. Code Ann. r. 62B-33.0051 (2020). . Grosso, *supra* note 68, at 247 (citing SE. FLA. REG'L CLIMATE CHANGE COMPACT COUNTIES, A REGION RESPONDS TO A CHANGING CLIMATE (2012), *available at* https://perma.cc/YND9-ETWJ). He notes that the Southeast Florida Regional Climate Action Plan recommends that local governments adopt a policy to "[c]oordinate 'living shorelines' objectives at regional scale to foster use of natural infrastructure (e.g., coral reefs, native vegetation and mangrove wetlands) instead of or in addition to grey infrastructure (e.g., bulkheads)." *Id.*

90. Mary F. Smallwood et al., *The Warren S. Henderson Wetlands Protection Act of 1984: A Primer*, 1 J. LAND USE & ENVTL. L. 211, 211 (1985).

91. *Id.*

92. FLA. STAT. § 373.421 (2020).

93. *Id.* § 373.019(27).

mandated to protect wetlands or marsh areas. Municipalities, counties, and regional planning councils may establish wetland buffers, and several have done so.[94]

In 1993, Florida consolidated wetland resource, mangrove alteration, and surface management permits into an "Environmental Resource Permit" (ERP).[95] ERP applicants must demonstrate that the activity will not harm water resources and provide "reasonable assurance" that the activity is not contrary to the public interest balancing criteria such as public health, conservation, and recreational values.[96] If the public interest test is not met, mitigation may be required to offset the activity's adverse effects.[97] Permitting districts must consider the cumulative impacts of their decisions.[98] Mitigation in the same drainage basin as the projected adverse impacts meets the cumulative impact requirement.[99]

Florida's wetlands law includes a statement that it is the Legislature's intent to protect "estuaries and lagoons" from "damage created by construction of vertical seawalls and to encourage construction of environmentally desirable shore protection systems, such as riprap and gently sloping shorelines which are planted with suitable aquatic and wetland

94. *See* Fla. Att'y.Gen., Attorney General Opinion 91-50 (July 11, 1991) (finding that a regional council was authorized to adopt an administrative rule establishing criteria for wetland buffers); VOLUSIA CTY. CODE §72-883 (2020) (requiring a 25-foot buffer); ST. JOHNS CTY, LAND DEV. CODE §4.01.06 (2020) (requiring a 50-foot upland buffer).

95. John J. Fumero, *Environmental Law: 1994 Survey of Florida Law—At A Crossroads in Natural Resource Protection and Management in Florida*, 19 NOVA L. REV. 77, 83–84 (1994). The ERP program operates independently of the Section 404 dredge-and-fill program under the Clean Water Act that is regulated by the Corps. Florida has created a joint application process with the Corps to streamline permitting. ERPs are processed either by one of the Florida Department of Environmental Protection's six district offices or one of Florida's five water management districts. FLA. DEP'T OF ENVTL. PROT., *Operating Agreements ERP Permitting: DEP District Offices and the Water Management District Offices*, ENVIRONMENTAL RESOURCE PERMITTING COORDINATION, ASSISTANCE, PORTALS, *available at* https://perma.cc/HP8W-LJPG.

96. FLA. STAT. § 373.414(a) (2020).

97. *Id.*§ 373.414(27). *See* Richard Grosso, *Regulating for Sustainability: The Legality of Carrying Capacity-Based Environmental and Land Use Permitting Decisions*, 35 NOVA L. REV. 711, 722 (2011).

98. FLA. STAT. § 373.414(8)(a) (2020); Sierra Club v. St. Johns River Water Mgmt., 816 So. 2d 687, 688 (Fla. Dist. Ct. App. 2002).

99. FLA. STAT. § 373.414(8)(b) (2020); Peace River/Manasota Reg'l Water Supply Auth. v. IMC Phosphates, 18 So. 3d 1079, 1086 (Fla. Dist. Ct. App. 2009).

vegetation."[100] An ERP is required for shoreline stabilization applicants.[101]

For these projects, "native aquatic vegetation" shall be used instead of stabilization structure unless an "applicant can affirmatively demonstrate that the use of such vegetation, including the existing undisturbed vegetation onsite, will not prevent erosion."[102] In such an instance, riprap or other "sloping revetments" may be utilized so long as specific requirements are met, including a "two horizontal to one vertical" slope requirement.[103] Riprap also is limited to shorelines less than 100 linear feet and where erosion has occurred or is likely to occur.[104] Shoreline stabilization activities exempt from permitting include riprap in artificially-created waterways such as canals,[105] restoration of existing seawalls or riprap under certain criteria, and new walls between existing, legal seawalls or riprap structures ("gap-filling").[106]

Living shorelines of 500 feet or fewer are also exempt from the ERP permitting process.[107] Florida has adopted Nationwide Permit 54 as well as a State Programmatic General Permit to "fast-track" these small-scale living shoreline projects.[108] Florida requires exempted projects to meet certain requirements

100. FLA. STAT. § 373.414(5)(a) (2020). "Estuary" is defined as a "semienclosed [sic], naturally existing coastal body of water which has a free connection with the open sea and within which seawater is measurably diluted with fresh water derived from riverine systems. *Id.*§ 373.403(15) (2020). "Lagoon" is defined as a "a naturally existing coastal zone depression which is below mean high water and which has permanent or ephemeral communications with the sea, but which is protected from the sea by some type of naturally existing barrier." *Id.* (16) (2020). "Seawall" is defined as "a manmade wall or encroachment (…) made to break the force of waves and to protect the shore from erosion. *Id.* § 373.403(17) (2020).

101. *Submitting an ERP,* FLA. DEP'T OF ENVTL. PROT., *available at* https://perma.cc/8J6T-FN22. Submerged lands are owned by the state of Florida, which must provide authorization for any activities occurring on submerged lands. FLA. STAT.§ 253.03 (2020); FLA. ADMIN. CODE ANN. r. 18-21.002 (2020).

102. *Id.*

103. *Id.*

104. FLA. ADMIN. CODE ANN. r. 62-330.431 (2020) (requiring natural boulders and prohibiting backfilling).

105. FLA. STAT. § 373.414(11)(2)(b) (2020).

106. FLA. ADMIN. CODE ANN. r. 62-330.051(12)(a) (2020).

107. *Id.* Property owners can verify that they meet this exemption by submitting a form. *Request for Verification of an Exception*, FLA. DEPT. OF ENVTL. PROT., *available at* https://perma.cc/SV2Q-3JWY.

108. U.S. ARMY CORPS OF ENG'RS, *State Programmatic General Permit (SPGP V) State of Florida,* JACKSONVILLE DISTRICT WEBSITE, *available at* https://perma.cc/J4HF-SQYV.

for planting, invasive species removal, and breakwater allowances.[109] Nature-based shoreline stabilization projects larger than 500 feet likely require an individual ERP permit.[110]

B. Georgia

While only about 100 miles from north to south, Georgia's coastline is one of the most pristine in the nation, consisting of eight major barrier islands in addition to the seashore. Only three island groups—Tybee, St. Simons/Sea Island, and Jekyll—are accessible by a paved causeway and bridge. The other islands—Cumberland/Little Cumberland, Sapelo/Blackbeard, St. Catherines, Ossbaw, and Wassaw—are under state or federal administration and are accessible only by boat.[111] Although Georgia's ocean-facing coastline is only 100 miles long, its shore twists and winds through marshlands and tidal creeks; the state contains approximately 378,000 acres of salt marsh, representing almost one-third of the total salt marsh area on the entire eastern seaboard.[112] Comparatively undeveloped compared to most Atlantic states' coasts, Georgia's coast possesses tremendous coastal marsh resources. Approximately 92% of Georgia's shoreline is dominated or fronted by salt marsh with only 5% of the shoreline armored.[113]

Georgia's highly active tidal range is another distinguishing feature of its tidal ecosystem. Georgia's coast is located behind a chain of barrier islands that extends from Cape Fear, North Carolina, to Cape Canaveral, Florida, as part of a curved coastline known as the Georgia Bight.[114] Tides approaching the Atlantic coast reach the northern portion of the Bight first,

109. *Id.*

110. THOMAS T. ANKERSEN, ET AL., FLA. SEA GRANT COLL. PROGRAM, UF/IFAS EXTENSION, STREAMLINING RESILIENCY: REGULATORY CONSIDERATIONS IN PERMITTING SMALL-SCALE LIVING SHORELINES IN FLORIDA (2018).

111. Vernon J. Henry, *Geology of the Georgia Coast*, NEW GA. ENCYCLOPEDIA (May 9, 2019), *available at* https://perma.cc/88F8-GXXZ. Jekyll Island, while accessible by bridge and a causeway, was established as a state park in 1947 and placed under Georgia's control in 1950. *Island History*, JEKYLL ISLAND GEORGIA, *available at* https://perma.cc/36E5-ZUY4; GA. CODE ANN. § 12-3-230 (2020). By law, approximately 65% of the island may not be developed. *Id.* § 12-3-243.

112. *Marsh and Shore Permits*, GA. DEPT. OF NAT. RES. COASTAL RES. DIV., *available at* https://perma.cc/2QVS-YFX6.

113. N.E. Peterson et. al, *supra* note 36, at 2.36

114. Miles O. Hayes, *The Georgia Bight Barrier System*, *in* GEOLOGY OF HOLOCENE BARRIER ISLAND SYSTEMS 223, 223 (Richard A. Davis Jr. ed. 1994).

resulting in two-foot tides in that area. As the tides continue inland, however, towards the inner curvature of the coast itself, they increase in volume and height, with the water "piling up."[115] By the time the water reaches Georgia's coast, the tidal range has increased dramatically in comparison to areas such as North Carolina and South Florida, rising and falling between six and ten feet twice every day.[116]

1. Ocean Edge: The Shore and Beach Preservation Act

The 1979 Shore Protection Act protects Georgia's beaches and dunes.[117] Specifically, the Act aims to protect the natural sand-sharing system that sustains the beaches and dunes, which in turn act as a buffer of protection for private property and serve as important natural recreation resources linked to Georgia's coastal economy.[118] The Act creates a protected jurisdictional area known as the "dynamic dune field," which is created by defining the ordinary high-water mark as the seaward boundary, and one of the following for the landward boundary:

- the first occurrence of the seaward-most portion of a structure existing on July 1, 1979,
- the landward most line that is 25 feet landward of the landward toe of the most landward sand dune, or
- 25 feet landward of the crest of a serviceable shoreline stabilization activity.[119]

115. *Id.*

116. *Overview: Georgia Coast*, UNIV. OF GA. MARINE EXTENSION AND GA. SEA GRANT, *available at* https://perma.cc/2MS3-FMCN.

117. GA. CODE ANN. § 12-5-231 et seq (2020).

118. *Id.* § 12-5-231 (finding that "coastal sand dunes, beaches, sandbars, and shoals comprise a vital natural resource system, known as the sand-sharing system, which acts as a buffer to protect real and personal property and natural resources from the damaging effects of floods, winds, tides, and erosion…that the coastal sand dunes are the most inland portion of the sand-sharing system and … that ocean beaches provide an unparalleled natural recreation resource which has become vitally linked to the economy of Georgia's coastal zone … that this natural resource system is costly, if not impossible, to reconstruct or rehabilitate once adversely affected by man … that this sand-sharing system is a vital area of the state and is essential to maintain the health, safety, and welfare of all the citizens of the state).

119. *Id.* § 12-5-232(8). The jurisdictional area was amended in 2019. Prior to this time, the jurisdictional area contained the unique provision of a landward line that, in addition to retaining 1979 structures, was drawn from "trees equal to or taller than 20 feet." If

If none of the above exists, the line is drawn 25 feet landward of the ordinary high-water mark. A 100-foot setback is required for state-owned property.[120] Construction of a structure or alteration of the natural topography or vegetation of land is allowed within the jurisdictional area pursuant to a permitting process.[121] For structures or land alterations related to private residences and commercial structures, permits may be issued if the proposed activity occupies the landward part of the parcel and is landward of the sand dunes if feasible; more than 30% of the parcel will be retain its natural vegetation and topography; the proposed project follows applicable hurricane-resistant standards; activities related to construction are minimized and temporary; the natural vegetation and topography are restored using best available technology upon project completion; and the proposed project will uphold the functions of the sand-sharing system.[122]

Georgia allows "shoreline engineering activity" to stabilize the shoreline.[123] The activities associated with construction must be temporary, with "complete restoration of any beaches, dunes, or shoreline areas altered as a result of that activity."[124] The project must minimize its effects on the "sand-sharing mechanisms from storm-wave damage and erosion" both to the parcel it adjoins and "at other shoreline locations."[125] Finally, if

an existing structure, shoreline engineering activity, or other alteration that forms the landward boundary, is more than "80 percent destroyed by storm driven water or erosion," the 1979 exception no longer controls. *Id.* § 12-5-237(b).

120. GA. CODE ANN. § 12-5-237(b) (2020).

121. GA. CODE ANN. § 12-5-237(b) (2020). Permits are not required for structures, shoreline engineering activity, or land alteration that existed on or before July 1, 1979, unless any modification, addition, or extension of the activity would have a negative impact on the sand-sharing system. *Id.* § 12-5-237(b).

122. GA. CODE ANN. § 12-5-239(c)(1); GA. COMP. R. & REGS. 391-2-2-.02 (1992). In Georgia, a Shore Protection Committee evaluates permit applications. GA. CODE ANN § 12-5-235. It may consider historic photographs and topographic data; accepted scientific investigations necessary to determine impacts on the surrounding systems; the potential effects of shoreline engineering structures (seawalls, groins, jetties, etc.) on the proposed project; historic, climatological, tidal data, and meteorological records; and "new scientific information which, through recent advances, would effect a more competent decision relative to wise use and management of Georgia's sand-sharing system." *Id.* § 12-5-239(d).

123. GA. CODE ANN. § 12-5-239(3) (2020).

124. *Id.*

125. *Id.*

shoreline stabilization is necessary and no reasonable or feasible alternative exists, "low-sloping porous rock structures or other techniques which maximize the dissipation of wave energy and minimize shoreline erosion" shall be used.[126]

2. Estuarine Edge: Coastal Marshlands

The Coastal Marshlands Protection Act of 1970 (CMPA) protects Georgia's coastal marshes.[127] When enacting the CMPA, the Georgia General Assembly declared that coastal marshlands "comprise[d] a vital natural resource system" that provides nutrients to important species of plants and wildlife, filters pollution, provides a buffer against flooding and erosion, and is a natural recreation resource linked to the state's coastal and statewide economy.[128] Coastal marshlands are defined as "any marshland intertidal area, mud flat, tidal water bottom, or salt marsh . . . within the estuarine area of the state, whether or not the tidewaters reach the littoral areas through natural or artificial watercourses."[129] "Vegetated marshlands" have at least one of fourteen listed marsh plant species.[130] If salt marsh peat exists at the undisturbed surface of an area, this is deemed "conclusive evidence" of a salt marsh.[131]

A permit is required to remove, fill, alter, or locate a structure over marshlands.[132] Projects must depend on waterfront access and typically include marinas, community docks, bridges, dredging, and bank stabilizations such as

126. *Id.* § 12-5-239(c)(3).

127. *Id.*§ 12-5-281-282.

128. *Id.* § 12-5-281.

129. *Id.*; &M Enters, of Ga. v. Williams, 346 Ga. App. 79, 90 (2018), *cert. denied* C&M Enters. of Ga. v. Williams, No. S18C1407, 2019 Ga. LEXIS 52 (Jan. 7, 2019) (holding that "any marshlands that result from such artificial watercourse constitute jurisdictional marshlands" and that the jurisdictional line draw by the agency was appropriate). In Georgia, an "estuarine area" consists of "all tidally influenced waters, marshes, and marshlands lying within a tide-elevation range from 5.6 feet above mean tide level and below." GA. CODE ANN. § 12-5-282(7) (2020).

130. GA. CODE ANN. § 12-5-282 (2020) (listing species).

131. *Id.*

132. GA. CODE ANN. § 12-5-286 (2020). *See* Ctr. for a Sustainable Coast v. Coastal Marshlands Prot. Comm., 284 Ga. 736 (2008) (analyzing scope of the phrase "otherwise alter"). The estuarine area is the "tidally influenced waters, marshes, and marshlands lying within a tide-elevation range from 5.6 feet above mean tide level and below." A five-member Coastal Marshlands Protection Committee is responsible for the permitting and leasing processes under the CMPA. GA. CODE ANN. § 12-5-282 (2020). For leasing information, *see* GA. CODE ANN. § 12-5-287 (2020).

bulkheads or riprap of more than 500 feet.[133] All permit applications must meet a "public interest" test that considers factors such as whether natural flow of water will be obstructed, whether increased erosion will occur, and the extent of interference with conservation of marine life, wildlife, or other resources.[134]

While a landowner who seeks to construct a bulkhead less than 500 feet in length may not be required to obtain a permit under the CMPA, any bulkhead or structure that is below the high tide line or within a marsh jurisdictional area requires a "Revocable License," the granting of which serves as a type of approval process for smaller bank stabilization projects.[135] Once a license is issued, the landowner can proceed to the next step in the permitting process, which requires determining whether a buffer variance—described next—must be obtained prior to construction of the bulkhead.

Georgia has established a coastal marsh buffer of 25 feet through its Erosion and Sedimentation Act of 1975 (ESA) and in reference to the CMPA.[136] The buffer is measured "horizontally from the coastal marshland-upland interface" defined in the CMPA, commonly referred to as the "vegetated buffer."[137] Land-disturbing activities are prohibited in vegetated buffer areas without a variance. [138] Buffer variances are considered for

133. GA. CODE ANN. § 12-5-288(a) (2020); GA. COMP. R. & REGS. 391-3-7-.11(9) (2020). In addition, the higher cost of an alternative site is not sufficient reason to decide that the alternative site is infeasible. *See* In re Young, No. CMPC-005, 1978 WL 14315 (Aug. 23, 1978); In re Atkinson, No. CMPC-004, 1977 WL 16175 (Dec. 14, 1977).

134. GA. CODE ANN. § 12-5-286(g) (2020). Filling in marshlands for activities such as commercial, residential, and industrial uses, private parking lots and roadways, dump sites, dredging, mining, waste treatment or structures that might obstruct the view of neighboring landowners are considered "normally against the public interest," although the Coastal Marshlands Protection Committee may grant permits for such activities in its "sound discretion." *Id.*

135. Dorroh v. McCarthy, 265 Ga. 750 (1995). Like most states, Georgia owns fee simple title to the foreshore on navigable tidal water, which includes water bottoms up to the high water mark, and this tideland area may be regulated for "the public good." GA. CODE ANN. §50-16-61 (2020).; COASTAL MARSHLANDS PROTECTION PROGRAM, GA. DEPT. OF NATURAL RES., COASTAL RES. DEV., 47, *available at* https://perma.cc/P7WC-ZBBD.

136. GA. CODE ANN. § 12-7-2 (17)(A) (2020).

137. *Id.*

138. *Id.* § 12-7-4; GA. CODE ANN. § 12-7-6 (2020). The Georgia Environmental Protection Division is the only entity that may approve vegetative buffer variances. Ga. Att'y Gen., Attorney General Opinion 90-40 (Dec. 3, 1990). However, a property owner

projects such as those involving the maintenance of existing infrastructure such as a dam or dock or the crossing of utility lines.[139] Bank and shoreline stabilization structures also require permits.[140] Factors considered for variance applications include: locations of natural features such as wetlands and marshlands, the property's physical characteristics, the extent of the buffer intrusion, whether reasonable alternatives exist, whether the mitigation plan proposed is at least as protective of natural resources, the current condition of the existing buffer, and the long-term water quality impacts.[141]

Georgia has a "highly active shoreline" because of its large tidal range, and shoreline modification using hard armoring in response to erosion has been identified as a management concern. In addition, because of Georgia's large tidal range, the most effective living shorelines involve oyster shells and oyster restoration, which dissipate the tidal energy well.[142] Georgia includes living shorelines among its stabilization options and has supported several pilot projects.[143] The state also has funded a Geographic Information System (GIS) inventory of estuarine restoration and management of its shorelines, identifying shoreline segments stabilized with bulkheads, riprap or other man-made materials in addition to living shorelines.[144] The

in a buffer area may trim vegetation so long as "protective vegetative cover remains." GA. CODE ANN.§ 12-7-2 (17)(B) (2020).

139. GA. COMP. R. & REGS. § 391-3-7-.11(2), (9) (2020). A variance from the 25-foot buffer along coastal marshlands is not required to maintain any currently serviceable structure such as retaining walls or bulkhead if "adequate erosion control measures" are incorporated into the project plans and fully implemented. *Id.* § 391-3-7-.11(d). They are determined by the Georgia Environmental Protection Division.

140. *Id.* 391-3-7-.11(9)(b). Certain activities are considered to have "minimal impact" on water quality and aquatic habitat and are deemed to have an approved buffer "variance by rule." *Id.* 391-3-7-.11(9)(r).

141. *Id.* 391-3-7-.11(5).

142. GA. DEPT. OF NAT. RES., COASTAL RES. DIV., LIVING SHORELINES ALONG THE GEORGIA COAST (2013), *available at* https://perma.cc/JN3E-X5PM.

143. GA. DEPT. OF NAT. RES., COASTAL RES. DIV., *Streambank and Shoreline Stabilization*, GREEN GROWTH GUIDELINES (2014), *available at* https://perma.cc/9YJG-X8SF; *Living Shorelines*, GA. DEPT. OF NAT. RES., COASTAL RES. DIV., available at http://gcmp.maps.arcgis.com/apps/MapTour/index.html?a-pid=fa83fbc0786542ff99dbf12b509ffbc5&webmap=b5e08e21085a403faec4086381edcb34 (last accessed Feb. 16, 2021); *Living Shorelines*, GA. DEPT. OF NAT. RES., COASTAL RES. DIV., *available at* https://perma.cc/Q2KG-YXWC.

