



consulting for the future

Shoreham Adur
Tidal Walls
(West Bank)

Consultation Document for Flood Risk
Management Options - March 2006

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Why should the flood defences along the west bank of the Adur Estuary at Shoreham-by-Sea be improved?


The west bank of the Adur Estuary between the western harbour breakwater and the A27 flyover is the 'last link in the chain' of flood and coastal defence improvement works recommended by the 'Rivers Arun to Adur Coastal Defence Strategy' produced by the Environment Agency, Worthing Borough Council, Adur District Council and Arun District Council in 2000.



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Study Area and Flood Risk Zone 3 Map

 Flood Zone 3: Fluvial and coastal flooding if there were no flood defences under a 1:200 year coastal event, 1:100 year tidal event

 West Bank Study Limits

The land protected by the flood defences along this section of the west bank of the Adur Estuary is low-lying and at risk of extensive tidal flooding if the existing defences are not improved. Additionally, some areas protected from flooding from the coast by the groynes and renourishment

place along the beachfront, are still vulnerable to storm surges flowing up the estuary and into the floodplain over the west bank.

The Environment Agency is working with Adur District Council to investigate options for phased improvement of the flood defences

Stakeholder consultation is an important part of the work that we do and this document will explain the issues for consideration in the development of a flood defence scheme. We will then present the options being considered. At this stage we are seeking your comments on the options as stakeholders.

ENVIRONMENT AGENCY



134846



why are we investigating this problem?

Saltmarsh with Old Shoreham Toll Bridge in the background

We have a supervisory duty in relation to flood defence, and it is our responsibility to review flood risk. We do this by producing river and coastal plans and strategies with the other operating authorities and stakeholders. We have permissive powers to construct and maintain flood defences against the sea or tidal and river water. In the study area, we are the operating authority for parts of the west bank, along with Adur District Council and various private landowners.

Owners of riverside properties (riparian owners) have rights and responsibilities in law regarding the river banks on their property. In most circumstances there is no requirement on a riparian owner to maintain or improve the flood defences unless they were to fail and cause an obstruction to the flow in the river. If it is only the riparian property that is at risk of flooding behind the defences, then

it is unlikely that we will carry out any works. However, if other non riparian properties are at risk, we may carry out works to the defences under our permissive powers where those works meet the criteria to attract national funding.

Further on in this document we have shown the general responsibility for each section of the defences and under our supervisory duty we have

considered the needs of all the sections irrespective of that maintenance responsibility. When we later produce the Project Appraisal Report to develop the preferred option for each reach, we will indicate the party responsible for maintaining and improving each section of the defences.

We are looking to provide protection against a flood event having a 1 in

200 year chance of happening – this design water level is 1.3 metres higher than the present high spring tide level. The final level of the defence would also include a *freeboard allowance*¹, which would vary between 0.15 metres and 0.5 metres, depending upon the type of defence structure. Additionally, we need to build defences that take account of climate change. This adds another 0.6 metres to the height of the defences over the 100 year life of the scheme (see below).

The preferred option for each section will be selected taking into account many factors, which include technical, financial, environmental, sustainability, health and safety, social and legal.

Climate change

Climate change is recognised as a real issue and its impact upon flood

risk needs to be considered when planning the requirements of future flood risk management. The Department for Environment, Food and Rural Affairs (Defra) sets the policy for flood risk management in England. Based on analysis by a number of bodies who are experts in the field of climate change, Defra has derived allowances which have to be built into a scheme to allow for future changes to mean sea level, rainfall levels and river flow. For this scheme, where the major threat is tidal flooding, we include an allowance for sea level rise at a rate of 6mm per year. The appraisal period for the scheme is 100 years, so we have to accommodate this additional 0.6 metre requirement into the final defence crest level. As the sea levels are predicted to rise over the whole life of the scheme, we can consider including this additional height in phases over the life of the options considered.

Environmental issues








There are a number of areas of environmental importance and interest in the study area:

- Adur Estuary Site of Special Scientific Interest (SSSI);
- Royal Society for the Protection of Birds (RSPB) Reserve;
- South Downs Area of Outstanding Natural Beauty (AONB);
- Old Fort Scheduled Ancient Monument (SAM);
- Shoreham Beach Site of Nature Conservation Interest (SNCI);
- Old Shoreham Toll Bridge Grade II Listed Structure;
- 'Childing Pinks', protected flower species;
- World War II pillbox structures.

These are shown on the figure below.



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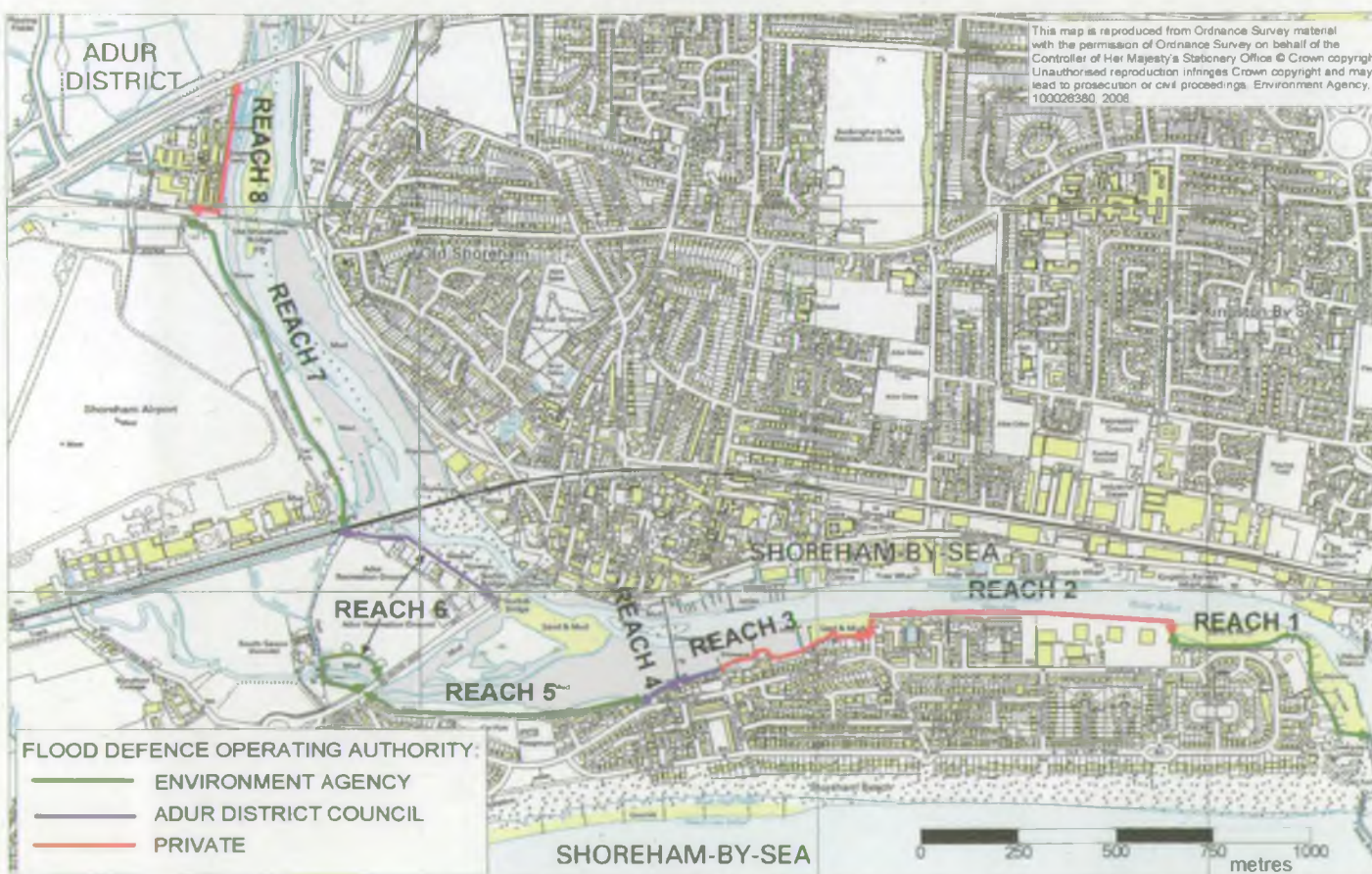
	Adur Estuary SSSI		Shoreham Beach SNCI		WWII Pillbox
	RSPB Reserve		Childing Pinks Enclosure		
	South Downs AONB		Old Fort SAM		

