SAVE THE BAY®
NARRAGANSETT BAY

Coastal Erosion and Adaptation on the Rhode Island Coastline

Summary Report, May 2013

Summary

Rhode Island shorelines are eroding and coastal properties and public infrastructure are becoming more and more vulnerable as the rate of sea level rise increases. As a result, there is growing pressure on the state's Coastal Resources Management Council (CRMC) to allow hardening of shorelines where previously such activities were forbidden. This study seeks to assess various alternatives to shoreline hardening available to homeowners and municipalities who face difficult decisions in the coming years. Various methods of addressing coastal erosion are described including traditional shoreline armoring, nonstructural techniques, the "living shorelines" suite of techniques, and infrastructure abandonment and retreat. The study then presents an assessment of the applicability of various alternatives to traditional hardening in Rhode Island waters. An appendix provides an analysis by town of potential coastal adaptation projects. This project is a joint venture between Save The Bay and the RI Coastal Resources Management Council with funding from NOAA to assess implementing "living shorelines" in Rhode Island. It evolved into a wider assessment of shoreline adaptation strategies once it was determined that the "living shorelines" approach presented a wide range of difficulties in Narragansett Bay and Rhode Island's coastal ponds.

Background

The Rhode Island shoreline is naturally eroding and migrating over time. A recent USGS study showed that 84% of measured coastal transects between South Dartmouth Massachusetts and Napatree Point, Rhode Island are erosional (USGS, 2010). Much of that erosion occurs during short term storm events, which include both hurricanes and extra-tropical Nor'easters. Long term erosion rates have been measured and are available to the public through Shoreline Change maps (http://www.crmc.state.ri.us/maps/maps_shorechange.html). The Rhode Island shoreline is migrating landward as a result of sea level rise and local factors such as fetch, wave energy, and other shoreline dynamics. Coastal salt marshes that have nowhere to migrate are being lost. Existing coastal salt marshes are also being impacted by lack of sediment input, sea level rise, goose predation, subsidence, ditching and drought leading to hyper-saline conditions.

A major response to this erosion has been armoring of the coastline in critical areas. Type 1 waters (defined in Section 200.1 of the RI Coastal Resources Management Program as (1) water areas that are within or adjacent to the boundaries of designated wildlife refuges and conservation areas, (2) water areas that have retained natural habitat or maintain scenic values of unique or unusual significance, and (3) water areas that are particularly unsuitable for structures due to their exposure to severe wave action, flooding, and erosion) have largely been spared, and many areas of marsh and natural shoreline have been protected. Shoreline protection structures are permitted through the Coastal Resources Management Program in Type 2 through Type 6 waters. About 25% of Narragansett Bay's shoreline is hardened (Tiner et al. 2003). Some of this hardening occurred prior to the establishment of the CRMC and is found in Type 1 waters. Coastal development exists in about 54% of the 500 foot coastal buffer (Tiner et al. 2003) and has resulted in conditions that require shoreline hardening to protect existing infrastructure and make retreat or abandonment of infrastructure more difficult options.

While much of the hardening of the Rhode Island coastline has happened after major storms, hardening also occurs in a piecemeal fashion as development gets permitted around the state. As shoreline protection structures reach the end of their design lives and sea level rise accelerates, tough decisions need to be made. Many of these decisions are made after storms when there is a frenzy of rebuilding and requests for emergency maintenance of structures. Hurricane Sandy did not hit Rhode Island directly, but caused a huge amount of damage and is opening up the conversation about how to rebuild.

Storm related erosion is causing problems for land owners on our open ocean coastline as is evident in areas like Matunuck, where a Type 1 water classification is limiting how much landowners can protect their rapidly eroding shoreline. Decisions about where and when to protect or move coastal infrastructure such as roads, sewers, water mains, recreational infrastructure and neighborhoods are being forced upon us. We cannot possibly afford to protect every stretch of coastline that will be inundated in the coming decades.

