

North Norfolk Coast Management

The people living near the coast in North Norfolk have battled with the sea for hundreds of years. It has retreated approximately 1 - 2 kilometres over the last 900 years and several villages have disappeared. Land has frequently been lost as cliffs are eroded and low lying areas have flooded. With the possible increased threat from climate change, there is likely to be even greater impacts in the future.

The coast at Happisburgh and Sea Palling faces north east and is very vulnerable from storms which come from the north. These storms have a very large fetch and can produce big, powerful waves. The cliffs along this stretch of coast are made up of sands and clays which were deposited in the area during the last ice age. The cliffs are soft and crumble easily. They also soak up rainwater which percolates through the cliffs. This rainwater can cause the cliffs to slump. The cliffs are also attacked by 'sub-aerial' processes such as weathering. Along with mass movement it has caused a varied landscape and resulted in cliffs collapsing onto the beach. In winter, erosion caused by groundwater causes gullying in the cliff face which together with the frequent storms, causes small-scale landslides. The fallen material makes up the beach, but is also removed southwards by longshore drift. Where the sea is able to hit the base of the cliffs they are easily eroded. At Happisburgh the cliffs are 6 to 10 metres high.

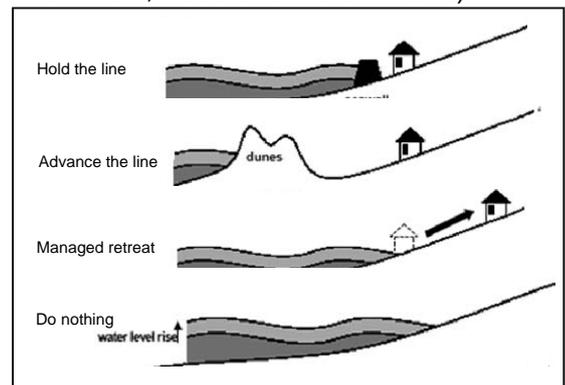
In 1953 the natural defences of the coast were broken when the North Sea flooded large areas of eastern England. Storms from the north-west combined with the high spring tide caused a rise in the sea level. Together the floods resulted in over 2,000 deaths in the UK. After the flood, coastal defences were developed, especially wooden groynes, sea walls and other 'hard' defences. The risk of floods in some areas and varying rates of erosion in others, has led to a variety of coastal management strategies.

The coastline is divided up into a number of management units and for each unit a 'Shoreline Management Plan' is produced. For each unit anything which is of economic or environmental value is identified and its level of risk from erosion or flooding by the sea is investigated. A proposed defence plan is then produced. This must take into account the following:-

- The impacts any defences would have on other areas (e.g. affecting longshore drift);
- The impact any defences would have on habitats and the environment;
- The costs and benefits - where the cost of the scheme is greater than the benefits it is protecting, the plan will not be allowed to go ahead.

A set of rules has been set up by DEFRA (Department for the Environment, Food and Rural Affairs). There are 4 options for managing coasts:-

1. Hold the line:- the coastline is held at its present place by building or maintaining defences;
2. Advance the line:- build new defences to build up the coast into the sea;
3. Managed retreat:- allow the coastline to retreat by not maintaining defences which already exist;
4. Do nothing:- take no action including the maintenance or removal of defences.



Cost of defences

The actual cost of sea defences will depend on the circumstances at each individual location. However typical costs are:-

Seawalls -	£5,000 per metre	Timber revetment -	£1,500 per metre
Rock armour -	£1,000 to £3,000 per metre	Timber groynes -	£100,000 per groyne
Rock groynes -	£125,000	beach nourishment -	£10+ per cubic metre
Offshore bars (reefs) -	£1 million - £2 million		

Happisburgh - Norfolk:- Background information

Most of the village of Happisburgh is set well back from the cliff top but Beach Road runs out to the cliffs where it is cut off at the cliff edge. (Google Earth may still show its route which is now in the sea). The properties here are situated right on the cliff edge although not long ago there was another line of homes between them and the sea. At Happisburgh there is not enough beach to protect the base of the cliffs and so they are under attack by the waves. The sea, hitting the base of the cliff causes undercutting which results in cliff falls. This adds to the impact of slumping after heavy rain so that the area is one of the fastest retreating coastlines in Britain.