Environmental Interests in the Study Area

¹ Freeboard - the height added to a flood defence to take account of (amongst others) local wave action, small-scale settlement of defences and small inaccuracies in the flood prediction model.

why are we producing this document?

The Coastal Defence Strategy recommended that the defences along the west bank be improved in phases. Starting from this point, we carried out a more detailed assessment of the condition and levels of the existing defences. Some of the defences are old and in a poor condition. Some of them will last for a number of years, but have a low defence level, so will not protect against large flood events.



As there are different types of defences along the river, we split the west bank study area into a

number of sections ('reaches') to simplify the assessment.

We have developed a list of scheme objectives, against which the options will be assessed:



Common lizard

Options for managing flood risk

We have developed a number of options for managing flood risk in each of the reaches, which are discussed in the following pages. In addition to these 'improvement options' there are two other options that we consider:

Do nothing – this would not involve any work to the flood defences, which includes ongoing maintenance, improvement works or even repairs if the defences collapsed. Over time the condition of the existing defences would worsen and the structures would fail, resulting in widespread flooding.

Do minimum – this would involve only doing works necessary to maintain the defences in their current form and position. Repairs would be undertaken but the standard of protection would fall over time as sea level rises.

To make commenting on the options easy, we are using a numbering system for each reach. Option 1 is 'Do nothing' and option 2 is 'Do minimum'. The improvement options for each reach (as shown in the following pages) are numbered from 3 onwards.

Please let us have your comments on the options presented in this document either at the exhibition using the feedback form or by sending them to our consultation manager whose details are given at the end of the document under "Have your say".

- To raise awareness of the risk of flooding and the dangers of climate change.
- To reduce the risk to life and property from flooding by providing safe, sustainable flood defences, where appropriate.
- Minimise impact on the environment and seek to provide enhancement wherever possible.
- To ensure that the constructed defences are suitable for their setting and in keeping with the character of the surrounding landscape and land use.
- To keep local residents regularly informed of progress and to encourage feedback.

Reach 1 - from the western harbour arm to Sussex Wharf

Existing defences

(A) rock revetment, (B) steel sheet piled walls, beach and groynes, (C) shingle beach, groynes and breastwork, (D) floodwall, revetment and rock gabions, (E) shingle beach and vegetated bank.

Flood risk

Flooding in this reach can happen due to high water levels and also waves washing over the defences along sections A and B. Based on existing water levels and the levels of the steel sheet piles and the garden levels in section B, there is a 1 in 10 year chance of flooding occurring. This risk will increase as sea level rise occurs and as the condition of the defences worsens. Erosion of the shingle along section C will further increase this risk.

Issues

The land behind the defences in this area is quite high and flooding in this reach would not be extensive. However, the defences are in a poor condition and need to be replaced to prevent erosion of the land behind them. Erosion of the shingle beach along sections B and C is also an issue.

Options for consideration

[Figures are for illustrative purposes and are not to scale.]

Option 3: Replacement of the steel sheet piles along section A, with the new piles having a higher crest level, reconstruction of the timber groynes along sections B and C, minor maintenance to the revetment in section D, replacement of the brick-filled gabions with rock-filled wire baskets (gabions) in section D.

This option would reduce flood risk through raised piled defences. The new groynes will help to maintain good beach levels.

Option 4: As option 3, but with a rock revetment constructed in front of the new steel sheet piles in section B. In addition to the flood risk benefits highlighted in option 3, the revetment will reduce wave reflection from the sheet piles. This will reduce the potential for erosion of the beach in front of the structure. The rock revetment may be extended around Section C to lessen erosion in this area.

In both options 3 and 4, beach recharge (placing shingle on the beach) would take place in future years to boost beach levels.

Constraints

- Ensuring that the area with the Chiding Pinks is protected during construction.
- Ensuring that the Old Fort SAM is not affected by the works.



Reach 1 Overview
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Reach 1 Option 3



Reach 1 Option 4

- Ensuring that the Shoreham Beach SNCI is not affected by the works.
- There is a low population of reptiles present, which should not be affected by the works.
- Ensure that safe access to the river from the Sailing Club is maintained.

Opportunities

- Improve the amenity value of the beach.

Reach 2 - Sussex Quay



Reach 2 Overview

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Existing flood defence

Steel sheet piled quay walls with a concrete capping beam.

Flood risk

There is a 1 in 2 year chance of flooding, at Emerald Quay, based on present levels. This risk of flooding will increase over time due to sea level rise.

Issues

South Wharf was developed after the strategy was completed and the quay level was raised to provide the required standard of flood defence. Sussex Wharf is undergoing development. The quay here has not been raised, but the development has been built with higher ground levels and the floor levels in the properties are also high.

However, Emerald Quay was developed in the mid 1980s before the coastal defence strategy was published and when planning requirements in relation to flood risk were different.

Options for consideration

[Figures are for illustrative purposes and are not to scale.]

Option 3: Riverside Road would be used as the flood defence, with ground and road levels being raised where necessary. This would result in Emerald Quay remaining at risk of flooding.

Options 4 to 6, described right, involve raising the level of the quay around the Emerald Quay development. Pre-cast concrete units would be used, all illustrated on page 10.

