Guidelines for Design of Structures along NYS Coastlines

General guidelines for repairs, along with guidance that can help avoid future property damage and habitat impacts when conducting coastal projects, are outlined below. Note: These activities may require a CEHA permit from NYSDEC or local ordinance office.

ENGINEERS AND SURVEYORS SHOULD BE PART OF THE DESIGN PROCESS

The design of coastal structures often have complex geology, drainage issues, structural conditions and wave climates that require careful consideration, planning and design which can benefit from the expertise of professional engineers and surveyors. Failure of an erosion control structure, even over a period of years, may result in loss of additional upland, threaten existing buildings and result in damage to adjacent properties. The repair of a failed structure may be as expensive as the original construction.

Professional Engineers (PE) and Licensed Land Surveyors (LS) certify that the design work is prepared with direct supervisory control, according to the best professional standards in a manner that is protective of public welfare and property.

The planning of a project also requires a field survey. The LS is best suited to provide the critical site information needed by the PE for design including existing site contours, the location, dimensions and elevations of structures and the offshore bathymetry. A surveyor determines the boundary of the upland parcel and the partition lines for littoral rights extending into the waterbody. If a submerged land lease is needed, an LS prepares a metes and bounds description and plat. These products can only be prepared by a New York Licensed Land Surveyor.

The design objective for all shore structures is to minimize the changes to wave energy at adjacent properties and to retain the same flow of littoral material along the shore.

EFFECTS ON ADJACENT OR NEARBY PROPERTIES

The design objective for all shore structures is to minimize changes to wave energy at adjacent properties and to not change the flow of littoral material along the shore. If the proposed structure will result in significant changes to wave energy or the littoral system, the engineer must fully consider the expected magnitude of the potential effects, justification for the extent of potential harm and a plan to mitigate such effects.

The two most important questions related to effects on adjacent or nearby properties that must be addressed in the design of a shore structure are:

- Will the structure sufficiently change the direction or magnitude of wave energy at an adjacent or nearby property to adversely affect the shore or bluff?
- Will the project change the flow patterns, interrupt or entrap sufficient littoral material to create a deficit of beach material and increased erosion along the shore on nearby properties?

IMPACT OF DESIGN ON HABITAT

Structures that occupy existing beaches or the shallow nearshore areas have impacts on these unique and limited habitats. In simplest terms, structures use space that would otherwise be available to the organisms that would normally be there.

Beaches are ephemeral over seasons and years but they can be sustained and augmented with appropriate care and design. Unfortunately, shore structures, such as revetments and seawalls, can result in the complete loss of the beach that cannot be replaced. The cumulative impact of the addition of thousands of small shore structures along the shore over many decades has significantly changed both the quality and the quantity of beach and near shore habitats.

The most straight-forward design approach to minimize the impact on beach and nearshore habitats is not to construct on the beach but instead locate structures up the bluff or bank face. This is not always possible, so the next level of habitat-impact design is to minimize the distance the structure extends from the toe of the bluff or bank.

Structures that extend waterward beyond a minimum distance from the toe of the bluff or bank must be balanced between one person's use and the good of all the people.

OTHER DESIGN CONSIDERATIONS OF SHORE STRUCTURES

There are factors in addition to those discussed above that need to be considered in planning the general arrangement of shore structures.

First, access structures such as seawalls may not be necessary along the full length of a property's shore. In some cases, projects will provide better functionality if access structures and erosion control measures are combined. Second, a structure needs to be rounded and merged into the upland as it approaches the littoral property boundary to avoid both impacts to adjacent property and minimize the potential for flanking around the ends of the structure. Straight, shore perpendicular ends of structures can lead to chaotic wave conditions that can result in increased wave-based erosion at such corners.

One of the most common issues associated with shore structures is the large size and weight of the material required. In many cases, this also means a significant amount of area upland must be used for staging, movement of materials and heavy construction equipment such as dozers, track-hoes and cranes. Access for trucks is also usually required. The use of heavy equipment on a small residential lot can have a serious impact on the property and may even result in damage to the bluff or to neighboring properties. Experienced contractors and engineers who specialize in building along the shoreline have valuable insight into the planning and logistics needed to deal with these issues. Projects along multiple parcels involving a number of property owners should be coordinated.

