Borough Council of King's Lynn & West Norfolk

Environment Agency

Managing our coastline

The Wash East Coastal Management Strategy for public consultation

28 July to 8 September 2014

Contents

What is The Wash East Coastal Management Strategy?

The Wash East Coastal Management Strategy (the Strategy) sets out to identify the most suitable way of managing flood and erosion risk to local communities between Hunstanton and Wolferton Creek, whilst protecting the internationally important natural and historic environments along this stretch of coastline.

Working together the Borough Council of King's Lynn & West Norfolk and the Environment Agency have involved representatives from local communities, businesses and Norfolk County Council, throughout the study period, to inform the Strategy.

The Strategy makes a number of management recommendations for the short term (next 25 years) and an approach to future management over the long term (next 100 years). These recommendations build on the policies published in the Wash Shoreline Management Plan (SMP) published in November 2010, available on www.eacg.org.uk

The Strategy recommends an 'adaptable' approach to the future management of this coastline which does not preclude any future opportunities to further improve the standard of protection – dependent on available funding.

Development of the Strategy

We have investigated this coastline's unique coastal processes by using the latest survey data and talking to local people about their experiences of the coast. We needed to understand how this coastline works to help us best decide how to manage it in the future.

The Strategy is supported by an Strategic Environmental Assessment Report which ensures that all recommendations take account of their potential impact on the environment and habitats. There are two versions of the report:

- Wash East Coastal Management Strategy Strategic Environmental Assessment Environmental Report
- Wash East Coastal Management Strategy Strategic Environmental Assessment Environmental Report Non-Technical Summary

These documents will be available on https://www.gov.uk/government/publications or they can be requested from the Strategy Project Team via 01733 464149 or emma.love@environment-agency.gov.uk

Defences were severely tested during the East Coast Tidal Surge on 5 December 2013. Climate change studies indicate that sea levels will continue to rise and consequently the impact of future tidal events could escalate with an increasing number of storm events. We must plan now for the future protection of this coastline from the effects of flooding and coastal erosion.

A partnership approach

The preceding SMP recommended that a Key Stakeholder Group was established to support and contribute to the development of the Strategy and to investigate how to fund future management of this coastline.

An Advisory Group was drawn together from this group, complemented by statutory consultees such as Natural England and English Heritage, to ensure that local issues were taken into consideration as the strategy developed, and to share progress with the communities they represented. The Advisory Group included:

Beach Bungalows Associations
Country Land & Business Association
Heacham Parish Council
Hunstanton Town Council
Snettisham Parish Council
Hunstanton Chamber of Trade
King's Lynn Internal Drainage Board
Natural England
Regional Flood and Coastal Committee
Caravan Park Owners' representative
English Heritage
Norfolk Historic Environment Service
Hunstanton cliff top residents
Landowner representative
Norfolk County Council
RSPB

During 2012, we held public events in the area, giving local people the opportunity to comment on possible coastal management options for this coastline. All comments made by the public have been taken into consideration while developing this Strategy.

Assisted by the Advisory Group we have assessed options for future management of this coastline against the following criteria:

1. Social impact; how could an option affect the local tourism and way of life?
2. Economic impact; how could changes affect the local and national economies?
3. Environmental impact; how could an option affect the local environment/habitats?

4. Funding: how might this option be funded in the future?

We recognise that it is important that all these impacts are taken into account when making short/long term decisions about this coastline.

Delivering the Strategy

The Environment Agency is responsible for taking a strategic overview of the management of all sources of flooding and coastal erosion. This includes setting the direction for managing the risks through strategic plans as well as providing a framework to support local delivery. The Environment Agency has permissive powers (but not a duty) to carry out flood and coastal risk management work and to regulate the actions of other flood risk management authorities on the coast.[1]

Defra has overall national responsibility for policy on flood and coastal erosion risk management, and provides funding for flood risk management authorities through grants to the Environment Agency and local authorities.

Under the Flood and Water Management Act 2010, local authorities and district councils (as coastal erosion risk management authorities) have a fundamental role in managing and protecting the coastline by leading on coastal erosion management activities, leading and supporting coastal groups and producing SMPs through the relevant coastal group.

For more detailed information about responsibilities under the Flood and Water Management Act 2010 see: https://www.gov.uk/flood-risk-management-information-for-flood-risk-management-authorities-asset-owners-and-local-authorities#managing-flood-risks-who-is-responsible

This Strategy makes recommendations about how the coastline will be managed going forward. It does not commit any organisation referenced within it to undertake any immediate action as a result of it. It does however provide a strategic plan on how organisations need to work together to sustainably manage coastal erosion and flood risk in the future.

Funding future works arising

It is unlikely that any works arising as a result of recommendations made within this Strategy would be fully funded by national government. This is due to the limited number of properties and infrastructure at risk of flooding and erosion. However, changes to the way government funding is allocated, introducing a partnership funding approach, makes it possible for government to part-fund works as long as local funding can be secured. This makes it possible for communities to contribute towards managing their coastline to help reduce the risk of coastal flooding and erosion under a Partnership Funding approach.

The Strategy requires that a partnership approach to funding is established between public sector bodies and the local community - primarily caravan site owners, other local business and landowners who are most likely to directly benefit from the continued

[1] Environment, Food and Rural Affairs Committee, first report of session 2014-15. Winter Floods, HC240

protection of this coastline.

The Borough Council and Norfolk County Council support the Strategy and are jointly committed to developing a partnership funded approach to the future management of the coastline to protect people, property and the natural environment.

The Borough Council, Norfolk County Council and the Environment Agency are willing to make a contribution to the up-front capital costs required to sustain the current standard of protection and manage future climate risks.

What is the Wash East Coastal Management Strategy Public Consultation?

We recognise the knowledge and experience of local communities and have worked hard to capture this local expertise throughout the study. We are inviting you to provide a final review of the recommendations made.

This document has been produced by the Strategy project team for the purpose of consulting with local communities, businesses and other interested parties to seek feedback and comment.

Your views count

Please read this document and respond to the questions asked, giving due consideration to the recommendations made in relation to your knowledge and personal experience of flood risk and coastal erosion in this area.

The public consultation runs from Monday 28 July 2014 until Monday 8 September 2014. We will be holding public events during this time so that you can discuss the recommendations with the Strategy Project Team before commenting on the recommendations.

