

Coastal Defence Strategy: Rivers Arun to Adur

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Executive Summary

Extract from Consultation Draft

The following is a much abridged edition of the document. Some context may have been lost in the editing and it is therefore strongly suggested that the full consultation document (PDF) is downloaded.

Introduction

The Strategy was commissioned by a consortium of four authorities:

Environment Agency (EA)

Arun District Council (ADC)

Worthing Borough Council (WBC)

Adur District Council (AdDC)

It was prepared by Scott Wilson Kirkpatrick Ltd. of Basingstoke, in association with ABP Research & Consultancy Ltd. and Risk & Policy Analysts Ltd.

Objectives

The development of the Strategy was managed by a project group which included EA, ADC and WBC plus representatives of English Nature and MAFF. There was also a Steering Committee consisting of other bodies with expertise or interest in the study area.

The project was financed through contributions from the EA, ADC and WBC, and also receives grant from the Ministry of Agriculture, Fisheries and Food (MAFF) and funding from West Sussex County Council.

The purpose of the Strategy study was to establish a sustainable policy for the management of coastal defences between the Rivers Arun and Adur over the next 50 years.

The Strategy covers the coastal defences between the River Arun and the River Adur. This extent has been chosen as it forms a discrete unit in terms of sediment processes and flood risk areas.

Strategies are planned for the adjacent coastlines to the east and west which have been identified as Pagham to the River Arun and River Adur to Brighton Marina. Both strategies are due to commence in 2000.

The Strategy has been prepared in accordance with MAFF guidelines on Strategy Planning and Appraisal (MAFF, 1997). It is not a statutory document, but it will set the coastal defence policy to be implemented along this coast. It will also inform the Statutory planning system.

In order to ensure that the whole-life cost of options has been taken into account, the Strategy considers a 50 year period. Within this, a 5 year programme of priority works has been proposed.

This Strategy reviews the recommendations in the Shoreline Management Plan (SMP) for Selsey Bill to Beachy Head (South Down Coastal Group, 1997) which is a higher level plan, setting objectives for coastal defence Management Units within the Strategy area. This Strategy is consistent with those objectives.

Background

The coast between Littlehampton and Shoreham consists of a wide sandy lower beach and a narrower shingle upper beach. Much of the coast is protected by groynes, mostly timber, but with some recently constructed in rock. There are concrete seawalls or rock revetments, and along a considerable part of the frontage the shingle beach is backed by an earthen bund, often incorporated in a promenade. Generally, the shingle beach provides the principal coastal defence.

There are a number of areas below predicted high water level, which would flood in the event of a breach of the defences, and other higher areas which cannot be inundated but which could be subject to gradual coastal erosion. Almost all of the coastal strip is densely developed with residential properties and with significant industrial and commercial developments. The majority of the coast is also important for recreation and amenity.

The management of the coastal defences along the frontage is divided between three authorities:

- The frontage between Littlehampton and Ferring is managed by Arun D.C. under its permissive powers as the Coast Protection Authority given by the Coast Protection Act 1949.
- The whole Worthing frontage is managed by Worthing Borough Council under its permissive powers as the Coast Protection Authority given by the Coast Protection Act 1949. The Council also maintain, as landowner, the coastline between Sea Lane, Ferring and the western Borough Boundary (approx. 250m).
- Whilst the Coast Protection Authority for the frontage between Western Road, Lancing and Shoreham Harbour is Adur D.C., it is managed by the Environment Agency, as is a short length of coast at Ferring Rife, under its permissive power given in the Water Resources Act 1991.

Shoreham Port Authority (SPA) has jurisdiction over a 250 m length of coast immediately adjacent to the western breakwater, and Littlehampton Harbour Board (LHB) has rights over a 500m length of coast immediately to the east of the Pier at Littlehampton. The Environment Agency are responsible for the majority of the river defences, with the rest the responsibility of the LHB and SPA or private owners. The Agency has a supervisory duty over all flood defences given under the Environment Act 1995. This Strategy has been developed using an allowance for relative sea level rise of 6mm/year in accordance with MAFF guidelines. Studies of coastal processes have been undertaken as part of this Strategy. These have included waves, water levels, river levels, currents and sediment transport. The main conclusions from these studies are that:

- Over the past 25 years the beach at Shoreham West Beach has increased by 166,000 m³
- Elsewhere there has been little significant change and volumes are stable
- The groyne systems maintained by the authorities are effective in controlling littoral drift to maintain beaches in a reasonably stable condition.
- Longshore transport increases along the frontage from Littlehampton, peaks at Worthing (c. 40,000 m³/year). and then decreases towards Shoreham. Shoreham breakwater acts as a complete barrier to shingle transport, in contrast to Littlehampton, where most of the material passes the training wall.
- An open beach policy is not sustainable
- Interrupting littoral drift at Littlehampton would result in erosion of 1-2m per year on beaches to the east.
- The coastline would not be severely affected by likely changes in wave climate arising from climate change
- Dredging of the entrance to the River Arun would have little direct effect on the coastline. (However, it is possible that the dredged area would be filled with sediment which would otherwise have passed onto the beaches downdrift)

Existing Defences

Over the last 10 years Arun DC, Worthing BC and the Environment Agency have implemented a policy of maintaining existing defences, and making improvements where these are shown to be necessary and viable.

There have been approximately 50 mostly minor, reported flood incidents since 1983. There are areas where the ground level is below 4m ODN. In the event of flood water overtopping or breaching the defences, these areas would be at risk of inundation. The area at risk depends on the severity of a storm. In addition to breaching, flooding can occur due to overtopping of defences, but is likely to affect only the most seaward line of properties along the coast.

The entire coastal frontage has been divided into 20 sections, each with similar characteristics in terms of existing defences. Apart from 2 sections, the whole of the coast is managed, and littoral drift is controlled by groynes, either timber or rock. The exceptions are sections 2 (Littlehampton golf course to east green car park) and 20 (Shoreham West Beach) where the beach is naturally stable and groynes are not required.

Most groynes have a residual life of 10-15 years if properly maintained. There are exceptions, such as at Worthing Pier and localised areas elsewhere, where the residual life is much less.

River frontages - Given a reasonable level of maintenance, the residual life of all defences has been estimated at 50 years.

The failure of either the training wall to the west of the river entrance or the West Pier would have a major adverse impact on the river, in terms of both navigation and upstream flooding, but rather less of an impact on coastal defences and beaches.

SPA have a number of development proposals under consideration. Because the existing breakwater is effectively a complete barrier to shingle transport, none of the development proposals have significance for coastal defences to the west.

Shoreham Airport have proposed a scheme to improve protection to their defences on the River Adur. It is understood that the scheme involves raising defence levels on line, which is one of the options considered in this Strategy.

Summary of the Problem

- The existing standard of defences is generally lower than the MAFF indicative standard of protection against events up to 1 in 200 years.
- The residual life of key defence elements - principally timber groynes - is much less than the 50 year period of the Strategy.
- Without provision of coastal defences the coastline will be subject to both erosion and flooding.

- Predictions for sea level rise indicate that coastal defences will be subject to increasingly onerous conditions.
- The Strategy needs to address both river and coastal processes, and determination of flood defence policy on the tidal river lengths must be integrated with policy on the open coast.
- There are no critically deficient areas where emergency works are required.

Overview of Management Options

The preferred Strategy has been determined by consideration of technical, economic and environmental issues.

- The entire study coastline has been categorised into 'Operational Management Units', within which there will be common objectives and approaches
- A short list of potentially viable and acceptable options has been produced for each operational management unit along the coast.
- The options on the shortlist have been reviewed in the Strategic Environmental Assessment

The economic analysis has been undertaken in accordance with MAFF requirements, which are set out in Project Appraisal Guidance Note (PAGN). A full range of options being evaluated in addition to alternative methods of implementing these options. The full list included managed realignment, emergency works only, an open beach, sea walls and breakwaters

The SMP recommends 'hold the line' for all Management Units within the Strategy area. It qualifies this by noting that it may be appropriate in the longer term to consider managed realignment treat at some locations where there is a greensward between the beach and developed areas.

In determining the preferred Strategy, particular consideration has been given to the standards of service that are appropriate for individual scheme lengths, based on the assets at risk.

In order to achieve the objective, the coastline has been split into a number of 'Operational Management Units', or OMU's. The aim of this is to address the specific requirements of different lengths of the coast whilst still retaining a Strategic level of planning.