144.*Streambank and Shoreline Stabilization*, *supra* note 143, at 9, 40; C. Alexander, *Geospatial characterization studies for advancing estuarine restoration and management*

Corps' Nationwide Permit 54 has been approved by the state with certain conditions.[145]

C. South Carolina

With 2,876 miles of tidal shoreline, 165 linear miles of beaches, 504,000 acres of salt marsh habitat, and 40 barrier islands, South Carolina's coast supports a complex ecosystem and a myriad of coastal and marine species.[146] A 2010 study found that approximately 25% of the state's coastline is armored.[147]

1. Ocean Edge: The Beach Management Act

The Beach Management Act (BMA) protects South Carolina's "beach/dune system."[148] Efforts to protect the beach system have been particularly complicated in South Carolina. The BMA was South Carolina's first concrete shore protection law in 1988, attempting, as two commentators put it well, to create a "line in the sand" known as a "baseline" in order to "replicate the likely position of the public beach and to prohibit any construction seaward of that line."[149] The baseline famously eliminated the economic viability of several oceanfront lots as a result.[150] In 1990, the BMA became the subject of significant challenges to its constitutionality (including the famous case

in Georgia in FINAL REPORT TO THE GEORGIA DEPARTMENT OF NATURAL RESOURCES, BRUNSWICK, GA 1, 21 (2016)

145. SOFTENING OUR SHORELINES, *supra* note 58, at 36.

146. *About Coastal South Carolina*, S.C. SEA GRANT CONSORTIUM, *available at* https://perma.cc/UFU5-LHZL.

147. M Mary D. Shahid & Angelica M. Colwell, *The Regulation of Coastal Properties in an Era of King Tides*, 53 REAL PROP. TR. & EST. L.J. 101, 113–14 (2018) (citing S.C. DEP'T OF HEALTH & ENVTL. CONTROL, ADAPTING TO SHORELINE CHANGE: A FOUNDATION FOR IMPROVED MANAGEMENT AND PLANNING IN SOUTH CAROLINA 94 (2010)).

148. S.C. CODE ANN. § 48-39-250(a)-(d) (2020) (finding that the beach/dune system "protects life and property by serving as a storm barrier which dissipates wave energy and contributes to shoreline stability in an economical and effective manner"; "provides the basis for a tourism industry that generates approximately two-thirds of South Carolina's annual tourism industry revenue which constitutes a significant portion of the state's economy"; "provides habitat for numerous species of plants and animals, several of which are threatened or endangered"; and "provides a natural healthy environment for the citizens of South Carolina to spend leisure time which serves their physical and mental well-being").

149. *Id.* § 105–07 (2018).

150. *Id.*

Lucas v. S.C. Coastal Council),[151] and the Act was amended to allow special permits for property seaward of the baseline.[152] Prior to 2018, the BMA also emphasized a specific 40-year policy of managed retreat from imperiled areas, with safety, environmental protection, and tourism as primary objectives.[153] Amendments enacted in 2018 eliminated the BMA's policy of retreat, replacing it with a "policy of beach preservation" instead.[154]

South Carolina's coastal jurisdictional area is created by two lines that are established to regulate development in the coastal zone: the baseline, which is the more seaward line, and the setback line, which is the more landward line.[155] The area between these two jurisdictional lines is known as the "setback area." [156] Construction, reconstruction, or alterations to habitable structures within the setback area is allowed under a permitting process, with different requirements for homes built prior to 1988 and newer homes.[157]

The seaward baselines established depend on whether the line is in a "standard erosion zone"[158] or an "inlet erosion zone."[159] Determining the crest of the primary oceanfront sand dune is the driving factor for these zones, with the exception of inlet erosion zones not stabilized by jetties, terminal groins, or other structures.[160] The landward setback lines must extend 40

151. Lucas v. S.C. Coastal Council, 505 U.S. 1003, 1004 (1992).

152. *Id.* *See also* J. Peter Byrne, *A Fixed Rule for A Changing World: The Legacy of Lucas v. South Carolina Coastal Council*, 53 REAL PROP. TR. & EST. L.J. 1, 22–23 (2018) (describing the dramatic effect that *Lucas* had on regulators); Michael Allan Wolf, *Supreme Court Roadblocks to Responsive Coastal Management in the Wake of Lucas*, 53 REAL PROP. TR. & EST. L.J. 59, 60 (2018) (observing how the BMA "was based in large part on expert findings regarding sea level rise caused by climate change attributable to greenhouse gas emissions").

153. S.C. CODE ANN. 48-39-250 (2020).

154. *Id.* § 48-39-280; H. 4863, 2017-2018 Leg., 122nd Sess. (S.C. 2018).

155. S.C. CODE ANN. § 48-39-290(A) (2020).

156. *Id.* Through a special permit provision that was added in 1990, some construction such as groins related to shoreline stabilization is allowed seaward of the baseline. *Id.* § 48-39-290(A)(8).

157. *Id.* § 48-39-290(B)(1)-(2).

158. *Id.* § 48-39-270(6).

159. Id. § 48-39-270(7).

160. For standard erosion zones, baselines are "established at the location of the crest of the primary oceanfront sand dune in that zone." *Id.*§ 48-39-280(A)(1). DHEC must use the best available scientific and historical data to determine where the crest of the primary oceanfront sand dune would have been located if the shoreline had not been altered. *Id.* In the case of inlet zones, which are more dynamic areas, the baseline is the

times the average annual erosion rate landward of the baseline, and they may not be less than 20 feet landward of the baseline.[161] Fripp Island—a private island "entirely revetted with existing erosion control devices"—is exempted from these rules, and instead has a baseline from "the landward edge of the erosion control device," with the setback line twenty feet landward of this baseline.[162]

The BMA requires South Carolina's Office of Ocean and Coastal Resource Management (OCRM) to review the baseline and setback lines every seven to ten years.[163] In 2016, the BMA was amended to prohibit any "seaward movement" of the baseline after December 31, 2017.[164] The lines had last been drawn in 2009, and OCRM's efforts to set new lines by the deadline were met with such intense opposition that the deadline was extended into 2018.[165] In the meantime, the BMA itself was amended in 2018, changing the Act's policy of retreat, as noted above, and including a provision requiring that the jurisdictional lines not move "seaward from the most seaward location" of one of the following:

"most landward point of erosion at any time during the past forty years, unless the best available scientific and historical data of the inlet and adjacent beaches indicate that the shoreline is unlikely to return to its former position." *Id.* § 48-39-280(A)(2). In contrast to standard erosion zones, "the actual location of the crest of the primary oceanfront sand dune of that erosion zone is the baseline of that zone, not the location if the inlet had remained unstabilized." *Id.*

161. *Id.* § 48-39-280(B).

162. *Id.* § 48-39-290(2)(E).

163. *Id.* § 48-39-280(C). Reviews have been conducted during the following cycles: 1990-1991, 1999-2001, 2008-2010, and 2016-2018. *See* SOUTH CAROLINA BAR, A DAY AT THE BEACH: HOW TO SURVIVE THE CHANGING TIDES OF ENVIRONMENTAL CASES (2019), *available at* https://perma.cc/GU2C-T86M.

164. S. 139, 2015-2016 Leg., 121st Sess., (S.C. 2016).

165. *See, e.g.,* Kiawah Island Inn Co. v. S.C. Dep't of Health & Envtl. Control, No. 18-ALJ-07-0048-CC, 2018 WL 4677748, at *1 (S.C. Admin. Law Ct. Sept. 20, 2018); Mariners Walk Horizontal Prop. Regime v. S.C. Dep't of Health & Envtl. Control, No. 18-ALJ-07-0066-CC, 2018 WL 4208282, at *1 (S.C. Admin. Law Ct. Aug. 28, 2018); Wild Dunes v. S.C. Dep't of Health & Envtl. Control, No. 18-ALJ-07-0018-CC, 2018 WL 4208267, at *1 (S.C. Admin. Law Ct. Aug. 24, 2018); The Ocean Course Golf Club v. S.C. Dep't of Health & Envtl. Control, No. 18-ALJ-07-0045-CC, 2018 WL 3996282, at *1 (S.C. Admin. Law Ct. Aug. 9, 2018). *See also* Shahid & Colwell, *supra* note 147, at 107 (noting the politically charged nature of these issues in South Carolina); Gregg Bragg, *DHEC Holds Public Hearing Over Jurisdictional Lines*, THE ISLAND EYE NEWS (Nov. 11, 2017), *available at* https://perma.cc/QYJ4-3LSB; Kate Phillips, *DHEC Extends Public Comment Period on Proposed Beachfront Jurisdictional Lines Until April 6, 2018*, S.C. DEP'T OF HEALTH AND ENVTL. CONTROL (Nov. 3, 2017), *available at* https://perma.cc/X4W5-S8CN.

- the baseline established during the 2008–2012 cycle;
- the location of the baseline as proposed by OCRM on October 6, 2017; and
- the location of the proposed October 6, 2017 baseline as revised by OCRM pursuant to a review or an appeal initiated before January 1, 2018.[166]

OCRM has developed an online tool known as the "Beachfront Jurisdictional Line Viewer" to assist property owners with identifying baselines and setback lines, although a survey is ultimately required to establish the lines definitively.[167] The figure below is an image from of the viewer of an area on the Isle of Palms. The yellow line indicates that the area is an "unstabilized inlet zone."[168] The red line is the 2008–2012 baseline. The blue line is the 2008-2012 setback line. The dotted green line is the 2016–2018 baseline. The dotted purple line is the 2016–2018 setback line.

The 2018 Amendments require OCRM to "initiate a new baseline cycle by no sooner than January 1, 2024."[169] Until that time, the baseline and setback line in effect for landowners are the most seaward of the following:

1. The 2008-2012 baseline (red line above) or the baseline proposed by OCRM on October 6, 2017 (dotted green baseline); and

166. S.C. CODE ANN. § 48-39-280(C)(4) (2020).

167. *S S.C. Beachfront Jurisdictional Lines,* S.C. DEP'T OF HEALTH AND ENVTL. CONTROL, *available at* https://perma.cc/54GF-4DBP. When establishing these jurisdictional lines, OCRM must "utilize the best available scientific and historical data in the implementation." S.C. CODE ANN. § 48-39-280(A) (2020). In South Carolina, this includes LiDAR, survey-grade GPS, and aerial photography**.** The state also utilizes AMBUR ("Analyzing Moving Boundaries Using R"), a spatial-temporal statistical analysis tool designed to analyze shoreline change. *Coastal HVA Help*, S.C. DEP'T OF HEALTH AND ENVTL. CONTROL, *available at* https://perma.cc/8FB7-TFCT. AMBUR informs OCRM's online tool known as the "Beachfront Jurisdictional Line Viewer," which assists property owners with identifying baselines and setback lines, although a survey is ultimately required to establish the lines definitively. *S S.C. Beachfront Jurisdictional Lines*, *supra*.

168. *S S.C. Beachfront Jurisdictional Lines, supra* note 167.

169. S.C. CODE ANN. § 48-39-285(A) (2020).

Figure 3: Image of Jurisdictional Lines in Northeastern Area of Island of Palms

2. The 2008-2012 setback line (blue line) or the setback line proposed by OCRM on October 6, 2017 (dotted purple line).[170]

Notably, as the image in Figure 3 indicates, baselines and setback lines do not necessarily run parallel with each other and may even create an "X"-type of boundary, where different sections of some baselines are more seaward than others on the same piece of property or setback lines are more seaward than baselines. At times, because the most seaward line must be chosen, it appears that some parcels may have both a 2008-2012 baseline and an October 6, 2017 baseline that is the most seaward line, depending on how the lines fall.

170. *Id.* § 48-39-285. The October 6, 2017 lines may be found in the S.C. Beachfront Jurisdictional Line website under the tab "View Line Reports." *See, e.g.*, S.C. DEP'T OF HEALTH AND ENVTL. CONTROL, LINE REPORT: PROPOSED BASELINE AND SETBACK LINE: ISLE OF PALMS (2019), *available at* https://perma.cc/QD85-7G5H.

Under the BMA, erosion control structures or devices include seawalls, bulkheads, and revetments.[171] The BMA prohibits new erosion control structures and limits repair and maintenance of existing structures.[172] Existing and functional erosion control structures may not be enlarged, strengthened or rebuilt, although they may be maintained in their present condition.[173] If destroyed more than "fifty percent above grade," the structure must be removed at the owner's expense.[174]

There are, however, exemptions to these prohibitions.[175] The BMA, for example, exempts all of Fripp Island because only a small percentage of its shoreline was unarmored at the time of the BMA's adoption.[176] Folly Beach is entirely exempt from the general rules under the rationale that its erosion was caused by harbor jetties built for a federal navigation project and so was not the result of chosen activity by local landowners.[177] The "planned unit development" clause exempts the small number of development projects which had been approved and for which building permits had been issued at the time the BMA was adopted, but which had not yet been fully constructed.[178]

Recently, some property owners have used the BMA's "pilot project" exemption to implement "Wave Dissipation Systems," fence-like structures based upon local resident's design, intended to reduce wave energy levels.[179] These devices are designed to fall outside the category of prohibited erosion control devices but have been controversial in implementation and have not even been proven to work.[180] Homes protected by such

171. S.C. CODE ANN. 48-39-270(1) (2020) (defining erosion control structures or devices as seawalls, bulkheads, and revetments).

172. The prohibitions were adopted in 1990 and were based on legislative findings indicate strong awareness of the issues related to hard armoring. Shahid & Colwell, *supra* note 145.

173. S.C. CODE ANN. § 48-39-290(b) (2020).

174. *Id.* § 48-39-290(b)(iv).

175. Shahid & Colwell, *supra* note 145; H. 4863, 2017-2018 Leg., 122nd Sess. (S.C. 2018).

176. *Id.*

177. *Id.* Folly Beach's baseline is on the landward edge of all existing erosion control devices. For properties without erosion control structures, the baseline occurs where the baseline is drawn from erosion control devices on adjacent properties. *Id.*

178. S.C. CODE ANN. § 48-39-290 (C)(1) (2020).

179. *Id.*. § 48-39-320(C) (providing for pilot projects). *See* Jennifer Tuohy, *Wave Dissipation System Approved By Legislature,* THE ISLAND EYE NEWS (Jun. 5, 2014), available at https://perma.cc/G6PP-DC7C.

180. *See* Shahid & Colwell, *supra* note 145 at 106.

devices were destroyed after Hurricanes Matthew and Irma, and environmental groups have alleged that the devices threaten nesting sea turtles in violation of the Endangered Species Act.[181] Finally, by means of a budget proviso, the South Carolina legislature authorized OCRM to issue a special permit for reconstruction of a specific existing structure, several decades old, which protected approximately twenty-five properties and was seaward of a beach renourishment project.[182] Environmentalists have raised concerns about this approach, noting that, without uniform rules, every community with an eroding beach will seek an exception, and that broader planning will be required as sea-levels rise.[183]

2. Estuarine Edge: Coastal Tidelands and Wetlands Act

In 1977, South Carolina enacted the Coastal Tidelands and Wetlands Act, which established the state's coastal zone management program and a regulatory process to protect critical areas, including coastal waters, tidelands, beaches, and the beach/dune system described above under the BMA.[184] The Act is designed "to protect the quality of the coastal environment and to promote the economic and social improvement of the coastal zone… ."[185] When implementing the Act, "specific" policies including promoting "economic and social improvement," encouraging "development of coastal resources," and providing "adequate environmental safeguards" should be considered.[186] South Carolina defines two critical areas involving the estuarine system: coastal waters and tidelands.[187]

181. *Id.* (citing Sierra Club v. Von Kolnitz, No. 2:16-CV-03815-DCN, 2017 WL 3480777, at *1 (D. S.C. Aug. 14, 2017)).

182. Shahid & Colwell, *supra* note 145, at 110. Two legal challenges have been brought as a result of a special permit issued pursuant to the proviso.

183. Chloe Johnson, *Special Exceptions in SC Law Could Save 17 Beach Houses, But At What Cost?*, THE POST AND COURIER (May 10, 2019), *available at* https://perma.cc/3VPK-K7G5; Chloe Johnson, *SC Beach Building Boundaries Would Stop at Existing Houses Under New Bill,* THE POST AND COURIER, (Jan. 29, 2020), *available at* https://perma.cc/BFZ7-GUTH.

184. S.C. CODE ANN. § 48-39-10(J) (2020).

185. *Id.* § 48-39-30(A).

186. *Id.* § 48-39-30(B)(1)-(5).

187. *Id.* (defining "coastal waters" as "navigable waters of the United States subject to the ebb and flood of the tide and which are saline waters, shoreward to their mean high-water mark" and "tidelands" as "all areas which are at or below mean high tide and coastal wetlands, mudflats, and similar areas that are contiguous and adjacent to coastal

OCRM, using biological field surveys and aerial photography, establishes the boundary—known as the "critical area line—for these areas and publishes them on an official map.[188] All coastal waters and tidelands seaward of this boundary are considered to be within the critical areas.[189]

In critical areas, a permit is required for erosion-prevention and water-drainage structures "in or upon the tidelands" and submerged water bottoms (lands which remain covered by waters) in coastal waters.[190] Bulkheads and revetments (rip-rap) may be permitted if they conform to the critical area line and do not create reflective wave energy that destroys marine bottoms or creates safety hazards.[191] Structures should be constructed up to eighteen inches from the existing escarpment if feasible, and they are prohibited where "marshlands are adequately serving as an erosion buffer, where adjacent property could be detrimentally affected by erosion or sedimentation, or where public access is adversely affected unless upland is being lost due to tidally induced erosion."[192]

South Carolina requires that critical areas must permit uses that "insure the maximum benefit to the people, but not necessarily a combination of uses which will generate measurable maximum dollar benefits."[193] While the state has "adopted the policy that the public interest is usually best served by preserving tidelands in their natural state,"[194] South

waters and are an integral part of the estuarine systems involved"). Coastal wetlands are "periodically inundated by saline waters" either by natural or artificial water courses and that are "normally characterized by the prevalence of saline water vegetation" as long as they are an integral part of an estuarine system." S.C. CODE ANN. REGS. 30-10(A).

188. S.C. CODE ANN. REGS. 30-10(B).

189. *Id.* 30-10(C).

190. S.C. CODE ANN. § 48-39-120(F) (2020); S.C. CODE ANN. REGS. 30-12(G) (2020).

191. S.C. CODE ANN. REGS.30-12(C) (2020).

192. *Id.*

193. S.C. CODE ANN. § 48-39-30(D) (2020). In addition, for critical areas in South Carolina, OCRM requires ten "general considerations" to be weighed, including assessing the impact of the activity on natural resources and a balancing test that considers "[t]he extent of the economic benefits as compared with the benefits from preservation of an area in its unaltered state." S.C. CODE ANN. REGS. 30-11 (B)(1)-(10) (2020). How the proposed use could affect the "value and enjoyment of adjacent owners" must also be considered. *Id.* (B)(10). In addition to these "general considerations," OCRM must also consider the "long-range, cumulative effects of the project" in the "context of other possible development and the general character of the area." *Id.* 30-11(C).

194. Kiawah Dev. Partners v. Dep't of Health & Envtl. Control, 411 S.C. 16, 29 (2014).

Carolina courts have struggled with the conflicting ways that the public interest can be served when determining whether or not to allow for shoreline armoring. In complicated 2014 litigation surrounding an area known as "Captain Sam's Spit," the South Carolina Supreme Court prohibited a large-scale bulkheading project of 2,513 feet because the project created a financial benefit only for a large-scale development and did not result in a benefit that flowed to the public more broadly.[195] In 2018, however, while upholding its approach to the large project, the Supreme Court allowed a smaller project—a 270-foot bulkhead and revetment—to proceed because some shoreline would be entirely lost without it, and "the public could no longer use the area for the recreational purposes many citizens currently enjoy.[196]

OCRM's "strategy goals" include the "development of success criteria for evaluating the performance of living shorelines, monitoring of existing living shorelines, establishment [of] a regulatory definition of living shorelines, and the development of specific regulatory project standards for the permitting of living shoreline projects in South Carolina."[197] A Living Shoreline Working Group meets regularly to support these goals. The living shorelines which have been implemented to date have qualified for a research exemption to the state's permitting process.[198] South Carolina has not approved the Corps' Nationwide Permit 54.[199]

D. North Carolina

North Carolina boasts 12,331 miles of coastal shoreline—approximately 322 miles of ocean shoreline and more than 10,000 miles of estuarine coastline. Home to 23 barrier islands, the state is also home to the second largest estuarine system in the United States, and its estuaries are among its most

195. *Id.* at 30; Kiawah Dev. Partners, II v. Dep't of Health & Envtl. Control, 422 S.C. 632, 635 (2018).

196. Kiawah Dev. Partners, II v. Dep't of Health & Envtl. Control, 422 S.C. 632, at 635.

197. *Living Shorelines Regulations Update*, SOUTH CAROLINA DEP'T OF HEALTH AND ENVTL. CONTROL, *available at* https://perma.cc/S8J5-H7W4.

198. *See Softening Our Shorelines*, *supra* 58, at 58.

199. *Id.*

biologically productive regions.[200] Motivated by a desire to protect its ecologically rich shoreline, the North Carolina General Assembly passed the North Carolina Coastal Area Management Act of 1974 (CAMA). Encompassing North Carolina's 20 coastal counties, CAMA includes "the estuarine system, the barrier dune system, and the beaches...."[201] North Carolina also has an extensive GIS inventory in its Interactive Map Viewer that includes information such as wetland type and location in 37 coastal counties, setback lines, shoreline stabilization approaches, flood zones, and erosion areas.[202]

CAMA's purpose is to "safeguard and perpetuate" the shorescape's "natural productivity and [its] biological, economic and esthetic values."[203] Development consistent with "ecological considerations" is also identified as a goal, and North Carolina courts have held that CAMA "seeks to balance public interests with private property interests."[204] While the role that coastal beaches and estuarine areas play in mitigating storm surge hazards and flooding is not mentioned in CAMA's legislative findings and goals section, such values appear in administrative regulations as a matter of general policy.[205] As of the writing of this article, the North Carolina Coastal Resources Commission (CRC) was in the process of updating the state's sea-level rise assessment, with a report to be issued in 2021.[206]

200. *Tracing the Coastline*, UNC-TV SCIENCE, *available at* https://perma.cc/8R5Z-3GQD; N.C. GEN. STAT. § 113A-102 (2020).

201. N.C. GEN. STAT. § 113A-102(1) (2020).

202. *N.C. ArcGis Coastal Mapping Tool*, N.C. DIVISION OF COASTAL MANAGEMENT, https://ncdenr.maps.arcgis.com/apps/webappviewer/index.html?id=f5e463a929ed43009 5e0a17ff803e156 (last visited July 23, 2020).

