06 Seawalls and Groynes

Environmental impact	1/3
Risk protection	2/3
Durability	3/3
Affordability	1/3

Intro

Seawalls are large and engineered installations to protect the coast and shoreline from the impact of the sea. Most commonly, they are constructed as vertical armors along the coast. However, seawalls can also be built perpendicularly from the shore (in some contexts called “groynes”, for managing the sediment budget of beaches) or can be freestanding in the sea with a distance from the shore (also called “breakwaters”). The structures can be combined with tetrapods and geotextile containers, among others. Due to their reverse risks, scale and costs, seawalls should not be prioritized in the context of refugee settlements.

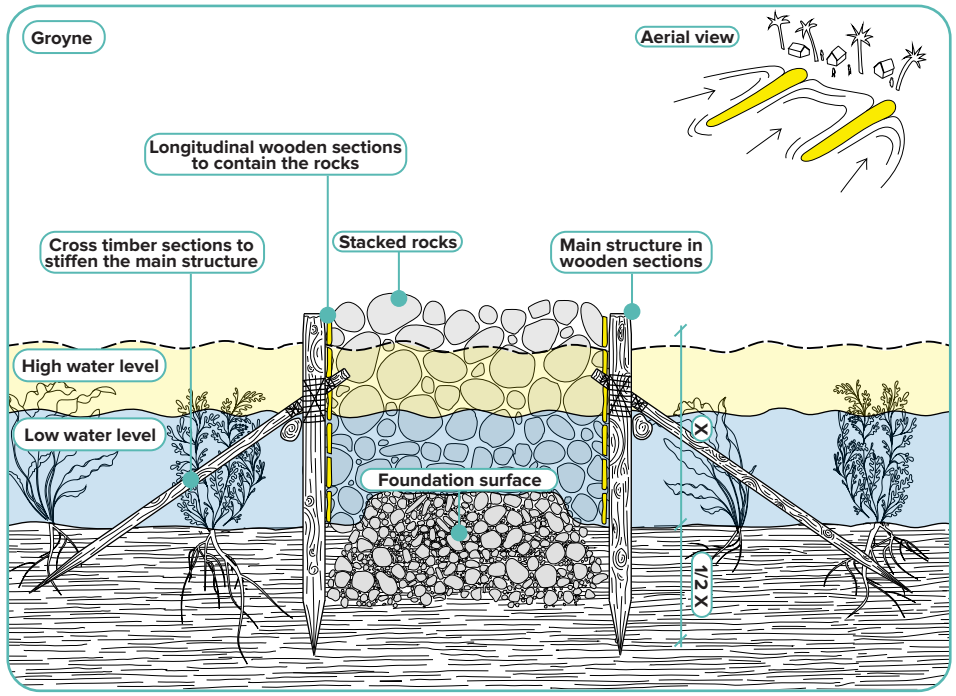
Benefits and Risk

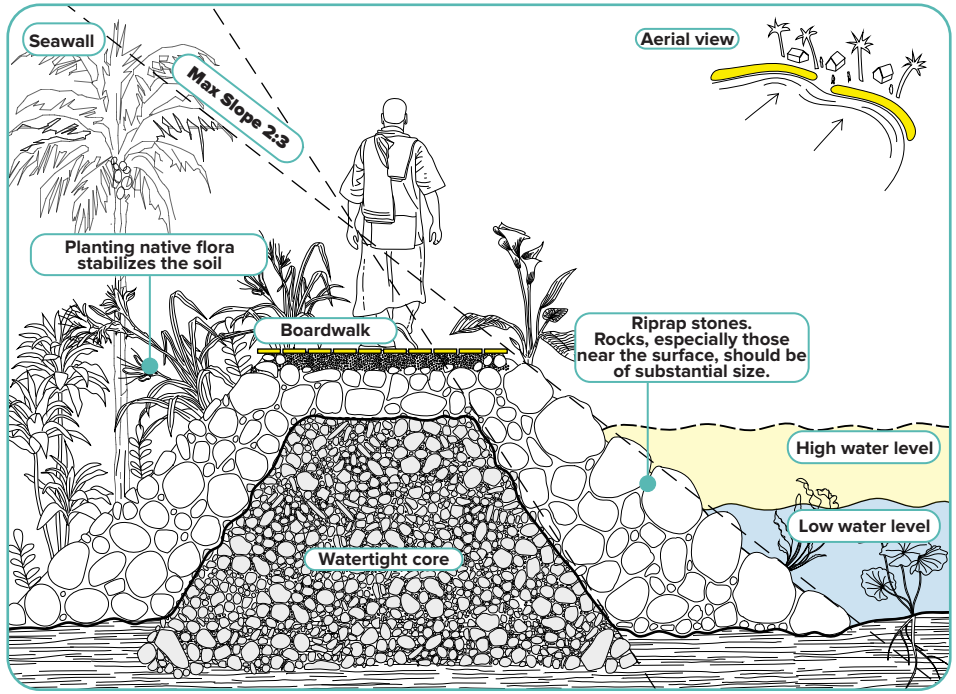
Seawalls can benefit the shoreline protection and the uplands by mitigating the damaging effects of waves, tides or storm surges. However, the vertical design of seawalls results in the sharp reflection of the waves, which accumulate the energy at the bottom or toe of the structure which can lead to its deterioration over time.