Unlike many other coastal states, Rhode Island has a strong Coastal Resources Management Program that has historically been very protective of natural shorelines and public access. The current regulation states that non-structural (e.g. vegetation, beach nourishment) methods are preferred and that owners must "exhaust all reasonable and practicable alternatives" to hardened shoreline structures. What those alternatives are, however, have not been well defined in either policy or practice.

The CRMC is preparing to develop a shoreline change Special Area Management Plan, referred to as the Beach SAMP. This SAMP will go beyond our south coast beaches and will deal with shoreline change in the Bay as well. As policies and regulations are debated and put in place, we hope that this report can help inform the discussion.

Save The Bay, through a partnership with the CRMC funded by the National Oceanic and Atmospheric Administration (NOAA) was tasked with assessing the applicability of various coastal adaptation techniques along the Rhode Island shoreline to help CRMC define alternatives to hardened shoreline structures and strengthen their regulations. The project began as a way to develop a Living Shorelines Policy for Rhode Island, based on new regulations and techniques being used in the Mid-Atlantic States. The State of Maryland, for example, requires Living Shorelines as a preferred alternative unless an applicant can demonstrate that the technique will not work in that location.

The shoreline assessment included a review of potential pilot projects that could demonstrate the use of a Living Shoreline technique. Through the field assessment process, it was difficult to find applicable sites for the use of Living Shorelines as used in the Mid-Atlantic region due to fetch, bathymetry, eroding salt marshes and shoreline topography. Living Shorelines will not be able to solve our most pressing problems which are related to accelerating sea level rise and inundation of coastal features and infrastructure.

This study was then broadened to include many techniques such as coastal retreat, including shoreline grading, and relocation of infrastructure. These techniques are often more contentious and divisive, but they need to be discussed as true alternatives to addressing ongoing erosion of coastal areas.

Coastal Adaptation Techniques

This paper will discuss three categories of coastal adaptation: structural hardening, non-structural erosion control or retreat, and a hybrid approach. Living Shorelines as defined in this report are considered a hybrid approach. The following section will describe each category, along with the benefits and drawbacks of each approach.

Structural Shoreline Hardening

Structural shoreline hardening in Rhode Island often takes the form of rock revetments, but also includes bulkheads and other types of walls or groins. Much of Rhode Island's Type 2 and 3 shorelines are already hardened, along with some of our Type 1 shorelines. Much of this is historic hardening that took place before coastal regulations existed. The sizes and types of structures vary widely, as do their condition and age. Areas that are not hardened are either undeveloped or the development is well buffered from the shoreline. This piecemeal approach makes it all the more difficult to fit non-structural techniques in to an already hardened environment.

Structural shoreline protection will continue to be an important tool for protecting important public infrastructure along the coast, but it leaves us vulnerable to inundation and flooding from storms as sea level rises. Structures also need to be maintained in perpetuity and will likely need to be built larger and higher over time.

Shoreline hardening alters the natural beach and intertidal ecosystem. By stopping erosion, it starves downdrift beaches and marshes from much needed sediment and impedes long-shore drift of sediment in the near shore environment. Marshes become more vulnerable to subsidence and erosion with lack of sediment. Structures can alter the connectivity between upland and aquatic environments. Over time, as shorelines retreat up against walls and revetments, there will be a loss of lateral beach access as well as loss of foraging habitat for birds and other wildlife and the loss of habitat for egg laying horseshoe crabs. Many of the effects are very localized, with wave action reflecting off of hard structures and causing scour at adjacent properties. (Shipman, 2009)

Non-structural Erosion Control

Non-structural approaches include vegetation enhancement, intertidal shellfish reefs, bioengineering, bank grading and beach nourishment.

Bioengineering

Bioengineering or soft engineering techniques include the use of biodegradable materials such as jute and coir fibers to protect shorelines from erosion. Coir logs are made from woven coconut fiber and can be used at the base of an eroding bank or salt marsh. This is an example of a project in Charlestown, RI where a combination of coir logs and marsh grass was used.

Coir envelopes are coir fabric filled in place with locally compatible sand and then stitched together, holding the sand in place. These envelopes can then be used to create a terraced bank where natural material and sand absorb wave energy and reduce erosive wave reflection. Coir envelopes should be planted or seeded with native grasses or coastal shrubs to prevent breakdown of the material by UV exposure. This is an example from Byway Road in Barrington, RI.