Project area overview

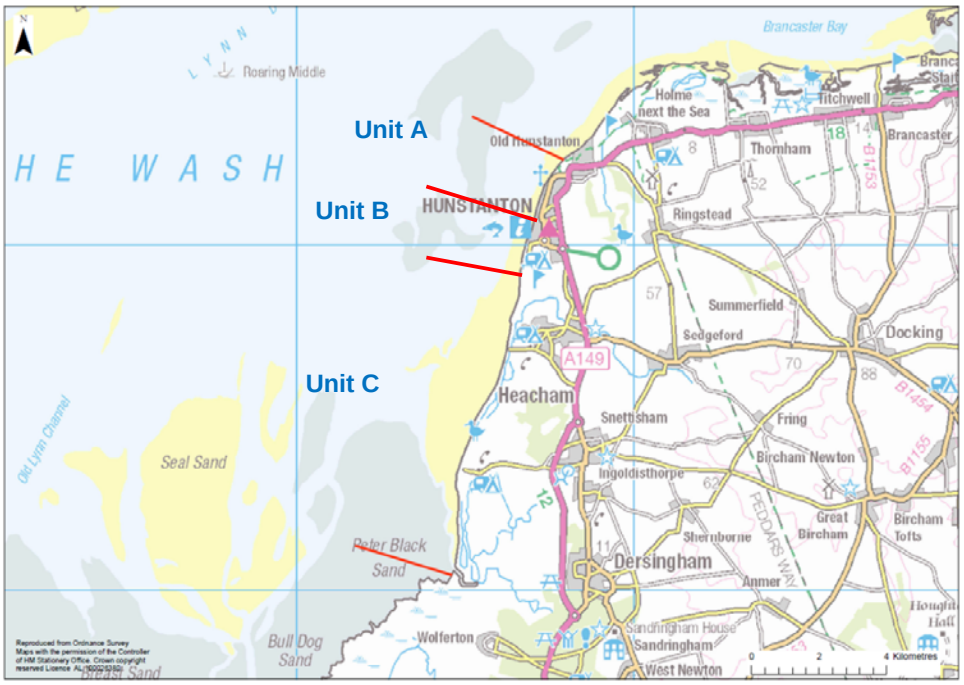
The Strategy covers the shoreline from Hunstanton Cliffs to Wolferton Creek. The cliffs and sea defences along this coastline protect over 1,100 residential properties, about 4,000 caravans, key infrastructure, tourism amenities, agricultural land and priority habitats.

This stretch of coastline has many environmental and historical features including:

- Rich cultural heritage with sites including Roman, Saxon and medieval settlements, WWII sites and over 200 listed buildings.
- The lighthouse and St Edmunds Chapel ruins on the Hunstanton cliff top are of local, regional and national significance.
- Valuable inshore fisheries.
- Internationally important sites for birds, conservation, and wildlife and designated sites such as the Hunstanton Cliffs.
- Being part of the Norfolk Coast Area of Outstanding Natural Beauty.

Based on the environmental features, the nature of the coastline and the existing coastal defences the coastline has been split into three units:

- Unit A: Hunstanton cliffs; at risk of coastal erosion
- Unit B: Hunstanton town frontage; defended by a sea wall
- Unit C: South Hunstanton to Wolferton Creek; defended by a mixture of hard (concrete) and soft (shingle embankment) defences



Although the Environment Agency has a strategic overview of all sources of flooding, the Borough Council is responsible for coastal protection in Unit A (Hunstanton Cliffs) and Unit B (Hunstanton Town). In Unit C, the Environment Agency oversees the management of coastal flood risk. Recommendations for each unit are covered in this document.

Unit A

Hunstanton Cliffs

Hunstanton cliffs are undefended and eroding at an average rate of three metres every ten years. The ongoing cliff erosion provides an important geological interest and landscape feature, and has a positive (but limited) impact as a source of beach material for Units B and C. On the other hand, erosion is likely to threaten a listed lighthouse, important historic features and the recreational use of the cliff top in the short term, and will threaten the B1161 (cliff top road) and properties in the long term. The Borough Council is responsible for coastal protection along Hunstanton cliffs.

Cliff erosion is caused by waves at the toe of the cliff but also through saturated ground leading to slumping of the top of the cliff, as seen in cliff falls in 2012 following heavy rainfall.

Recommendation

The Strategy has determined that the approach to manage erosion is to pilot a range of low cost options that reduce erosion caused by wave action at specific locations. The purpose of erosion reduction options would be to reduce wave attack at the base of the cliffs during regular tides and small storms.

The erosion reduction options will be focused on short lengths of cliff and aim to slow down erosion which threatens the historic features and the cliff top which the local community considers to be of high value. However it also ensures that some erosion continues along Unit A to maintain the fresh geological cliff face that Hunstanton cliffs are so well known for and for which they are designated.

The erosion reduction options have been considered based on the impact on the beach and cliffs and are in line with the conservation objectives for the cliffs SSSI status and potential for local community involvement. Each option will undergo a detailed assessment to ensure no detrimental effect to the cliffs as a result of implementation operation or removal of these options.

As a result, the following order is initially proposed for the pilot:

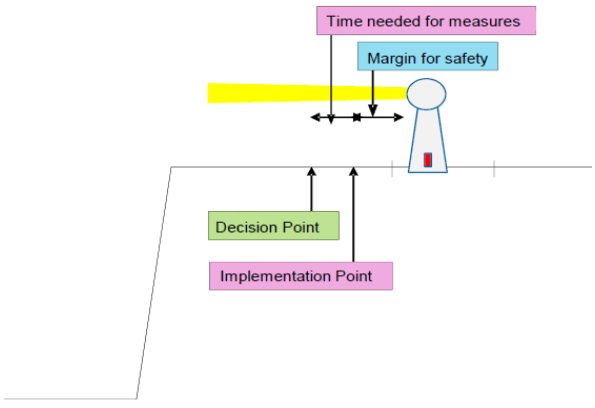
1. Base netting
2. Sand bags
3. Gabions (rock filled wire baskets)
4. Rock sill

If the piloting of the base netting is unsuccessful, then the piloting would move to the next option. Further information on each option can be found in Appendix 1.

There is currently no urgent need to reduce erosion. However recent cliff falls during the Winter storms have required one of the shelters to be moved, the coastal path around the lighthouse is becoming narrow and protective fencing may have to be realigned. The proposed options will only slow down, not stop the erosion.

Trigger approach

The Strategy uses a trigger approach to help identify when decisions need to be taken.