A wooden revetment stretched all the way from Happisburgh to the Cart Gap seawall, but in 1990 a storm destroyed about 300 metres of revetment to the east of Happisburgh. This led to rapid erosion of the cliffs which had agricultural land at the top. The remaining revetment was damaged by more storms and in 1996 another length was lost. Rapid erosion followed and 6 cliff top properties were lost.

Over the years the management of the area has changed as can be seen below.

1959	Timber revetments and groynes built	2004	Garages on cliff top demolished. EU experts say defences have been badly managed. New management plan suggests managed retreat is the only cost effective and sustainable way to manage the coast. 99.6% of those consulted object to the new plans
1968	Beach Road groynes constructed	2006	Cliff House tea shop announce they will not reopen
1982	Damaged revetment and groynes partially rebuilt	2007	North Norfolk District Council spend £200,000 on emergency works. Coastal Concern Action Group raise £47,500 to fund an extra 1,000 tonnes of rock armour on the beach. Government commits £10 million to help communities deal with the effects of coastal erosion where other defences are not 'appropriate'. Largest storm surge for 50 years hits Britain, weakening defences still further.
1991	Unsafe section (300m) of revetment removed to south of village	2008	Natural England plan to allow the sea to flood the area, covering six villages and creating a new bay.
1992-1995	Various schemes rejected or costs are greater than benefits	2010	North Norfolk District Council offer to buy the 10 homes in Beach road most in danger for demolition. They offered the homeowners up to half the value of the homes if they were inland and at no threat of erosion. Owners call it an insult and want 100%. Offer help to move the caravan park to from its cliff top location.
1996	Storm damages 400m of revetment. Cliff top house goes over the edge of cliffs		
1997	Another scheme rejected		
2002	Another scheme rejected. Lifeboat ramp collapses. 4,000 tones of rock placed at foot of cliffs as a short term emergency measure		
2003	House dismantled before it collapses onto the beach. Metal staircase giving beach access opens		

Land use of the coastal strip at Happisburgh

(The coastal strip stretches from the base of the cliffs to 300 metres inland.)

From Happisburgh caravan park to Cart Gap Eccles

Agricultural	67%
Residential	22% (1/3 are second homes)
Public	6%
Tourism	4%
Commercial	1%

North of Happisburgh

Agricultural	94%
Residential	3%
Recreational	3%

Residential - includes housing, hotels and guesthouses.

Public buildings - schools, libraries, hospitals, churches, lighthouses, cemeteries, car parks.

Recreational - includes parks, golf courses and play areas

Agricultural - includes farmland, farm buildings and woodland.

Agricultural land North Norfolk is valued at between £6,500 and £7,500 per hectare. However, this land is subsidised so when calculating the value for coastal defence schemes the value is reduced to between £3,750 to £3,750 per hectare.

Sea Palling - Norfolk

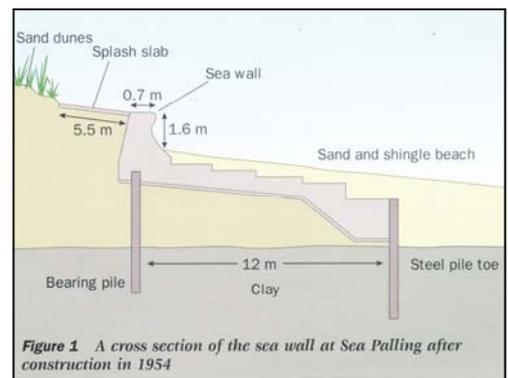
Background Information

Sea Palling is a small settlement on a low-lying area of the North Norfolk coast. Between the settlement, the low-lying land and the sea is a line of sand dunes. If the sea were to break through these dunes, 6,000 hectares of land could be flooded with salt water. This includes settlements, farmland, SSSIs and the Norfolk Broads National Park which is a major tourist attraction as well as being a unique, environmentally sensitive habitat.