Bank Grading

In this case at City Park Beach in Warwick, there was an area where there was room to grade and carve back the shoreline to create a more gradual, dissipative slope. In some of these areas, it may be possible to combine a living shoreline approach. Shoreline grading is regulated under Section 300.2 of the CRMC regulation. The standards for shoreline grading state that “cutting into rather than filling out over a coastal bank is the preferred method of changing upland slopes”.

Vegetation Enhancement

Bank grading and bioengineering require additional planting and enhancement of vegetation to create a stable bank. Minor erosion can also be reduced by protecting and enhancing vegetation cover that already exists in the upland or on the shoreline feature, and by increasing the natural vegetated buffer. This protection provides control of upland runoff and erosion from waves and tides. The most suitable sites for this technique are areas where upland runoff causes minor erosion and where the buffer can be widened. The use of vegetated stormwater management practices such as bioretention and vegetated swales can help to intercept and infiltrate runoff before it reaches the shoreline feature. These practices are detailed in the *RI Stormwater Design and Installation Standards Manual* as well as the *RI Stormwater Management Guidance for Individual Single-Family Residential Lot Development.*

Intertidal Shellfish Reefs

This technique involves using natural materials to recruit bivalves such as ribbed mussels or oysters to stabilize low marsh edges. The approach combines the use of coir fabric and logs with shell bags or other substrate. The shellfish bind tightly together and allow sediment to accumulate while adding habitat complexity and preventing erosion of the marsh edge. Mussel beds can also protect the marsh edge from goose predation and can benefit other species of fish and crabs. This example from Delaware Bay shows the use of shell bags in front of coir logs that were seeded with mussels (Whalen, et al. 2011).

Beach Nourishment

Beach nourishment involves placing clean sand on an existing beach in order to increase the beach width and elevation and improve storm protection. Beaches are dynamic shoreline features that are constantly shifting in response to predominant wind and wave direction. Suitable sand sources with appropriate grain size must be identified. This technique may not be long lasting depending on storms and erosion rates.

Beach nourishment is regulated under Section 300.9 of the CRMC regulation. The standards state that:

(a) The placement of dredged materials on a beach is a preferred disposal alternative, providing that the materials in question are predominantly clean sands possessing grain size and such other characteristics to make them compatible with the naturally occurring beach material.

(b) In areas where the processes of littoral drift would result in significant re-entry of dredged sediments into a navigable waterway, dredged materials must be placed on the downdrift side of the inlet.

(c) All applicable requirements of Section 300.2 shall be met.

Shoreline Retreat and Removing Coastal Infrastructure

There are areas where shoreline retreat may be the best adaptive technique when dealing with erosion and sea level rise. This could include closing roads that are located in a tidal marsh or removing infrastructure. In areas where roads are at or just above high tide, alternative access will need to be provided during storm events and spring tides. Long term planning for moving recreational facilities and homes or outbuidlings may also be appropriate where erosion rates are significant or where there is space to move the structure inland. This public access area at the end of Samuel Gorton Ave in Warwick may need to be removed in the future.

Stormwater Abatement

Stormwater impacts the coastline where roads end along the shore. At these end of road locations there is often opportunity for removal of infrastructure (pavement), infiltration of stormwater runoff and enhancement of the intertidal habitat impacted by runoff.   While the extent is small, these are areas where it would be possible to enhance an existing or eroded fringe marsh through the use of a stone sill with a swale that can treat stormwater in the upland area. This pavement at the end of Kickemuit Ave. in Bristol will be removed to provide an area for stormwater infiltration and water quality improvement.

Hybrid Techniques

Hybrid approaches incorporate non-structural components such as planted marsh and beach nourishment, with low revetments called marsh sills or toe revetments.