In the case of Unit A, the triggers for decisions are linked to when erosion gets within a particular distance from a particular feature. For example, this could be within around 10m from the lighthouse. A decision will also need to be taken in terms of erosion of the cliff top green.

The triggers have to take account of the time needed to make decisions and to implement them. The use of triggers means that variation in the rate of erosion over time can be taken into account. If erosion is faster than expected then the triggers would highlight that decisions need to be taken earlier. If the recommended piloting is effective and slows down the erosion then this will lengthen the time until features are affected.

Funding

Funding for flood and coastal erosion risk management projects is determined by the government's partnership funding approach. Using this, the options recommended by this Strategy for Unit A are only likely to attract a limited amount (if any) of national government funding. The benefits of protecting the recreational area, lighthouse, chapel and ultimately the road do not exceed the costs of the potential options, as there are limited properties and infrastructure at risk of erosion at present.

Any pilots taken forward would need to be funded from local sources.

Future opportunities

The pilots would help inform the decision on more extensive works if needed/justified in the future.

Summary

The recommended approach is a piloting scheme of low cost erosion reduction options which will reduce, but not stop, erosion. Pilot schemes will be monitored to assess effectiveness in slowing down the rate of erosion. If one of these options was found to reduce erosion, then the local community could look to continue this into the future subject to available funding.

Your views count

Unit A

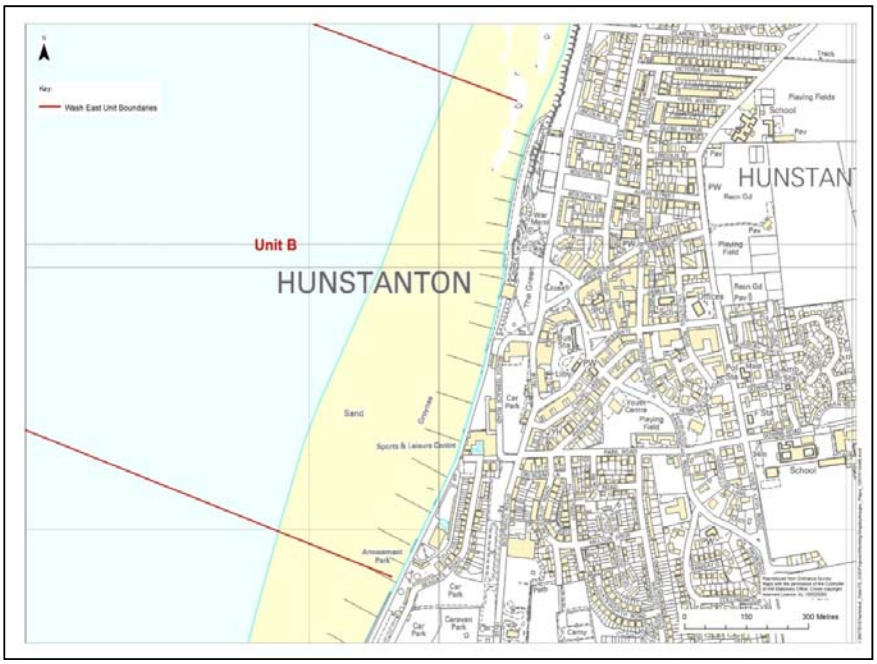
A.1 Given your local knowledge and experience do you feel that the recommendation made is the most appropriate?
If not please explain your reasons.

A.2 Do you think the pilot scheme and the erosion reduction methods proposed are appropriate for the location?
If not please explain your reasons.

Unit B

Hunstanton Town

The coastal defences in this area consist of a sea wall and promenade which is fronted by a beach with groynes. These defences are the responsibility of the Borough Council and provide protection against erosion for the majority of this unit.



The coastal defences have been developed since the existing natural defence failed during the storm surge of 1953. The December 2013 storm surge resulted in significant flooding on and behind the promenade and exposure of construction joints and cracks on the surface behind the defences.

Recommendation

The recommended approach for Unit B is to hold the line by maintaining the promenade and sea wall, including maintaining the groynes as they currently are.

This decision was strongly influenced by the Hunstanton Regeneration masterplan (published in 2008) that states that the promenade is essential for Hunstanton's economic future.

For further information on Hunstanton Regeneration masterplan visit http://www.west-norfolk.gov.uk or contact Hunstantonregeneration@westnorfolk.gov.uk.

Trigger approach

As with Unit A, the Strategy uses a trigger approach to identify current and future strategic decision points, and changes that would trigger these decisions. For Unit B, the trigger relates to the structural stability of the existing promenade and sea wall. The Hunstanton Sea Wall and Promenade Condition Survey undertaken in 2012 found that the estimated life span of some lengths of the sea wall is between 15 and 20 years. Therefore on-going monitoring and maintenance would be carried out to inform when the trigger for replacement is reached. At this point, a decision would be needed on when to replace the sea wall and promenade - what and how to do so will be decided at that point.

Funding

Using the partnership funding approach, it is estimated that the options recommended by this Strategy for Unit B are only likely to attract a limited amount of national government funding due to the number of properties and infrastructure at risk of erosion. However, the economic value of tourism and recreation would need to be calculated and taken into account at the time that a funding bid is submitted and could positively influence the amount of national funding available.

Any options taken forward in the future would need significant contributions from other local sources. Given that the promenade is considered to be essential for Hunstanton's economic future it is likely that the majority of funding will be provided by the Borough Council's own funds when the time comes.

Future opportunities

There is a potential to regenerate the sea wall and promenade before the trigger for the structural stability of the existing promenade and sea wall is met, but this work would only be feasible if a developer was willing and able to invest.

Summary

The recommendation for Unit B is to hold the line by maintaining the promenade and sea wall, including the groynes. The decision about how the promenade will be maintained in the long term does not have to be made until the existing structures have come close to the end of their structural life. This is not expected to be before 2029.

Your views count

Unit B

B.1 Given your local knowledge and experience do you feel that the recommendation made is the most appropriate?
If not please explain your reasons.

B.2 When the sea wall and promenade are close to the end of their structural life, what improvements would you like to see?

Unit C

South Hunstanton to Wolferton Creek

The coastal defences in this unit are comprised of two lines of defences that protect low lying land from flooding.

The first line between South Hunstanton and Heacham North Beach is a hard (concrete) structure. This becomes a soft shingle ridge, some sections of which are reinforced with concrete structures, between Heacham North Beach and Snettisham. Parts of the beach are supported by groynes.