In general, the large coastal structures can cause extensive harm to the beaches as well as to the marine and coastal environment. In this light, larger coastal structures should be built only in combination with comprehensive environmental assessments and management.

Good practice

TetraPOT concrete blocks with mangroves.
The TetraPOT is a hybrid form of sea defense as it combines concrete blocks (also: tetrapod) and large pre-seeded and compostable plant pots for mangroves. Together with the mangrove root system, the blocks support flood defense, impede soil erosion, and protect natural habitats. The one-ton heavy tetrapod requires less concrete and production time than traditional sea defense bollards. In addition, the growing mangroves (protected from the concrete) can spread through holes in the engineered block. After around 14 months, the mangroves are grown enough to anchor the tetrapods through their roots (Tucker 2016).





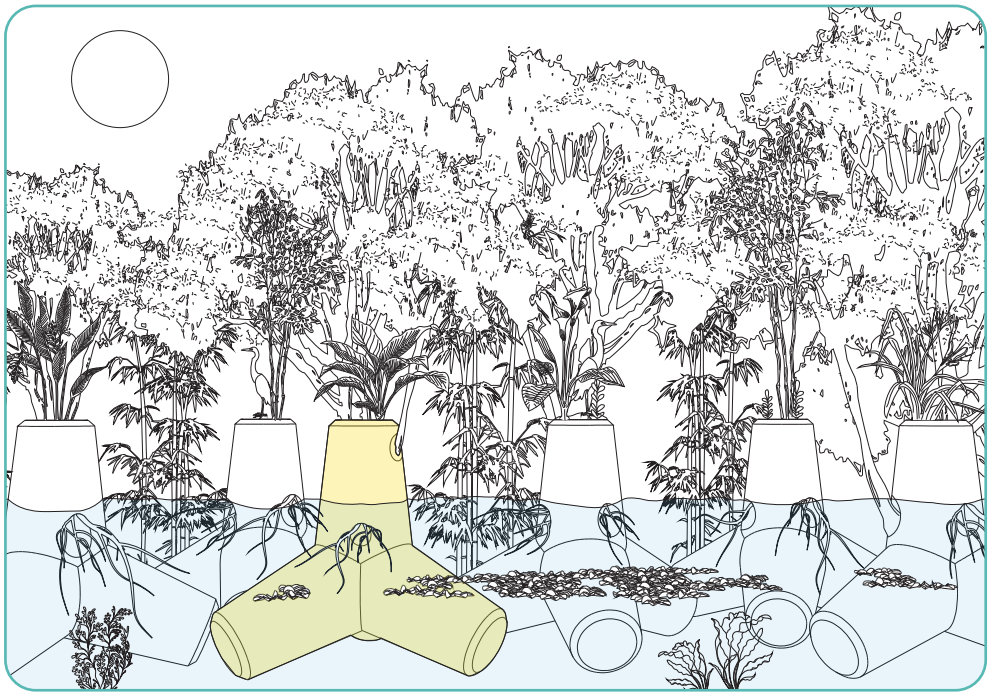


Fig. 08: *Example of a TetraPOT. Beaumé and Pabón 2023 based on Tucker 2016.*

Overview of Criteria

Type of Intervention:
Engineered.

Scale of Intervention:
Supra-settlement.

Materials:
Concrete, Metal, Timber, Steel (Selection).

Environmental Impact:
Seawalls can harm the marine and coastal environment and biodiversity. In addition, they can cause interruptions in habitat migration.

Targeted Natural Hazard:
Coastal/Riverine Flood

Targeted Vulnerable Assets:
Buildings, Transport, Technical Infrastructure, Land Cover.

Strategy Type:
Reduce Hazard Magnitude.

Implementation Time:
Medium (1 month - 1 year).

Effect Duration:
Long-term (>10 years).

Investment Costs:
High.

Maintenance Costs (yearly):
Low (<10% investment costs).

Climate ADAPT (2023)
Seawalls and jetties.
Available online at
https://climate-adapt.eea.europa.eu/en/metadata/adaptation-options/seawalls-and-jetties, updated on 9/29/2023:17:14.

Tucker, Emma (2016)
TetraPOT is a greener alternative to concrete coastal defences.
In dezeen.
Available online at
https://www.dezeen.com/2016/10/24/tetrapot-coastal-defence-design-plant-pot-sheng-hung-lee-china/.

Watson, Donald; Adams, Michele (2010)
Design for Flooding: Architecture, Landscape, and Urban Design for Resilience to Climate Change: John Wiley & Sons Inc.
Available online at
https://www.wiley.com/en-us/Design+for+Flooding%3A+Architecture%2C+Landscape%2C+and+Urban+Design+for+Resilience+to+Climate+Change-p-9780470475645#download-product-flyer.

Flood Risk in Humanitarian Settlements: Compendium of Mitigation Measures

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