Living Shorelines

Living Shorelines are defined as an erosion management tool that provides erosion control by protecting, restoring or enhancing vegetated shoreline habitats. This is accomplished through the strategic placement of plants, stone, fill, or other structural and organic materials. Living Shorelines exist on a continuum from purely non-structural, utilizing plants alone, to the use of stone sills and placement of fill and offshore breakwaters or groins. While a Living Shoreline may restore some previously lost habitat such as an eroded fringing marsh, these techniques are not meant for habitat restoration. Neither are they meant for protection of properties from flooding, storm surge or sea level rise.

Living Shorelines are designed as erosion management tools. While they may have components of natural systems, they are not meant to replicate or restore natural salt marsh environments. For this reason, they may have limited applicability as mitigation for filling or degrading existing coastal features. Not enough peer-reviewed research exists to know exactly what ecosystem services these marshes provide in comparison to native salt marsh habitats. There are also potentially significant tradeoffs when existing benthic habitat is converted for this use.

Marsh Sill

The Living Shorelines technique that could be potentially suitable for Rhode Island coastlines is the hybrid living shoreline technique of creating fringing marsh with a stone sill as toe protection, also known as a marsh sill.

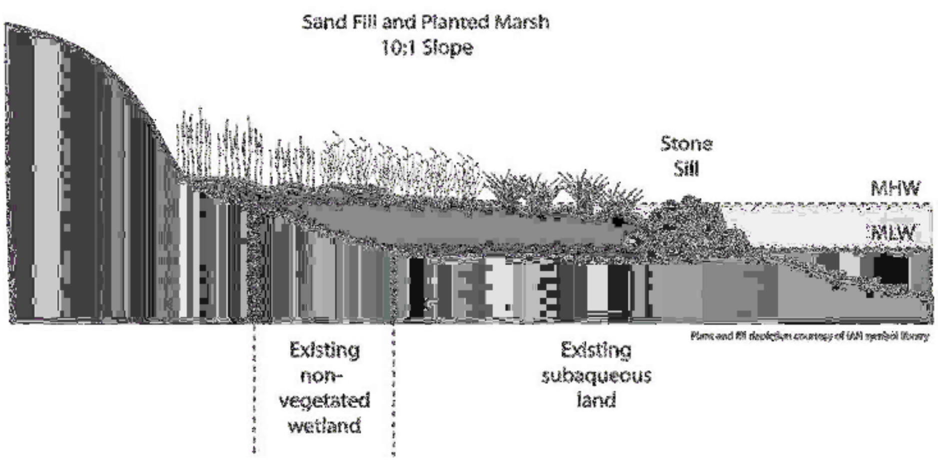


Photo courtesy of Virginia Institute of Marine Science

The marsh sill technique utilizes stone as erosion protection at the edge of the marsh. The design is often segmented or offset so that habitat continuity is not interrupted and fish and other animals can move in and out of the marsh. The example above is from the Chesapeake Bay where the tidal range is lower and the intertidal area is wide and flat.

While a slope of 10% is shown in much of the design guidance for marsh sills, a more gradual slope closer to 20:1 has been used as design guidance for marsh sill projects in Narragansett Bay. Maryland's Living Shoreline regulations recommend no greater than 3.5 feet of water depth 30 feet from the edge of the existing shoreline in order to create the 10:1 slope.

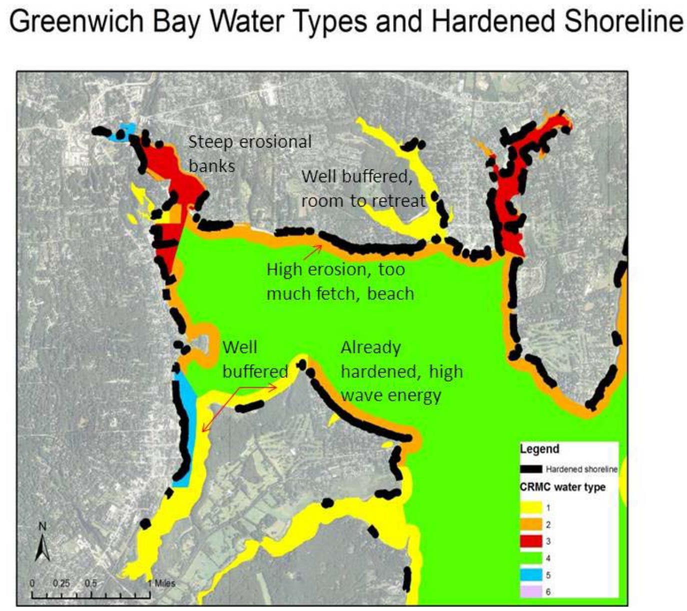
Marsh sills are being used extensively in the Mid-Atlantic region because regulations allow structural shoreline hardening at virtually any site, regardless of erosion rate. As a result, they are often implemented where there is only minor erosion, or where there is room for retreat. Site criteria being used by practitioners in the Mid-Atlantic Region for suitable marsh sill applications include the following factors:

- Minor bank erosion or undercutting
- Wide intertidal area and shallow subaqueous area
- Low to moderate wave energy
- Bank height less than 30 feet
- Gradual shoreline retreat
- Erosion caused by upland runoff rather than tidal or wave action
- Regular high tide does not reach bottom of upland bank *(Karen Duhring, Virginia Institute of Marine Science, presentation at Center for Coastal Resources Seminar on Living Shorelines)*

In Rhode Island, it is hard to find a location that meets these criteria. Much of the open Bay shoreline has too much fetch, current or wave action to be suitable for most Living Shoreline methods. Our shorelines tend to be either rocky intertidal, cobble beach or very narrow fringing marshes with erosional edges. This leaves the inner coves, rivers or coastal ponds as potential sites, many of which are designated as Type 1 and Type 2 waters. In addition, the geology of Narragansett Bay is such that there are few wide intertidal areas and the offshore bathymetry is steeper when compared to areas such as the Chesapeake Bay. Living Shoreline projects in many areas of the Bay would require large amounts of intertidal fill and large linear extents to tie in to existing coastal features. The high quality of our benthic habitat for shellfish, juvenile fish and eelgrass further limits the areas that would be appropriate for intertidal or sub-tidal fill.

Shoreline Assessments

Save The Bay assessed the suitability of the various shoreline adaptation techniques through field visits and aerial map interpretation of shorelines around the Bay. These assessments are grouped by town in an appendix to this report. Greenwich Bay was used as a pilot site for assessment of the suite of adaptation techniques evaluated and is presented here for discussion purposes. Greenwich Bay includes a variety of water types, development, and shoreline features. The assessment included end of road stormwater retrofit opportunities, retreat options and shoreline grading opportunities.



Greenwich Bay

While the inner coves of Greenwich Bay could be suitable for non-strucutural shoreline erosion control methods or hybrid techniques like Living Shorelines, much of the outer Bay has too much wave energy and fetch, or is already substantially hardened. Several areas within Type 1 waters have been hardened in Greenwich Bay. A vast majority of the outer Bay within Type 2 waters is also hardened and will most likely continue to be hardened in the future. These are high energy coastlines with significant erosion. Greenwich Cove, Brush Neck and Buttonwoods Coves are Type 1 waters and are more protected waters making them potentially suitable for more non-structural shoreline protection structures.

There are few areas where Living Shorelines would be a viable option in Greenwich Bay because much of the shoreline is already hardened or it is well buffered and there is room for retreat. The use of the Living Shoreline marsh sill technique may not be suitable in the Type 1 waters of Buttonwoods, Brushneck and Greenwich Coves since there is already a fringing salt marsh adjacent to the shore. Apponaug Cove is Type 3 waters, and would be suitable due to the water type classification, but has several areas with very steep banks. There is already quite a bit of fringe marsh in this cove, often in front of shoreline structures. Warwick Cove could also be a suitable location, but there is already a significant amount of fringing marsh habitat present.

In areas where the shoreline is already hardened, it would be difficult to design a Living Shoreline marsh sill that would tie into the existing coastline.

