

Coastal Protection



Sea defences seek to prevent or limit erosion of the shoreline. Global climate change and predicted sea level rise will increase the pressure that is exerted on sea defences. Consequently, existing defences may become less effective in the future and will need higher levels of maintenance. The type of defence used depends on historical factors, coastal policies, funding availability and the impact that they may have, both on local and adjacent coastlines.

Seawalls

Seawalls protect the base of the cliff from the action of the sea and are intended to reflect and/or refract wave energy. Ideally seawalls should be placed behind a large beach, with the sea only reaching the wall during storm conditions. Therefore seawalls are the final defence from flooding and erosion. However, in some conditions seawalls can be subjected to wave action more regularly and when in these conditions, they require more frequent repairs.



Concrete seawall at Walcott

Cost: minimum **£4000** per metre

Groynes

Groynes are designed to create and maintain a healthy beach which protects the land behind. They act as a barrier to physically stop longshore sediment transport, which causes a build-up of beach on one side of the groyne. A series of groynes (groyne field) interrupts the tidal flow forcing the tidal current further offshore beyond the groyne end. This causes a slower inshore tidal current which encourages the deposition of sediments on the beach.



Groynes at Cromer: Here you can see the uneven build-up of sediment

Cost: minimum **£100,000 - 150,000**

Revetments

Revetments are sloping timber structures which run along the top of the beach, parallel to the cliff. They are designed to absorb the wave's energy and reduce erosional impact on the cliff. Revetments are also less detrimental to beach levels than seawalls, for they reduce beach scour by dissipating wave energy rather than reflecting it. Often sediments – including sand, shingle and pebbles – are carried through or over the structure and, due to the less turbulent water behind, are deposited. This creates a buildup of beach at the base of the cliff helping to protect further against erosion.



Revetments at Overstrand, protecting the cliff behind

Cost: minimum £2500 per metre

Gabions

Gabions are large metal wire cages filled with rock and are usually used above seawalls. They act as an additional barrier to the sea when on occasion it overtops seawalls. Gabions lessen the damaging impact of a wave by intercepting it and reducing the energy of the wave before it reaches the cliff toe. In addition gabions strengthen and add weight to the toe of the cliff in order to prevent landslides. In normal conditions gabions perform well, however in storm conditions when they are subject to direct wave action they may easily be damaged.



Gabions at Overstrand improving cliff stability

Cost: minimum £700 per metre

Offshore reef at Sea Palling, seen from above



Reefs

Sea Palling is the only location on the North Norfolk coastline that has offshore reefs. The purpose of a reef is to prevent storm waves from reaching the beach and to alter natural coastal processes so that a wider beach is able to develop. Reefs at Sea Palling are supplemented with beach renourishment in order to manage wider coastal impacts. To find out more about the reefs at Sea Palling, contact the Environment Agency (www.gov.uk/environment-agency)

Rock Armour



Rock armour at Happisburgh absorbs wave energy and protects the cliff toe

Cost: minimum £750 - £1600 per metre

Rock armour dissipates wave energy and can be used on beaches and in front of seawalls. The rocks are specifically placed with spaces amongst them. The spaces allow

the water to flow around the rocks causing the wave to release energy. Subsequently, by the time the wave reaches the cliff toe, much of the wave energy has already been released and the wave has a greatly reduced impact on the cliff face.

Renourishment

Photo courtesy of: Tendring District Council and the Clacton and Holland on Sea Coast Protection Scheme



Beach Renourishment in action at Clacton

Cost: minimum £6500 per metre of beach

If beach levels become low, it may be beneficial to undertake beach renourishment. This involves adding large quantities of sand/shingle to a location in order to create wider, more gradually sloped beaches. This reduces the destructive impact of waves as long sloping beaches cause the waves to break earlier and lose much of their energy before they reach sea defences and cliffs. Once the material has been added to the beach, it will be subject to natural sediment transport and therefore it may be necessary to carry out further renourishment over time in order to maintain the beach at the desired level.

On the following page you will find a table explaining the benefits and considerations of each protection strategy.

	BENEFITS	CONSIDERATIONS
Sea wall	<ul style="list-style-type: none"> • Effective long term protection • Can incorporate amenities and promenades • Many different types suitable for different locations • Withstands extreme weather more effectively than other sea defence types 	<ul style="list-style-type: none"> • Cost • Prevents erosion and release of sediment from cliffs and thus reduces beach levels • Repairs and maintenance required over lifetime • Supplementary defences often required • Not always aesthetically pleasing
Groynes	<ul style="list-style-type: none"> • Can be effective in building natural beaches • Long term protection • Can be constructed in a range of materials and designs • Relatively quick to build • Can be altered or contain features (i.e. groyne gates) to control sediment movement along foreshore 	<ul style="list-style-type: none"> • Need to be deployed in groups otherwise only a limited beach is likely to only form • Some designs can trap too much sediment and can increase down-drift erosion • Disturbs natural movement of sediment • Can require frequent maintenance
Revetments	<ul style="list-style-type: none"> • Cheaper alternative to sea wall • Minimal wave energy reflected so results in very little beach scour, if any. • Trapped sediment provides further protection to the cliff. 	<ul style="list-style-type: none"> • Dependent on beach levels to keep structure from being exposed. • Sediment can be trapped behind the revetment removing it from the system. • Potentially high maintenance costs
Rock Armour	<ul style="list-style-type: none"> • Effective at dissipating wave energy • Easy to re-place if moved in storms • More resistant than local sediment/materials • Long lasting and requires little maintenance • Can be re-deployed if priorities change • Quick to install compared to other sea defences 	<ul style="list-style-type: none"> • Expensive to install • Aesthetics – does not fit with North Norfolk landscape • Rocks can be moved in heavy storms • Can create hazard to beach users
Gabions	<ul style="list-style-type: none"> • Cheaper than many sea defence types 	<ul style="list-style-type: none"> • Difficult to remove • Do not effectively withstand strong weather conditions and storm events • Expensive to maintain • More effective when used for cliff stability than for sea defense • Most effective when used in conjunction with other defences
Beach renourishment	<ul style="list-style-type: none"> • A more natural approach to coastal protection • Aesthetically pleasing • Uses natural processes • Reduces erosion and pressure on defences • Can improve sediment transport and benefit down-drift beaches • Possible benefits to tourism and provision of amenities 	<ul style="list-style-type: none"> • Requires periodic input of sediment to maintain beach levels • Expensive • Outcomes can be unpredictable



For more information concerning the coast, visit www.northnorfolk.org/environment. Or contact the Coastal Management Team:
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