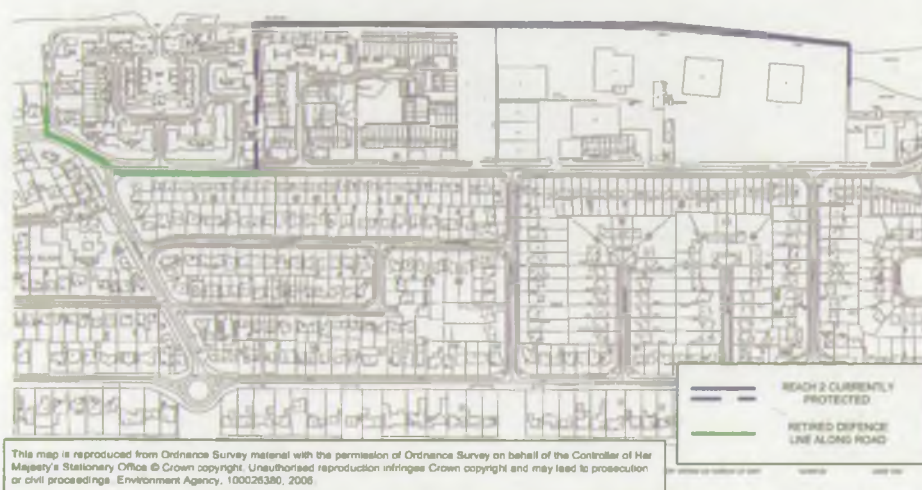


Emerald Quay existing defences

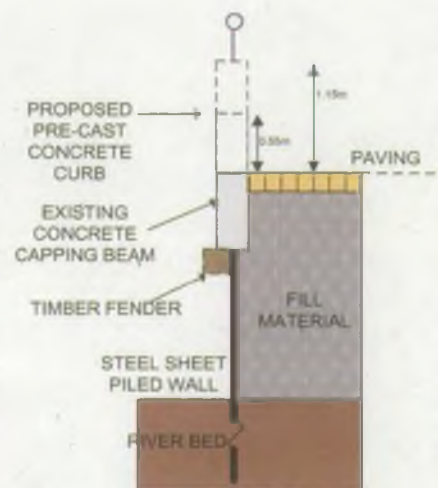
Option 4: The level of the quay wall along the riverside would be raised using pre-cast concrete units. A floodgate would be installed at the entrance to the marina, which would prevent water entering.

Option 5: The level of the quay wall along the riverside would be raised using pre-cast concrete units, with two small floodgates across the pedestrian walkways beside the marina entrance. Flood water would enter the marina, but would be contained in the mooring basin area by local road raising (like speed humps) around the marina area.

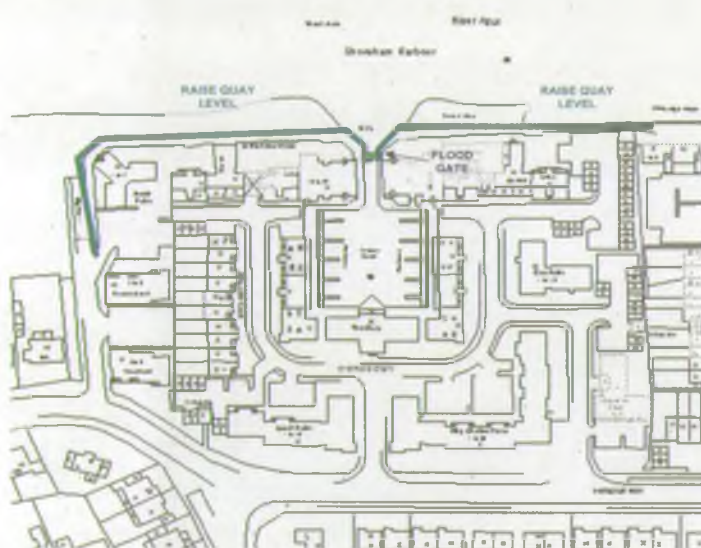
Option 6: The level of the quay wall along the riverside and marina would be raised using pre-cast concrete units. Flood water would enter the marina but would be contained within the basin by the floodwalls.



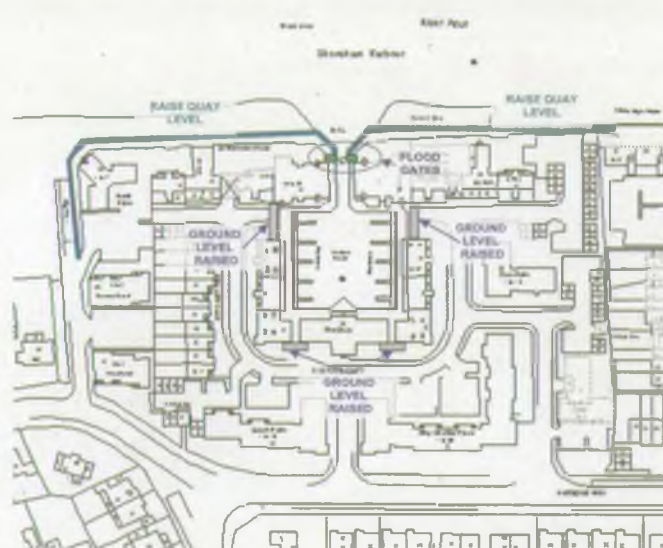
Reach 2 Option 3 overview



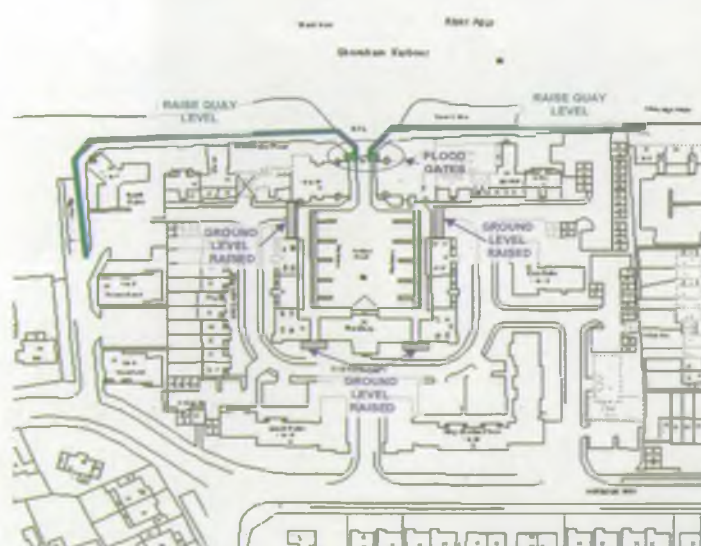
Reach 2 Options 4-6 Quay raising



Reach 2 Option 4 overview



Reach 2 Option 5 overview



Reach 2 Option 6 overview

Constraints

- Floodgates are not a permanent defence – they need to be closed following a flood warning. Failure to close them in time will result in flooding occurring.
- Floodgates would require regular maintenance and exercises to ensure that they operate in an emergency.
- Ensuring that there is suitable access to the pontoons for the marina users.
- Ensuring that access is maintained to the slipway on the western side of Emerald Quay.

Opportunities

- Construction works may offer the opportunity to clean up the debris littering the foreshore along this section.

Reach 3 - Emerald Quay to the footbridge



Reach 3 overview

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Existing defences

Flood defence along much of this reach is provided by the rear boundary walls of the properties of Riverside Road. These walls are a mixture of brick, concrete, timber and steel sheet piles. In front of the car park there is a steel sheet piled wall. There is a hump in the road in front of the properties beside the car park which provides some defence.