OMU	Location	From:	To:
1	River Arun	Ford railway bridge	Littlehampton, east pier
2	Littlehampton	Littlehampton, east pier	Sea Lane, Rustington
3	Rustington	Sea Lane, Rustington	Sea Lane Goring (excl. Ferring Rife)
4	Ferring Rife	Ferring Rife outfall	
5	Marine Crescent	Sea Lane, Goring	George V Avenue, Goring
6	West Worthing	George V Avenue	Brooklands, Seamiill Park Avenue
7	Brooklands-Shoreham	Brooklands, Seamiill Park Avenue	Shoreham West Breakwater
8	River Adur	Shoreham West Breakwater	Shoreham by-pass(A27)

These boundaries have been selected based on coastal processes.

Environmental Assessment

A Strategic Environmental Assessment (SEA) has been undertaken as part of the Strategy. It provides an environmental overview at a strategic level to ensure that:

- the objectives and policies of relevant plans and other strategies which cover the study area are taken into account,
- the environmental interests and issues in the study area are identified and understood
- the views of consultees are taken into account
- identify objectives and criteria for option selection
- identify key issues, impacts and mitigation associated with potential options
- identifying the need for future detailed environmental studies
- identify the environmental assessment which is likely to be required for each scheme or project

The SEA process has involved:

- a review of all environmental data, policies and plans;
- preliminary consultation with statutory consultees and key stakeholders;
- visits to the study area to review issues in the field;
- close liaison during development of engineering options to ensure that they take account of the environmental issues and objectives of various policies.
- analysis and evaluation of the options in relation to their impact on environmental interests in the area and their integration with regional and local policy strategic plans.

The SEA found that all of the preferred options were acceptable, insofar as there were no adverse impacts which could not be successfully mitigated by appropriate measures. The SEA also sets out objectives for environmental enhancement.

Economics

The economic appraisal has been undertaken in line with current MAFF and Treasury guidance. The economic appraisal considers the value of a project or development in terms of its value to the nation as a whole.

An option is considered to be 'justified' if the benefits outweigh the costs. Benefits are the damages avoided by implementing the option.

The assets within the study area between the rivers Arun to Adur consist mainly of domestic properties with some industrial/commercial properties in built-up areas.

Agricultural land is only affected north of the road bridge on the Arun.

Care has been taken to eliminate double counting, with focus on the different types of damage that may result within an OMU.

Implementation Plan

1. Defences will be maintained throughout the Strategy - this is consistent with the 'Hold the Line' recommendations in the SMP. No erosion of assets will be allowed.
2. Throughout the Strategy area it is envisaged that the coast will be managed through the use of groynes, similar to those already in place.
3. The Strategy has been developed on the premise that shingle accumulating at Shoreham would naturally have passed onto the beaches of Shoreham Port Authority (SPA).
4. Maintaining the controlled passage of shingle across the entrance to the Arun is essential to its sustainability. It is recommended that any material extracted from the channel is used beneficially to nourish the beaches.
5. There are five areas which can breach, with a serious risk of flooding : the Arun east bank, Ferring Rife, Marine Crescent, Brooklands to Shoreham, Adur west bank. Within the Strategy the preferred option for each area is to improve these existing defences

6. The current predicted sea level rise is 0.3m over the next 50 years. Of the five areas noted above, the three areas on the coast will be protected against this by increasing the beach height gradually over the same period. The two river areas will be protected by additional raising of defences after 25 years.
7. With the exception of Rustington-Goring all areas will be protected against erosion and overtopping by continued maintenance and construction of improved defences once existing defences reach the end of their useful life. At Rustington-Goring the existing defences will be maintained but not improved. The case for investing in modifications will be reviewed after 5 years.

(Sea level rise will be countered by raising the beach height.)

Proposed works for each Operational Management Unit

OMU	Location	Benefit Frontage	Preferred OptionDescription
1	River Arun	1	Phased improveRaise banks
1		2	Phased improveRaise walls
2	Littlehampton-Rustington	3	Improve-deferGroynes plus beach nourishment
2		4	Improve-deferGroynes plus beach nourishment
3	Rustington-Goring	5a	MaintainMaintenance only
4	Ferring Rife	5b	ImproveRevetment
5	Marine Crescent	6	Improve-deferGroynes plus beach nourishment plus cut-off wall
6	West Worthing	7-8	Improve-deferGroynes plus beach nourishment
7	Brooklands-Shoreham	9-12	ImproveGroynes plus beach nourishment
8	River Adur	13	Phased improveRaise banks and wall

Proposed standards of protection for each OMU.