Several other coastal adaptation techniques were identified within Greenwich Bay including shoreline grading and shoreline retreat. Some of these recommendations include discontinuing the use of roadways that are either in a salt marsh, or are partially inundated during high tide including Midgely Avenue and Edgewater Drive. The Warwick City Park beach was identified as an area where the shoreline could be carved back and graded in response to continued erosion. This project was completed by the City of Warwick in 2012 as a pilot project identified through this assessment. Arnold's Neck Road, which is the primary access to Apponaug Cove Marina and the Arnold's Neck neighborhood, was identified as a critical piece of infrastructure that should be protected. The road is currently situated just above the high tide line, and will face continued inundation with sea level rise. This road could be protected with a Living Shoreline marsh sill if it was also raised and if the design included infiltration of storm water. It would be difficult to raise this road because of clearance issues with the overhead rail line.

Apponaug Cove: *This shoreline in Apponaug has areas of patchy fringe marsh. It has most likely been impacted by goose predation and shading. The high tide reaches the base of the bluff which is very steep. The intertidal area is shallow, but it still may not be an ideal site for a Living Shoreline marsh sill since the existing marsh area is impacted by geese predation and it would be difficult to establish a new marsh area.*

Arnold's Neck Road on Apponaug Cove, *is a possible Living Shoreline site due to low fetch and wide intertidal areas. Challenges include managing stormwater to reduce erosion in an area with limited space and infiltration opportunities. The existing salt marsh is eroding and damaged by a large swan and goose population. A Living Shoreline marsh sill technique would require intertidal fill and a stone sill to create the necessary slope for salt marsh vegetation. The Living Shoreline technique would not solve the flooding from the cove during moon tides due to the road's low elevation.*

Edgewater Drive on Apponaug Cove *is a potential site for abandonment by restricting vehicular access while maintaining public access. This is an unimproved road that still gets use at low tide. It is almost impassable at high tide and could become a safety hazard if not blocked to traffic. Vehicular use in the intertidal area and subsequent soil compaction has impeded fringe marsh from developing.*

Brushneck Cove, end of road stormwater abatement *- Canfield Avenue has opportunities for removal of pavement and a concrete swale that directs stormwater directly to the shore causing erosion of the fringe marsh. Approximately 60 feet of pavement could be removed to allow for stormwater infiltration and the marsh could be replanted.*

Warwick City Park - *In 2004, the City of Warwick received a permit from CRMC to grade an area of the beach shoreline and to remove part of a boardwalk structure at the top of the bank. Erosion of the site continued and the structure continued to be undermined. In 2012, The City received a permit to grade the bank further to reduce the slope and to provide the beach an area to migrate inland as erosion continues.*

Policy Recommendations

The Coastal Resources Management Council should develop a coastal adaptation section as part of the shoreline change SAMP which includes definitions for different coastal adaptation techniques and criteria for when they may be required. The CRMC may also want to come up with a coastal adaptation worksheet or flowchart to determine whether a particular coastal adaptation technique would be a desired (or required) alternative. The State of Maryland requires Living Shorelines as a first alternative for shoreline protection, unless the applicant can demonstrate through a waiver form that a Living Shoreline would not work. The Virginia Institute of Marine Science has developed an Integrated Shoreline Management Decision Tree to help make decisions for individual parcels of property. The decision tree is designed to help promote consistent decision making. More information can be found here: http://ccrm.vims.edu/education/workshops_events/april2010/1-Bradshaw-ShorelineDecisionTree.pdf

Current CRMC Policy for Shoreline Protection Facilities

The regulation of shoreline protection facilities is outlined under Section 300.7 of the Rhode Island Coastal Resources Management Program. Section 300.7.B.1 states that non-structural methods for controlling erosion such as stabilizing with vegetation and beach nourishment are preferred alternatives. The current regulations do not include a definition of "non-structural methods." If structural shoreline protection is proposed, Section 300.7.B.3 states "the Council shall require that the owner exhaust all reasonable and practical alternatives including, but not limited to, the relocation of the structure and nonstructural shoreline protection methods." Section 300.7.E.3 outlines the requirements that applicants must meet to receive a Category B Assent including:

- Existence of erosion hazard
- Site not suitable for non-structural methods
- No practicable or reasonable alternatives (such as relocation)
- Proposed structure not likely to increase erosion in adjacent areas
- Must consider long-term erosion rate, effects of storms, stability of shoreline

CRMC has a no net loss policy for coastal wetlands (section 210.3(B)). The reality is, however, that in Type 2 and 3 waters where hardening is now allowed, hardening will most likely continue to be the norm and an incremental loss of wetlands will occur as sea level rises. It will most likely be easy to prove the inability to use non-structural protection methods when much of the shoreline is already hardened. As sea levels rise, a loss of public lateral access and a loss of fringing marsh along the shoreline will continue as high tide meets the base the of shoreline structures.