Flood risk

Based on existing levels along the defences in front of the car park, there is a 1 in 2 year chance of the wall being overtopped by floodwater. The land rises up to Riverside Road, so the flooding in this area would be limited but would increase with a more severe flood event. Sea level rise will mean that the extent of the area at risk of flooding will increase over time.



Reach 3 Foreshore and defences

Issues

The saltmarsh and mudflats between the low and high tide levels (the 'inter-tidal zone') are valuable habitats.

There are three houseboats moored in front of the Waterside Inn and many of the properties along Riverside Road have direct access to the river from their properties.

Options for consideration

Option 3: Use Riverside Road as the defence, with the road level raised where necessary. This would not provide flood defence to the riverside properties along this section. The level of the defences in front of the car park would be raised.

Option 4: Construct a flood bund along the riverside to the rear of the properties between the footbridge and Emerald Quay.

Option 5: Raise the level of the road/pavement in front of the car park, with local raising to tie it into higher ground. No works would be undertaken between the Waterside Inn and Emerald Quay.

Option 6: Construct a steel sheet piled wall along the riverside of the properties between the footbridge and Emerald Quay. Local raising of the land around the boatyard may be more suitable to maintain access.



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— RETIRED DEFENCE
ALONG ROAD
— RAISE LEVEL

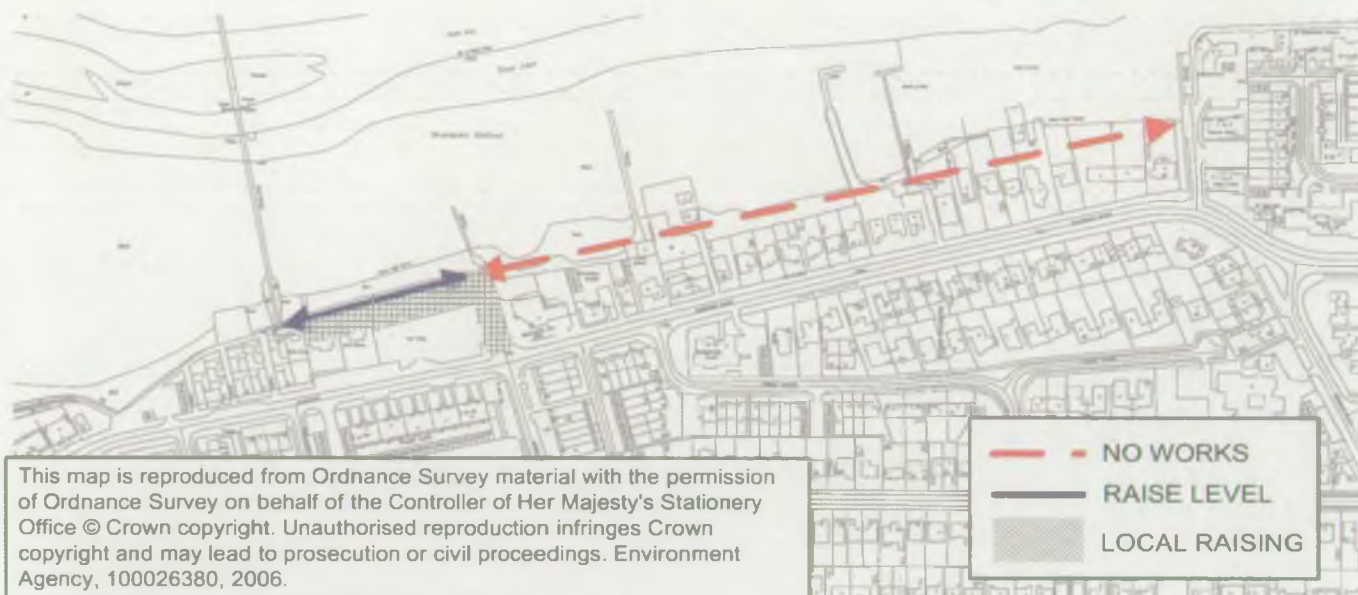
Reach 3 Option 3 overview



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— NEW FLOOD BUND
(Indicative alignment)

Reach 3 Option 4 overview



Reach 3 Option 5 overview



Reach 3 Option 6 overview

Constraints

- Constructing a flood bund, which has a large footprint, would mean losing valuable inter-tidal habitat.
- Ensuring that access to the footbridge is maintained.
- Not restricting access to the river from the properties, jetty access etc.
- Raising the road may require significant ground modelling to retain access to/from driveways along Riverside Road.
- Maintain access to the houseboats.

Opportunities

- Construction works may offer the opportunity to tidy up the foreshore along this reach.

Reach 4 - Footbridge to the houseboats



Reach 4 overview
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Existing defences

There is a concrete flood wall along the riverside in this reach.

Flood risk

There is a 1 in 15 year chance of flooding, based on present levels. This will increase to a 1 in 2 year chance in 25 years time, due to sea level rise.



Reach 4 Existing Defences

Issues

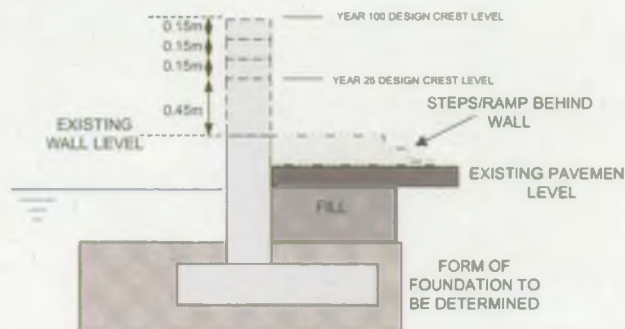
This reach is within the area covered by the Adur Estuary SSSI.

Options for consideration

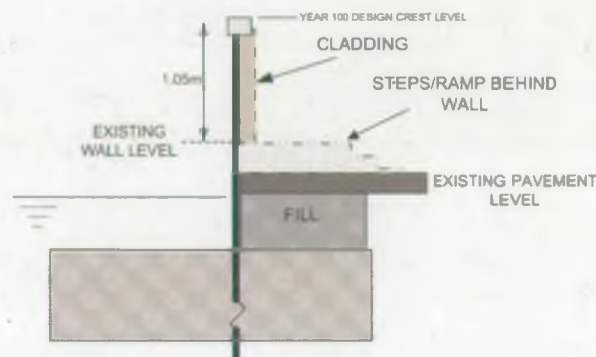
[Figures are for illustrative purposes and are not to scale.]

Option 3: Construct a new concrete flood wall with a higher crest level than the existing wall.

Option 3a: provide a 1 in 200 year standard of defence with 100 years allowance of sea level rise now. In this option the wall level would be raised by 0.9m in one construction phase.



Reach 4 Option 3



Reach 4 Option 4

Option 3b: provide a 1 in 200 year standard of defence in phased construction stages.

In options 3a and 3b, the level of the pavement along the rear of the new wall would be raised by around 0.25m to allow viewing across the river for pedestrians. There would be stepped access on the front, with ramped access at either end.

