Sea walls

Challenge: Sea level rise **Adaptation response:** Built infrastructure for shoreline protection

Description

Sea walls are solid engineered structures with the primary function of preventing shoreline. They are built parallel to the shore and aim to hold or prevent sliding of the soil, while providing protection from wave action (UNFCCC 1999). Although their primary function is erosion reduction, they have a secondary function as coastal flood defences. The physical form of the structures is highly variable – they can be vertical or sloping and constructed from a wide variety of materials. They are sometimes also called revetments.

Sea walls are one of several available options when land needs to be protected. They provide a high level of protection, but their long-term sustainability should be considered.

Implementation

Sea walls form a defining line between sea and land. They are frequently used in locations where further shore erosion will result in excessive damage, for example when roads and buildings are in danger of falling into the sea. However, while they prevent shoreline erosion, they do not deal its causes (French 2001).

Sea walls range in type and may include steel sheet-pile walls, very large concrete barriers, rubble mound structures, brick or block walls, or gabions (Kamphuis 2000). Sea walls are typically heavily engineered and inflexible, expensive to construct, and require proper design and construction supervision (UNFCCC 1999). The shape of the seaward face is important when considering incoming waves: smooth surfaces reflect wave energy, while sloping or irregular surfaces can scatter and dissipate it. Waves are likely to hit the structure with high force, moving sand off and along the shore away from it (Kamphuis 2000). Sea walls usually have a deep foundation for stability. Burying earth anchors with connecting rods upland from the shore can further stabilize them. This reduces pressure on the landward side of the structure (Dean and Dalrymple 2002).

Environmental Benefits

- Provides high amenity value – in many countries, sea walls incorporate promenades which encourage recreation and tourism.

Socioeconomic Benefits

- Provides a high degree of protection against coastal erosion. An appropriately designed and well-maintained sea wall will also set a solid boundary between the sea and land to ensure no further erosion will occur.
- Provides protection against flooding and extreme water levels. If they are appropriately designed, sea walls will provide protection against water levels up to their height. In the past the design height of many sea walls was based on the highest known flood level (van der Meer 1998).

Opportunities and Barriers

<u>Opportunities:</u>

- They require less space than other coastal defences such as dikes, particularly if a more vertical design is used. Reduced space requirements may reduce construction costs, as in many areas, land in the coastal zone is highly sought-after
- When considering climate change adaptation, an advantage of sea walls is that it is possible to progressively upgrade the structures by increasing the structure height in response to sea level rise. It is important, however, that a sea wall upgrade does not compromise the integrity of the structure
- Provided they are adequately maintained, sea walls are potentially long-lived structures. The sea wall in Galveston, Texas was constructed in 1903 and continues to provide coastal flood and erosion protection to the city to this day

Barriers:

- They are subject to significant wave impact and therefore must be designed to remain stable under repeated extreme pressure
- Smooth, vertical sea walls reflect wave energy seaward, which creates turbulence that could suspend sediment (Bush et al. 2004), thus making them more susceptible to undercutting and beach erosion
- Scour at the foot of vertical sea walls can cause structural instability, and can be an important factor in their failure or collapse
- They do not address sediment loss, the root cause of erosion, threatening beach environments. In turn this can impact recreational values, and over time increase wall wave loads by allowing larger waves closer to the shore. Furthermore, coastlines down drift of the wall often experience increased erosion

Implementation considerations*

Technological maturity:	4-5
Initial investment:	2-4
Operational costs:	2-3
Implementation timeframe:	2-3

* This adaptation technology brief includes a general assessment of four dimensions relating to implementation of the technology. It represents an indicative assessment scale of 1-5 as follows:
Technological maturity: 1 - in early stages of research and development, to 5 – fully mature and widely used
Initial investment: 1 – very low cost, to 5 – very high cost investment needed to implement technology
Operational costs: 1 – very low/no cost, to 5 – very high costs of operation and maintenance
Implementation timeframe: 1 – very quick to implement and reach desired capacity, to 5 – significant time investments needed to establish and/or reach full capacity
This assessment is to be used as an indication only and is to be seen as relative to the other technologies included in this guide. More specific costs and timelines are to be identified as relevant for the specific technology and geography.

Sources and further information

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