Recommended changes to the Coastal Resources Management Program:

Rhode Island needs to have a broad discussion about sea level rise, erosion, and public trust issues all along the coastline. Within the shoreline change SAMP, CRMC should create a section of regulation and/or policy for coastal adaptation techniques that includes definitions of non-structural methods including bioengineering techniques, living shorelines, shoreline grading and beach nourishment referring to other sections of the regulation where they are addressed. A coastal adaptation worksheet could be used to help guide people to the most useful adaptation method based on a set of established criteria.

The CRMC should add specificity to Section 300.7, Shoreline Protection Facilities. Specific policy recommendations include the following:

Section 300.7.B - Refer to the sea level rise policy and describe how to design shoreline protection structures with sea level rise in mind.

Section 300.7.E.1 - Increase the specificity of requirements that the applicants must demonstrate prior to receiving a permit for a hard structure.

300.7.E.1(b) - Describe more clearly the conditions that would make nonstructural shoreline protection “not suitable”.

300.7.E.1(c) - Outline in detail other potential alternatives such as grading the shoreline, using living shoreline marsh sills and bioengineering approaches, or retreat. Refer to a new coastal adaptation policy.

300.7.E.1(e) - Include reference to historic coastal erosion maps and hardened shoreline data

Section 300.7 (d) states that structural shoreline protection facilities are prohibited when proposed to be used to regain property lost through historical erosion or storm events. In some areas, erosion is occurring behind walls or at the top of revetments. In these cases, if there is sufficient room, it may be possible to carve back the shoreline behind the wall, leaving part of it as toe protection. Backfilling behind and up to existing walls should be prohibited. Section 300.2 (f) states that “cutting into rather than filling out over a coastal bank is the preferred method for changing upland slopes”. If backfilling occurs up to an existing wall that is too low, material will continue to erode.

There are areas where many feet of lawn exist between the developed structure (house) and the shoreline edge. The current CRMC policy is to protect the coastal feature with a buffer, but these buffers do not always get maintained or if the development occurred prior to the creation of the CRMP, maintenance of lawn area is a grandfathered activity. If there is sufficient set-back for the property to be protected from shoreline erosion for a significant amount of time, based on long terms rates of erosion, grading should be considered before structural shoreline protection techniques. There should be a public purpose to any shoreline hardening, and a way to compensate for loss of lateral shoreline access.

Maintenance of Existing Shoreline Structures

Despite the best intentions of the CRMC policy, structural hardening has and continues to occur in areas where it is prohibited. This hardening has occurred through several different mechanisms, including changing the water type, classifying the shoreline as man-made, special exceptions, emergency assents, and permits after the fact.

Many areas of the Rhode Island shoreline can demonstrate that some amount of shoreline hardening had taken place prior to the existence of CRMC. In these cases, coastal property owners can apply for a permit for maintenance activities. Many times, repair or maintenance applications are given a Finding of No Significant Impact (FONSI), even though they may result in an expansion of the shoreline structure.

For maintenance of existing shoreline protection structures, it is important therefore, to clarify triggers for more substantial review. For example:

- Is the structure being expanded in size or area?
- Is there filling below mean high water?
- Will the structure be extended seaward?
- What is the threshold for the addition of new stone as a percent of what is existing on the site?
- Will the structure extend in linear feet?
- Will the structure protect property under sea level rise scenarios?

The current definition of maintenance requires that to the maximum extent practical, there be no seaward expansion of the structure. It also allows for the addition of limited quantities of riprap stone provided that no impact to coastal resources or lateral access results. These standards need to be enhanced and clarified.

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