The second line earth embankment defence is approximately 0.5km inland from the first line.

Between the first and second line defences there are many caravan sites, residential properties, holiday homes and an important brackish habitat. Behind the second line defence are a number of residential properties, the A149, a waste water treatment works and agricultural land.

Flooding in Unit C could pose a significant risk to life due to the presence of a large community in a low lying area, directly behind the defences. The existing defences provide a Standard of Protection that varies from 1:50 (2%) chance of flooding in any one year (at South Hunstanton), to as low as 1:10 (10%) chance of flooding in any one year locally near Shepherd's Port (Appendix 2). This was confirmed by the near-breaches in the December 2013 storm.

Recommendation

The Strategy confirms that it is sustainable to hold the line for the short and medium term. It has also confirmed that it is preferable to continue with the existing balance of hard and soft defences along Unit C, including maintaining the existing groynes. In the longer term, continued beach recycling may not be sustainable, for economic, social or environmental reasons.

The defences need continuous maintenance. The Environment Agency's operational staff undertake an annual beach recycling activity after the Winter and Spring tides have eroded the shingle defences (during February). If this maintenance were to stop, it could result in an immediate increase in flood risk.

The beach recycling work was paid for by government funding until 2013, as part of a previous scheme (2006). The introduction of the government's partnership funding approach has meant that the work can no longer be fully funded by government and so between 2013 and 2015 the work will be paid for by Local Levy funding provided by the Regional Flood and Coastal Committee (RFCC). The RFCC have also recently approved the use of Local Levy funding to extend the beach recycling operation to February 2016 with funding also coming from the Borough and Norfolk County Council.

The Strategy has developed a number of adaptable options (see table below and appendix 3) with varying Standards of Protection requiring varying levels of funding contributions. The standard of protection that the defence provides depends on the level of contributions that the local community and businesses can afford.

All options to be implemented will need to be further assessed for their impact on the environment based upon their location within areas of designated conservation interest.

Trigger approach

As with Units A and B, the Strategy uses a trigger approach to identify current and future strategic decision points, and what would trigger these decisions. For Unit C, decisions could be triggered by combinations of three situations:

- If funding (from any source) for continued defence management is insufficient;
- If the environmental impacts of defence management become unacceptable; or
- If the frequency of flood evacuations becomes unacceptable.

The Strategy deals with the first strategic decision point for Unit C in the short term by considering how properties and businesses can continue to be protected in a way that is sustainable and affordable in the future. To do this, it will be essential to keep reviewing emerging evidence related to climate change, defence performance and social, economic and environmental changes that influence future flood risk. The Strategy aims to set up a monitoring and review cycle, to monitor the trigger points.

Option	Description and investment	Outcome		Indicative figures		
				Total scheme costs (cash)	FDGiA estimate	Remaining contributions required
Do Nothing	Cease all current maintenance activity, no investment	Shingle bank erodes rapidly and stops providing protection in 3 to5 years; hard defences weaken over 15 to 20 years; low lying areas frequently flooded, caravan parks and agricultural use no longer sustainable	Initial amount Year 1	£0	£0	£0
			Annual amount Year 2-40	£0	£0	£0
Do Minimum	Continue current annual recycling work at the same investment level	Shingle bank gradually erodes and stops providing protection in around 30 years; chance of flooding gradually increases up to that point.	Initial amount Year 1	£175k	£80k	£95k
			Annual amount Year 2-40	£175k	£80k	£95k
Sustain Defence Standard	Continue current annual recycling work; gradual increase of amount of ten yearly recharge and refurbishment of hard defences	Standard of protection remains at current level, despite climate change (i.e. a chance of between 1:10 and 1:50 of flooding in any one year).	Initial amount Year 1	£175k	£50k	£125k
			Annual amount Year 2-40	£250k	£70k	£180k
Equal Improvements 1	Improve to 1:20 chance of flooding in any one year around Snettisham and to 1:50 chance of flooding in any one year around Hunstanton / Heacham. Similar investment in both areas.	Initial limited investment to improve standard, followed by recycling, recharge and refurbishment as needed to keep standard of protection at improved level despite climate change. Some reduction of chance of flooding, similar for both areas.	Initial amount Year 1	£3.5M	£0.7M	£2.8M
			Annual amount Year 2-40	£275k	£60k	£215k
Equal Improvements 2	Improve to 1:50 chance of flooding in any one year around Snettisham and to 1:75 chance of flooding in any one year around Hunstanton / Heacham. Similar investment in both areas.	Initial significant investment to improve standard, followed by recycling, recharge and refurbishment as needed to keep standard of protection at improved level despite climate change. Significant reduction of chance of flooding, similar for both areas.	Initial amount Year 1	£6.0M	£1.3M	£4.7M
			Annual amount Year 2-40	£275k	£60k	£215k
Equal Standards 1	Improve to 1:50 chance of flooding in any one year throughout the frontage. Higher investment around Snettisham than around Hunstanton / Heacham.	Initial limited investment to improve standard, followed by recycling, recharge and refurbishment as needed to keep standard of protection at improved level despite climate change. Some reduction of chance of flooding, more for Snettisham than for Hunstanton / Heacham.	Initial amount Year 1	£5.0M	£1.1M	£3.9M
			Annual amount Year 2-40	£275k	£60k	£215k
Equal Standards 2	Improve to 1:75 chance of flooding in any one year throughout the frontage. Higher investment around Snettisham than around Hunstanton / Heacham.	Initial significant investment to improve standard, followed by recycling, recharge and refurbishment as needed to keep standard of protection at improved level despite climate change. Significant reduction of chance of flooding, more for Snettisham than for Hunstanton / Heacham.	Initial amount Year 1	£6.5M	£1.3M	£5.2M
			Annual amount Year 2-40	£275k	£60k	£215k

Funding

According to the government's Partnership Funding policy, some national government funding for Unit C options will only be available if partnership funding contributions can be secured. Using this Partnership Funding approach, the options recommended by this Strategy for Unit C could attract a contribution of approximately 25% of the cost of the option from national government funding.

The annual beach recycling operations which have been undertaken over many years along this coast will need to continue for all but the 'do nothing' options identified by the Strategy. Funding has been identified and secured for this work to continue until 2016 after which an alternative source of funding will need to be agreed.