Option 4: Construct a new steel sheet piled flood wall with a higher crest level than the existing wall. This option can be installed in phases, although it is more complicated than option 3.

As with option 3, the level of the footpath along the rear of the new wall would be raised by around 0.25m to allow viewing across the river for pedestrians. There would be stepped access on the front, with ramped access at either end. There would be stepped access on the front with ramped access at either end to accommodate wheelchair users.

Constraints

- Minimise disturbance to the SSSI.
- Maintain access to footbridge.
- Maintain access to properties.

Opportunities

- Lessen visual impact of works using cladding and planting.

Reach 5 - The houseboats



Reach 5 overview

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Existing defences

There is a flood embankment along this reach, with a concrete towpath along its crest approximately 1.5 metres wide. A visual inspection of the embankment has estimated its residual life as being less than 10 years. As we are planning the defences for the next 100 years, it is likely that significant reconstruction or replacement of the structure will be required.

Flood risk

Based on existing levels, there is a 1 in 50 year chance of flooding occurring. This risk of flooding will increase with sea level rise and as the condition of the embankment worsens.

Issues

This area is covered by the Adur Estuary SSSI, which starts at the footbridge and extends upstream. The SSSI includes the rear of the embankment, which is a habitat for lizards. There is an RSPB reserve in the inter-tidal area. There is a public footpath which runs along the towpath.

At present, the towpath is too narrow to allow the Environment Agency to undertake any maintenance along this reach. If the flood defences are to be improved, the new structure must allow for unimpeded access both landward and riverside for inspection, maintenance and emergency repairs following a flood event. Where it is not possible to provide the access along either base of the embankment, it needs to be provided along the crest and should ideally be at least 4m wide for Health and Safety reasons. Where this is not possible, the crest width can be reduced to 3m provided suitable safety protection is provided.

There is very limited space available for construction of the defences, so the access requirements will be assessed in relation to the physical limitations of the site.

There are a number of houses which are very near to the towpath, whose residents look out onto the embankment from their properties.

The level of the land protected by the flood defence is very low, with some of it lying below the level of average high tides. If flooding did occur in this area, the floodwater is likely to be deep enough to pose a risk to life. For this reason, the defence constructed must be permanent, i.e. floodgates or openings to be closed when a flood warning is issued cannot be permitted along this section.

Options for consideration

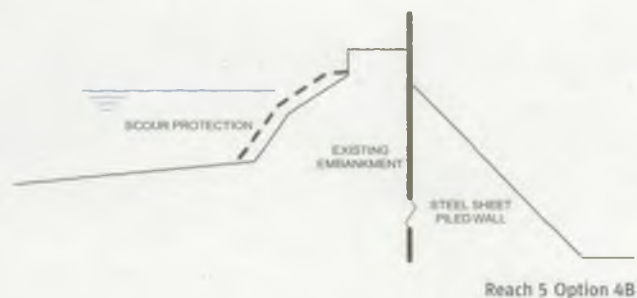
[Figures are for illustrative purposes and are not to scale.]

(For clarity, handrails hPt been shown on the figures. Handrails would be provided in accordance with health and safety legislation.)

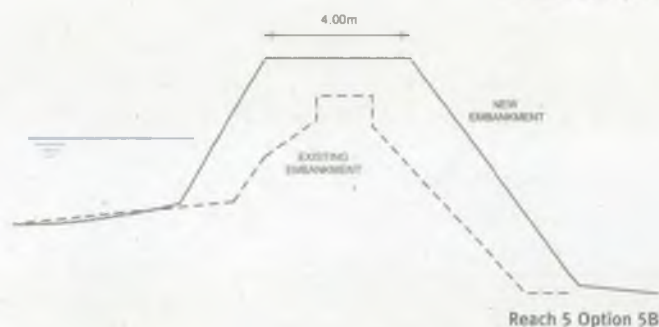
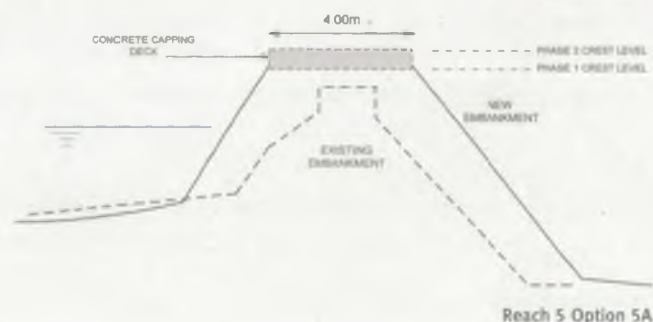
Option 3: Install timber planking along the crest of the existing embankment. This option is likely to involve some reconstruction of the existing embankment. The planking could be constructed on the riverside of the towpath (option 3A) or the landward side of the towpath (option 3B, as shown). Timber has a relatively short design life, so the defence would need to be replaced a number of times over the 100 year period.



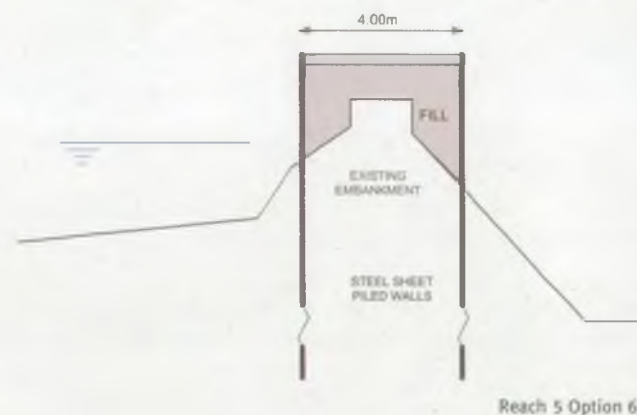
Option 4: Install a steel sheet piled wall along the crest of the existing embankment. This option is likely to involve some reconstruction of the existing embankment. The piling could be driven on the riverside of the towpath (option 4A) or the landward side of the towpath (option 4B, as shown). Steel has a longer design life than timber, so would involve less future disruption.



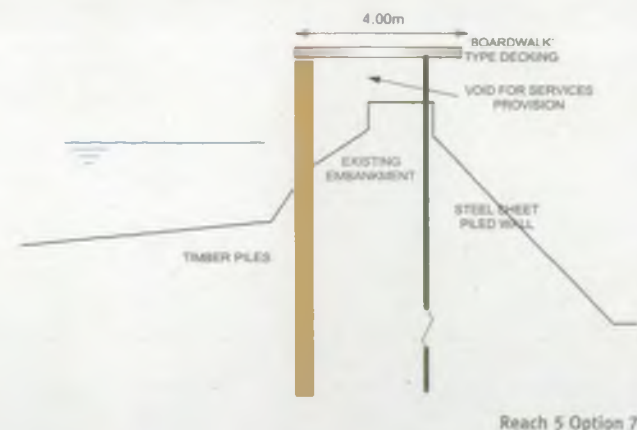
Option 5: Reconstruct embankment with a higher crest level. This would be a larger structure than the existing embankment, both in terms of height and width. Option 5a involves phased construction to provide a suitable level of flood defence for the next 50 years, with the crest level being raised in the second phase to provide protection against further future sea level rise. Option 5b does not include phased construction and the embankment would be raised and widened in one operation.