OMU	Benefit Frontage	Protection from Flooding due to Overtopping	Protection from Flooding due to Breaching
1	1	NA	in excess of 1 in 100 years
1	2	in excess of 1 in 100 years	in excess of 1 in 100 years
2	3	1 in 100 years	NA
2	4	1 in 100 years	NA
3	5a	1 in 50 years	NA
4	5b	NA	1 in 200 years
5	6	1 in 100 years	1 in 200 years

6	7-8	1 in 100 years	NA
7	9-12	1 in 100 years	1 in 200 years
8	13	1 in 100 years	1 in 100 years

It can be seen that the standards of protection for both overtopping and breaching meet the MAFF indicative standards with the exception of the overtopping standard along OMU 3 which only can be justified to a 1 in 50 year standard of defence.

Results of economic analysis

Overall Cost Benefit Analysis for the frontage as a whole.

OMU	Benefit Frontage	Benefits (£m)	Cost (£m)	NPV (£m)	B/C
1	1	1.20	0.22	0.98	5.49
1/2	2 and 3	16.84	1.18	15.67	14.27
2	4	5.89	2.11	3.78	2.79
3	5a	6.97	3.62	3.35	1.93
4	5b (Ferring Rife only)	18.86	1.33	17.52	14.15
5	6	6.41	1.72	4.69	3.73
6	7-8	47.20	7.48	39.72	6.31
7	9-12	88.47	13.12	75.35	6.74
8	13	3.42	0.82	2.60	4.19
	Total for frontage	195.26	31.60	163.66	6.18

Emergency Works

No defects have been identified within the study area such that emergency works are required.

Capital Works Programme

Major works unconstrained by funding issues have been programmed for year 2-3, i.e. 2001-2003. This gives sufficient time for consultations, approvals, further studies, detailed design and procurement. Given the consequences of failure, it is recommended that priority is given to those areas which are at risk of catastrophic flooding. For the frontages where breaching cannot occur priority will be given to areas with the least residual life.

Within the first 5 years improvements to the Worthing frontage are required to those areas where the residual life of the structures is below 5 years. Elsewhere on this frontage only minor works are necessary.

Provisional programme for the implementation of the Strategy

Frontage	Priority scoring	Major works in years 2-3	Major works after years 2-3
1 - Arun east bank between Ford railway bridge and A259 road bridge	24	Yes - year 3 to allow for other studies to be completed	Yes - year 25, additional raising
2 - Arun east bank between A259 road bridge and Pier	28	Yes - year 3 to allow for other studies to be completed	Yes - year 25, additional raising

3 - Littlehampton East Pier to the Green	16	No	Yes - groyne renewal after year 10
4 - The Green to Rustington	18	No	Yes - groyne renewal after year 10
5 - Rustington to Sea Lane Goring	6	No	Yes - groyne renewal after year 10
5a - Ferring Rife	22	Yes - revetment	Yes - groyne renewal
6 - Marine Crescent	22	Yes (cut-off wall)	Yes - groyne renewal after year 10
7-8 - Worthing	28	Yes - phase 1 (pier area)	Yes - remaining phases to complete frontage
9-12 - Brooklands to Shoreham West Beach	22	Yes - phases 1 and 2 (entire frontage)	No
13 - Adur west bank from Pier to A27 flyover	20	Yes-year 3 to allow for other studies to be completed	Yes - year 25, additional raising

A more detailed breakdown of expenditure is given in the full document.

In approving grant aid for projects, MAFF prioritise projects using a scoring system. There may be a delay in implementation for capital projects scoring less than about 22 points.

Strategy Management

In the past, the three authorities managing the coast within the Strategy area have implemented their programmes of works separately, albeit with liaison to ensure that no adverse impact have occurred to a neighbour's frontage.

With the development of this Strategy there is an opportunity to bring together implementation as a single programme.

The three authorities have proposed the following arrangement:

- A steering group made up of the sponsoring authorities will manage the Strategy. These authorities will arrange for the recommendations of the Strategy to be adopted by each of the authorities in a statement to the effect that will be authorised by the Chief Executive (or equivalent) of each authority.
- The future management of the Strategy will be carried out in joint partnership of the three sponsoring authorities and they will meet biannually to discuss implementation of the works schedules in the Strategy.

The group will review and report to the authorities on the progress of the implementation and further view the Strategy in 2004.