The option that provides the greatest benefits for the costs incurred is Equal Improvements 2. This involves improving the Standard of Protection to a 1 in 50 chance of flooding in any one year around Snettisham and to a 1 in 75 chance of flooding in any one year around Hunstanton/Heacham (see Appendix 4). Although this option provides the greatest benefits for the costs incurred it would need significant up-front capital investment to improve the standard, followed by ongoing maintenance of the defences – to pay for beach recycling and refurbishment to keep the standard of protection at the improved level taking account of sea level rise.

The currently most affordable option is Sustain the Defence Standard which would maintain the current standard of protection (a 1 in 10 to 1 in 50 chance of flooding in any one year) and manage future climate risks.

The Borough Council, Norfolk County Council and the Environment Agency are willing to make a contribution to the up-front capital costs required to Sustain the Defence Standards to help maintain the current standard of protection.

Norfolk County Council would seek approvals to provide their contribution from its Coastal Fund and bid with partners for Environment Agency Flood Defence Grants.

Options that provide a higher standard of protection would require additional up-front funds to be provided.

If members of the local community would like to pursue a Strategy option that further improves the Standard of Protection, then they could do so if they are willing and able to provide additional up-front funds.

The Strategy identifies the need for funding from the local community for the on-going maintenance of the defences. Environment Agency partnership funding is potentially available to contribute to the annual maintenance costs but this is dependent on contributions being secured from the local community.

Managing future community contributions

The Borough Council is currently exploring establishing a Community Interest Company (CIC) that could help manage local funding contributions from business and land owners.

The CIC provides a mechanism for capturing voluntary funding contributions which would then be managed for the purpose of maintaining or improving the coastal defences. It is anticipated that those local businesses and land owners that would benefit directly from maintained or improved standards of protection would contribute to and manage the CIC. Contributions would not be sought from individual members of the public in the first instance, though private contributions would not be refused. All contributions would, under the rules of the CIC, be contractually confirmed.

Future opportunities

The Strategy concludes that it is sustainable to keep holding the existing line in the short and medium term. However, it may be possible to continue to protect properties, holiday parks and other tourism facilities and create new intertidal habitats by carrying out a managed realignment in the country park area.

This is not proposed as an option in this Strategy, but the opportunity is being explored for the medium term. Further investigation will include detailed discussions with landowners and an assessment of the impacts on coastal processes. This would have to ensure that this does not increase flood risk for people and property along the frontage.

Summary

The Strategy has developed an 'adaptable' approach to the future management of this coastline which does not preclude any future opportunities to further improve the standard of protection - dependent on available funding.

The Borough Council, Norfolk County Council and the Environment Agency are willing to make a contribution to the up-front capital costs required to sustain the current standard of protection and manage future climate risks.

The Strategy identifies the need for the authorities and the community to work together to fund the on-going maintenance of the defences. If members of the local community would like to pursue a Strategy option that further improves the Standard of Protection, then they could do so if they are willing and able to provide additional funding.

The Borough Council of is currently exploring establishing a Community Interest Company (CIC) that could help manage local funding contributions from business and land owners.

Your views count

Unit C

C.1 Given your local knowledge and experience do you feel that the recommendation made is the most appropriate?
If not please explain your reasons.

C.2 If a partnership funding approach could be established what would be your preferred option?

C.3 Given the national government funding pressures, where else should funding come from to manage flood risk along Unit C?

What happens next?

Consultation arrangements

How to respond

You can view the consultation and respond online at https://consult.environment-agency.gov.uk. This will allow you to make your comments more efficiently, while helping us to gather and summarise responses quickly and accurately.

Alternatively hardcopies of the consultation are available at Environment Agency Offices in Wisbech Road, King's Lynn and Brampton (as below), and Borough Council offices in Chapel Street, King's Lynn and Valentine Road, Hunstanton. If you would like a hardcopy sent to you please call 03708 506506 or email WashEast@environment-agency.gov.uk.

To return written responses please send to:

Environment Agency

Brampton Office,

Bromholme Lane

Brampton

Huntingdon

PE28 4NE

or email your response to WashEast@environment-agency.gov.uk.

Next steps

Your feedback will be used by the WECMS project team to influence ongoing funding discussions with potential contributors and to gauge community engagement and support of the Strategy recommendations.

We will then present the completed Strategy to the Borough Council for cabinet approval and support.

Once we have achieved this the Strategy will be submitted to the Environment Agency approval process for formal sign off by the Environment Agency Operations Director.

We anticipate that the Strategy will be approved by the Environment Agency during March 2015.

We will progress the development of projects arising from the Strategy in parallel to this approval process, to allow the funding support to be formalised and confirmed.

Appendix 1

Erosion reduction options

Base Netting

Netting at the base of the cliff could be used to collect fallen cliff material, preventing it from being dispersed and washed away. The accumulated material would then start to form a protection against wave impact on the cliff toe. This option is a way of working with natural processes to gradually reduce erosion and could be appropriate where there is a large amount of cliff fall material collected at the base of the cliff.

Netting would result in a reduction of the overall beach size which could potentially impact the number of visitors to the area. There could also be associated safety issues with having a large volume of rocks on the beach. However, both the geological and biological interest features of the SSSI would be maintained. From a landscape point of view, the netting would not result in a significant change to existing conditions as material gathered would be the same as that already present.

Netting is a cheap and short term option to reduce erosion. If it does not work effectively, it could be removed easily with little impact on the beach and cliffs. The netting would need regular maintenance to ensure that it was kept in a suitable state to prevent health and safety incidents and if an extreme storm were to occur during the pilot, it would need replacing.

Sand bags

Sandbags could be placed at the base of the cliff to reduce wave energy but also to capture cliff material to build up additional erosion protection. Sand bags would need regular maintenance for health and safety purposes and if an extreme storm were to occur during the pilot, they would need replacing. Sand bags are likely to be more expensive than netting initially and replacement costs are higher. Sand bags could be an option if they were only to be used for a short time period to limit costs but their longevity is low and a more robust and expensive option would be required in the future.

To be effective, sand bags would need to constructed to create a small sand bag wave energy reduction area on the beach or alternatively as a sand bag wall. Sand bags could support the material that is already at the base of the cliff and hold it in place.

Nesting birds would be able to continue to use the cliff face and any erosion from the top of the cliff would maintain the geological interest of the site. Any maintenance would require significant intervention with vehicles on the beach which could potentially disturb nesting birds (dependent on the timing of the works).

Sand bags have previously demonstrated little effectiveness in reducing erosion at the base of cliffs, but they could be trialled as part of a pilot option.