203. *See* Riggings Homeowners, Inc. v. Coastal Res. Comm'n of State, 228 N.C. App. 630, 643 (N.C. App. 2013) (citing N.C. Const. art. XIV, § 5 and noting that North Carolina's Constitution recognizes the importance of protecting the state's coastal areas "to preserve as a part of the common heritage of this State its ... beaches ... and places of beauty").

204. *Id.* at 643.

205. 5A N.C. ADMIN. CODE 7M.0201 (2020).

206. *Sea Level Rise Study Update,* NORTH CAROLINA DEP'T OF ENVTL. QUALITY, *available at* https://perma.cc/PP82-BLGX. Sea-level rise, as some readers may recall, has been a source of great controversy in North Carolina. *See, e.g., Colbert Spoofs North Carolina on Sea Level Rise Legislation*, YALE CLIMATE CONNECTIONS, *available at* https://perma.cc/WVR5-Z2T2; John Schwartz & Richard Fausset, *North Carolina, Warned of Rising Seas, Chose to Favor Development*, N.Y. TIMES (Sept. 12, 2018), *available at* https://perma.cc/DU6Y-TQTH. *See* N.C. GEN. STAT. § 113A-107.1 (2020); 15A N.C. ADMIN. CODE 7H.0305(10) (2017). Nevertheless, in 2015, the CRC provided an updated a new assessment that included a range of projections over a 30-year timeframe

North Carolina's coastal area is comprised of the counties along the Atlantic and seven specified "coastal sounds," which CAMA defines as the "limits of seawater encroachment" on each sound's tributary rivers "under normal conditions" that do not include tides associated with hurricanes or storms.[207] CAMA provides for two primary activities to further coastal resource management. The first requires the CRC to develop and adopt planning guidelines for coastal areas to inform local land-use plans, which are in turn used as criteria for issuing or denying development permits in areas of environmental concern.[208] The second is the designation of "areas of environmental concern" (AECs) in the coastal zone.[209] Coastal wetlands, public trust areas, historic resources, "bogs in an urban complex," floodplains, floodways, sand dunes, beaches, primary nursery areas, and others all fall within the CRC's jurisdiction to designate as AECs.[210] Development under CAMA is defined broadly and includes building and enlarging structures, dredging, filling, excavating, bulkheading, driving of pilings, and alteration of the shore, bank, or "bottom of the Atlantic Ocean or any sound, bay, river, creek, stream, lake, or canal."[211]

1. Ocean Hazard Areas

The CRC has created "setback rules" for AECs known as Ocean Hazard Areas,[212] which are "natural areas along the Atlantic Ocean shoreline where, because of their special vulnerability to erosion or other adverse effects of sand, wind, and water, uncontrolled or incompatible development could unreasonably endanger life or property."[213] Ocean hazard areas encompass beaches, frontal dunes, inlet lands, and other areas

based on three scenarios: existing rates (2.4 to 5.4 inches), low greenhouse gas emissions (3.5 to 8.0 inches), and high greenhouse gas emissions (4.8 to 9.4 inches).

207. N.C. GEN. STAT. ANN. § 113A-103(2-3) (2020) (defining "normal conditions" as "regularly occurring conditions of low stream flow and high tide…not unusual conditions such as those associated with hurricane and other storm tides").

208. *Id.* § 113A-106; *id.* § 113A-118.

209. *Id.* § 113A-113.

210. *Id.* § 113A-113.

211. *Id.* § 113A-103(5)(a).

212. *Id.* § 113A-103(2-3). Busik v. N. Carolina Coastal Res. Comm'n, 230 N.C. App. 148, 151, 753 S.E.2d 326, 329 (2013); 15A N.C. ADMIN. CODE 7J.0102 (2020).

213. 15A N.C. ADMIN. CODE 7H.0301-303 (2020).

where "geologic, vegetative and soil conditions indicate a substantial possibility of excessive erosion or flood damage."[214]

For development to occur in these areas, an "ocean hazard setback" is established. It is determined by the shoreline long-term erosion rate and the size of development, which is defined by total floor area for structures and buildings.[215] The relevant erosion rate is the long-term average based on available historical data; the current long-term average erosion rate data for each segment of North Carolina is depicted on the "2011 Long-Term Average Annual Shoreline Rate Update."[216] North Carolina then determines the setback using structure size. Smaller structures are allowed closer to the ocean. Buildings of fewer than 5,000 square feet have a 60-foot or 30 times the shoreline erosion rate setback, while buildings larger than 100,000 square feet have a 180-foot or 90 times the shoreline erosion rate setback. Buildings between these two size limits have setbacks between the two setback extremes.[217]

How these parameters apply also depends on whether a building is located in one of three areas: the Ocean Erodible Area, the Inlet Hazard Area, and the Unvegetated Beach Area.[218] The oceanward boundary for each of these areas is the mean low water line.[219] Depending on the area, the landward ocean hazard setback is measured from the vegetation line, recession line, the measurement line, the static vegetation line, and/or the development line.

The setback requirements for buildings in Ocean Erodible Areas involve a combination of annual erosion rates, the location of the first stable, natural vegetation line, and the size of the building.[220] The landward boundary is the "recession line,"

214. *Id.* 7H.0301-303.

215. *Id.* 7H.0306(a)(4).

216. *Id.* 7H.0304(1); *see* N.C. DIV. COASTAL MGMT., NORTH CAROLINA 2011 LONG-TERM AVERAGE ANNUAL OCEANFRONT EROSION RATE UPDATE STUDY (2012). The next review was scheduled to begin in 2016. *See* N.C. DIV. COASTAL MGMT., COASTAL EROSION STUDY (2016).

217. 15A N.C. ADMIN. CODE 7H.0306(5) (2020). Construction is prohibited seaward of the ocean hazard setback distance and the development line may not be established below the mean high water line or "perpetual property easement line, whichever is more restrictive. *Id.* 7H.0306(a)(3).

218. *Id.* 7H.0304.

219. 15A N.C. ADMIN. CODE 7H.0304(1) (2020).

220. *Zito v. North Carolina CRC*, No. 2:19-CV-11-D, 2020 WL 1493476, at *2 (E.D.N.C. Mar. 27, 2020) (citing 15A N.C. ADMIN. CODE 7H.0304 (2020)).

which is established from the "vegetation line," the first line of stable and natural vegetation, either by multiplying the long-term annual erosion rate by 90 or establishing it 120 feet landward of the vegetation line if there has been no long-term erosion or if the rate is less than two feet per year.[221]

Because of their proximity to dynamic ocean inlets, Inlet Hazard Areas are highly vulnerable to erosion, and the regulations require a consideration of inlet migration as well as a structure-density requirement.[222] The landward boundary for these areas must be "a distance sufficient to encompass that area within which the inlet migrates."[223]

Unvegetated Beach Areas are areas, often created by storm events, where no stable natural vegetation is present.[224] They are designated on CRC-approved maps after being identified by studies which use a "measurement line," which is an approximation of the point at which a stable vegetated line is expected to return based on the line's location in the most current pre-storm aerial photography and a comparison to the stable vegetated line at the closest vegetated site.[225]

A "static vegetation line" was adopted in 1995 to determine the setback line on beaches that had been renourished.[226] It was established for large-scale beach-fill projects, and is determined by the vegetation line that existed within one year prior to the onset of the beach-fill project construction.[227] In 2009, the CRC found that, in communities where there had been a long-term commitment to beach renourishment and maintenance, the vegetation had become stable and had migrated oceanward.[228]

221. In place since 1979, the vegetation line refers to the first line of stable and natural vegetation generally located at or immediately oceanward of the seaward tow of the frontal dune or erosion escarpment. 15A N.C. ADMIN. CODE 7H.0305(a)(5) (2020). For areas within the boundaries of a large-scale beach fill project, the static vegetation line is used, "which is the vegetation line that existed within one year prior to the onset of project construction." *Id.* 7H.0305(a)(6).

222. 15A N.C. ADMIN. CODE 7H.0310(a).

223. *Id.* 7H.0304(2).

224. *Id.* 7H.0304(3). For areas "suddenly unvegetated as a result of a hurricane or other major storm," the CRC may designate them as Unvegetated Beach Areas on a temporary basis until vegetation has been reestablished. *Id.*

225. *Id.* 7H.0304(3). Unvegetated Beach Areas are areas "where no stable natural vegetation is present …. on either a permanent or temporary basis …." *Id.*

226. KEN RICHARDSON, N.C. DIVISION OF COASTAL MANAGEMENT, FISCAL ANALYSIS 3 (2015), *available at* https://perma.cc/4YXH-MZK8.

227. 15A N.C. ADMIN. CODE 7H.0305(6) (2020).

228. RICHARDSON, *supra* note 222, at 3.

It established an intensive exception process to allow communities to measure the setback line from the first line of stable vegetation.[229] In 2016, after some local governments raised concerns about the "difficulties and costs associated with the static vegetation line rules and its exception procedures," the CRC amended some of its exception requirements and proposed new "development line" rules.[230] With the approval of the CRC, local governments may now adopt development lines, which "allow a local government to delineate the most oceanward location for new development."[231] When requesting a development line, the petitioner must use "an adjacent neighbor sight-line approach, resulting in an average line of structures."[232]

With respect to all of these lines, two critical factors are whether a primary dune (or frontal dune closest to the beach) exists in any of these areas or whether such a dune is landward of the lot where the development is proposed.[233] Where a primary dune exists, development must be landward of either the dune's crest, the ocean hazard setback, or development line, whichever is farthest from whatever line applies.[234] Existing lots are exempt from this requirement where it would "preclude any practical use of the lot," allowing for location oceanward of the primary dune as long as it is not located on or oceanward of a frontal dune or the development line.[235] If no primary dune exists but a frontal dune exists, the development must be landward of the frontal dune, ocean hazard setback, or development line, whichever is farthest from the setback line that applies.[236] If neither a primary nor a frontal dune exists, the structure must be landward of the ocean hazard setback or the development line, whichever is more restrictive.[237]

229. *Id.*; 15A N.C. ADMIN. CODE 7J.1201 (2020).
230. RICHARDSON, *supra* note 222, at 3.
231. *Id.*
232. 15A N.C. ADMIN. CODE 7J.1301(c) (2020).
233. Craig R. Sloss, Michael Shepherd & Patrick Hesp, *Coastal Dunes: Geomorphology*, NATURE EDUCATION KNOWLEDGE 3(10):2 (2012) Coastal Dunes: Geomorphology (explaining how "primary" dunes are defined as dunes with sand supplied to them from the beach and are closest to the shoreline).
234. 15A N.C. ADMIN. CODE 7H.0306(6) (2020).
235. *Id.*
236. *Id.*7H.0306(7).
237. *Id.* 7H.0306(7)–(8).

In North Carolina, breakwaters, bulkheads, groins, jetties, revetments, seawalls and similar structures are considered "erosion control structures."[238] North Carolina law distinguishes between shoreline armoring depending upon whether it occurs on an "ocean shoreline" or an "estuarine shoreline."[239] Permanent armoring on ocean shorelines is generally prohibited because it is understood to possibly cause "significant adverse impacts on the value and enjoyment of adjacent properties" and to potentially interfere with public access to the beach.[240] Temporary armoring on ocean shorelines is limited to sandbags, which must be placed landward of the mean high water line and must be placed parallel to the shore.[241] North Carolina rules allow the use of sandbags for up to eight years, depending upon the size of the structure, whether a there is an ongoing or proposed renourishment project at the beach, and whether a property is located in a Hazard Inlet Area.[242]

2. Estuarine and Ocean System Areas of Concern

North Carolina has 2.2 million acres of estuarine waters.[243] The state has designated estuarine shorelines, coastal wetlands, public trust areas, and estuarine and public trust shorelines as areas of environmental concern (AECs), subordinate to an overall Estuarine and Ocean System AEC.[244] The CRC has

238. N.C. GEN. STAT. ANN. § 113A-115.1(a)(1) (2020).

239. *Id.* §§ 113A-115.1(a)(1a)–(2). "Ocean shoreline" includes the Atlantic Ocean, the oceanfront beaches, and frontal dunes. *Id.* It also includes ocean inlets and adjacent lands "but does not include that portion of any inlet and lands adjacent to the inlet that exhibits characteristics of estuarine shorelines." *Id.* § 113A-115.1(a)(2). Estuarine waters include "all the water of the Atlantic Ocean within the boundary of North Carolina and all the waters of the bays, sounds, rivers, and tributaries thereto seaward of the dividing line between coastal fishing waters and inland fishing waters, as set forth in the most recent official published agreement adopted by the Wildlife Resources Commission and the Department of Environmental Quality." *Id.* § 113A-113(2).

240. *Id.* § 113A-115.1(b); 15A N.C. ADMIN. CODE 7H.0308(a)(1)(G) (2020). *See* Riggings Homeowners, Inc. v. Coastal Res. Comm'n of State, 228 N.C. App. 630, 632, 747 S.E.2d 301, 303 (2013) (discussing historic sites exception).

241. 15A N.C. ADMIN. CODE 7H.0308(2)(A) (2020).

242. *Id.*

243. N.C. DEPT. OF ENVTL. AND NAT. RES., CAMA HANDBOOK FOR DEVELOPMENT IN COASTAL NORTH CAROLINA, *available at* https://perma.cc/6JAQ-AN4V [hereinafter CAMA HANDBOOK]. In 2012, the state completed its Shoreline Estuarine Mapping Project, where all 12,000 miles of estuarine shoreline was digitally mapped. *North Carolina Maps Estuarine Shoreline*, NOAA, *available at* https://perma.cc/6SJX-JAPB.

244. 15A N.C. ADMIN. CODE 7H.0201 (2020).

stated that its objective is to conserve and manage these areas as "an interrelated group of AECs, so as to safeguard and perpetuate their biological, social, economic, and aesthetic values…."[245] This objective includes protecting public rights of access and ensuring that development in AECs "is compatible with natural characteristics so as to minimize the likelihood of significant loss of private property and public resources."[246]

Water-dependent armoring such as bulkheads, revetments, and groins are allowed in coastal wetlands, estuarine waters, and coastal shorelines through development permits.[247] In estuarine waters not on the oceanfront, public trust areas include coastal waters and submerged lands and are measured to the normal high water mark.[248] Coastal wetlands are marsh areas that have regular or occasional flooding by tides—including wind tides, but not including hurricanes or tropical storm tides—and contain one or more of ten designated marsh plant species.[249] When issuing permits in these three areas, the location, design, and need for development are all considered, as well as whether the construction activities involved meet the Estuarine and Ocean System AEC management objective.[250] Activities must avoid significant adverse impacts on coastal wetlands and estuarine and ocean resources, and may not cause

245. *Id.* 7H.0203.

246. *Id.*

247. *Id.* 7H.0208(a)(1).

248. *Id.* 7H.0207. "Estuarine waters" include the Atlantic Ocean within the state's boundary and all bays, sounds, rivers, and tributaries seaward of coastal fishing waters and ends at inland fishing waters. N.C. GEN. STAT. ANN. § 113-229(n)(2) (2020).

249. 15A N.C. ADMIN. CODE 7H.0205 (2020). Williams v. N. Carolina Dep't of Env't & Nat. Res., 166 N.C. App. 86, 88 (N.C. Ct. App. 2004). In addition to CAMA, the Conservation of Marine and Estuarine Wildlife Resources Act of 1969 also affords coastal marshlands some protection under a provision typically referred to as the "Dredge and Fill Law." N.C. GEN. STAT. ANN. § 113-229. *See, e.g.,* State ex rel. N.C. Dep't of Env't & Nat. Res. v. Pharr, 223 N.C. App. 102 (N.C. Ct. App. 2012). Under North Carolina rules, "regular or occasional flooding" is established through field indicators such as the observation of tidal water on the site, changes in elevation, presence of periwinkle, presence of crab burrows, staining, or wrack lines. 15A N.C. ADMIN. CODE 7H.0205(a). Whether "regular flooding" exists appears to be often a contested issue as the make up the most recent reported cases on this provision. *See* State ex rel. N.C. Dep't of Env't & Nat. Res. v. Pharr, 223 N.C. App. 102 (N.C. Ct. App. 2012); Williams v. N. Carolina Dep't of Env't & Nat. Res., 166 N.C. App. 86, 88 (N.C. Ct. App. 2004).

250. 15A N.C. ADMIN. CODE 7H.0208(A)(2)(a) (2020).

siltation, create stagnant water bodies, interfere with navigation, or damage archaeological or historic sites.[251]

Based on an agreement adopted between the North Carolina Wildlife Resources Commission and the Department of Environmental Quality, coastal shorelines are drawn from the normal high water line or normal water line and include lands 30 feet landward from this line for public trust waters, 75 feet landward along estuarine waters, and 575 feet landward for "outstanding resource waters."[252] An added shoreline management objective also applies for coastal shorelines; shoreline development "shall be compatible with the dynamic nature of coastal shorelines" and should "safeguard and perpetuate [the ocean or estuarine system's] biological, social, aesthetic, and economic values" in a coordinated way that maximizes the system's benefits as a whole and benefits the people of North Carolina.[253] Under the "buffer rule," new development must be located 30 feet landward of normal water level or high water level.[254] Water-dependent armoring as well as infrastructure such as decks, crab shredders, fences, and "small houses" are exempt from the buffer rule.[255]

3. Shoreline Stabilization: Estuarine

North Carolina allows the following methods for stabilizing estuarine shorelines: planting vegetation, stone riprap (or revetments), bulkheads, and living shorelines.[256] To allow marshes to migrate and the "system to remain neutral," the CRC encourages property owners to plan setbacks, buffers, and no action vegetation control," which involves planting or preserving existing vegetation. [257] A permit is not required for planting vegetation if the shoreline does not need grading.[258]

251. *Id.*

252. *Id.* 7H.0209(a)(1)–(2). *See* Canady v. N. Carolina Coastal Res. Comm'n, 206 N.C. App. 329 (N.C. Ct. App. 2010). 15A NCAC 7H.0106(1) (defining "Normal High Water"); 15A N.C. ADMIN. CODE 7H.0106(2) (defining "Normal Water Level").

253. 15A N.C. ADMIN. CODE 7H.0209(c) (2020).

254. *Id.* 7H.0209(a)(1).

255. *Id.*; Canady v. N. Carolina Coastal Res. Comm'n, 206 N.C. App. 329, at 331.

256. *Section 4: Rules for Specific Types of Projects*, N.C. ENVTL. QUALITY, *available at* https://perma.cc/6WZN-HQXH.

257. *Stabilization Options,* N.C. ENVTL. QUALITY, *available at* https://perma.cc/WZL4-PE8F.

258. *Id.*

For the construction of riprap revetments and bulkheads, North Carolina has two general permits—one for estuarine waters, public trust waters, and ocean hazard areas, and the other for wetland protection in estuarine waters and public trust waters, which allows the placement of riprap revetments immediately adjacent to and waterward of the "wetland toe."[259] Bulkheads must approximate the location of normal high water (also referred to as "normal water level" in North Carolina)[260] and be constructed landward of coastal wetlands.[261] Exceptions are allowed in areas below normal high water or normal water level when the property "has [an] identifiable erosion problem, whether it results from natural causes or adjacent bulkheads, or it has unusual geographic or geologic features, e.g. steep grade bank."[262] To qualify for the exception, adjacent property owners must not be affected, the bulkhead alignment may extend no further than necessary, and the DCM must document the need for the bulkhead.[263]

Living shoreline approaches such as marsh toe protection revetments, wetland riprap revetments, and sills require either general or major permits in North Carolina.[264] In 2019, North Carolina streamlined its general permitting process for living shorelines, allowing applicants to receive approval in a matter of days; this is likely one of the fastest permitting processes for living shorelines in the nation.[265] It has also adopted the Army Corps of Engineers' Nationwide Permit 54.[266] North Carolina has issued several reports over the years documenting the use and effectiveness of living shorelines, focusing on marsh sills in particular as alternatives to traditional shoreline armoring

259. 15A N.C. ADMIN. CODE 7H.1101 et seq (2020); 15A N.C. ADMIN. CODE 7H.2404 (2020).

260. In North Carolina, the "normal water level is the ordinary extent of high tide, based on the location of the apparent high tide line and site conditions, such as the presence and location of vegetation that is distributed by tides (wrack line)." *See* CAMA HANDBOOK, *supra* note 243, at 19.

261. 15A N.C. ADMIN CODE 7H.0208(7) (2020).

262. *Id.*

263. *Id.*

264. *Id.* 7H.2401; *Id.* 7H.2701.

265. *Coastal Permits Now Available for Mash Sill Living Shorelines*, N.C. ENVTL. QUALITY (Apr. 2, 2019), *available at* https://perma.cc/7USR-XSQW.

266. *Softening Our Shorelines*, *supra* note 58, at 54.

techniques such as bulkheads.[267] These sills typically involve stones, sand, rock gabion baskets, or living reefs made of oysters or mussels being placed parallel to the shoreline or vegetated slope, often with a "gapped" approach to allow for greater tidal exchange and better waterfront access. The state's water Community Conservation Assistance Program provides technical and financial assistance to landowners who develop vegetation controls or install riparian buffers or marsh sills.[268] Local soil and water conservation districts assist with designing these installations, and the landowner may be reimbursed up to 75% of the average cost of the project, if it involves best management practices (BMP).[269]

E. Virginia

Although only 29% of Virginia's land falls within its coastal zone, more than 60% of its population lives in this zone.[270] Virginia's ocean-facing shoreline stretches for only 132 miles, just a fraction of the more than 7,000 miles of estuarine shoreline in the Commonwealth that borders the Chesapeake Bay.[271] As such, the Chesapeake Bay, the second-largest estuary in the world, largely dominates the Commonwealth's coastal identity. Shore protection efforts are driven in large part to protect this incredible resource.

1. Ocean Edge: Dune Act

Much of Virginia's ocean-facing shoreline—84.8% (112 miles)—is protected. The city of Virginia Beach has the most publicly accessible beachfront area, with 28 miles of public

267. N.C. DIV. OF COASTAL MGMT., LIVING SHORELINES STRATEGY (2014). In 2019, North Carolina streamlined its marsh sill permit: *Coastal Permits Now Available for Mash Sill Living Shorelines*, N.C. ENVTL. QUALITY, *available at* https://perma.cc/9LZG-CMK4.

