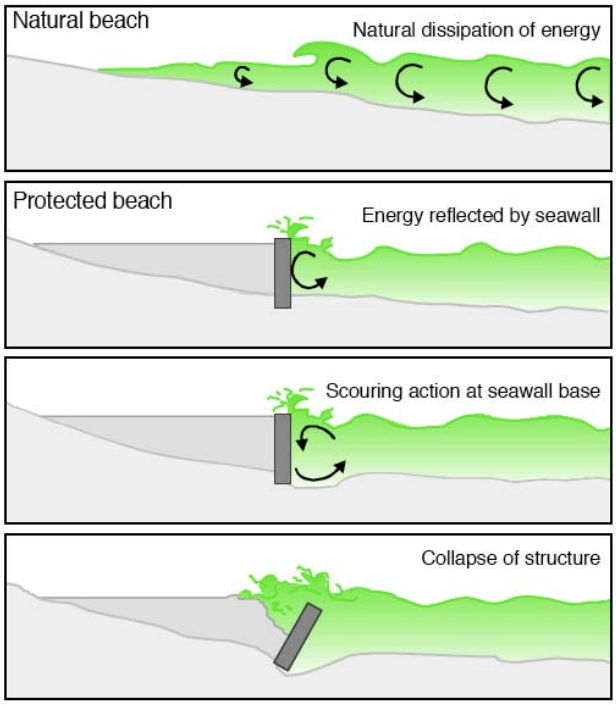
Hard Engineering Approaches to Coastal Construction

Seawalls, bulkheads and sheet piling are solid vertical walls constructed of concrete, masonry, or metal which all serve the same purpose. These methods are used to combat erosion because they require less material and space. However, due to their vertical nature, reflective wave energy is maximized, creating the potential for undermining and destruction of the beach or other land form being protected, as indicated in the following figure.



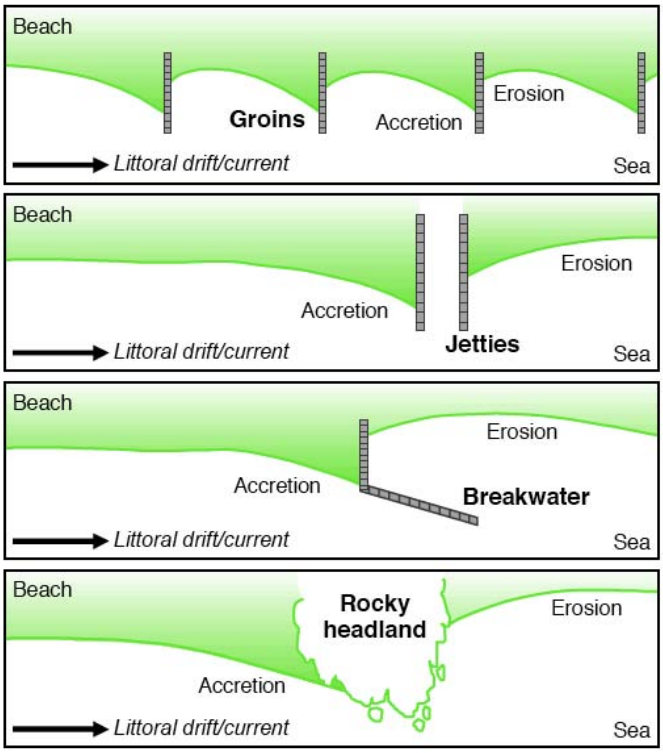
Undermining of a seawall built on a high-energy coastline.
Source: Sustainable Coastal Tourism Handbook for the Philippines, 2002

Due to the increased scouring action of waves at the base of seawalls, seawalls inevitably lead to loss of beach sand at the base of the seawall. Thus, though a seawall will temporarily protect the land behind the seawall, it is also virtually certain to accelerate loss of the beach in front of the seawall. And eventually, when the seawall falls, the land behind the seawall will be at greater risk than before, due to greater water depth due to loss of the beach.

Seawalls are a short-term solution only, and will usually accelerate loss of the beach over the long term.

Groins, breakwaters and jetties are structures predominantly built with rocks or concrete. Groins or their variations are placed perpendicular to the shoreline to trap sand on the up-drift side by extending out into the water and interrupting the littoral drift, causing deposition of sand. However, after the water column loses its suspended sand load, its velocity increases, causing it to wrap around the groin and pull more sand away from the down-drift side, resulting in beach loss and erosion. (These processes occur naturally around rocky headlands.) Such structures

tend to cause more problems than they solve unless they are very carefully designed and placed appropriately in relation to the shoreline features, drift and wave patterns of the water.



Source: Sustainable Coastal Tourism Handbook for the Philippines, 2002

Revetments (see handout) are sloping rock walls and similar protective structures that are used along the coast to prevent undermining and erosion of coastal lands. The slope of the wall and the spaces between the rocks act to dissipate wave energy and minimize reflective waves. They are often more affordable than more costly bulkheads, breakwaters, seawalls and groins.

Beach nourishment is another form of erosion control in which sand is brought onto an eroding beach to replace lost sand. Nourishment must be done periodically if beach erosion continues. Nourishment is costly and since it is usually prohibited to mine sand, the source of sand may be limited or not available. An eroding beach needs to be analyzed for what is causing the erosion and the most appropriate solution sought considering nature, cost and legal restrictions.

When planning a coastal tourist establishment, the hazards of beach erosion may be avoided by following several “golden rules” for combating beach erosion:

- Understand the natural beach system before it is altered. Site-specific studies may be required.
- Develop a setback line *before* construction begins
- Never mine the sand from the dune, beach, or nearshore sandbars
- Where a major obstruction to longshore water transport is built, such as a harbor, use soft solutions, such as sand nourishment or diversion of channels, rather than hard solutions, such as revetments or seawalls
- Do not panic after a storm has drastically altered the beach. Wherever possible, let the normal beach cycle return the sand.