Gabions

Rocks are placed in steel cages and then positioned along the cliff base. These reduce wave energy but also capture cliff material to build up additional erosion protection.

Gabions are the most expensive option due to the regular maintenance and replacement required as the steel cages become weak and break. The high wave energy association

with Unit A could cause health and safety concerns with the steel cages breaking and rocks dispersing.

The environmental impacts are minimal as nesting birds would still be able to use the cliff face and any erosion at the top of the cliff would maintain the geological interest of the cliffs.

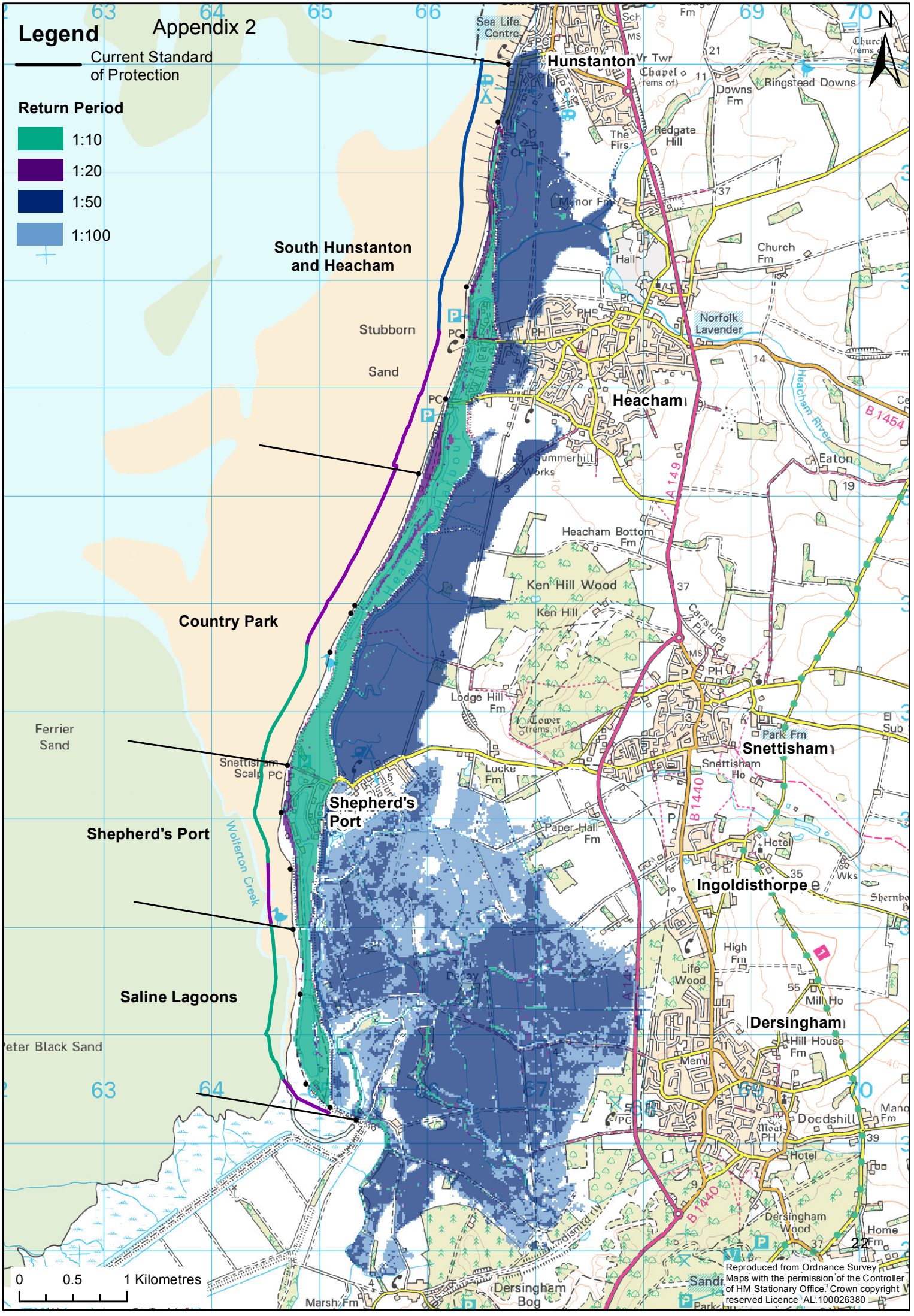
Rock sill

A rock sill could be placed either at the toe of the cliff or on the beach to reduce the impact of the waves during regular tides. The rock could also be used to capture cliff fall material to further reduce erosion. The rock would be placed on top of existing material and would be expected to settle over time. The rock could be tied in to the existing material at the base of the cliff. It is assumed that the rock would need to be replaced after 100 years and there would be maintenance every 20 years.

A rock sill in the short term is an expensive measure to reduce erosion but over time could cumulatively be a cheaper option due to minimal maintenance work required.

The placement of rock along the bottom of the cliff would result in the reduction of beach available to visitors and locals. Nesting birds would be able to continue to use the cliff face and any erosion from the top of the cliff would maintain the geological interest of the site. In addition, there would be a change in landscape character as a result of the rock placement.

There could be some limited environmental impacts due to maintenance which would require significant intervention with vehicles on the beach which could potentially disturb nesting birds (dependent on the timing of the works). Rock would be difficult to remove if it were not found to effectively reduce erosion.