268. *N.C. Division of Soil and Water Conservation* [sic] *Community Conservation Assistance Program (CCAP)*, N.C. ENVTL. QUALITY, *available at* https://perma.cc/M6LS-2427.

269. *Id.*

270. *What is the Virginia Coastal Zone Management Program*?, VA. DEP'T OF ENVTL. QUALITY, http://www.deq.virginia.gov/Programs/CoastalZoneManagement/DescriptionBoundary.aspx (last visited, July 23, 2020).

271. Marcia Berman, *How Long is Virginia's Shoreline?*, VIRGINIA INST. MARINE SCI., *available at* https://perma.cc/5FCU-4CYG.

beach.[272] While Virginia's Atlantic mainland shoreline is relatively modest, a chain of 23 mostly uninhabited barrier islands sits just offshore, representing one of the longest undeveloped stretches of shoreline on the East Coast. Most of these barrier islands are conserved and managed by non-government organizations and state and federal agencies. The Commonwealth's dune system includes estuarine areas on the Chesapeake Bay as well as the ocean-facing shore.[273] In this way, Virginia's dune-protection efforts are intertwined with its tidal marsh protection law and policies.[274]

The 1980 Coastal Primary Sand Dune Protection Act ("Dune Act") was modeled on a dune protection ordinance administered by Virginia Beach and on the Commonwealth's 1972 Tidal Wetlands Act, which is discussed in more detail below.[275] The Dune Act originally covered eight localities—five counties and three cities.[276] In 2008, the Dune Act was amended to protect all of the Commonwealth's beaches and tidal dunes. The Dune Act's purpose is to "preserve and protect coastal primary sand dunes and beaches and prevent their despoliation and destruction" while "accommodat[ing] necessary economic development in a manner consistent with the protection of these features."[277]

The Dune Act establishes the jurisdictional boundaries and permitting process for beaches, coastal primary sand dunes, and barrier islands.[278] It authorizes localities with an existing Wetlands Zoning Ordinance to adopt a model ordinance known

272. *Southeast Atlantic Coast,* VIRGINIA INST. MARINE SCI., *available at* https://perma.cc/U88K-JCES; *VB Geofacts & Information*, CITY OF VIRGINIA BEACH, *available at* https://perma.cc/7UPM-T7WV.

273. LYLE VARNELL & C.S. HARDAWAY, THE COASTAL PRIMARY SAND DUNE AND BEACH ACT, VA. INST. OF MARINE SCI., WILLIAM & MARY 21 (2007), *available at* https://perma.cc/TD3B-MPMQ.

274. UNITED STATES ARMY CORP OF ENGINEERS, JOINT PERMIT APPLICATION (2014), *available at* https://perma.cc/TTY4-TZKJ.

275. VARNELL & HARDAWAY, *supra* note 273.

276. *Id.* The counties were Accomack, Northhampton, Mathews, Lancaster, and Northumberland; the cities were Virginia Beach, Norfolk, and Hampton. *See* VA. CODE ANN. § 28.2-1403; *see also* City of Virginia Beach v. Bell, 255 Va. 395, 397 (1998) (noting that The Dune Act was originally codified in VA. CODE ANN. §§ 62.1-13.21 to 62.1-13.28 (2020) and recodified in 1992 as Coastal Primary Sand Dunes and Beaches in VA. CODE ANN. §§ 28.2-1400 to 28.2-1420 (2020)).

277. VA. CODE. ANN. § 28.2-1401 (2020).

278. *Id.* § 28.2-1400 et seq. Virginia adopted a Barrier Island Policy to more stringently protect barrier islands. 4 VA. ADMIN. CODE 20-440-10 (2020).

as the Coastal Primary Sand Dune Zoning Ordinance ("Model Dune Ordinance"). This allows localities to use the existing local Wetlands Board for "dune disturbance" permit applications.[279] If a locality lacks a dune management ordinance and declines to adopt one or to adopt the Model Dune Ordinance, the Virginia Marine Resources Commission (VMRC) is authorized to administer the Act in that locality.

In Virginia, the beach begins at the low water line and extends landward to the "marked change in material composition or physiographic form, the line of woody vegetation, or the nearest impermeable manmade structure."[280] A coastal primary sand dune is defined as "a mound of unconsolidated sandy soil which is contiguous to mean high water," having at least one of ten specified plant species, and falls between the mean high water mark and the point where the landward dune grade falls below ten percent.[281] Through its requirements for the Model Dune Ordinance, the Dune Act requires that the regulatory authority—either the local wetlands board or the VMRC—balance preserving and protecting primary sand dunes with accommodating "necessary economic development."[282] Dune disturbance permits shall be issued if the "anticipated public and private benefit of the proposed activity exceeds its anticipated public and private detriment."[283] The activity may not permanently impair the dune's natural functions, physically alter it, or destroy vegetation growing on it unless the regulatory authority determines there will be "no significant adverse ecological impact," or that granting the permit "is clearly

279. 4 VA. ADMIN. CODE 20-440-10 (2020). *See also* VA. CODE ANN. § 28.2-1403 (2020); City of Virginia Beach v. Bell, 255 Va. 395, at 395.

280. VA. CODE. ANN. § 28.2-1403 § 2 (2020) provides that "'[b]each' means the shoreline zone comprised of unconsolidated sandy material upon which there is a mutual interaction of the forces of erosion, sediment transport and deposition that extends from the low water line landward to where there is a marked change in either material composition or physiographic form such as a dune, bluff, or marsh, or where no such change can be identified, to the line of woody vegetation (usually the effective limit of stormwaves), or the nearest impermeable man-made structure, such as a bulkhead, revetment, or paved road."

281. *Id.*§ 28.2-1403 § 2 (listing species).

282. *Id.* § 28.2-1403 § 9.

283. *Id.* § 28.2-1403 § 10.

necessary and consistent with the public interest, considering all material factors."[284]

A notable exemption exists for some development permits through a General Permit permissible in the Sandbridge Beach Subdivision in Virginia Beach and the City of Norfolk.[285] Specifically, landowners within the Sandbridge Beach Subdivision who have property deemed to be in "clear and imminent danger from erosion and storm damage due to severe wave action or storm surge" may construct and maintain protective structures with the approval of the Virginia Beach Wetlands Board. In addition, the Virginia Beach Wetlands Board is prohibited from imposing "arbitrary or unreasonable conditions upon its approval of any such bulkhead or other structural improvement," and it is responsible for ensuring that such improvements are maintained safely and are "structurally sound."[286] Property owners must undertake responsible, cost-effective sand management practices that protect and enhance the value and use of their property and also preserve and protect coastal primary sand dunes and public beaches.[287]

Meanwhile, stricter requirements apply to barrier islands under Virginia's Barrier Island Policy, which states that "[b]arrier islands are transient landforms," and "[t]heir dynamic and unstable nature poses significant risk to life and property there."[288] On barrier islands, the setback for structures is 20 times the local 100-year long-term annual shoreline recession rate from the dune crest, defined as the "highest elevation of the coastal primary sand dune on the lot."[289] The local 100-year long-term recession rate is the "average shoreline recession over fixed one-mile intervals averaged over the period between surveys of 100 years or more."[290] If the local mean high water mark comes

284. Emphasis added (quoting VA. CODE. ANN § 28.2-1408 (2020)). The proposed development must also not violate the purposes of the Act and meet guidelines promulgated pursuant to the Act. *Id.*

285. *Id.* § 28.2-1408.2.

286. *Id.*

287. *Id.*

288. 4 VA. ADMIN. CODE 20-440-10A.2 (2020).

289. *Id.* 20-440-10(C)(1)(c)(4). The dune crest is the "highest elevation of the coastal primary sand dune on the lot." The local 100-year long-term recession rate is the "average shoreline recession over fixed one-mile intervals averaged over the period between surveys of 100 years or more." *Id.*

290. *Id.* 20-440-10(A)(1).

within 10 times the average erosion rate, a plan to move or relocate the structure must be submitted.[291] Structures that have been condemned by health or local building officials due to damage from natural events may not be reconstructed, and must be relocated or removed within two years.[292] Development is limited to "low density single family" use.[293] "Cuts" through the dune, shore hardening structures, the "artificial relocation of sand," and sand fences or barriers are prohibited.[294]

Under the Dune Act, a dune disturbance permit is not required for the "normal maintenance of any groin, jetty, riprap, bulkhead, or other structure designed to control beach erosion which may abut a coastal primary sand dune."[295] New structures such as groins, jetties, riprap, and bulkheads must be authorized through the Commonwealth's permitting process.[296] Living shorelines do not require a dune disturbance permit and are discussed in more detail below.[297]

2. Estuarine Edge: Chesapeake Bay Act, Tidal Wetlands Act, and Living Shorelines Policy

With a tidal shoreline that runs 7,213 miles and approximately 250,000 acres of estuarine wetlands, Virginia identifies as a "tidewater" state for good reason.[298] From swamps to saltwater marshes to tidal flats, Virginia's wetland resources are diverse and productive, providing considerable aesthetic, cultural, recreational, and ecological opportunities and services.[299] Seagrass beds, oyster reefs, marshes, and nearshore habitats support the Chesapeake Bay's tremendous marine and coastal communities, serving as critical habitat

291. *Id.* 20-440-10(E)(1)(c).
292. *Id.* 20-440-10(B)(2).
293. *Id.* 20-440-10(C)(1).
294. *Id.* 20-440-10(C)(2).
295. VA. CODE. ANN. § 28.2-1403 § 3(6); § 4 (2020).
296. U.S. ARMY CORPS OF ENGINEERS, *supra* note 267.
297. VA. CODE. ANN. § 28.2-1403 §13 (2020).
298. VA. DEPT. OF ENVTL QUALITY, VIRGINIA STATE WETLANDS PROGRAM PLAN 2015-2020 (2015), *available at*https://perma.cc/C5BU-LHTQ; Berman, *How long is Virginia's shoreline?*, *supra* note 263.
299. U.S. FISH AND WILDLIFE SERV., NATIONAL WATER SUMMARY: VIRGINIA WETLAND RESOURCES 387 (1996).

and nursery grounds for resident and migrating bird species.[300] Virginia protects these resources through its Chesapeake Bay Preservation Act, the Tidal Wetlands Act, and the Living Shorelines Policy.

i. Chesapeake Bay Preservation Act

Virginia protects its tidewater areas with a 100-foot vegetated buffer and various land use management requirements.[301] A "cooperative state-local program," the Chesapeake Bay Preservation Act (Bay Act), was adopted in 1988 to improve water quality in the Bay by reducing non-point source pollution.[302] The Bay Act begins with a policy statement declaring that balancing economic development and a "healthy Chesapeake Bay" are "not mutually exclusive."[303] Under the Act, counties, cities, and towns establish "Chesapeake Bay Preservation Areas" pursuant to criteria set by the State Water Control Board.[304] The Bay Act provides a series of specific criteria that the Board "shall encourage and promote" related to improve water quality, reducing pollution, and conserving water resources, with coastal resilience and adaptation to sea-level rise added as criteria in 2020.[305] The Board must also give "due consideration to, among other things, the economic and social costs and benefits which can reasonably be expected to obtain as a result of the adoption or amendment of the criteria."[306]

The Board has directed local governments to divide Chesapeake Bay Preservation Areas into two types: Resource Protection Areas (RPAs) and Resource Management Areas (RMAs).[307] RPAs establish a "buffer area" of at least 100 feet adjacent to and landward of "lands adjacent to water bodies with

300. *Coastal Habitats,* CENTER FOR COASTAL RES. MGMT., VA INSTITUTE FOR MARINE SCI., *available at* https://perma.cc/5MMC-8T85.

301. *Id*; VA. CODE. ANN. § 62.1-44.15:68 (2020) (defining the jurisdictions that make up "Tidewater Virginia").

302. *Id.* § 62.1-44.15:67.

303. *Id.*

304. *Id.* § 62.1-44.15:69; H.B. 504, 2020 Leg., 2020 Sess. (Va. 2020). *See also Water Laws, Regulations, and Guidance*, VA DEPT. OF ENVTL. QUALITY, *available at* https://perma.cc/YA38-5CDX; *Laws and Regulations (Citizen Boards and Board Meetings)* VA DEPT. OF ENVTL. QUALITY, *available at* https://perma.cc/K9FB-VN8K.

305. VA. CODE. ANN. § 62.1-44.15:72B (2020).

306. *Id.* § 62.1-44.15:72C.

307. 9 VA. ADMIN. CODE 25-830-70 (2020).

perennial flow" as well as tidal wetlands, nontidal wetlands connected by surface flow and contiguous to tidal wetlands or water bodies with perennial flow, tidal shores, and other lands the local government may consider necessary to protect state water quality.[308] RMAs are land areas which, "if improperly used or developed," may potentially cause significant water quality degradation or diminish the RPA's "functional value."[309] Where development has already severely altered the natural state of an area, local governments may designate the area as an Intensely Developed Area (IDA); this is an "overlay" to redirect development to these areas in order to prevent development on relatively untouched land.[310]

With local government approval, land development is allowed in RPAs if it is water dependent, constitutes redevelopment, constitutes development or redevelopment within a designated IDA, is a road or driveway where no reasonable alternative exists and is designed to minimize encroachment on the RPA and adverse effects on water quality, or is a flood control or stormwater management facility satisfying certain conditions.[311] Redevelopment outside of IDAs "shall be permitted in RPAs" so long as the redevelopment does not increase impervious cover.[312] In addition, "encroachments" into a buffer areas are permitted under different criteria depending upon whether a lot or parcel was recorded prior to October 1, 1989,[313] or between October 1, 1989, and March 1, 2002.[314] Modifications are also allowed subject to local approval, including removal of existing vegetation to provide for creating

308. *Id.* 25-830-80. The regulation also establishes how local governments are to determine whether water bodies have perennial flow providing one of three methods. *Id.* Daylighted streams are exempted from the RPA requirement, although a water quality assessment is required. *Id.* A 100-foot wide buffer area is "deemed to achieve a 75% reduction of sediments and a 40% reduction of nutrients." *Id.*

309. *Id.* 25-830-90 ("land categories" include floodplains, highly erodible soils, including steep slopes, highly permeable soils, nontidal wetlands not included in the RPA, and other lands the local government may consider necessary to protect state water quality).

310. *Id.* 25-830-100.

311. *Id.* 25-830-140. Water wells, passive recreation facilities such as boardwalks, trails, and pathways, and historic preservation and archaeological activities are exempt pursuant to local government review. *Id.*

312. *Id.*

313. *Id.* at 4(a)(1).

314. *Id.* 4(b)(1).

reasonable sight lines, access paths, for general woodlot management, and to control erosion."[315]

ii. Tidal Wetlands Act

Virginia's 1972 Tidal Wetlands Act is designed to "preserve and prevent the despoliation and destruction of wetlands while accommodating necessary economic development in a manner consistent with wetland preservation."[316] As it develops regulations and guidelines, the Virginia Marine Resources Commission (VMRC) must consult with "all affected state agencies" and consider the "unique character of the Commonwealth's tidal wetlands, which produce and support marine and inland wildlife, serve as a valuable protective barrier against floods, tidal storms and erosion, absorb silt and pollutants, and are important for recreational and aesthetic enjoyment and for the promotion of tourism, navigation and commerce.[317] To further the Tidal Wetlands Act's purpose, Virginia adopted a "no-net loss" wetlands policy.[318] In 2012, the Virginia Institute of Marine Science (VIMS) released a report finding that the no-net loss goal had not been met.[319]

In Virginia, the term "wetlands" includes both "vegetated" and "nonvegetated" wetlands.[320] Vegetated wetlands extend from the mean low-water mark to 1.5 times the mean tide range where specified vegetation such as saltmarsh cordgrass or cattail is present."[321] Nonvegetated wetlands occur from the low-water mark to the mean high-water mark where no emergent vegetation exists.[322] The Tidal Wetlands Act allows for either the VMRC or a local wetlands board, if it has adopted the model Wetlands Zoning Ordinance, to issue permits for development in

315. *Id.* 5; 9 VA. ADMIN. CODE 25-830-150(C)(1) (2020).

316. VA. CODE ANN §§ 28.2-1300-1315 (1972); *Id.* § 28.2-1301(B).

317. *Id.* § 28.2-1301(D).

318. 4 VA. ADMIN. CODE 20-390-20. The policy references the Virginia Institute of Marine Science research that found 132 acres of tidal wetlands had been lost under the permitting process over an eleven-year period. *Id.*

319. VA. INST. OF MARINE SCI., CENTER FOR COASTAL RESOURCES MANAGEMENT, REGULATORY FIDELITY TO GUIDANCE IN VIRGINIA'S TIDAL WETLANDS PROGRAM (2012), *available at* https://perma.cc/RPA8-MBSA [hereinafter REGULATORY FIDELITY].

320. VA. CODE ANN. § 28.2-1302.

321. *Id.* (listing species).

322. *Id.*

wetlands.[323] Most of Virginia's tidal wetlands are locally regulated, with 34 counties and cities, and 2 towns, having adopted the model ordinance.[324] VMRC is the permitting authority for 12 localities that have not adopted the model ordinance.[325]

Under the Act, a development permit shall be granted if "the anticipated public and private benefit of the proposed activity exceeds its anticipated public and private detriment."[326] In addition, the proposed development may not "unreasonably disturb" ecological systems in wetlands of "primary ecological significance."[327] Development, "to the maximum extent practical," must be concentrated in wetlands of "lesser ecological significance" *and* conform with VIMS's Wetlands Guidance.[328] The Act has not operated this way in practice. In 2001, a Virginia court made the Wetlands Guidance advisory, concluding that "Wetlands Guidelines are just that, guidelines."[329] That court also observed that, without the proposed bulkhead on the property, erosion would have continued, and, in any event, the Act was intended to "thwart large-scale development in wetland areas" and was "not designed to create unnecessary and prolonged litigation over backyard repair and maintenance" in "very small" areas.[330]

The Wetlands Boards have turned out to be friendly to property owners as well. In 2012, VIMS conducted a study comparing permitting decisions with the preferred shoreline management strategies provided to boards in the guidance, finding that 44% of projects were submitted "in some form of consistency" with guidance while 56% were submitted not consistent with any form of guidance.[331] In addition, the

323. 4 VA. ADMIN. CODE § 20-1330-10; VA. CODE ANN. § 28.2-1302 § 3.

324. *Id.* §§ 28.2-1300-28.2-1320; VA DEPT. OF ENVTL QUALITY, VIRGINIA STATE WETLANDS PROGRAM PLAN 2015-2020*, supra* note 298, at 8.

325. 4 VA. ADMIN. CODE §§ 28.2-1300-28.2-1320*; Id.* § 20-1330-50. In addition, waters within the boundaries of the Baylor Survey are excluded from this permit. *Id.* § 20-1330-50.

326. *Id.* § 28.2-1308. *See* Stearns v. Virginia Marine Res. Comm'n, 57 Va. Cir. 213 (Va. Cir. 2001).

327. *Id.*

328. VA. CODE ANN. § 28.2-1308 (2020).

329. Stearns v. Virginia Marine Res. Comm'n, 57 Va. Cir. 213, at 221.

330. *Id.*

331. *See* REGULATORY FIDELITY, *supra* note 319, at v.

majority of projects were approved as submitted and did not require the built project to adhere to the approved plan. Therefore, whether the built project officially complied with guidance depended entirely upon whether the plan for the project adhered to the guidance initially. In other words, the Wetlands Boards' review of project plans had little influence on property owners' decisions to follow the guidance. The report also found that Wetlands Boards prioritized protecting private property and the property owners' preferences over protecting ecosystem services or supporting the no-net loss goal. Board members believed that they lacked authority to require applicants "to do something they did not want to do" and that they lacked "jurisdiction" to recommend actions such as planting riparian areas, installing vegetated berms, and requiring project changes.[332] Boards also expressed a lack of confidence in "softer" approaches to erosion control.[333]

In 2011, Virginia adopted legislation establishing that "it is the policy of the Commonwealth to support living shorelines as the preferred alternative for stabilizing tidal shorelines."[334] Virginia defines a "living shoreline" as a "shoreline management practice that provides erosion control and water quality benefits; protects, restores or enhances natural shoreline habitat; and maintains coastal processes through the strategic placement of plants, stone, sand fill, and other structural and organic materials."[335] In 2020, the Virginia General Assembly began requiring permit applicants to incorporate living shorelines into their plans unless the best available science indicated it would not be suitable for the site.[336] They also stated that a living shoreline may "enhance coastal resilience and attenuation of wave energy and storm surge."[337] To our knowledge, this is the first occurrence of statutory language in our study area which directly connects living shorelines to coastal resilience goals.

332. *Id.*
333. *Id.*
334. VA. CODE ANN. § 28.2-104.1 (C)(1) (2020). Living shorelines do not require a dune disturbance permit. *Id.* § 28.2-1403 §13.
335. *Id.* § 28.2-104.1 (A).
336. H.B. 1375, 2020 Leg., 2020 Sess. (Va. 2020).
337. *Id.*

To promote the use of living shorelines, Virginia authorized a General Permit for Living Shorelines and an expedited permit review process for qualifying projects.[338] The Commonwealth also has approved Nationwide Permit 54.[339] Virginia has divided its living shoreline permitting process into two "groups." Living Shoreline Group 1 includes non-structural approaches in tidal wetlands.[340] The application of these approaches, involving specified types of vegetation and sand fill, are limited to shorelines having very low fetch, specifically, a half mile of fetch at any angle at a maximum.[341] Property owners employing these approaches may not encroach on the property rights of others, and any adverse impacts of the projects on adjacent properties must be minimized.[342] Living Shoreline Group 2 includes a variety of structural approaches in tidal wetlands, beaches and submerged lands, such as marsh toe revetments and sills.[343] To qualify, property owners must show clear evidence of active detrimental erosion at the site, and the maximum fetch of the location may not exceed 1.5 miles in any shore angle direction.[344] A maximum water depth (2 feet at mean low water) and extension limitation (30 feet channelward of mean low water) apply.[345] The project must include an existing or created tidal wetland with a minimum total width of eight feet.

For both Groups, applicants must submit a Joint Permit Application to the VMRC, the Corps of Engineers, the Virginia Department of Environmental Quality, and the local Wetlands

338. VA. CODE ANN. § 28.2-104.1 (B). For an excellent overview of Virginia's Living Shoreline program, *see* CHRISTOPHER ANTOINE, INCREASING LIVING SHORELINE IMPLEMENTATION IN VIRGINIA: LEGAL AND POLICY RECOMMENDATIONS (2018) , *available at* https://perma.cc/JQ7M-UEFS.