Option 6: Double piled wall with raised towpath. This involves installing two rows of steel sheet piles and filling in the space between. The towpath would be raised and widened. The position of the new structure on the cross-section is variable, i.e., it could be moved towards the river or towards the land.



Option 7: Piled defence with timber boardwalk. This involves installing a steel sheet piled wall along the landward side of the existing embankment. This would provide the flood defence. Timber piles would be installed along the riverside of the existing embankment. A timber deck would be supported between these two structures to form the towpath, at a higher level than the existing level. The position of the new structure on the cross-section is variable, i.e., it could be moved towards the river or towards the land.



Option 8: Combined fill and pile option. Steel sheet piles would be installed and the space between the existing embankment and the pile would be filled up to the existing towpath level. The piling could be driven on the riverside face of the towpath (Option 8A) or on the landward side of the towpath (Option 8B, as shown).

Option 9: Double piled wall with phased construction. This involves two rows of piles, similar to Option 6. However, the piles would be driven to different levels, reducing the amount that the towpath had to be raised. The pile along the landward side would be installed to provide flood defence and include for sea level rise for the next 50 years. The defences would be raised in 50 years time by the addition of timber capping beams to provide defence against sea level rise after 50 years. The rear face of the pile could be clad with timber to reduce the visual impact when viewed from the houses along the rear of the embankment. The position of the new structure on the cross-section is variable, i.e., it could be moved towards the river or towards the land.

Constraints

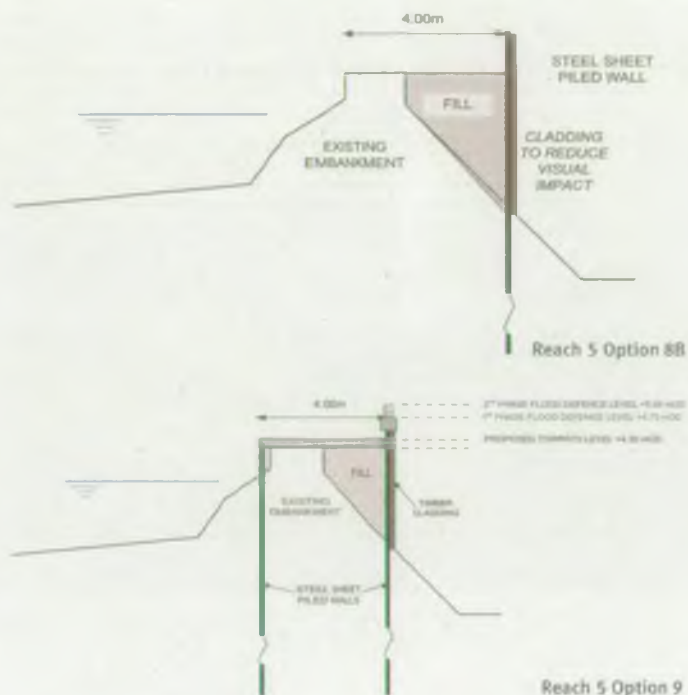
Due to the large number of issues related to flood risk management in Reach 5, the constraints have been grouped into categories:

Space limitations

- There is a very limited amount of land available for construction.
- A flood defence structure with a 3m or 4m wide crest for some options would require construction on saltmarsh and/or gardens in some locations.
- Widening the towpath may result in the towpath being moved towards the properties, which means that pedestrian traffic will move closer to the houses and gardens.

Environmental issues

- Avoid moving houseboats onto RSPB reserve land.
- Minimise disturbance to the SSSI.
- Reducing the visual impact of the proposed works on the riverside properties.
- Reducing the visual impact of the proposed works from the east bank and Norfolk Bridge.
- Concerns over increased light pollution caused by higher towpath.



Access/health & safety

- Raising the level of the towpath may hinder the rescue of anyone falling into the estuary (although handrails would be provided as required by health and safety legislation).
- There are concerns that a wider towpath would encourage vehicular traffic. Controls would be necessary to prevent this.
- Maintain access along towpath.
- Maintain access from the towpath to the car park and open space.
- Maintain access from towpath to houseboats. Raising the level of the towpath will require raising of the houseboats' jetties and access structures.

Other issues

- Floodgates/floodboards/openings through the defences would not be allowed along this section due to the low lying land that the flood defence protects.
- Raising the level of the towpath may result in a loss of privacy for residents along the rear of the defence, as pedestrians would look down into houses and gardens.

Opportunities

- There may an opportunity to provide connection to the foul main sewer for the houseboats, most of which discharge directly into the estuary at present.
- There may be an opportunity to tidy up the inter-tidal area and along the embankment, removing debris.

Reach 6 - Norfolk Bridge to the railway viaduct



Reach 6 overview
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Existing defences

There are no defences along the riverside at present. The bunds in the car park are there to restrict vehicle movements and do not provide flood defence.

Flood risk

The level of the riverbank is at its lowest between the Sea Scouts Hut and the railway viaduct. In this area, there is a 1 in 1 year risk of flooding based on existing levels.

The tide also flows under Saltings Bridge and fills up the tidal pool. There are defences to the south and west of the pool but none on the north side where there is a 1 in 1 year risk of flooding occurring.

The risk of flooding will increase with sea level rise.

Issues

The Adur Recreation Ground was used as a landfill site in the 1950s through to the 1970s. The riverbank is eroding with material from the land fill becoming exposed.

There are two outfalls along the western edge of the tidal pools. These prevent the tide from flowing inland through the drainage system.

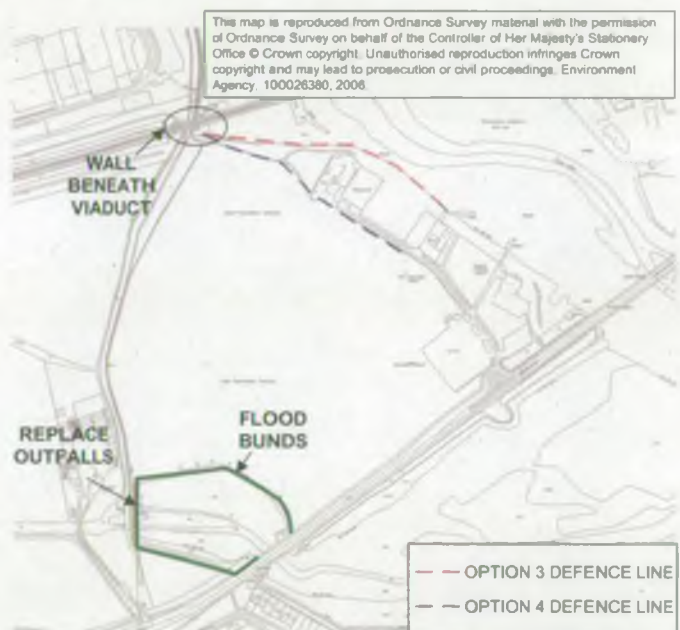


Reach 6 Erosion of riverbank

Options for improvement

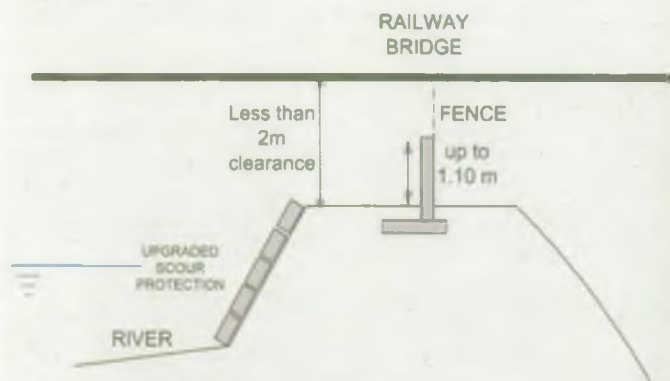
[Figures are for illustrative purposes and are not to scale.]