Legend
Appendix 2
Current Standard of Protection
Return Period
1:10
1:20
1:50
1:100
N
Hunstanton
South Hunstanton and Heacham
Stubborn Sand
Heacham
Country Park
Ferrier Sand
Snettisham Scalp
Shepherd's Port
Shepherd's Port
Wolferton Creek
Saline Lagoons
Peter Black Sand
Snettisham
Ingoldisthorpe
Dersingham
Dersingham Bog
Ken Hill Wood
Ken Hill
Lodge Hill Fm
Heacham Bottom Fm
Summerhill Works
Eaton
Church Fm
Norfolk Lavender
Redgate Hill
Ringstead Downs
Downs Fm
Sea Life Centre
Chapel (rems of)
Manor Fm
Hall
Heacham River
Carrstone Pit
Park Fm
Snettisham Ho
Locke Fm
Paper Hall Fm
Hotel
High Fm
Life Wood
Mill Ho
Hill House Fm
Doddshill
Dersingham Wood
Home Fm
Marsh Fm
A149
B1454
B1440
0
0.5
1 Kilometres
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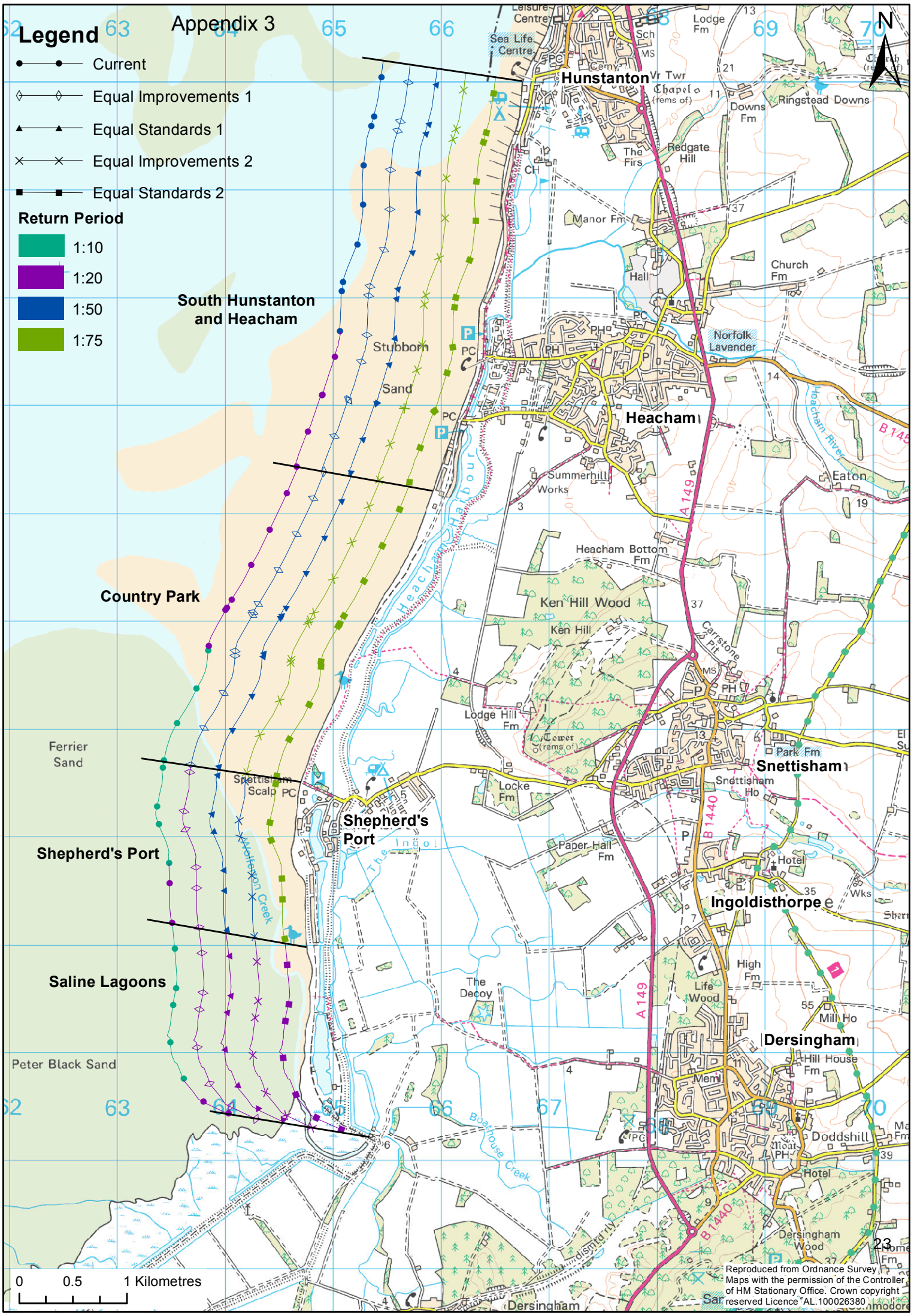
Appendix 3
Legend
Current
Equal Improvements 1
Equal Standards 1
Equal Improvements 2
Equal Standards 2
Return Period
1:10
1:20
1:50
1:75
South Hunstanton and Heacham
Country Park
Shepherd's Port
Saline Lagoons
Hunstanton
Heacham
Snettisham
Ingoldisthorpe
Dersingham
Shepherd's Port
Stubborn Sand
Ferrier Sand
Peter Black Sand
Wolferton Creek
Boathouse Creek
Heacham Harbour
Heacham River
Ken Hill Wood
Ringstead Downs
Norfolk Lavender
Sea Life Centre
Leisure Centre
Lodge Fm
Redgate Hill
Manor Fm
Church Fm
Summerhill Works
Eaton
Heacham Bottom Fm
Ken Hill
Carrstone Pit
Lodge Hill Fm
Park Fm
Snettisham Ho
Locke Fm
Paper Hall Fm
Hotel
High Fm
Life Wood
Mill Ho
Hill House Fm
Doddshill
Dersingham Wood
A 149
B 1440
0
0.5
1 Kilometres
N
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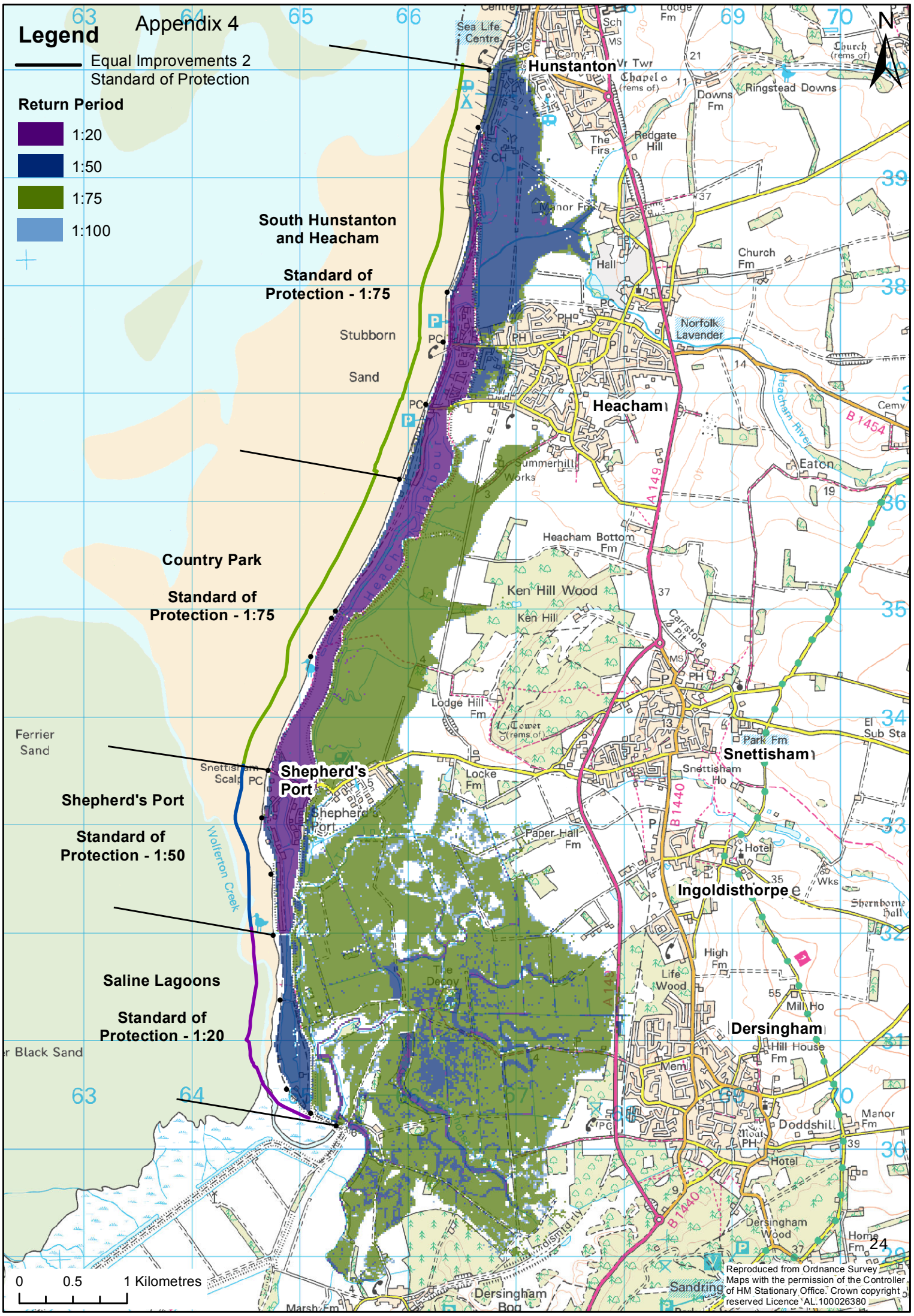