In 1953 a storm surge in the North Sea caused major flooding along the east coast. At Sea Palling the sea broke through the dunes. Seven people died and many houses were washed away. As a result, in 1954 sea walls were constructed in front of the dunes to ensure the inland areas were protected from flooding.

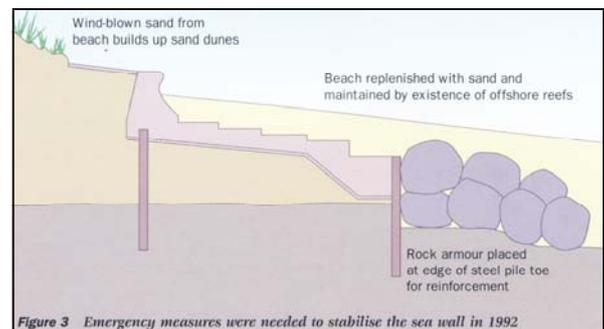
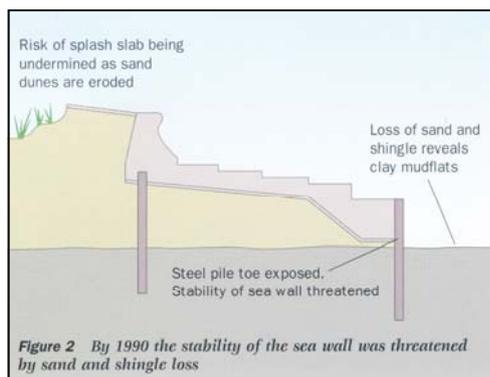


Further along the coast at Eccles, a number of groynes were built to trap sediment being moved southwards by longshore drift and so protect the beaches. This was effective producing wide beaches at Eccles, but prevented much of the sediment from reaching Sea Palling. By the 1990s the beach at Sea Palling had been reduced so much that during storms the sea reached the sea wall and the foundations were uncovered, which threatened the stability of the wall. In 1992 a beach management plan was started to protect the sea wall for a further 50 years. The plan could have only a small impact on the environment. It could not significantly affect other nearby coastal areas and it had to be cost effective.



What was done at Sea Palling

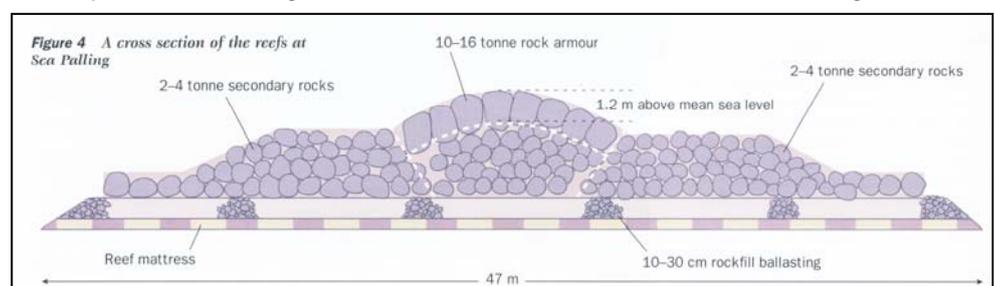
- 150,000 tonnes of rock armour (rip rap) were placed at the foot of the sea wall to prevent it from being undermined any further.



- 1.4 million cubic metres of sand was added to the beach, covering the rock armour and widening the beach.
- A set of offshore bars were constructed parallel to the coast. The first four reefs were completed in 1995 and cost £5.9 million. They were built 250 metres offshore on an existing sand bar to help reduce costs. 312,000 tonnes of rock was used. Each reef was 240 metres long with 240 metres gap between each one. They were 2.8 metres above sea level high.

