3.10 Managing coastal erosion and flooding

In this section, you'll learn about different approaches to managing the risks associated with coastal erosion and flooding.

Can coastal erosion be stopped?

Coastal erosion can be prevented – up to a point – but it's an expensive business. The cost of protecting the coast is often controversial. Many people, e.g. along the Holderness coast (see pages 126–131), want their own stretches of coast protected – but they don't necessarily see why their taxes should be used to pay to protect someone else's coastline! Until the 1990s, it was usual for local councils to tackle coastal erosion by designing **hard-engineering** structures (see Figure 1). However, most of those structures are very expensive to build, so now the use of **soft-engineering** techniques is more popular. But what are the advantages and disadvantages of the different methods?

Key words

Hard engineering – This involves building structures along the coast (usually at the base of a cliff or on a beach), e.g. sea walls, groynes and revetments.

Soft engineering – This approach is designed to work with natural processes in the coastal system, in order to manage (but not necessarily prevent) erosion.

Type of structure	Advantages	Disadvantages	Cost
Groynes Timber or rock structures built at right angles to the coast. They trap sediment being moved along the coast by longshore drift – building up the beach.	The built-up beach increases tourist potential and protects the land behind it. Groynes work with natural processes to build up the beach. Not too expensive.	Groynes starve beaches further along the coast of fresh sediment, because they interrupt longshore drift. This often leads to increased erosion elsewhere. Groynes are unnatural and rock groynes can be very unattractive.	£5000 to £10 000 each (at 200-metre intervals).
Sea walls Made of stone or concrete at the foot of a cliff, or at the top of a beach. They usually have a curved face to reflect waves back into the sea.	Effective prevention of erosion. They often have a promenade for people to walk along.	They reflect wave energy, rather than absorbing it. They can be intrusive and unnatural looking. They are very expensive to build and maintain.	£6000 a metre.
Rip rap (rock armour) Large rocks placed at the foot of a cliff, or at the top of a beach. It forms a permeable barrier to the sea – breaking up the waves, but allowing some water to pass through.	It is relatively cheap and easy to construct and maintain. It's often used for fishing from, or for sunbathing by tourists.	The rocks used are usually from somewhere else (e.g. granite), so they don't fit in with the local geology and can look out of place. It can be very intrusive. The rocks can be dangerous for people clambering over them.	£100 000 to £300 000 for 100 metres.
Revetments Sloping wooden, concrete or rock structures – placed at the foot of a cliff or the top of a beach. They break up the waves' energy.	They are relatively inexpensive to build.	They are intrusive and very unnatural looking. They can need high levels of maintenance.	Up to £4500 a metre
Offshore breakwater A partly submerged rock barrier, designed to break up the waves before they reach the coast.	An effective permeable barrier	It is visually unappealing. It's a potential navigation hazard.	Similar to rock armour – depending on the materials used.

Figure 1 *Hard engineering – advantages and disadvantages*

Hard engineering and Holderness

The Holderness coast is 85 km long. Only 9.2 km are protected by hard-engineering structures (maintained by the East Riding of Yorkshire Council). An additional 2.15 km are protected by other bodies. The rest of the coastline is unprotected.

Most of the defences on the Holderness coast consist of a mixture of nineteenth-century structures, together with more-recent upgrades, extensions and alterations.

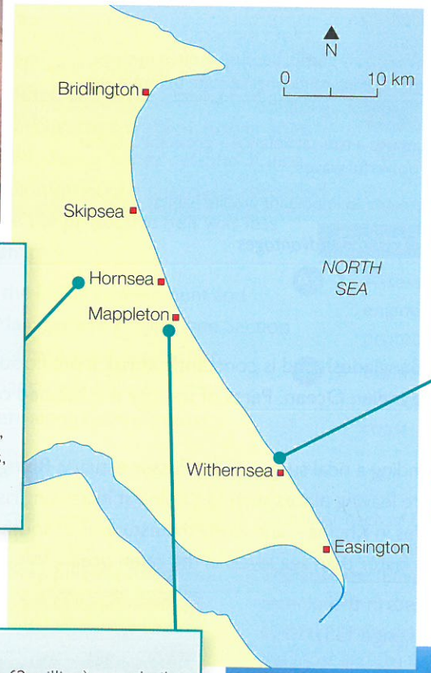
Hard engineering – the impacts

Decisions taken by councils and coastal authorities to use hard-engineering methods to protect particular places on the coast, can then lead to problems elsewhere (see Figure 2).

Hornsea

Defences: Concrete sea walls, groynes, rock armour (see above).

Impact: The groynes trap sediment and maintain the beach at Hornsea, but Mappleton downdrift has been starved of sediment as a result. There, rapid wave attack has eroded the cliffs, so that by the 1990s, nearly 4 metres of cliff were being eroded each year.



Withernsea

Defences: A straight sea wall was built in 1875. However, over time, wave energy eroded (**scoured**) the base of the wall – causing it to collapse. So, in the 1990s (following a **cost-benefit analysis**) the straight wall was replaced by a curved wall – at a cost of £6.3 million (£5000 per metre).

Impact: The waves are now noisier when they break against the wall, and the promenade is smaller. The views from sea-front hotels have also been restricted. Some tourists find the rip-rap at the base of the sea wall unattractive.

Mappleton

Defences: Two rock groynes (costing £2 million) were built in 1991 (see right), with the aim of preventing the removal of the beach by longshore drift. Rock armour was also used.

Impact: At Cowden, 3 km south of Mappleton, the resultant sediment starvation caused increased erosion of the cliffs (from 2.5 to 3.8 metres a year between 1991 and 2007).

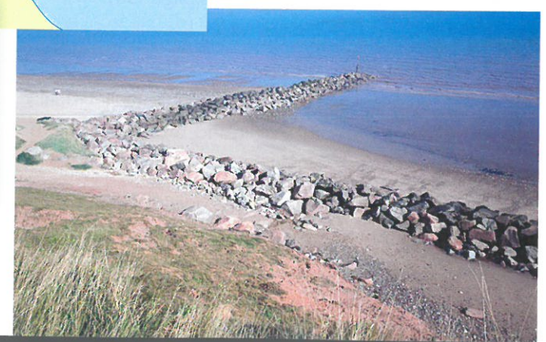


Figure 2 *Some of the impacts of hard engineering*

BACKGROUND

Cost-benefit analysis (CBA)

A cost-benefit analysis is carried out before a coastal-management project is given the go-ahead. Costs are forecast (e.g. a sea wall – its design, building costs, maintenance, etc.) and then compared with the expected benefits (e.g. value of land saved, housing protected, savings in relocating people, etc.). Costs and benefits are of two types:

- **Tangible** – where costs and benefits are known and can be given a monetary value (e.g. building costs).
- **Intangible** – where costs may be difficult to assess but are important (e.g. the visual impact of a revetment).

A project where costs exceed benefits is unlikely to be given permission to go ahead.