Glossary

Base netting	An erosion reduction option where netting is placed at the base of the cliff and collects fallen cliff material.
Beach recharge	Refilling a depleted beach using imported granular material.
Beach recycling	To move sediment from an area of deposition to an area of depletion to restore volume, width and level at a particular section of the beach
Brackish	Water that has more salinity than fresh water, but not as much as seawater.
Breach	A failure of a flood defence caused by water breaking through the defence itself.
Capital	Investment of funds for improvement works, where an asset is created which has a useful life greater than one year.
Coastal protection	Works undertaken by coastal local authorities to manage the risk of coastal erosion.
Community Interest Company (CIC)	A CIC is a special type of limited company which exists to benefit the community rather than private shareholders.
Gabions	Rocks or concrete placed in steel cages.
Groynes	A man-made barrier built across a beach (from the back of the beach down into the sea). They are usually made of wood or concrete and are built to trap sand and hold it on the beach.
Hard defence	Construction of artificial structures to protect against flooding such as a sea wall.
Hold the line	An aspiration to build or maintain artificial defences so that the position of the shoreline remains.
Local Levy	A local income raised by each RFCC to fund Flood and Coastal Erosion Risk Management activities that are a local priority and to support Partnership Funding projects. The Local Levy required is discussed by the RFCC annually in January and voted on by Local Council members only. The total agreed levy needed is raised from all Lead Local Flood Authorities within the RFCC boundary and is proportioned across them based on the equivalent number of band D council tax properties that each LLFA has in the RFCC's area. Local Levies do not have to be spent in the year they are raised as balances can be carried forward.
Maintenance	Work that sustains the Standard of Service expected at that time in the asset's life.
Managed realignment	Managed realignment aims to achieve sustainable flood defences by recreating eroded saltmarsh and mudflat habitats. This is done by creating new defences further inland and allowing the existing defence line to breach.
Partnership funding	Partnership funding policy for allocating capital funding to flood and coastal erosion risk management projects is determined by the Department for Environment, Food and Rural Affairs. . Instead of meeting the full costs of a limited number of schemes, the partnership funding approach means that government money can help meet the costs of any worthwhile scheme. The primary function is to reduce the risk of flooding and coastal erosion to properties. Wider economic benefits including the benefits to protecting businesses, infrastructure and agricultural land are also taken into account.
Permissive powers	The authority has 'powers' rather than duties' and will not be liable for the failure to exercise these powers.

RFCC	Regional Flood and Coastal Committee (RFCC) help to provide governance for the Environment Agency Flood and Coastal Erosion risk management functions and cover all flood risks that are not the responsibility of the water companies. RFCCs ensure there are plans for identifying, communicating and managing flood and coastal erosion risks across catchments and shorelines; promote efficient, targeted and risk-based investment in flood and coastal erosion risk management that optimises value for money and benefits the local communities; and provide a link between the Environment Agency, LLFAs, other risk management authorities, and other relevant bodies to develop mutual understanding of flood and coastal erosion risks in its area.
Rock sill	A layer of rocks placed either at the bottom of a cliff or on the beach.
Shingle ridge	A steeply sloping bank of shingle heaped upon and parallel with the shore.
Shoreline management plan	A large-scale planning document that identifies policies for coastal defence for a specified length of coastal that takes account coastal processes, human and other environmental influences and needs. A large-scale assessment of the risks associated with coastal processes and helps reduce these risks to people and the developed, historic and natural environments. Coastal processes include tidal patterns, wave height, wave direction and the movement of beach and seabed materials.
Slumping	Slope or cliff movement where material moves a short distance down a slope.
Soft defence	A form of flood defence that uses the natural resources or processes such as beach recycling.
Standard of protection	The effect of the asset on the flood risk. The standard is often measured in a return period such as 1:100 – a 1 in 100 chance of flooding in any one year. The Standard of Protection is determined partly by the asset's design and current condition but also by other factors such as climate change and altered river flows.

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