Construction atop a vertical shale bluff such as that pictured can be challenging as the weight of heavy trucks and equipment at the edge of a bluff can cause damage and lead to erosion.

Bulkhead and Seawall Repairs and Replacements

- Repair at original location or landward of original location
- An appropriate design will avoid abrupt, shore-perpendicular ends at property boundaries. In general, both revetments and seawalls are to be "rounded" off at the ends and/or meet the existing bluff/bank slope contours. This will reduce the potential for erosion at the adjacent property that could work its way back behind the structure and cause upland slope failure and possible failure of the end of the revetment or seawall. If existing structures are present at adjacent properties, the proposed design must transition to these as smoothly as possible.
- Adequate toe protection is to be included in the design to prevent sliding failures, scour and undermining at the base of a seawall. Both revetments and seawalls must have an adequate foundation set into the underlying strata.
- Drainage and filtration – In order to allow water that collects behind the structure to pass through the seawall/bulkhead and avoid pressure behind the structure that could crack it or push it over, weep holes are to be installed to allow excess water to drain from behind a seawall, and filtration in the form of synthetic filter fabric or graded gravel behind and beneath the wall to retain soil particles must also be included. In some cases, drain pipe will also be needed with the drainage directed such that it does not erode the toe of the structure, the soil behind it, or the beach below it.

Revetment Repair

- The crest width should be only as wide as necessary for a stable structure. In general, the revetment should follow the cross-section of the bluff/dune and be located as close to the bluff/bank as possible. Suitably sized stone should be placed with an excavator, as opposed to the dumping of rock from the top of the bank, which often requires much more rock to complete repairs, and can result in a less stable structure.
- Adequate toe protection is to be included in the design to prevent sliding failures, scour and undermining at the base of a seawall. Both revetments and seawalls must have an adequate foundation set into the underlying strata.
- The maximum recommended slope of a random-placed armor stone revetment is 1.5 horizontal to 1 vertical. Slopes greater than this will tend to be unstable. A 1.5H to 1V slope results in the smallest stable footprint along the shore. Where possible, revetment slopes should be selected to match the

existing bluff/bank slope's stable angle of repose. In practice, revetment slopes range from 1.5 to 1 to 2.5 to 1. Slopes greater than 3 horizontal to 1 vertical are rarely specified, mostly due to the higher cost of armor stone needed to construct what would be a wider revetment than might be necessary.

Removing Deposited Debris and Sediment

- Remove debris from tidal wetlands and CEHA.
- Stage debris in areas located upland of wetland boundary and CEHA.

Dune Repair

- The re-grading of eroded dunes should be done using only clean sand, and in a manner that ensures existing vegetation is not damaged.
- Vegetation is important to holding a dune in place; a dense vegetative mat will also protect the dune from scouring from wave action. Dunes should be re-vegetated as soon as possible following a damaging event with native species tolerant to salt spray and sand burial, such as American beach grass.
- Foot and vehicle traffic should always be avoided on dunes.
- Sand fencing can be placed to entrap sand in order to maintain or increase the height and width of dunes.

The following information provides guidelines for the repair of dwellings in coastal areas. Note: These activities require a CEHA permit from NYSDEC or your local ordinance office.

Repairing Damaged Homes

- If possible, repair house in original location. If not, move house landward as far as possible.
- If raising house, moving it landward must be considered.
- Raise house elevation to handle future storms and move appliances and other valuables to higher floors
- Replace damaged septic systems as far from tidal wetlands and/or Costal Erosion Hazard Areas (CEHA) as possible
- Do not expand the footprint of the house
- The repair or reconstruction of structures with a cost that is greater than 50% of the estimated full replacement cost of the structure is not permitted within Natural Protective Feature Areas.
- The repair or reconstruction of structures with a cost that is greater than 50% of the estimated full replacement cost of the structure is allowed within a Structural Hazard Area with a NYSDEC standard CEHA permit, if the structure is considered moveable, and meets all requirements of the Coastal Erosion Management Regulations 6 NYCRR Part 505.7
- The repair or reconstruction of structures with a cost that is greater than 50% of the estimated full replacement cost of the structure is considered substantially damaged under FEMA NFIP regulations, and the structure will be required to meet FEMA and state building code elevation requirements.

Replacing Accessory Structures

- Replace existing accessory structures at original location or further landward.