339. §401 WATER QUALITY CERTIFICATION DECISION (MEMO AND REPORT), VA DEPT. OF ENVTL. QUALITY (2017).

340. 4 VA. ADMIN. CODE 20-1300-30.

341. *Id.* § 20-1330-20 (defining "fetch" as "the distance along open water over which the wind blows"). "). *See* Bilkovic, et al., *Practical Living Shorelines: Tailored to Fit Chesapeake Bay, in* LIVING SHORELINES: THE SCIENCE AND MANAGEMENT OF NATURE-BASED COASTAL PROTECTION, *supra* note 33, at 190, 190. (explaining how scientists have defined categories of fetch most amenable to living shoreline projects: very low (less than .5 miles); low (0.5 to 1 mile); medium (1 to 5 miles), and high (five to ten miles), with the higher categories typically requiring breakwater projects).

342. 4 VA. ADMIN. CODE 20-1300-30 (2020) (listing ten permit conditions).

343. *Id.* 20-1330-30A.

344. *Id.* 20-1330-40.

345. *Id.*

Board.[346] Group 1 applicants are not charged any fees and are not required to notify adjoining property owners.[347] Group 2 applicants may be charged a fee, and must notify adjoining property owners, who must express no opposition to the project for it to move forward.[348]

Virginia has also developed several incentives to promote living shorelines. Living shorelines approved through the General Permit process are fully exempted from local property taxes.[349] Local governments can receive funding to establish living shorelines or to provide loans or other incentives to businesses and private individuals to "facilitate the establishment of living shorelines" within the Rural Coastal Virginia Community Enhancement Authority.[350] Eligible businesses categories added to the loan program in 2019 include bed-and-breakfast operations, campgrounds, and businesses that use working waterfronts.[351]

In addition, VIMS's Center for Coastal Resources Management has developed significant basic and applied research and management tools to support living shorelines and tidal wetlands management generally.[352] Its Tidal Marsh Inventory covers every tidal marsh in Virginia. The inventory was first conducted in the 1970s and has been updated regularly, providing invaluable information about changes in marsh distribution attributable to factors such as land-use change and sea-level rise.[353] VIMS also has produced an extensive Shoreline Inventory, which is published online and allows for GIS shapefiles so that external modelers can also use the information.[354] VIMS has developed a Shoreline Management

346. *Id.* 20-1300-30.
347. *Id.* 20-1300-30.
348. *Id.* 20-1330-30.
349. VA. CODE ANN. § 58.1-3666.
350. *Id.* § 62.1-229.5.
351. *Id. See also Guidelines for New Living Shoreline Program*, VA. DEPT.. OF ENVTL. QUALITY, *available at* https://perma.cc/VW6D-L8SN.
352. *Center for Coastal Management Research*, VA. INST. OF MARINE SCI., *available at* https://perma.cc/QSH4-KFW2.
353. Molly Herman et al., *Marsh Persistence Under Sea-level Rise is Controlled by Multiple, Geologically Variable Stressors*, 3 ECOSYSTEM HEALTH AND SUSTAINABILITY (2017).
354. *Shoreline and Tidal Marsh Inventory*, VA. INST. OF MARINE SCI., *available at* https://perma.cc/8JJL-7C22.

Model to predict the best management practices for a given shoreline and to identify where living shorelines are suitable.[355]

F. Maryland

As in Virginia, the Chesapeake Bay dominates Maryland's approach to tidal and shoreline management. The Bay has held a prominent place in Maryland's culture for centuries and remains a critical environmental, economic, and cultural resource today. Two-thirds of the state falls within the coastal zone, which is home to almost 70% of Maryland's population and encompasses 16 counties, and Baltimore (which is an independent city, not contained in any county).[356] The state also has five "coastal bays" which drain directly into the Atlantic Ocean.[357] Ocean City is a popular beach destination for tourists, despite having only 31 miles of ocean-facing shoreline. Two-thirds of Assateague Island National Seashore—famous for its wild horses—is located in Maryland.[358] Maryland is planning for 1.7 meters of sea-level rise by 2100.[359]

1. Ocean Edge: Beach Erosion Control and Replenishment Act

Enacted in 1987, Maryland's Beach Erosion Control and Replenishment Act protects the beaches on Maryland's Atlantic Coast. The Maryland General Assembly found that disturbing beach and dune areas endangers their "integrity and continuity," prevents "adequate maintenance, shore erosion, and sediment control, and storm protection of [beach and dune systems] and adjacent areas," and imposes financial burdens on the state's citizens.[360]

355. *Shoreline Management Model*, VA. INST. OF MARINE SCI., *available at https://perma.cc/3XSW-F87P.*

356. *Id.*; *Maryland's Coastal Zone*, MD. DEPT. OF NAT. RES, *available at* https://perma.cc/REZ3-SNSR.

357. MD. DEPT. OF NAT. RES, PRIORITY AREAS FOR WETLAND RESTORATION, PRESERVATION, AND MITIGATION IN MARYLAND'S COASTAL BAYS (2004), *available at* https://perma.cc/BG54-HSJZ.

358. *Assateague Island History and Culture,* NAT. PARK SERVICE, DEPT. OF THE INTERIOR, *available at* https://perma.cc/8PS8-PPV4.

359. MD. DEPT. OF NAT. RES., MARYLAND COASTAL RESILIENCY ASSESSMENT 8 (2016), *available at* https://perma.cc/2MDG-FJTJ.

360. MD. CODE ANN., NAT. RES. § 8-1101 (2020).

The Act prohibits land clearing, construction activity, and the building of permanent structures in an area that is defined as "the beach erosion control district."[361] Exemptions to this prohibition include approved projects for storm control, sediment control, beach erosion prevention, and maintenance projects designed to benefit the district generally, as well as specific areas in Ocean City to allow activities such as boardwalk widening.[362]

Maryland law essentially creates two erosion control districts: one for Assateague Island, which "coincides, more or less, with the west crest of the existing natural dune" on the island, and the other for Ocean City, "which coincides, more or less, with the existing Ocean City building limit line and on occasion may coincide with the crest of the littoral system."[363] Maryland regulations further divide the Ocean City district between a northern section, determined by an existing plat, and a southern section, which is drawn by series of geographic "control points" established by the Baltimore District of the Army Corps of Engineers.[364] Ocean City, along with the county and the state, has a 50-year agreement with the Army Corps to perform periodic beach renourishment.[365]

2. Estuarine Edge: Critical Area Law and Tidal Wetlands Act

Maryland's total tidal shoreline runs approximately 7,000 miles—of that length, approximately 6,000 miles line the Chesapeake Bay.[366] Maryland protects its tremendous estuarine resources through its Critical Area Law and Tidal Wetlands Act.

i. Critical Area Law

361. *Id.* § 8-1102.
362. *Id.* § 8-1102(2).
363. *Id.* § 8-1105.1.
364. MD. CODE REGS. 08.09.02.01-.02 (2020).
365. *Beach Renourishment*, TOWN OF OCEAN CITY, MD., *available at* https://perma.cc/2YGS-E865.
366. MD. DEPT. OF NAT. RES, MARYLAND'S SHORE LENGTH BACKGROUND AND GUIDANCE (2013), *available at* https://perma.cc/W3F6-33GW; *VIMS Updates Chesapeake Bay Coastal Inventory*, VA. INST. MARINE SCI., *available at* https://perma.cc/3DTM-FRZ9.

In 1984, the Maryland General Assembly enacted the Critical Area Law to "protect the Chesapeake and the Atlantic Coastal Bays and their tributaries by fostering more sensitive development activity for certain shoreline areas so as to minimize damage to water quality and natural habitats".[367] The legislative history of the Critical Area Law shows that it was spurred by consideration for the beauty, ecological value, and economic impact of the area, saying that "shoreline and adjacent lands, particularly the buffer areas, constitut[ed] a valuable, fragile, and sensitive part" of the entire estuarine system.[368]

The Critical Area Law established "critical areas"—essentially land within 1000 feet of the Bay's tidal influence—and required controls on development and land use in these areas based on the following land classifications: Intensely Developed Areas (IDAs), Limited Development Areas (LDA), Resource Conservation Areas (RCAs), and Habitat Protection Areas (HPAs).[369] To implement the law, the General Assembly created a commission to develop management criteria and help local jurisdictions establish individual Critical Area programs to implement the criteria through local planning and zoning ordinances.[370]

The Critical Area Law also created a protective "buffer of at least 100 feet landward from the mean highwater line of tidal waters, tributary streams, and tidal wetlands."[371] Local jurisdictions must expand this buffer pursuant to certain criteria when it is contiguous to a steep slope, a nontidal wetland, a nontidal wetland of "special State concern," a hydric soil, or a highly erodible soil.[372] In RCAs, the minimum buffer

367. Chesapeake Bay Found., Inc. v. DCW Dutchship Island, LLC, 439 Md. 588, 612 (Md. 2014) (citing MD. CODE ANN. § 8–1801(a), (b)(1) (2014))).

368. MD. CODE ANN. § 8–1801(a)(1)-(2) (2020).

369. Id. at ix-x; MD. CODE ANN., NAT. RES. § 8-1807 (2020); MD. CODE REGS. 27.01.01.01 (2020); MD. CODE ANN., NAT. RES. § 8-1802 (2020) (describing the three land classification categories).

370. MD. CODE ANN., NAT. RES. §§ 8-1806, 1808 (1984); MD. CODE REGS. 27.01 et seq (2020).

371. MD. CODE ANN., NAT. RES. § 8-1801(a)(4) (2020); MD. CODE REGS. 27.01.09.01 (2020) (establishing a minimum 100-foot buffer). A "tributary stream" is a "perennial stream or an intermittent stream within the critical area that has been identified by site inspection or in accordance with local program procedures approved by the Commission." MD. CODE ANN., NAT. RES. § 8-1802(a)(23) (2020).

372. MD. CODE REGS. 27.01.09.01(A) (2020); Vieglais v. Maryland Dep't of Nat. Res., No. 80, 2019 WL 4131944, at *1–2 (Md. Ct. Spec. App. Aug. 30, 2019).

must be 200 feet from tidal waters or a tidal wetland and 100 feet from a tributary stream.[373]

Maryland regulations require property owners planning development or redevelopment on lots that include buffer areas to "establish the buffer area" with certain plantings.[374] When development occurs within the buffer, it must be related to a "water-dependent activity" other than a shoreline stabilization project or be authorized by a variance.[375] If a variance is granted, mitigation is required. Mitigation includes plantings to replace buffer functions; if plantings are not sufficient, the property owner must pay a fee-in-lieu of planting.[376] In addition, applicants much submit a buffer management plan.[377] Such plans are also required for shoreline stabilization projects authorized under the Tidal Wetlands Act.

ii. Tidal Wetlands Act

In 1970, the Maryland General Assembly enacted the Tidal Wetlands Act, declaring that it was the "public policy of the State, taking into account varying ecological, economic, developmental, recreational, and aesthetic values, to preserve the wetlands and prevent their despoliation and destruction."[378] The Tidal Wetlands Act created a process for the Critical Area

373. MD. CODE ANN., NAT. RES. § 8-1808.10(b)(1) (2020). The 200-foot buffer may be reduced if it "strict application" would preclude subdivision of the property at a density of one dwelling unit per 20 acres or an intra-family transfer. *Id.*

374. MD. CODE REGS 27.01.09.01-1 (2020).

375. *Id.* 27.01.09.01; 27.01.03.01(B) (defining water-dependent activities). *Id.* 27.01.04.01 (defining "shore erosion protection works" in Critical Areas). To receive a variance, the applicant must show the following: 1) unwarranted hardship; 2) that the applicant is deprived of a use of land or structure permitted to others; 3) that granting the variance does not confer any "special privilege"; 4) the request is not based upon conditions or circumstances that are the result of actions by the applicant; 5) the request does not arise from any conforming or nonconforming condition on any neighboring property; 6) the granting of the variance would not adversely affect water quality or adversely impact fish, wildlife, or plant habitat within the jurisdiction's local Critical Area; and (7) the granting of the variance "would be in harmony with the general spirit and intent of the Critical Area law, the regulations in this subtitle, and the local Critical Area program." *Id.* 27.01.12.04.

376. *Id.* 27.01.09.01-2; 27.01.09.01-5. *See also* ADKINS ARBORETUM AND THE CRITICAL AREA COMM. FOR THE CHESAPEAKE AND ATLANTIC COASTAL BAY, THE GREEN BOOK FOR THE BUFFER, *available at* https://perma.cc/9SVF-9U7E.

377. MD. CODE REGS. 27.01.09.01-3 (2020).

378. MD. CODE ANN., ENVIR. § 16-102(b) (2020); Assateague Coastal Tr., Inc. v. Schwalbach, 223 Md. App. 631, 652–53 (Md. Ct. Spec. App. 2015), *aff'd*, 448 Md. 112, 136 A.3d 866 (Md. 2016)

Commission and the Maryland Department of Environment to develop a permitting procedure for the construction of piers and bulkheads in tidal wetlands.[379] It also required the "suitable maps or aerial photographs on a scale of 1 inch to 200 feet" of all tidal wetland resources.[380]

The Tidal Wetlands Act creates two jurisdictional areas: "state wetlands" and "private wetlands".[381] The Act also creates distinct permitting and licensing requirements, including for the construction of bulkheads and revetments.[382] Maryland has a joint state and federal application with the Army Corps of Engineers.[383] Instead of approving Nationwide Permits 13 (hard structures) or 54 (living shorelines), the Baltimore District for the Army Corps of Engineers implemented Maryland State Programmatic Permit-5, which predates Nationwide Permit 54 and is designed to streamline the permitting process.[384] Factors involved in the review process include the Act's public policy values, whether shore erosion is controlled, and whether the proposed activity is consistent with Critical Area laws.[385] Applicants are required to design projects to minimize the loss of tidal wetlands and, when loss is unavoidable, conduct mitigation.[386]

Maryland has amended the Tidal Wetlands Act to require the use of living shorelines to control shoreline erosion. From

379. MD. CODE ANN., ENVIR. § 16-105 (2020).

380. *Id.* § 16-301.

381. *Id.* § 16-101(p). State wetlands include "any land under the navigable waters of the State below the mean high tide, affected by the regular rise and fall of the tide." *Id.* Private wetlands are lands other than state wetlands "bordering on or lying beneath tidal waters, which is subject to regular or periodic tidal action and supports aquatic growth." *Id.* § 16-101(l)(1).

382. *Id.* § 16-202(a); MD. CODE REGS. 23.02.04.04(B) (2020); *Id.* 6.24.02.01(B). (providing also that routine maintenance of a bulkhead or revetment does not require a permit); M.D. DEPT. OF THE ENV'T, SHORE EROSION CONTROL GUIDELINES FOR WATERFRONT PROPERTY OWNERS, 2ND EDITION (2008), *available at* https://perma.cc/Q5VF-V8X9.

383. *Tidal Wetlands Permits, Licenses and Certifications*, MD. DEPT. OF THE ENV'T, *available at* https://perma.cc/U3ST-MRD3.

384. *Permit Types and Processes*, U.S. ARMY CORPS OF ENG'RS, *available at* https://perma.cc/X5T7-6EA4.

385. MD. CODE REGS. 26.24.02.03 (2020). For example, the project site is evaluated using "predicted tide range elevations, meteorologic conditions, vegetation and other biological factors, and physical indicators." A further description of considerations can be found in *Id.* 26.24.02.03(B)(1-19).

386. *Id.* 26.24.01.01(A).

high cliffs to low marsh, Maryland's shoreline is highly diverse, and more than 1,000 miles of Maryland's 7,000-mile shoreline has been stabilized with "hard" structures.[387] The state has struggled with eroding shorelines for more than a century.[388] The Shore Erosion Control Revolving Loan Fund was created in 1968 to provide technical and financial assistance to public and private property owners.[389] In 1999, due to continued public concern about shoreline erosion, the Maryland General Assembly passed a resolution requesting that the Governor establish a Shore Erosion Task Force.[390] The task force issued a report in 2000 which highlighted the need to harmonize shore erosion strategies and to account for sea-level rise, as well as the need to improve coordination and to develop comprehensive and regional shore erosion planning.[391]

In 2008, the Maryland General Assembly passed the Living Shorelines Protection Act, which amended the Tidal Wetlands Act's permitting process. Prior to the Act, living shorelines were "recommended" but not required.[392] The Act was passed in response to the Maryland Commission on Climate Change's recommendation that the "State begin to actively address the impacts on the natural environment of shore erosion induced by sea level rise" and in response to the Commission's finding that sea-level rise contributes to the erosion of approximately 580 acres of Maryland shoreline annually.[393]

Under the Tidal Wetlands Act, a permit for an erosion control project requires evidence of erosion, and it may not be granted if existing state or private wetlands are "effectively preventing erosion" or if the project may adversely affect a

387. MD. DEPT. OF THE NAT. RES., EROSION TASK FORCE FINAL REPORT 16 (2000), *available at* https://perma.cc/F7UK-H4HL.

388. *Id.*; MD. CODE ANN., NAT. RES. § 8-1001; *Detailed Descriptions of Laws and Programs*, MD. DEPT. OF THE ENV'T, *available at* https://perma.cc/928W-744V.

389. *Id.* In the early 1990s, Maryland moved from direct assistance to property owners for structural controls, supporting, instead, non-structural projects with matching grants: *Water Quality Revolving Loan Fund,* MD. DEPT. OF THE ENV'T, *available at* https://perma.cc/6P9D-465E; MD. DEPT. OF THE NAT. RES., *supra* note 379.; MD. DEPT. OF THE NAT. RES., *supra* note 387, at 15.

390. MD. DEPT. OF THE NAT. RES., *supra* note 379,at 6.

391. *Id.*

392. Alex Roy, MD. DEPT. OF THE ENV'T, LIVING SHORELINES, STATE REGULATIONS, PERMITTING AND ASSISTANCE, *available at* https://perma.cc/XG6U-EDYD.

393. H.B. 973, 2008 Leg., Reg. Sess. (Md. 2008).

neighboring property, navigation, endangered or threatened species, natural oyster bars or private oyster leases.[394] The Living Shorelines Protection Act changed the permitting process to require "nonstructural shoreline stabilization measures" to control shoreline erosion.[395] Maryland rules define nonstructural shoreline stabilization measures as those "dominated by tidal wetland vegetation" and "designed to preserve the natural shoreline, minimize erosion, and establish aquatic habitat."[396] This includes living shorelines.[397]

While the law requires living shorelines, "structural shoreline stabilization measures" may be used in areas identified as appropriate for hardened structures and as mapped by the state, which is required to develop and maintain such maps on its website.[398] Applicants also may seek a waiver from the nonstructural requirement if "a structural shoreline stabilization measure is the only feasible alternative that will protect and maintain the person's shoreline."[399] A series of criteria are then used to evaluate whether the site is suitable for a nonstructural shoreline, including the width of the waterway,

394. MD. CODE REGS. 26.24.04.01 (2020). Maryland has a General Wetlands License process that covers activities such as adding stone or concrete to a revetment or up to ten feet channelward of a bulkhead, allowing for revetments for shore erosion control less than 500 feet and no more than ten feet channelward of mean high water, and fill areas of less than 500 feet and no more than 35 feet channelward for "tidal vegetated wetland creation." *Id.* 26.24.02.04(B). The state also has a General Wetlands Permit that includes, of relevance to shoreline stabilization activities, activities conserve "soil, vegetation, water, fish, shellfish, and wildlife using best management practices." *Id* .26.24.02.05(B)(2). These projects do not require public notice. *Id.* 26.24.01.04.

395. MD. CODE ANN., ENVIR. § 16-201(C)(1) (2020) (stating that "[i]mprovements to protect a person's property against erosion shall consist of nonstructural shoreline stabilization measures that preserve the natural environment, such as marsh creation…."). Under Maryland rules, applicants must consider no action and relocating threatened structures first. MD. CODE REGS. 26.24.04.01 (2020). If neither is feasible, the law requires a "nonstructural shoreline stabilization measure." Public notice is also required for individual permits. MD. CODE REGS. 26.24.01.04(C). Applicants must notify adjoining riparian property owners in writing at the time of application. *Id.*

396. MD. CODE REGS. 26.24.01.02(35-1)(a) (2020).

397. *Id.* 26.24.01.02 (35-1)(b).

398. *Id.* 26.24.04.01-1; *See Structural Shoreline Stabilization Maps,* MD. DEPT. OF THE ENV'T, *available at* https://perma.cc/HN8G-MFYG.

399. MD. CODE ANN., ENVIR. § 16-201(c)(1)(ii) (2020); MD. CODE REGS. 26.24.04.01-2(C) (2020).

fetch, bank elevation and orientation, degree of erosion, and tides.[400]

G. Delaware

All of Delaware's three counties are coastal, bordering either the Delaware Bay, the Chesapeake Bay, or the Atlantic Ocean.[401] The state has approximately 28 miles of ocean-facing shoreline and 381 miles of tidal estuarine and bay shoreline.[402] Based on an inventory of approximately 320,000 acres in 2007, approximately 25% of the state is covered by wetlands, with tidal wetlands representing 23% of that amount.[403] Delaware is already a densely populated state, and its population is expected to grow by 22% by 2040, increasing impacts on coastal and estuarine areas.[404] In the meantime, because the state is low-lying and flat, sea-level rise threatens to exacerbate already challenging issues of coastal erosion, flooding, and tidal wetland loss.[405]

1. Ocean Edge: Beach Preservation Act

Enacted in 1972, Delaware's Beach Preservation Act declared that the state's Atlantic Ocean beaches and Delaware Bay shoreline are "valuable natural features which furnish

400. MD. CODE REGS. 26.24.04.01-2(B)(1-9) (2020) (the elements include: 1) waterway width; 2) bottom elevation and slope at mean low water; 3) bottom substrate; (4) fetch; 5) bank elevation and orientation; 6) degree of erosion; 7) height and regularity of tides; 8) any other physical constraints that would impede or prevent successful establishment of a nonstructural shoreline stabilization measure; and 9) any other relevant environmental resources, including a Critical Area buffer and other plant, fish, and wildlife habitat, and the likely adverse or protective impact of a nonstructural shoreline stabilization measure on those resources in comparison to the likely adverse or protective impact of a structural shoreline stabilization measure on those resources).