Option 3: Construct a flood bund along the river between the sea scouts hut and the railway viaduct. A concrete flood wall would be constructed along the rear of the footpath underneath the railway bridge. Bunds would be constructed along the banks of the tidal pools and the existing outfalls would be upgraded. Gabion baskets would be installed along the riverbank to prevent further erosion. Although the existing ground levels between Norfolk Bridge and the Sea Scouts Hut are high enough at the moment to prevent flooding, it is likely that some land raising would be required in the future to deal with increased water levels caused by climate change.



Reach 6 overview of Options 3 and 4

Option 4: This option is essentially the same as option 3, but the defences between the Sea Scouts Hut and the railway viaduct would be constructed to the rear of the play park area. This would maintain the uninterrupted views across the river enjoyed at present. The slopes of the embankment would be gentle, allowing for ease of access over them for pedestrians. However, the land between the defence and the river would remain at risk of flooding during storm events.



Reach 6 Floodwall under railway viaduct



Reach 6 Example of gabion baskets



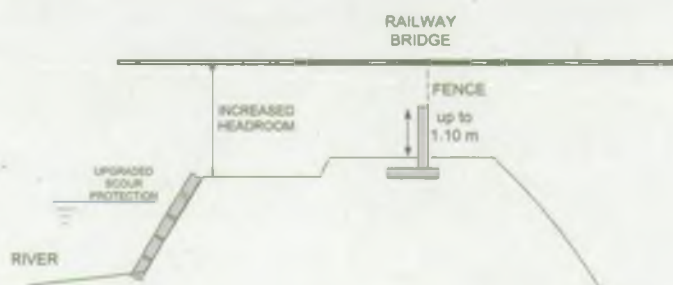
Potential widening of path.
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Constraints

- This reach is within the Adur Estuary SSSI.
- There is limited space beneath the railway viaduct, with the SSSI on the riverside and land owned by Network Rail on the landward side.
- Access to the river for the Sea Scouts and the Adur Outdoor Activities Centre should be maintained.
- Contents of land fill material may influence option selection and the alignment of the defences.

Opportunities

- Construction works may offer the opportunity to tidy up the foreshore.
- There may be the potential to widen the footpath underneath the viaduct. This would improve access along this section. Lowering a section of the path would increase the headroom available for cyclists.



Reach 6 Options 3 and 4 -
potential widening of footpath

Reach 7 - Shoreham Airport



Reach 7 Overview
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Reach 7 Existing embankment defence

Existing defences

Flood defence is provided by an earth embankment with pre-cast concrete slabs along the crest. Many of the concrete slabs have moved out of position and the footpath along the top is very uneven. At the north of the reach is a concrete floodwall, which is part of the Reach 8 flood defences.

Flood risk

Based on existing levels, there is currently a 1 in 2 year risk of flooding occurring. This risk of flooding will increase with sea level rise.

Issues

There is a ditch running along the rear of the embankment and two outfalls. Options must allow for continued drainage of the area. There is a lack of space in the southern section of the Reach, next to the car park. There is a public footpath running along the crest of the existing embankment.

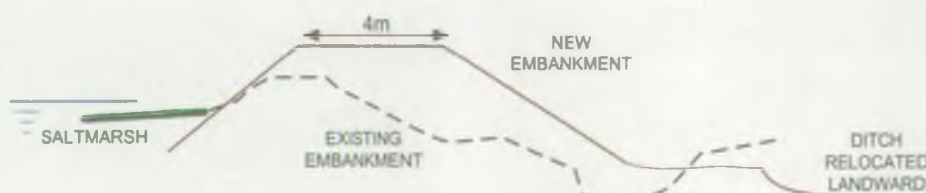
The residual life of the embankment, based on a recent visual inspection, is around 10 years.

Options for consideration

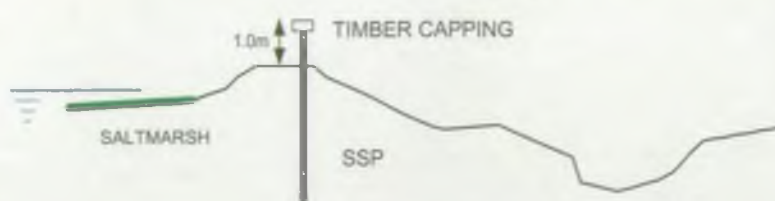
[Figures are for illustrative purposes and are not to scale.]

Option 3: Construct a new earth embankment. This would have a wider crest than the existing embankment to allow access for future maintenance and repairs. The crest of the embankment would be accessed from either end (as at present) and by a number of ramps from the land to the rear.

Option 4: Install a steel sheet piled wall. It is likely that this option would require reconstruction of the embankment. An access corridor would be constructed along the foot of the rear of the embankment. Access from the rear onto the path would be via a series of ramps from the land to the rear.



Reach 7 Option 3



Reach 7 Option 4

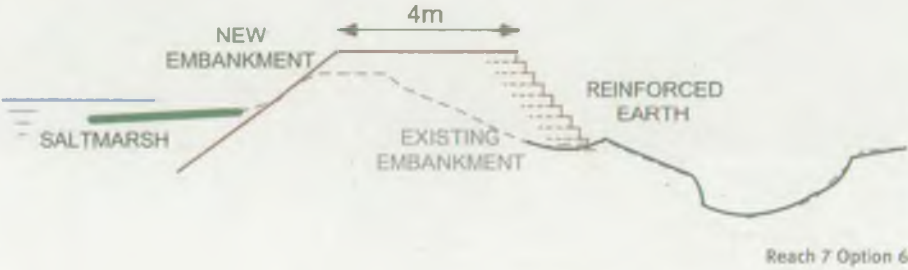
Option 5: Construct a concrete flood wall along the existing embankment. This would be similar in form and level to the concrete wall along Reach 8. It is likely that this option would require reconstruction of the embankment in order to support the concrete wall.



Reach 7 Option 5

An access corridor would be constructed along the rear of the embankment. Access would be via a series of ramps and steps from the land to the rear.

Option 6: An earth embankment featuring sections with a near vertical rear face. The embankment from option 3 would be constructed along the majority of the reach. However, in areas where there is limited space, such as next to the car park, the rear face would be a structure with a near vertical face. This could be achieved by using reinforced earth (as shown).