Soon after they were built, deposition began in the sheltered water between the reef and the beach. Eventually there was a 'tombolo' effect where the sand linked the bars to the shore. This interrupted the process of longshore drift increasing the amount of erosion further along the coastline.

- In 1996, five more reefs were built. These were 160 metres long with a gap of 160 metres to prevent erosion in the gaps.. They were only 1.2 metres higher than sea level to allow more waves to go over the top. This was designed to prevent the problems caused by the earlier reefs. The newer reefs used 220,000 tonnes of rock and cost £10.5 million.



Land use of the coastal strip at Sea Palling

(The coastal strip stretches from the base of the dunes to 300 metres inland.)

Agricultural	95%
Residential	2%
Public	1%
Tourism	1%
Commercial	1%

Value of the Norfolk Broads (2005 / 2006)

Biodiversity conservation -	£18 million
Recreation (water and land based) -	£310 million
Drinking water -	£17 million
Water for agriculture and farming -	£260,000
Carbon emission reduction -	£240,000

	Sea Palling	Happisburgh
Shoreline Management Plan recommendations	Due to the considerable assets at risk and the uncertainty of how the coastline could evolve, the policy is to hold the present line of defence. This policy is likely to involve maintenance of the existing sea walls and reef structures (bars), replacing groins as necessary and continuing to re-nourish beaches with dredged sand. This policy will provide an appropriate standard of protection to all assets behind the present defence line, and with the recharge, a beach will be maintained as well as a supply of sediment to areas along the coast.	It would not be appropriate to defend Happisburgh due to the impact this would have on the shoreline as a whole, as the coastal retreat on either side would result in the development of a promontory (headland) making it impact significantly upon the sediment transport to down drift areas (longshore drift). Although there are implications, such as loss of residential properties and amenities at Happisburgh, these are not sufficient to economically justify building new defences. The existing rock armour will continue to have a limited effect on the rate of retreat in the short term (5-10 years) but will not prevent cliff erosion.
Local opinion	<p>‘Sea Palling is the perfect destination for a beach break, with an inviting award winning sandy beach and excellent water for swimming and watersports’</p> <p>‘The beach is now wide and very long with golden sand which the kids love. The reefs make the water very safe for swimming’</p> <p>‘They built the first reefs too far apart so the sea still eroded the beach between them. The beach is now smaller in some areas and reaches the reefs in other places’</p> <p>‘The larger beach means we make more money from visitors in summer’</p> <p>‘With easy access to the beach and sea the area has grown to be a very important place for watersports such as jet skiing on the east coast. We even get people kite surfing’</p>	<p>‘All local people want is a clear strategy for the defence of Happisburgh which is going to be completed’</p> <p>‘Happisburgh has a number of local heritage sites which will be lost forever if the area is not protected’</p> <p>‘When I bought this house there was another row of houses between us and the sea. Today the sea is only 20 metres away’</p> <p>‘The problem is that if the beach is developed here, places further down the coast will be starved of beach material so they will suffer in the future’</p> <p>‘Happisburgh is a thriving community with local facilities and a worthwhile tourist industry so it is worth saving’</p>

<http://www.dailymail.co.uk/femail/article-1034456/Living-edge-The-owners-homes-going-cliff.html>

<http://www.happisburgh.org.uk/press/dailymail120708.html>

<http://www.youtube.com/watch?v=1YQPW41LWTU>

<http://www.bbc.co.uk/britainfromabove/stories/rewinds/happisburgh.shtml>

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<http://www.babelgum.com/141739/cliffhanger-story-coastal-erosion.html>

<http://www.bgs.ac.uk/landslides/happisburgh.html>

<http://www.geocases1.co.uk/printable/Coastal%20defences%20in%20Norfolk.htm>