401. *Oceans and Coasts,* DEL. DEPT. OF NAT RES., *available at* https://perma.cc/F4CS-FURP.

402. STATE OF DEL. COASTAL AND ESTUARINE LAND CONSERVATION PROGRAM PLAN 3 (2014), *available at* https://perma.cc/8CAL-KWMD.

403. RALPH W. TINER ET. AL, DELAWARE WETLANDS: STATUS AND CHANGES FROM 1992 TO 2007 (2011), *available at* https://perma.cc/TH39-5R32.

404. *Id.* at 4.

405. *Id.*; *See* Del. Exec. Order No. 41, Preparing Delaware for Emerging Climate Impacts and Seizing Economic Opportunities from Reducing Emissions (Sep. 2013), *available at* https://perma.cc/AJ7G-SXCM; Karen B. Roberts, *Delaware Geological Survey, DNREC Update Sea Level Rise Projections for Delaware*, UNIV. OF DELAWARE (Nov. 27, 2017), *available at* https://perma.cc/AM8C-8MAU; *Coastal Inundation Maps for Delaware*, THE DELAWARE GEOLOGICAL SURVEY, https://perma.cc/WQ6M-ASL4.

recreational opportunity and provide storm protection for persons and property, as well as being an important economic resource for the people of the State."[406] The Act's purpose statement also identifies rising sea levels, currents, tides, and storms as contributing to beach erosion and shoreline migration.[407] Activities seaward of the "building line" such as constructing or modifying structures, removing beach or depositing materials, and causing the "significant removal of vegetation" require a permit under the Act.[408] The building line is mapped by the state's Department of Natural Resources and Environmental Control (DNREC) based on topographic surveys, with reference to the National Geodetic Vertical Datum (NGVD) and the Delaware State Plane Coordinate System.[409] In addition, the Act provides for a building line along the westerly edge of the boardwalk in the commercial areas of Rehoboth Beach and Bethany Beach.[410] These maps are available in PDF format on DNREC's website.[411]

Projects involving beach erosion control or shore protection activities such as seawalls, revetments, bulkheads, and beach renourishment all require permits.[412] The Act also authorizes the state to take action to "reduce shoreline recession" on private beaches in three circumstances: when dangerous conditions exist constituting an emergency; where owners of private beaches allow free public use of their beach property in return for assistance; or when two-thirds of property owners in the property area along the private beach petition DNREC.[413]

406. DEL. CODE ANN. tit. 7, § 6801 (2020); State v. Putman, 552 A.2d 1247, 1250 (Del. Super. Ct. 1988).

407. DEL. CODE ANN. tit. 7, § 6801 (2020).

408. *Id.* § 6805(a)(1).

409. DEL. CODE REGS. 108-5.2.7.1-5.2.7.4 (2020) (listing specific land locations in four areas, i.e. "100 feet landward of the adjusted seawardmost 10-foot elevation contour above NGVD for beaches extending from the Delaware/Maryland line to the tip of Cape Henlopen").

410. DEL. CODE ANN. tit. 7, § 6802(4) (2020).

411. *Shoreline & Waterway Management*, STATE OF DELAWARE, http://www.dnrec.delaware.gov/swc/Shoreline/Pages/DNRECBuildingLineMaps.aspx (last accessed July 27, 2020).

412. DEL. CODE ANN. tit. 7, § 6805(a)(1) (2020); DEL. CODE REGS. 5.2.10 (2020).

413. DEL. CODE REGS. 5.2.14 (2020). Regulations also list a series of priorities for the "expenditure of limited beach preservation funds. *Id.*

2. Estuarine Edge: Wetlands Act and Subaqueous Lands Act

Enacted in 1973, the Delaware Wetlands Act is designed to "preserve and protect the productive public and private wetlands and to prevent their despoliation and destruction consistent with the historic right of private ownership of lands."[414] Wetlands also are valued as habitats for economically valuable finfish, crustacea and shellfish and support marine commerce, recreation and aesthetic enjoyment.[415] Wetland loss is identified as adversely affecting flood control and causing increasing silting of channels and harbor areas to the detriment of free navigation.[416]

The Act defines "wetlands" as lands at or below two feet above local mean low water, including any bank, marsh, swamp, meadow, flat or other low land subject to tidal action.[417] The lands must grow or be capable of growing certain plants such as saltmarsh cordgrass or eelgrass.[418] The locations of state-regulated wetlands are found on official State Wetland Maps.[419] A permit is required for activities involving dredging, draining, filling, and construction occurring in wetlands, including bulkheading.[420] When considering issuing a permit for an activity, the DNREC must consider the following factors: the activity's environmental impact,[421] its aesthetic effect,[422] the number and type of public and private supporting facilities

414. DEL. CODE ANN. tit. 7, § 6602 (2020); Matter of Dep't of Nat. Res. & Envtl. Control, 401 A.2d 93, 94 (Del. Super. Ct. 1978).

415. Matter of Dep't of Nat. Res. & Envtl. Control, 401 A.2d at 94.

416. *Id.*

417. DEL. CODE ANN. tit. 7, § 6603(h) (2020).

418. *Id.* (listing plant species).

419. 7 DEL. ADMIN. CODE 7502-17.0 (2020); *State Regulated Wetlands Map Index*, DE. DEPT. OF NAT. RES., *available at* https://dnrec.alpha.delaware.gov/water/wetlands-subaqueous/state-regulated-wetlands/ (last accessed Feb. 25, 2021).

420. DEL. CODE ANN. tit. 7, § 6603(a) (2020).

421. *Id.*; 7 DEL. ADMIN. CODE 7502-12.2 (2020).

422. DEL. CODE ANN. tit. 7, § 6604 (2020); 7 DEL. ADMIN. CODE 7502-12.3 (providing that consideration of the aesthetic effect may include "[p]resence of plants or animals of a high visual quality, [t]he presence of an associated water body; and [w]etland type of topographic diversity). In *Friends of Nanticoke River*, with respect to aesthetic concerns, the court seemed sympathetic to the argument that the "surrounding area" – not just the parcel itself – should be considered under this element, noting "[a]pparently, the Secretary was not concerned that the entire river's aesthetic value would be compromised in light of the number of boats that would use a marina of this size." Friends of Nanticoke River v. Dipasquale, No. CIV.A. 00A-10-001, 2001 WL 1628466, at *4 (Del. Super. Ct. Sept. 28, 2001).

required for construction or operation of the proposed activity,[423] and the effect on neighboring land uses.[424] If there are any state, county, or municipal comprehensive plans regarding development or conservation in the affected areas,[425] the DNREC must weigh these as well, along with any economic effects of the activity, including the number of jobs created, the income which will be generated by the wages from those jobs compared to the amount of land required, and the tax revenue from the activity potentially accruing to the state, county and local governments.[426]

In addition, under the Subaqueous Lands Act, Delaware regulates tidal waters up to the mean high water line and all non-tidal rivers, streams, lakes, ponds, bays, and inlets up to the ordinary high water line.[427] Leases are required for shoreline stabilization structures occurring channelward of the mean low water line.[428] A permit is required for projects that may contribute to water pollution, infringe on public or private rights, or connect with public subaqueous lands.[429] Shoreline control structures which require a permit include bulkheads, breakwaters, gabions, groins, jetties, rip-rap revetments, seawalls, vegetation, and grading of banks.[430] DNREC must consider the proposed structure's impact on the public interest and the environment,[431] extent of encroachment or interference with public lands, waterways or surrounding private interests, whether the project incorporates sound engineering principles and appropriate construction materials, whether the proposed

423. DEL. CODE ANN. tit. 7, § 6604 (2020); 7 DEL. ADMIN. CODE 7502-12.4 (2020).

424. 7 DEL. ADMIN. CODE 7502-12.412.5; 7502-3.3; 7502-5.0 (2020) (providing that "Neighboring Land Uses" is defined as "uses on land within 1000 feet of the project as measured in a straight line from the edge of the project activity upon which the proposed activity may be expected to have an impact.").

425. DEL. CODE ANN. tit. 7. § 6604 (2020); 7 DEL. ADMIN. CODE 7502-12.6 (2020).

426. DEL. CODE ANN. tit. 7. § 6604 (2020); 7 DEL. ADMIN. CODE 7502-12.7 (2020) (providing factors). While the statute mandates that all of the factors must be considered, how they are weighed is left to DNREC's discretion. Friends of Nanticoke River v. DiPasquale, No. CIV.A. 00A-10-001, 2001 WL 1628466, at *5–6 (Del. Super. Ct. Sept. 28, 2001).

427. 7 DEL. CODE ANN. §7201-7202 (2020).

428. 7 DEL. ADMIN. CODE 7504-2.4.2.1 (2020); *Wetlands and Subaqueous Lands Permits*, DEL. DIV. OF WATER, *available at* https://perma.cc/JCF5-RFMB.

429. DEL. CODE ANN. tit. 7. § 7205 (2020).

430. 7 DEL. ADMIN. CODE 7504-1.0, 7504-4.0 (2020).

431. 7 DEL. ADMIN. CODE 7504-4.6 (2020).

project "fits in" with surrounding structures, facilities, and uses, compliance with water quality standards, and whether shellfish beds or finfish activity may be adversely affected.[432] It may also require mitigation if approval results in wetland loss.[433]

Delaware has made several efforts to promote the use of living shorelines.[434] Structural shoreline erosion measures are not permitted in areas demonstrating minimal erosion and efforts which use methods that conserve nearshore habitat such as vegetation, revetments, and gabions are encouraged.[435] State regulations also describe where nonstructural measures are preferred and the activity allowed in such areas. In low wave energy areas with wetlands or where no significant shoreline erosion has occurred, introducing suitable vegetation is permissible.[436] In eroding areas "where combinations of structural/nonstructural measures would be a practicable and effective method of erosion control," allowable activities include regrading the shoreline and planting suitable vegetative cover, combining "low profile stone groins" and planting suitable vegetative cover, and "[p]roperly designed and constructed low-profile rip-rap revetments, marsh-toe sills, or other non-vertical structures which may be used in conjunction with vegetative stabilizing cover."[437]

In 2013, Delaware created a process known as the Statewide Activity Approval (SAA) for Shoreline Stabilization Projects in Tidal and Non-tidal Waters to expedite approval for living shorelines less than 500 feet long.[438] The process creates three categories for living shorelines: Conventional (e.g., "natural fiber logs"), Energy Dissipating (e.g., "oyster castles, wave

432. *Id.* 7504-4.7.

433. DEL. CODE ANN. tit. 7. § 7205 (2020).

434. A GIS map of some of the living shoreline projects implemented in Delaware is available at: *A Tour of Living Shorelines in Delaware,* DEL. LIVING SHORELINES COMM., *available at* https://perma.cc/4JN2-KB6U.

435. 7 DEL. ADMIN. CODE 7504-4.10.1.1 (2020).

436. *Id.* 4.10.1.3.1.

437. *Id.* 4.10.1.3.2.1 - 4.10.1.3.2.3.

438. DEL. DEPT. OF NATURAL RES. AND ENVTL. CONTROL, STATEWIDE ACTIVITY APPROVAL (SAA) FOR SHORELINE STABILIZATION PROJECTS IN TIDAL AND NON-TIDAL WATERS OF THE STATE OF DELAWARE 40, *available at* https://perma.cc/6R7Z-YAVS; JENNIFER DE MOOY, DEL. DEPT. OF NATURAL RES. AND ENVTL. CONTROL, GREEN INFRASTRUCTURE PRIMER (2016), *available* at https://perma.cc/6S8X-NV7L; *Permitting FAQ*, DEL. LIVING SHORELINES COMM, *available at* https://perma.cc/WFZ7-PXTB.

attenuation devices, log attenuation structures"), and Armored (e.g., "marsh toe revetment with a natural marsh and marsh toe sills with a planted marsh").[439] The SAA includes a series of requirements related to each of these categories. Delaware has also adopted the federal living-shorelines permit and approved Nationwide Permit 54.[440]

Structural shoreline erosion control measures are allowed if it is shown that a nonstructural approach would be "ineffective."[441] Such measures must address and satisfy elements such as protecting wetlands and habitat, "water quality, flushing, and naturally occurring littoral drift and flow," protecting against "toe scour" (damage caused by erosion at the base of a dam or similar structure), and allowing for "adequate flow" to support "the functional value of adjacent wetlands or aquatic habitat." [442] The measures should avoid or minimize increased erosion of adjacent or downdrift shorelines.[443] Bulkheads must be aligned, when possible, with any adjacent bulkheads.[444]

This examination from Florida to Delaware shows the tremendous breadth and depth of coastal management programs in the Mid-Atlantic and Southeast. Our survey revealed many common trends as well as distinctions, which we discuss more fully in the next section.

IV. SHORESCAPES IN THE MID-ATLANTIC AND SOUTHEAST: PATHS FORWARD

How environmental and land use problems are framed and addressed reveals human subjectivity in perspectives and values, often resulting in regulatory approaches that conflict with each other.[445] Some scholars have maintained that conceptualizing environmental law solely as preventing environmental harm or protecting the environment "masks

439. DEL. LIVING SHORELINES COMM, *supra* note 438, at 3.
440. Delaware has approved Nationwide Permit 54.
441. 7 DEL. ADMIN. CODE 4.10.1.2; 4.10.1.4 (2020).
442. *Id.* 4.10.1.6.1-4.10.1.6.7.
443. *Id.*
444. *See* 7 DEL. ADMIN. CODE 4.10.2.1-4.10.2.4 (additional requirements).
445. Todd S. Aagaard, *Environmental Harms, Use Conflicts, and Neutral Baselines in Environmental Law*, 60 DUKE L.J. 1505, 1508 (2011).

complexity," limits policy-makers' ability to analyze effects and choose among options, and obscures values and interests embedded in efforts to manage the human-natural system interface.[446] A careful reading of the shoreline and estuarine management laws discussed above supports such a broad conceptualization. Certainly, as shoreline management laws operate in the human-land interface, use conflicts are inherent in their development and structure, and a wide variety of values and interests are embedded throughout these laws as a result of the variety of interests at play along the country's shores.

As of late 2020, social scientists involved with our NSF project are investigating these very questions about values and interests, through surveys, interviews, and network analysis. Such work should inform future policies and regulatory frameworks as the shorescape management landscape continues to evolve. While managing our shorelines is inherently a local endeavor, commonalities nevertheless arise. Understanding how jurisdictions approach these common problems is necessary if we want to understand why shore protection laws work as they do and how they might work more effectively, particularly as sea-levels rise.

In addition, law is notoriously path dependent, building upon past decisions and approaches.[447] As such, there is much to learn about potential future coastal management solutions by looking at the various law and policy frameworks that exist throughout the Southeast and Mid-Atlantic. This section, therefore, strives to develop definitional baselines and categories for recurring approaches and issues revealed in the study-area analysis in order to set the stage for informing future adaptation approaches and policy. We begin by comparing jurisdictional areas, highlighting some notable common themes and distinctions, and examining primary frames and norms influencing shoreline law and policy.

446. *Id*. at 1513-15.

447. *See* BENJAMIN J. RICHARDSON, TIME AND ENVIRONMENTAL LAW: TELLING NATURE'S TIME 91 (2017).

A. Southeast and Mid-Atlantic Shorescapes: Drawing the Lines

Many would argue that coastlines in the United States are not regulated nearly enough, but construction and development near and within shorescapes across the country are more heavily regulated than other ecosystem areas. Each state determines the extent of this regulation based on natural features and processes evident in the landscape. These include elements such tide lines, vegetative communities, erosion rates, and elevation. The selection of the appropriate jurisdictional boundary or baseline is critical to the success of the regulatory program. This section describes how these boundaries and baselines are determined on both the ocean-facing shorelines and in estuarine areas within the shorescape.

1. The Ocean-facing Edge

Two of the seven states in our study area—Florida and South Carolina—use erosion rates to establish ocean-facing setback lines. Erosion rates are a useful metric because they capture the rate of change affecting the area in question. A higher erosion rate represents a landscape that is changing more quickly and thus needs a larger buffer to promote safety and resilience. Georgia, Maryland and Delaware use a more "fixed" approach, drawing setback lines from natural features defined by sand dunes (Georgia and Maryland) and "elevation contours" (Delaware).[448] While these measurements can still change as dunes shift landward or seaward or erosion changes local topography, they do not directly capture the local rate of change. North Carolina and Virginia employ both approaches.

Using erosion rates provides a more protective measurement than simply relying on established features, even dynamic and changing features, because consulting erosion rates allows the setback line to more accurately track how the shoreline moves, which in turn reflects natural processes such as accretion (accumulation of sediment) and avulsion (loss of sediment, often sudden). As an erosion rate methodology report developed by

448. *See* Julia Shelburne, *Shore Protection for a Sure Tomorrow: Evaluating Coastal Management Laws in Seven Southeastern States,* 10 SEA GRANT L. & POL'Y J. 103, 107–109 (2020) (discussing "fixed" set-back lines).

North Carolina explains, most shorelines are highly dynamic, growing or shrinking depending upon factors such as erosion of upland rivers and "longshore transport" from adjacent coastal landforms. These rates can vary widely across a region and can also vary widely even on a local level, resulting in setback lines that move seaward or landward, depending on the erosion activity in the area.[449] By recognizing the importance of these dynamic processes, incorporating erosion rates into a shoreline management regime reflects a classic adaptive management approach.[450] In addition, because increases in erosion rates are generally directly related to higher rates of sea level rise,[451] the use of erosion rates as a basis for shoreline regulation may provide a more responsive standard. Faster rates of sea-level rise will translate to higher erosion rates, which in turn will translate into greater protection for coastal structures.

Seaward baselines based on landscape features such as dunes or vegetation are less dynamic than erosion rates, which may limit the extent to which the setback lines are adaptive to changing conditions. This is particularly important in an era of accelerating sea-level rise. Seaward baselines are somewhat less protective because they do not account for the relative vulnerability of specific areas as effectively as erosion rates. These measures apply the same buffer width and setback requirements to areas highly vulnerable to change and to those with less exposure. This is important as rates of sea-level change are accelerating and can vary substantially between localities. However, these more fixed baselines generally have the advantage of being easier to administer. A uniform buffer width from a recognizable point is more readily communicated and understood by both regulators and private citizens.

The hybrid approaches used in North Carolina and Virginia attempt to capture the values of both approaches by applying the

449. S.C. CODE ANN. § 48-39-280(A) (2020) (requiring the utilization of the "best available scientific and historical data in the implementation"); GA. CODE ANN. § 12-5-239(d) (2020) (allowing "new scientific information which, through recent advances, would effect a more competent decision relative to wise use and management of Georgia's sand-sharing system.").

450. Richard Grosso, *Planning and Permitting to Reduce and Respond to Global Warming and Sea Level Rise in Florida*, 30 J. LAND USE & ENVTL. L. 201, 237–38.

451. S. P. Leatherman, et al., *Sea Level Rise Shown to Drive Coastal Erosion*, 81 EOS 81 55, 55–57 (2000).

more dynamic but more complicated approach in areas with high erosion vulnerability and the more straightforward method in lower risk areas. In North Carolina, when the erosion rate is less than two feet per year, the state utilizes a fixed setback approach, working landward from the first line of vegetation.[452] Otherwise, the setback line is calculated by applying a multiple of the annual erosion rate. Virginia uses a multiple of the erosion rate for its barrier islands and a fixed approach for its beachfront, which is primarily associated with Virginia Beach. The chart below indicates how Florida, South Carolina, North Carolina, and Virginia incorporate erosion rates in their setback lines.

STATE	SEAWARD BOUNDARY		EROSION RATE
FL	Spring tide	+	30-year erosion rate
SC	Three possible baselines	+	40-year erosion rate
NC ***Ocean Erodible Areas***	Mean low water line	+	Recession line—multiplying the long-term annual erosion rate times 90 *or* at 120 feet landward of the first line of stable and natural vegetation, if there has been no long-term erosion or the rate is less than two feet per year. The building size also determines the final setback, with smaller structures allowed closer to the ocean than larger ones.
VA ***Barrier Islands Only***	Dune crest	+	20 times the local 100-year long-term annual shoreline recession rate, which is average shoreline recession over fixed 1-mile intervals averaged over the period between surveys of 100 years or more.

Using natural features for buffer baselines can be a tool of administrative efficiency, or it can reflect a change in coastal policy management. South Carolina's recent effort to abandon its policy of retreat, for example, essentially freezes in time what had been a more dynamic approach. Under the current BMA, baselines are fixed as one of three options—the baseline established during the 2008–2012 cycle, the baseline proposed in October 2017, or a baseline revised pursuant to appeals initiated before January 2018.[453] In 2016, North Carolina adopted "development lines," allowing local governments to determine the most oceanward location for new development.[454] While these lines are not necessarily less restrictive than the other baselines in North Carolina, they do not have the same adaptive capacity to account for changing conditions as the previous methods of measurement. This is a concerning development; local pressure to change how baselines are established may reflect a trend towards "freezing" the most oceanward jurisdictional baselines. This suggests that rising sea-levels are creating pressure for communities to "hold the line" instead of adopting dynamic and adaptive responses.

In addition to addressing gradual changes to shorelines from erosion in measuring their buffers and setbacks, North Carolina and Florida also have provisions intended to address rapid erosion from events such as storm surges from hurricanes. North Carolina addresses this potential issue by identifying areas particularly vulnerable to this type of erosion and defining them as a management category, which largely consists of the state's unvegetated beaches.[455] Florida has a process by which its setback line, the CCCL, may be shifted further landward than the 100-year storm surge impact zone if the land does not extend beyond the landward toe of the coastal barrier dune structure.[456] These provisions allow for an added level of adaptive management by recognizing more diverse types of erosion and some of its myriad causes.

Finally, the relative dynamism of a shoreline protection regime may be determined by how frequently the metrics and

453. *See supra* note 166.
454. *See supra* note 231.
455. *See supra* notes 213 and 214.
456. *See supra* note 79.

baseline determinations are updated and revised. How often setback lines are established differs widely among the states in the study area; the process is sometimes driven more by state agency leadership than statutory requirements. South Carolina's Beach Management Act requires that its baseline and setback be reviewed every seven to ten years.[457] In Florida, the setback is subject to review when hydrographic and topographic data indicate shoreline changes have rendered the line "ineffective."[458] North Carolina, by rule, uses a 2011 erosion rate study with no provision for a required update.[459] Without provisions to regularly revisit these baselines and measurement factors such as the erosion rate, these buffers and setbacks can become obsolete and counterproductive as the vulnerabilities on the ground shift away from what is represented in the data and the processes informing setback requirements risks becoming under-protective.