Reach 7 Option 6

Constraints

- This reach is within the Adur Estuary SSSI, with a high population of reptiles present.
- There are five World War II pillbox structures of varying condition along the rear of the embankment.
- This area is visible from the South Downs AONB, so visual impacts of the proposed defences need to be minimised.
- Maintain access along public footpath.

Opportunities

- There is the potential to move the line of the defence landward in the north of the reach, which could create additional ecological habitat and visual diversity in addition to reducing loss of saltmarsh.
- Improvement of the condition of the footpath linking the airport and the town.
- Provision of a cycleway along the crest of the embankment, possibly connecting to the West Sussex County Council Coastal Link.
- There is some local aspiration for a road link between the A259 and the A27.



Potential realignment of defences. Aerial imagery is copyright of Getmapping plc, all rights reserved

Reach 8 - Old Toll Bridge to A27 flyover



Reach 8 Overview
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Existing defences

Flood defence is provided by a number of concrete flood walls and a floodgate.

Flood risk

Based on existing levels, the risk of a flood occurring is less than 1 in 500 years.



Reach 8 Existing defences

Issues

The existing defences were constructed in 1996, with a 40 year design life. The majority of the defences provide an adequate level of protection throughout the 100 year appraisal period. However, there is a lower point at the ramp on the western approach to the Old Toll Bridge.

Options for consideration

Option 3: Local future raising (ramp) and refurbishment works, to be implemented at the end of the design life of the current defence defences.

Constraints

- Minimise disruption to SSSI.
- Works should not prevent access to the Old Toll Bridge.
- Future site use may require a different approach to flood risk management.

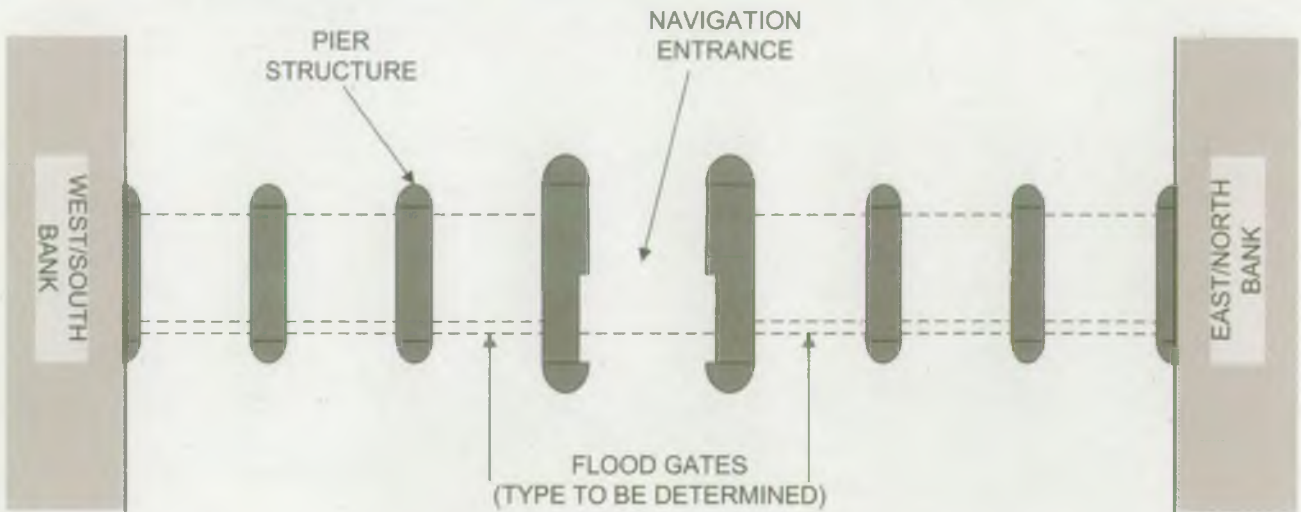
Flood barrier option



Potential locations for barrier structure

The final option being considered is a flood barrier. This would involve a number of flood gates across the estuary, which would remain open under normal conditions, allowing the tide to ebb and flow as usual. The gates would be closed when a flood warning was issued in advance of a storm (only in severe storms, not normal storms). Navigation access would be provided. The closed gates would then prevent the storm surge from flowing up the river and causing flooding. This option offers the potential to reduce tidal flood risk on both the west and east banks of the estuary. The barrier would operate in a similar manner to the Thames Barrier.

Works to the defences along the riverside would still be required. We must ensure that the riverside defences are strong enough to cope with the volume of river flow that may build up behind the barrier when the gates are closed at times of high river flow. Additionally, some of the defences may only last another 10 or 15 years, and so would require refurbishment or reconstruction in any case. This is particularly true of Reach 5, where the land to the rear is very low and a failure of the defence is likely to cause significant flooding.



Outline plan view of barrier structure, shown in Location 1

As the barrier would only be closed in severe storms, improvement works along the riverbanks may be required to make sure that the defences along the river provide adequate protection against flooding during the less severe storms when the barrier would remain open. The appraisal of the barrier option will weigh up the costs of limiting these wall improvements against the costs of increased operation of the barrier for lower event storms.

Constraints

- Longer planning and design required including the need for additional legislative powers.
- Potential impacts upon river flow in the estuary caused by the gate support structures, which could change sediment transport. This could affect habitats.
- Additional land ownership issues related to the bed of the estuary.
- Need to allow for navigation in estuary for port operations, leisure craft and replacement houseboats.
- May require additional works upstream of the study area to create flood storage areas to cope with high river flows while the gates are closed.

Opportunities

- A bridge could be incorporated into the structure, improving access between the east and west banks.

Appraisal of Options

All of the options presented in this document will be subject to appraisal on economic, environmental and sustainability factors, including the Do nothing and Do minimum options.

Examples of other flood barriers



Hartel Flood Barrier, Netherlands (Source: www.deltawerken.com)



Thames Flood Barrier, London

Notes

Notes

Have your say

We will be holding a public exhibition in Spring 2006 where members of our project team will be available to hear your feedback on the options in this document and discuss issues of concern that you may have.

If you want to provide feedback, please complete one of the forms at the exhibition or if you cannot come to the exhibition please contact our consultation manager:-

Terry Oakes Associates
PO Box 186
Lowestoft
Suffolk
NR33 0WY
Fax: 0871 243 8795
Email: consult@terryoakes.com.

Next Steps

After the exhibition, we will gather together all the feedback that we have received and use it in our detailed assessment of the options. This will be combined with the results of flood modelling, environmental appraisal and an assessment of the costs and benefits of each of the options to narrow down the wide range of options that we have, arriving at the selection of the 'preferred option' for each reach, which together will form the 'preferred scheme'. We will then produce another consultation document explaining how the preferred scheme was derived and hold another exhibition to let you know what is proposed for the management of tidal flood risk in this area for the next 100 years.

We will then produce a project appraisal report and environmental statement to attract national funding for the preferred scheme.

Once the preferred scheme is approved, the detailed design and applications for consents and licences will be undertaken.

**Would you like to find out more about us,
or about your environment?**

Then call us on

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