2. The Estuarine Edge

Estuarine management in our study area is accomplished through some combination of the following three approaches: (1) construction setbacks (buffers), (2) permitting programs regulating activities in marsh and/or tidal wetlands, and (3) licensing control of state-owned waterbottoms. Of the seven states in our study, four—Georgia, North Carolina, Virginia, and Maryland—have a statewide buffer requirement. All of the study states have permitting programs related to activities in marsh or tidal wetlands. When a project occurs on sovereign submerged lands, states typically require authorization for their use, often through a licensing process.[460] Some states, such as Georgia, use their legal status as owner of the land underlying many of these waters to operate a leasing and licensing program of waterbottoms to control the types of activities allowed in tidal

457. *See supra* note 155.

458. FLA. STAT. ANN. § 161.053 (2)(a) (2020).

459. 15A N.C. ADMIN. CODE 7H.0304(1); *see* N.C. DIV. OF COASTAL MGMT., NORTH CAROLINA 2011 LONG-TERM AVERAGE ANNUAL OCEANFRONT EROSION RATE UPDATE STUDY, *available at* https://perma.cc/7GYS-XQKW; The next review is scheduled to begin in 2016. *See* N.C. DIV. OF COASTAL MGMT., COASTAL EROSION STUDY, *available at* https://perma.cc/C5W3-TBF4.

460. *See, e.g.,* FLA. STAT. ANN. § 253.03 (2020); FLA. ADMIN. CODE ANN. r. 18-21.002 et seq (2020); O.C.G.A. §50-16-61 (2020); MD. CODE REGS. 26.24.01.01(A) (2020); MD. CODE REGS. 26.24.01.01 (2020).

wetlands.[461] This is similar to a permitting program in many ways, but since the state is acting as a landowner rather than a regulator, it can exercise greater flexibility in the approval process.

	SETBACK/BUFFER & PERMITTING PROGRAM	**TIDAL WETLANDS JURISDICTIONAL AREA/PERMITTING PROGRAM**
FLORIDA	No statewide setback. Comprehensive state wetlands permitting program through its Environmental Resource Permits.	Florida requires a "unified statewide methodology for the delineation of the extent of wetlands,"[462] working from a statutory baseline which defines wetlands as "areas that are inundated or saturated by surface water or groundwater at a frequency and a duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soils."[463]
GEORGIA	Coastal marsh buffer of 25 feet, which is measured "horizontally from the coastal marshland-upland interface," commonly referred as the "vegetated buffer." Permitting program for tidal wetlands; a "Revocable License" required for activities disturbing tidally-influenced waters.	Coastal marshlands are defined as "any marshland intertidal area, mud flat, tidal water bottom, or salt marsh . . . within the estuarine area of the state, whether or not the tidewaters reach the littoral areas through natural or artificial watercourses."[464] "Vegetated marshlands" have at least one of fourteen defined marsh plant species.[465] If salt marsh peat exists at the undisturbed surface of an area, this is

461. O.C.G.A. §50-16-61 (2020); MD. CODE REGS. 26.24.01.01(A) (2020) (applicants for permits and licenses are required to design projects to minimize the loss of tidal wetlands and, when loss is unavoidable, conduct mitigation).

462. *See supra* note 92.

463. *See supra* note 93.

464. *See supra* note 129.

465. *See supra* note 130.

		deemed "conclusive evidence" of a salt marsh.[466]
SOUTH CAROLINA	No statewide setback or buffer. Regulates critical tideland areas through a permitting process.	"Tidelands" encompass "all areas which are at or below mean high tide and coastal wetlands, mudflats, and similar areas that are contiguous and adjacent to coastal waters and are an integral part of the estuarine systems involved."[467] Coastal wetlands include areas "periodically inundated by saline waters" either by natural or artificial water courses and that are "normally characterized by the prevalence of saline water vegetation" as long as they are an integral part of an estuarine system."[468]
NORTH CAROLINA	"Buffer rule" requires new development 30 feet landward of high normal water or normal water level. Permitting required in coastal areas of "environmental concern" and include estuarine waters and coastal wetlands.	Coastal wetlands are marsh areas that have regular or occasional flooding by tides—including wind tides, but not hurricanes or tropical storm tides—and one or more of ten designated marsh plant species present.[469]
VIRGINIA	100-foot vegetated buffer and additional land use management requirements in tidewater jurisdictions. Permitting required in wetlands areas.	Vegetated wetlands extend from the mean low-water mark to 1.5 times the mean tide range where specified vegetation such as saltmarsh cordgrass or cattail is present."[470]

466. *See supra* note 131.
467. *See supra* note 187.
468. *Id.*
469. *See supra* note 249.
470. *See supra* note 321.

		Non-vegetated wetlands occur from the low-water mark to the mean high-water mark where no emergent vegetation exists.[471]
MARYLAND	A protective buffer of at least 100 feet landward from the mean highwater line of tidal waters, tributary streams, and tidal wetlands .“Local jurisdictions must expand this buffer when it is contiguous to a steep slope, a nontidal wetland, a nontidal wetland of “special State concern,” a hydric soil, or a highly erodible soil.” In Resource Conservation Areas, the minimum buffer must be 200 feet from tidal waters or a tidal wetland and 100 feet from a tributary stream. Critical Area and Wetlands Act permitting requirements.	The Tidal Wetlands Act creates two jurisdictional areas: “state wetlands” and “private wetlands.” State wetlands include “any land under the navigable waters of the State below the mean high tide, affected by the regular rise and fall of the tide.”[472] Private wetlands consist of land other than state wetlands “bordering on or lying beneath tidal waters, which is subject to regular or periodic tidal action and supports aquatic growth.”[473] “Tributary stream” means a perennial stream or an intermittent stream within the critical area that has been identified by site inspection or in accordance with local program procedures approved by the Commission.
DELAWARE	No statewide setback. State wetlands permitting requirements. State lease required for tidal waters up to the mean high water line and all non-tidal rivers, streams, lakes, ponds, bays, and inlets up to the ordinary high water line.	Wetlands are lands at or below two feet above local mean low water, including any bank, marsh, swamp, meadow, flat or other low land subject to tidal action. The lands must grow or be capable of growing certain plants.

471. *See supra* note 322.
472. *See supra* note 381.
473. *Id.*

For all of these estuarine management efforts, the spatial extent of the program relies on the presence of marsh and/or wetlands vegetation to establish the boundaries of the wetland or marsh. In other words, if there are certain plants associated with coastal wetlands or marsh, any area with those plants will be therefore defined as a wetland or a marsh. For buffer and setback requirements, the protected area extends a standard distance (e.g., 25, 30, or 100 feet) horizontally from the edge of the wetland or marsh.

Erosion rates and/or sea-level rates are not incorporated into the jurisdictional determinations even for shoreline armoring projects that are intended to address erosion or flooding. This is understandable, as the intent of the relevant marsh protection laws focus on the preservation of the wetland and marsh systems. While it is well understood that the extent of the marsh and wetland areas is shaped by various forces that cause it to shift and move based on sea-level, local topography, and hydrology, these systems generally move much more slowly than the seaward sand sharing system, which can move several feet in a relatively short amount of time due to a coastal storm or other powerful event.

However, this distinction is a relic of a past environment—one that was more predictable and stable than the environment we live in now and the one we anticipate in the future. Climate change and sea-level rise will likely make the changes in marsh and wetland boundaries much more dynamic than in the past. Indeed, in some cases, like Tybee Island, marsh areas may be more vulnerable to sea-level rise than ocean-facing ones.[474] Estuarine shoreline management therefore should incorporate more dynamic boundary determinations, such as erosion rates, or a method based on rates of local relative sea-level rise. Using more locally-specific and dynamic baselines, at least in areas which are expected to be vulnerable to relatively rapid changes, will create a regulatory system that is more strongly connected to the natural systems being managed.

Notably, in contrast to many of the ocean-facing setbacks and permitting approaches, no requirements exist for states to reevaluate jurisdictional boundaries in estuarine areas.

474. *See* JASON EVANS ET AL., TYBEE ISLAND SEA LEVEL RISE ADAPTATION PLAN (2016).

Shifting to more locally relevant baselines and jurisdictional determinations will necessitate regular updates to metrics used to measure estuarine boundaries in order for the provisions to stay relevant. While this clearly adds to administrative burdens, these regular updates build a level of adaptive management into these processes that will lead to coastal development which is less vulnerable and more resilient. Put another way, using more local data that is regularly updated will allow for more nuanced management and will produce better results.

B. Southeast and Mid-Atlantic Shorescapes: Frames and Norms

Shorescape protection laws operate in the human-land interface. Because of this, their very structure reveals a complicated effort to manage a variety of uses and values, from recreation to beach access to habitat protection. Here we take a broad look at some of the primary trends embedded within these management approaches.

1. Multiple Values, Many Conflicts, and "Balance"

Examining the laws and policies in our study area revealed a wide variety of values and interests, including habitat protection, dune preservation, beach access, hazard mitigation, recreation, economic development, property protection, public health, and aesthetics. Particularly in some of the ocean-facing protection laws, the tone, indeed, is almost celebratory, indicating a deep love for the beaches, placing them central, in many ways, to a state's identity.[475] In addition, throughout the legislative findings informing beach protection acts in our study area, the connection with tourism, recreation, and hazard protection is particularly strong.[476] Estuarine areas, while at

475. *See, e.g., supra* note 68 (beaches and dunes "represent one of the most valuable natural resources of Florida"; the beach/dune system "provides a natural healthy environment for the citizens of South Carolina to spend leisure time which serves their physical and mental well-being").

476. *See, e.g.,* DEL. CODE. ANN. tit. 7, § 6801 (2020) (providing Delaware's beaches and bay shoreline are "valuable natural features which furnish recreational opportunity and provide storm protection for persons and property, as well as being an important economic resource").

times also celebrated for their aesthetic contribution, are generally protected primarily for their value as contributors to ecological processes, often in order to prevent "despoliation."[477] Their important role in controlling floodwaters is rarely mentioned.

As strong as these values are, both for ocean-facing and estuarine areas, these "public interests" very often must be "balanced" with economic concerns and private property rights.[478] A North Carolina case involving the denial of a variance seeking to maintain sandbags in front of a condo threatened by erosion is instructive. The court acknowledged the difficult balance required, quoting legal scholar Daniel Esty:

> Indeed, [i]t is important to reiterate that there can be no truly optimal environmental governance because resource management as well as public health and ecological protection involve to some degree measuring the unmeasurable and comparing the incomparable. Optimizing one set of virtues will often entail compromising on other values. Many environmental problems have at their core questions over which people do not—and need not—agree. At this level, the policy process is art, not science.[479]

The court went on to explain that we must nevertheless engage in such balancing, endorsing Professor Esty's argument that promoting "fair governance" in the environmental policymaking process is a critical part of improving the decision-making outcome.[480] In its analysis, the court "balanced" the property owner's "substantial private property interest" in protecting his property from destruction from erosion against various public interests, including the prohibition of permanent erosion control structures under North Carolina law, aesthetic

477. *See, e.g.,* MD. CODE ANN. NAT. RES. § 8-1801 (2020); DEL. CODE. ANN. tit. 7, § 6602 (2020).

478. *See, e.g.,* Riggings Homeowners, Inc. v. Coastal Res. Comm'n of State, 747 S.E.2d 301, 309 (N.C. App. 2013); VA. CODE ANN. § 28.2-1301(B) (2020).

479. Riggings, 747 S.E.2d at 311–12 (quoting Daniel C. Esty, *Toward Optimal Environmental Governance*, 74 N.Y.U. L. REV. 1495, 1519 (1999)).

480. *Id.*

concerns and public beach access.[481] The court found in favor of the property owner, concluding that the property owner's proposed solution did not run afoul of the state's prohibition against permanent erosion control, that the public's aesthetic interests could be satisfied by visiting nearby beaches, and that, "although the public may have to walk around the sandbags, the sandbags do not completely prohibit beach access."[482] Ultimately, the court was clearly persuaded that the private property owner's interest in protecting his property from "destruction" was substantial, and that this interest outweighed the competing public interests considered by the state agency when it denied the variance. This case is a good example of how public interest values, as important as they are, are often eclipsed by strong sympathy for and bias towards individual private property owners, particularly when a structure's destruction is at stake. The Virginia Institute of Marine Science's (VIMS's) study finding that Wetlands Board members prioritized private property owners' concerns likewise highlights how these sympathies are deeply ingrained.[483] Rising sea levels and increased severity of storm events, of course, make such entrenched commitments problematic, as some properties inevitably will be destroyed no matter what stabilization efforts are utilized, and those stabilization efforts will have detrimental effects on coastal integrity in the meantime.

What, then, are we to do? If balancing tests ultimately tip in favor of one value over others, are they really balancing tests at all? They may be subconscious admissions that we, as a society, collectively consider the favored value to be more important. As inspiring as some of the legislative findings are in the laws we reviewed as part of this study, without strong direction that one value is weighed more heavily than another, no overarching value stands out, often leaving many decision-makers such as Virginia Wetland Boards inclined to accommodate individual property owners, who can show up to board meetings in a way that wetlands cannot.

481. *Id.*
482. *Id.* at 312.
483. *See supra* note 331.

Scholars researching enforcement have concluded that effective regulation requires clarity.[484] Achieving clarity also involves educating the regulated community, and studies have shown that such education efforts significantly improve compliance.[485] Surveys conducted as part of this project have identified communities where education could be particularly effective, including landscape consultants and builders in addition to private property owners. An article discussing these findings is planned.[486]

An additional possible corrective to the inherent difficulty in weighing values, Esty argues, is to improve the "analytic foundations for policymaking," as "considerable evidence suggests that the most sweeping and serious flaws in our environmental decision processes arise from data gaps and technical shortcomings."[487] We wholeheartedly agree and discuss how this might be achieved in Section 5 below.

2. Static Erosion Control: A Hardened Value for Stabilization Choices?

While values expressed in legislative findings are very helpful in determining how a regulatory framework functions (or, perhaps, was intended to function), examining how policies work in practice often reveals which values dominate. In the seven states we examined, there is a static idea of erosion control rooted within shoreline stabilization approaches—an idea which values a fixed understanding of stability and presumes that erosion, in and of itself, is the primary factor guiding stabilization structure choice. On the ocean-facing side, controlling erosion is at the forefront, from Florida's "erosion control line" to South Carolina's "standard erosion zone" to Maryland's "beach erosion control districts." Florida's policies regarding rigid coastal armoring reveal a strong attachment to this value; permits for armored beach stabilization structures may take "future installations" into account, incorporating a

484. David L. Markell & Robert L. Glicksman, *A Holistic Look at Agency Enforcement*, 93 N.C. L. REV. 1, 13–15 (2014).

485. *Id.*

486. *See supra* note 14

487. Daniel C. Esty, *Toward Optimal Environmental Governance*, 74 N.Y.U. L. REV. 1495, 1542–43 (1999).

forward-looking approach for armoring that does not appear as part of the state's Coastal Construction Control Line setting process. Certainly, from habitat conservation to beach access, other values are expressed in each of the ocean-facing shore protection acts evaluated here. Erosion control, however, is a primary driver, and the broad adoption and robust funding of beach renourishment policies reveals the extent to which maintaining the status quo—preserving the beach—is fundamental.

Erosion control as a driver is subtler on the estuarine side, as many of the relevant laws and policies were designed to protect and conserve wildlife habitat. Nevertheless, a careful review of the statutory language reveals how controlling erosion is a critical value, especially when comparing hard armoring policies with living shorelines. Indeed, hard armoring is arguably a manifestation of a "hardened" perspective of the shoreline. Policies related to living shorelines, by contrast, take elements of the dynamic environment into account, in addition to erosion control effectiveness.[488]

"Hard" stabilization structures appear to be evaluated not on whether they are the best approach based on erosion rates or other contextual factors, but whether erosion is occurring at all.[489] Living shorelines, in contrast, tend to be held to standards identifying whether the structure is appropriate for its proposed location based on structural suitability, erosion control attributes, and its contribution to the surrounding environment. In Virginia, for example, living shorelines are permitted depending on whether or not they control erosion and the shoreline's fetch. Non-structural approaches are limited to shorelines having very low fetch. Structural approaches, such as marsh toe revetments and sills, are limited to a fetch less than 1.5 miles in any shore angle direction, a maximum water depth (two feet at mean low water), and extension limitation (30 feet

488. In Florida, riprap is limited to where erosion has occurred or is likely to occur. In North Carolina, bulkheads are allowed in areas below normal high water or normal water level when the property is classified as an "identifiable erosion problem." In Maryland, a permit for a stabilization project requires "evidence of erosion." *See supra* notes 102 and 394.

489. Molly Mitchell et al., *Marsh Persistence Under Sea-Level Rise Is Controlled by Multiple, Geologically Variable Stressors,* 3 ECOSYSTEM HEALTH & SUSTAINABILITY 1, 2 (2017).

channelward of mean low water).[490] Maryland similarly determines whether a site is suitable for a living shoreline based on the width of the waterway, fetch, bank elevation and orientation, degree of erosion, and tides.[491]

Throughout the Mid-Atlantic and Southeast, shoreline armoring has been criticized as detrimental to ecological health and long-term coastal resilience; living shorelines have been proposed—either through regulation or guidance—as alternatives that better serve coastal ecosystems and are often more resilient than "hard" options.[492] Given these benefits, policymakers should be able to articulate why living shorelines are subject to more comprehensive and specific science-based requirements than hard armoring approaches.[493]

Controlling shoreline erosion in and of itself is a highly reasonable value and goal. The governing statutes, however, betray a presumption that hardened structures achieve erosion control more effectively than living shorelines—a position that is not supported by general scientific data and is highly location-specific. It also may reflect our historic approach to shoreline management, as well as cultural biases connecting security with human-made structures instead of natural-looking features. Certainly, in what is described as the "mere exposure effect," familiarity may itself be a value, as people value the familiar over the unfamiliar.[494]

Based on extensive work with regulatory programs in the region, project investigators have observed that shoreline property owners respond to varying perceptions of the risks of shoreline erosion when they seek permits to construct defensive

490. *See supra* notes 439-444.

491. MD. CODE REGS. 26.24.04.01-2(B) (1-9) (2020).

492. Carter S. Smith et al., *Hurricane damage along natural and hardened estuarine shorelines: Using homeowner experiences to promote nature-based coastal protection*, 81 MARINE POL'Y 350, 358 (2017); U.S. FISH AND WILDLIFE SERV., MULTI-SPECIES RECOVERY PLAN FOR SOUTH FLORIDA, COASTAL SALT MARSH 3–570 (2017), *available at* https://perma.cc/T256-GFVZ.

493. *See* Niki L. Pace & Nathan Morgan, *Living Shorelines: Eroding Regulatory Barriers to Coastal Resilience*, 31 NAT. RESOURCES & ENV'T 44, 44–45 (2017) (describing how it is often a more difficult regulatory and administrative process to get a permit for a living shoreline than for a bulkhead).

494. *See* Aagaard, *Environmental Harms, Use Conflicts, and Neutral Baselines, supra* note 445, at 1552.

structures.[495] Similarly, VIMS's study evaluating whether wetlands permit requests comported with guidance (the project's "regulatory fidelity") revealed that local wetlands boards lacked confidence in "softer" approaches to erosion control. Board members wrongly believed that they lacked authority to require applicants proposing hard armoring to undertake actions such as planting riparian areas and installing vegetated berms, revealing a strong bias towards the "hard" status quo.[496] More research is needed to explore how and why people feel "safer" with certain structures, and whether visual elements communicating stability—metal rods, for example—should be incorporated within living shoreline designs to possibly address biases toward "hard" and familiar-looking structures.

3. Minding the Gaps: Fragmentation, Alignment, and the Neighbor Effect

As shorelines become armored, habitats fragment. Armored areas offer little to no support for aquatic plants and animals. Shorelines become separated from upland ecosystems and from adjacent wetland and marsh areas.[497] Fragmented marshes—usually located in areas with high rates of development and shoreline stabilization structures—become even more vulnerable to erosion as sea-levels rise.[498] In a vicious cycle, this increased vulnerability to erosion leads to increased likelihood that these wetlands and marshes will need to be armored in the future. Fragmented shorelines often result in small "habitat patches" surrounded by inferior terrain, affecting ecosystem composition and diversity.[499] The remnant patches, however, can still be ecologically important; studies have shown that these

495. Sarah Stafford & Amanda Guthrie, *What Drives Property Owners to Modify Their Shorelines: A Case Study of Gloucester County, Virginia,* 40 WETLANDS 1739, 1739–1750 (2020): GUTHRIE ET. AL., THE SOCIAL AND ECOLOGICAL CONTEXTS OF LIVING SHORELINES (2019), *available at* https://perma.cc/Y6RD-R79N; GUTHRIE ET. AL., PROPERTY OWNER PERCEPTION AND INTERESTS MAY INFLUENCE SHORELINE MODIFICATION DECISION-MAKING (2019).

496. *See* REGULATORY FIDELITY, *supra* note 319.

497. *See Designing Living Shorelines, supra* note 45.

498. Molly Mitchell et al., *supra* note 489, at 11.

499. *Id.*

habitat patches have an "oasis effect" by serving as refuges for plants and wildlife with limited habitat options.[500]

The social science research conducted as part of this NSF project includes the intriguing finding of how neighbors greatly influence shoreline stabilization choices.[501] Project investigators describe this as the "neighbor effect" (i.e., people tend to build what their neighbors build), and have found that it is strongest for bulkheads and riprap revetments but less evident for living shorelines.[502] A 2019 survey of Florida coastal property owners likewise found that the presence of neighbor with coastal armoring was the most influential factor on an adjacent property owner's armoring decision.[503]

Meanwhile, the importance of neighbors for shoreline management law and policy is woven throughout our study area. These fall into four categories: policies designed to inform neighbors about proposed shoreline stabilization activities;[504] polices designed to avoid adverse impacts on adjacent properties;[505] policies designed to protect against structures interfering with the adjacent property owner's riparian rights;[506] and "gap-filling" and "shoreline alignment" policies designed to promote contiguous hardened shorelines.[507] As this list reveals,

500. D.M. Bilkovic & M. Roggero, *Effects of Coastal Development on Nearshore Estuarine Nekton Communities*, 358 MARINE ECOL. PROGRESS SERIES 27, 27–39 (2008).

501. *See* Stafford & Guthrie, *supra* note 495, at 1745.

502. *Id.*

503. Melissa K. Hill et. al, *Coastal Armoring and Sea Turtles: Beachfront Homeowners' Opinions and Intent*, 47 COASTAL MANAGEMENT 594, 594–610 (2019).

504. *See, e.g.,* GA. CODE ANN. § 12-5-239(b) (2020); VA. CODE ANN. § 28.2-1403 (2020); VA. CODE ANN. § 28.2-1302 (2020).

505. *See* FLA. STAT. ANN. § 161.085(8) (2020); S.C. CODE ANN. REGS. 30-12(C) (2020); MD. CODE REGS. 26.24.04.01 (2020); 4 VA. ADMIN. CODE 20-1300-50 (2020); DEL. CODE ANN. tit. 7, § 6604 (2020) (providing that the effect on neighboring land uses be considered).

506. *See, e.g.,* 15A N.C. ADMIN. CODE 7H.2705 (2020) (providing that, under the General Permit for Marsh Sills, the determination of a riparian access corridor line and providing that the sill may not interfere with the exercise of riparian rights by adjacent property owners).

507. 15A N.C. ADMIN CODE 7J.1201 (2020) (in North Carolina, when a petitioner requests a development line from the local government, they must use "an adjacent neighbor sight-line approach, resulting in an average line of structures"); 7-7000-7504 DEL. ADMIN. CODE § 4.10.2.1–4.10.2.4 (2020) (requiring bulkheads to be aligned with bulkheads); *see also* David L. Strayer & Stuart E.G. Findlay, *Ecological Performance of Hudson River Shore Zone, in* LIVING SHORELINES: THE SCIENCE AND MANAGEMENT OF NATURE-BASED PROTECTION 317, 326 (2017) (citing a report finding that people often prefer "tidy" shore zones that are easy to move around).

these approaches reflect distinct values, some of which arguably conflict. Policies to inform neighbors, protect against encroachment or adverse impacts, and protect against interference of riparian rights reveal concerns about nuisance, trespass, and invasion of property rights.

Gap-filling and shoreline alignment policies, on the other hand, facilitate the ability of one neighbor to follow another, promoting more standardized erosion control and reflecting values of fairness and even aesthetics over more functional considerations.[508] In our study area, Florida appears to be the most aggressive in encouraging gap-filling. Under Florida's Shore and Beach Preservation Act, for example, permits for a hardened structure that connects existing rigid coastal armoring structures are routine so long as an individual section is no more than 250 feet in length.[509] This, as a recent study put it, "allows for a simplified process of creating continued stretches of armored sections of beach, encourag[ing] the proliferation of coastal armor."[510] With respect to estuarine areas, "gap-filling" projects to connect existing, legal seawalls or riprap structures are exempt from the ERP permitting process, although regulations prohibit using riprap to "straighten" the estuarine shoreline.[511] On Fripp Island, the shoreline may continue to be armored precisely because only a small percentage of its shoreline was unarmored at the time South Carolina's Beach Management Act passed.[512] Not only is there is a presumption towards connecting armored structures but, once a shoreline becomes armored, it appears the connection is inevitable.

508. *See* S.C. CODE ANN. REGS. 30-11(B)(10) (2020) (requiring consideration of how the project could affect the "value and enjoyment of adjacent owners" must also be considered); 15A N.C. ADMIN. CODE 7H.1105 (2020) (providing that, when replacing an existing bulkhead, the new alignment shall be positioned so as not to exceed a maximum distance of two feet waterward of the current bulkhead alignment. To tie into a like structure on the adjacent property, replacement bulkhead position shall not exceed a maximum distance of five feet waterward of the current bulkhead alignment); 7-7000-7502 DEL. ADMIN. CODE § 5.0 (2020) (providing that "Neighboring Land Uses" is defined as "uses on land within 1000 feet of the project as measured in a straight line from the edge of the project activity upon which the proposed activity may be expected to have an impact.").

509. FLA. STAT. ANN. § 161.085(2)(c) (2020).

510. *See* Hill et al., *supra* note 503, at 596.

511. *See supra* note 107 and accompanying text; FLA. ADMIN. CODE ANN. R. 62-330.431 (2020)

512. FLA. ADMIN. CODE ANN. r. 62-330.431 (2020).

Other states in our study area take a less direct approach, relying instead on principles of "alignment." For example, North Carolina includes alignment requirements when existing bulkheads are replaced.[513] Delaware includes, as one factor when evaluating shoreline stabilization permits, "uses on land within 1000 feet of the project as measured in a straight line from the edge of the project activity upon which the proposed activity may be expected to have an impact," and one of the elements its regulatory agency must weigh is whether the proposed project "fits in" with surrounding structures, facilities, and uses.[514] Unlike Florida's gap-filling approach, these policies do not necessarily promote armoring, but they nevertheless reflect a human-centered conception of the shoreline, one that is "straight" and where structures are "connected" or "fit in" instead of a shoreline having a dynamic, natural contour. With that said, considering a structure's impact on the landscape beyond immediately adjacent parcels has the potential to support a more holistic approach if done with the natural—not the hardened—shorescape in mind. We discuss the merits of a shorescape approach in Section 5 below.

Certainly, potential erosion between structures—affecting both the unarmored parcel as well as it neighbors—is an important concern for shoreline managers. Presuming, however, that connecting hard structures is the most effective choice ignores other realities. Hardened shorelines often increase flooding and erosion on adjacent shorelines and are less resilient than living shorelines in the face of sea-level rise.[515] Meanwhile, the concept of alignment itself—especially if it is based on connecting existing structures and sight-lines—reflects a conception of the shoreline as a static and stable place. Such a conception stands in stark contrast to "coastal realignment" efforts underway worldwide to incorporate "soft" stabilization approaches using nature-based infrastructure to better manage sea-level rise, nuisance flooding, and increased extreme weather events.[516]

513. 15A N.C. Admin. Code 7H.1105 (2020).

514. *Id.* 4.7.

515. *See* Bilkovic & Mitchell, *supra* note 45, at 310.

516. *See, e.g.,* Matthew M. Linham & Robert J. Nicholls, *Managed Realignment*, CTCN, *available at* https://perma.cc/8X8Y-9PVF.

4. Facing the Future

Sea-level rise and extreme weather events, of course, also contribute to increased shoreline erosion and change. While several of the states in our study are studying or planning for sea-level rise, none of them have incorporated "future conditions" into their methodologies for determining erosion rates. Florida, for example, when establishing its ocean-facing Coastal Construction Control Line, requires a comprehensive engineering and topographical survey, but only using historical weather data—there is no requirement to consider future conditions.[517] Several states, such as Georgia and South Carolina, include terms such as "best available science" or "new scientific information" when outlining how setback and jurisdictional lines should be drawn, arguably allowing for the consideration of rising sea levels in decision-making.[518] Delaware includes rising sea levels in the purpose statement for its Beach Preservation Act, but the Act contains no direct requirement that sea-level rise be considered when jurisdictional lines are set.[519]

As noted, erosion rates and sea-level rates are not incorporated into the jurisdictional determinations for estuarine areas, even though those factors may have a greater impact on estuarine areas than on ocean-facing areas. Sea-level rise projections for Tybee Island, Georgia, show more inundation of coastal marsh on the "back" of the barrier island than of its ocean-facing beach, which is situated on the most elevated area of the island and is the location of regular beach renourishment.[520] Sea-level rise and "future conditions" should inform both ocean-facing and estuarine shoreline management laws and policies.

Unfortunately, there are indications that rising sea-levels may encourage policies or approaches that are *less* adaptive rather than *more* so. South Carolina has recently chosen to backpedal from its "policy of retreat"; while this is not explicitly connected to sea-level rise, it is difficult not to see it a refusal to

517. FLA. STAT. ANN. § 161.053(2)(a) (2020).
518. *See supra* note 449.
519. *See supra* note 407.
520. Evans, Tybee Adaptation, *supra* note 474.

address increasing vulnerabilities associated with sea-level rise. Likewise, the controversies in the past few years surrounding its efforts to update its ocean-facing jurisdictional lines are inescapably connected in to increasing concerns about increased erosion, likely caused by sea-level rise.[521] Florida's policy of allowing rigid coastal armoring structures in response to both present and future sea-level rise projection should also give us pause; the policy highlights a disconnect between arguably acknowledging rising sea-levels in its permitting process for hardening shorelines while not doing so in its process for developing its ocean-facing jurisdictional lines.[522] In Virginia, if property in Sandbridge Beach has been declared to be in "clear and imminent danger from erosion and storm damage due to severe wave action or storm surge," the owner must construct and maintain protective structures.[523] With the past as a guide, property owners in this situation are likely to opt for hard approaches as a default. These are often easier to get permitted and appear, to the untrained eye, familiar and appropriately strong.

5. Advancing Cooperative Federalism: Towards a Shorescape Perspective

The conflicts described in this paper, which thread throughout shoreline management law and policy, collectively arise from differing perspectives. Property owners and decision-makers tend to operate from a parcel-scale perspective, while research into coastal resource management highlights the need to consider the shorescape as whole.[524] One level higher, current science (as demonstrated by the NSF funded project that generated this paper) strives to be multi-disciplinary and holistic in its scope to improve human understanding of these systems and human interactions with them. Most of the statutes and many of the regulations used to manage these areas are decades old in their design and conception. They largely come from an era when environmental protection focused on a single resource or individual threat. Thus, it should not be a

521.*See supra* notes 163-165.
522. *See supra* notes 85–89.
523. *See supra* note 285.
524. *See, e.g.*, *supra* notes 504–508.

surprise that these regulatory schemes are not able to address the complexities inherent in managing dynamic systems, especially under the current circumstances of increasingly rapid change being introduced into these systems. Meanwhile, many decision-makers still associate rising sea levels primarily with ocean-facing shoreline management, when it is the entire coastal shorescape of bays, sounds, tidal creeks, marshes, bogs, canals, and drainage systems that is at risk.

To improve our ability to manage and protect the environment in which we live and the resources on which we depend, we need to develop a new paradigm of environmental regulation. We need a system that recognizes the varied dynamics of natural systems and the complexities of the burden placed on them by human demands. This system should consider multiple scales of both temporal and spatial data. By temporal data, we mean that this system account for more than just historical data and incorporates future projections. By spatial data, we mean that this system must consider the impacts of decisions beyond a single parcel or individual project. We need a system that can analyze the impacts of decisions at the site level, the local community level, the county level and beyond.

The idea for such a system is not new.[525] In the past however, such a system was not possible due to insufficient data on the constituent ecological systems, the lack of reliable projections of future conditions, and the fact that the required analytical tools and frameworks did not exist.[526] Broadly focused and multi-disciplinary research projects—such as this one—are addressing these deficiencies. In addition to building the technical information and tools needed to create such a system, law and policy experts, as well as public outreach professionals, are contributing input which allows policy-makers to imbue policy proposals with dependable scientific data and generate much needed new ideas for regulatory approaches.[527] A significant

525. *See, e.g.,* Richard A. Carpenter, *Using Ecological Knowledge for Development Planning*, 4 ENVIRONMENTAL MANAGEMENT 13, 13–20 (1980); Owen, *supra* note 1, at 221.

526. Owen, *supra* note 1, at 240-41.

527. Owen, *supra* note 1, at 222 (discussing how "increased data availability, new software systems, and exponentially greater computing power have combined to turn

amount of data is now available online related to erosion rates, projected rates of sea-level rise, ecosystem metrics, and habitat fragmentation, among other factors. Almost all of the states in our study area have data related to their ocean-facing and estuarine shorelines available online in GIS format (Delaware is the exception, with information in PDF format). The analytical tools for the system we propose now exist and are being continually refined. South Carolina has a "Beachfront Jurisdictional Line Viewer."[528] Statistical analysis is required in North Carolina when determining boundaries for inlet hazard zones.[529] AMBUR, a spatial-temporal statistical analysis tool, is routinely used by coastal managers and scientists to analyze coastal change.[530] VIMS has developed a Shoreline Management Model to predict the best management practices for a shoreline and to identify where living shorelines are suitable.[531] Maryland maps areas where hardened structures are suitable.[532]

Spatial and statistical analysis can promote a more integrative approach to environmental management by diagnosing how individual decisions at smaller scales cumulatively impact the broader system as well as by using data to identify how and where future problems are likely to happen.[533] Targeted approaches are now possible, instead of "one-size-fits-all" approaches. Collected data can also be understood at a broader scale, allowing decision-makers to consider impacts beyond the parcel level. "Measuring the unmeasurable" will always be a challenge, but given the amount of data we already have, as well as shoreline data being

spatial analysis— that is, quantitative analysis of data coded to specific geographic coordinates—into the coin of the environmental realm.").

528. *SC Beachfront Jurisdictional Lines*, S.C. DEP'T OF HEALTH AND ENVT'L CONTROL, *available at* https:/gis.dhec.sc.gov/shoreline (last visited Feb. 26, 2021).

529. 15A N.C. ADMIN. CODE 7H.0304(2) (2020).

530. *See supra* note 167 and accompanying text; *see, e.g.*, Chester W. Jackson et al., *Application of the AMBUR R Package for Spatio-temporal Analysis of Shoreline Change: Jekyll Island, Georgia, USA*, 41 COMPUTERS & GEOSCIENCES 199 (2012); GOVERNORS' SOUTH ATLANTIC ALLIANCE, COASTAL VULNERABILITY ANALYSIS USING AMBUR (2014), *available at* https://perma.cc/F45Y-VJT6.

531. *Shoreline Management Model - SMM*, VA. INST. OF MARINE SCI., *available at* https://perma.cc/JWY4-HBCE.

532. *See Structural Shoreline Stabilization Maps*, MD. DEPT. OF THE ENV'T, *available at* https://perma.cc/6UAA-D5ZN.

533. Owen, *supra* note 1, at 254.

continuously generated, it is now possible to enact a regulatory regime which is closely connected to and informed by the natural systems which it is charged with managing.

We therefore propose the development of a "shorescape approach" to managing our coastlines. A shorescape approach means designing a regulatory system that builds on usable science to set functional goals for the essential qualities of ecosystem vibrancy. Such an approach would go beyond parcel-by-parcel management of the "edge" of a shoreline to better manage increasing erosion and flooding and allow for marsh migration as sea levels rise.[534] It would be analogous to the watershed approaches that have been proposed and pursued throughout the country.[535] Of all the states in our study area, North Carolina comes closest to realizing a holistic shorescape approach, integrating its ocean-facing and estuarine shoreline management throughout its statutory framework. The next steps in this research should be to further investigate how spatial analysis and data should inform regulatory design and to compare, through modeling, how well a shorescape approach might work to protect coastal resources, compared to existing frameworks.

A shorescape approach would also advance the holy grail of environmental law: dynamic cooperative federalism.[536] We agree with Professor Owen that "[s]patial analysis can help complex systems of overlapping federalism work."[537] Spatial analysis allows for improved communication between different levels of within a single jurisdiction and improved interjurisdictional coordination.[538] Future scenarios planning, informed by spatial modeling, also allows for a more robust

534. *See* Bilkovic & Roggero, *supra* note 500, at 27, 36–37 (encouraging watershed planning at a scale larger than the parcel level).

535. Cynthia R. Harris & James M. McElfish, Jr., *Natural Resource Damages, Mitigation Banking, and the Watershed Approach*, 48 ENVTL. L. REP. NEWS & ANALYSIS 11001 (2018); William Andreen, *Developing a More Holistic Approach to Water Management in the United States*, 36 ENV'T. L. REP. 10677 (2006); Craig Anthony Arnold, *Fourth-Generation Environmental Law: Integrationist and Multimodal*, 35 W. & M. ENVTL. L. & POL'Y REV. 771, 775 (2011); William E. Taylor & Mark Gerath, *The Watershed Protection Approach: Is the Promise About to Be Realized?*, 11 NAT. RESOURCES & ENV'T 16, 16–20 (1996).

536. *See* Owen, *supra* note 1, at 273–74.

537. *Id.* at 273.

538. *Id.* at 275.

discussion of trade-offs and an examination of competing goals.[539] In the case of shoreline change, real potential exists to identify areas prone to marsh migration, allowing for high-priority corridors to be protected and preserved. As sea-levels rise, property owners will likely be tempted to turn to hard armoring, even in areas and situations where nature-based alternatives would be more effective. Identifying such "hot spots" would allow for targeted outreach and education, leveraging the "neighborhood effect" to improve shoreline management in an efficient and strategic way.

A shorescape approach fits well within the current federal framework for coastal management, the Coastal Zone Management Act (CZMA).[540] The CZMA communicates congressional concern that increasing economic development and population growth in coastal areas is causing irreparable harm to ecosystems,[541] with an overall goal of "developing land and water use programs for the coastal zone, including unified policies, criteria, standards, methods, and processes for dealing with land and water use decisions of more than local significance."[542] Administered by the National Oceanic and Atmospheric Administration (NOAA), the CZMA provides for management of the nation's coastal waters and their "adjacent shorelines," which include estuarine areas such as sounds, bays, lagoons, and bayous.[543]

In particular, the CZMA's National Coastal Zone Management Program has the most potential to direct state and local adaptation measures towards a more robust shorescape approach. The program provides federal funding assistance when states develop coastal management plans approved by NOAA that control uses impacting the state's coastal zone.[544] State programs also have a coordinating function involving local,

539. *Id.* at 276.

540. 16 U.S.C. §§ 1451 et seq (2020).

541. *Id.* §§ 1451(b)–(e) (2020).

542. *Id.* § 1451(i) (2020). When the CZMA was reauthorized in 1990, addressing nonpoint source pollution, planning for sea level rise, and developing ocean resource plans were added. *Id.* § 1451(l). Omnibus Budget Reconciliation Act of 1990, Pub. L. No. 101-508, 104 Stat 1388 (1990).

543. 16 U.S.C.A. § 1453(3)-(4) (2020).

544. *Id.* § 1451(h); *The National Coastal Zone Management Program*, NATIONAL OCEANIC ATMOSPHERIC ADMINISTRATION, *available at* https://perma.cc/4XJS-4SB7.

area-wide, and interstate plans and agencies with responsibilities for the coastal zone.[545] States also currently address, to varying extents, coastal nonpoint source pollution, sea level rise, and ocean planning.[546]

A comprehensive examination of how the CZMA could be adapted to promote a shorescape approach is beyond the scope of this Article, but it remains a foundation upon which a broader, more comprehensive shorescape management approach could be build. States participating in the program, for example, could be directed to integrate spatial modeling and future scenarios planning into their regulatory frameworks. In addition, in several of the states in this study, policies are in place to encourage assessment of cumulative impacts, although more could be done.[547] Policy-makers are becoming more aware of the dynamic and multi-scaled intersections that occur in the land and water uses of diverse individual property owners, who often have differing goals for and expectations of their property. A review of environmental management and policy literature, however, reveals little attention being paid to the CZMA generally, although there is some Congressional interest in using the CZMA to support living shoreline and resilience efforts.[548] Yet strong potential exists to build upon CZMA's framework to promote a shorescape approach encompassing the site level, the local community, and the entire coastal landscape.

V. CONCLUSION

Coastal areas, as inherently dynamic spaces, require dynamic management, especially in an era of rapidly increasing sea-level rise. Hard approaches such as groins, revetments, bulkheads, and sea walls are, at their core, non-adaptive and

545. 16 U.S.C. § 1455(d)(3) (2020).

546. 16 U.S.C. § 1455b (2020). While sea level rise was included as a part of 1990 reauthorization, neither a program nor a plan for NOAA approval was required. 15 C.F.R. § 923.3(b) provides, however, that programs should address sea level rise and flooding.

547. *See, e.g.,* FLA. STAT. ANN. § 373.414(8)(a) (2020); S.C. CODE ANN. REGS. 30-11(C) (2020).

548. *See, e.g.,* Living Shoreline Act of 2019, H.R. 3115, 116th Cong. (2019) (directing NOAA to make grants for climate-resilient living shoreline projects); Coastal State Climate Preparedness Act, H.R. 3541, 116th Cong. (2019) (requiring NOAA to establish a coastal climate change adaptation preparedness and response program).

"one-size fits all" stabilization methods. While appropriate in some instances, they also contribute to overall erosion, are not equipped to respond to rising sea-levels, and often are not the correct stabilization choice to protect property or ecosystem services. Nature-based living shorelines, in contrast, mimic the complex and unique coastal ecosystems in which they are placed, are able to adapt to changing conditions, allow for tailored approaches that respond more effectively to the changing environment, and are more resilient in the face of extreme weather events and rising sea-levels. Thanks to scientific and data management advances, we have a much more thorough understanding of how the shorescape works. The opportunity now exists to move beyond previous regulatory frameworks in order to better manage coastal zones.

Certainly, as we have stated above, accounting for current sea-level rise and projections of future sea-level rise will be necessary, both in ocean-facing and estuarine areas. As tempting as it might be to "draw lines in the sand" and establish certainty by freezing jurisdictional baselines, the waters will rise nevertheless, subsuming such efforts. Dynamic and adaptive responses using nature-based approaches such as living shorelines are more likely to be successful. In addition, regular evaluation of shoreline change will be necessary in order support more resilient future development.

The transition will not be simple. Regulatory frameworks should be more strongly connected to the natural systems under management, and all stabilization choices—hard and soft—should be subject to science-based requirements. Hard approaches, of course, are seductive in their appearance of solidity, even though it is their very rigidity that often makes them more vulnerable. Decision-makers and property owners will therefore need education to trust that nature-based approaches, appropriately sited, can protect their assets more robustly than hard structures. In addition, we need more research related to property owner behavior and how regulatory frameworks should evolve to leverage the "neighbor effect" to further encourage adoption of living shorelines instead of hard approaches. Finally, as sea levels continue to rise and extreme weather events occur, stabilizing the shoreline edge will require a broadening of our understanding of what the edge actually is—

an inextricable part of the broader shorescape. Only then will we be positioned to properly understand and protect our coastal areas.