Strategy Appraisal Report

Authority Scheme Reference	IMSO000556
Defra / WAG LDW Number	
Promoting Authority	Environment Agency – Southern Region
Strategy Name	Portchester Castle to Emsworth Coastal Flood and Erosion Risk Management Strategy

Flooding at the southern end of Langstone High Street, January 1995

Date	Sept 2012
Version	0.4

StAR for *Portchester Castle to Emsworth Coastal Flood and Erosion Risk Management Strategy*

Version	Status	Signed off by	Date signed	Date issued
0.1	First LPRG submission	RT	27-7-2011	27-7-2011
0.2	Re-submitted following LPRG review	SK	23-1-2012	23-1-2012
0.3	For Approval	RT	10-7-2012	10-7-2012
0.4	For Cabinet and EA Approval	RT	28-9-2012	28-9-2012

CONTENTS

TABLES

APPENDICES

For Technical Approval

Environment Agency Region: **South East**
Project name: **Portchester Castle to Emsworth Coastal Flood and Erosion Risk Management Strategy**

Approval Value: **£ 113 million**

Sponsoring Director: **David Jordan (Director of Operations)**

Financial Scheme of Delegation

The Non Financial Scheme of Delegation states that, for Flood and Coastal Erosion Risk Management Strategies, Director of Operations approval is required.

Approval Route

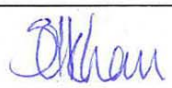
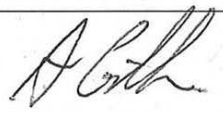
Local Coastal Authorities:

- Fareham Borough Council
- Portsmouth City Council
- Havant Borough Council
- Chichester District Council

Environment Agency:

National Capital Programme Manager	Miles Jordan
Area Flood and Coastal Risk Manager	Andrew Gilham
Large Projects Review Group	Ken Allison
Regional Director	Howard Davidson
Director of Operations	David Jordan

Approval History Sheet

APPROVAL HISTORY SHEET (AHS)			
1. Submission for review (to be completed by team)			
Project Title: Portchester Castle to Emsworth Coastal Flood and Erosion Risk Management Strategy		**Project Code:** IMSO000556	
Project Manager: Richard Townson		**Date of Submission:**	
Lead Authority: Environment Agency		**Version No:**	
Consultant Project Manager: Adam Schofield		**Consultant:** Halcrow Group Ltd	
The following confirm that the documentation is ready for submission to PAB or LPRG. The Project Executive has ensured that relevant parties have been consulted in the production of this submission.			
Position	**Name**	**Signature**	**Date**
Project Executive	Samina Khan		27/7/11
	Job Title:	ncpms, Team Leader (South East)	
Project Sponsor	Andrew Gilham		27/7/11
	Job Title:	Solent and South Downs Area Flood & Coastal Risk Manager	
NEAS Operations Manager			28/7/11
2. Review by: Large Project Review Group (LPRG)			
Date of Meeting(s):		**Chairman:**	
Recommended for approval: In the sum of £:		**Date:**	**Version No:**
3. Environment Agency FSoD approval *Officers in accordance with the FSoD: Specified Officer; Regional Director; Director of Operations; Chief Executive or Director of Finance: Agency Board*			
Version No:		**Date:**	
Project Approval	**By:** In the sum of: £	**Date:**	
4. Defra or WAG approval *(Delete as appropriate)*			
Submitted to Defra		**Date:**	
Version No. (if different):			
Defra Approval:		**Date:**	
Comments:			

NON FINANCIAL SCHEME OF DELEGATION (NFSoD) COVERSHEET FOR A FCRM COMPLEX CHANGE PROJECT / STRATEGIC PLAN

1.	**Project name**	Portchester Castle to Emsworth Coastal Flood and Erosion Risk Management Strategy			**Start date**	2005/2006
					End date	2011
	Business unit	South East, FCRM		**Programme**	FDGiA (Capital)	
	Project ref.	IMSO000556	**Regional SoD ref.**	F/1213/1116	**Head Office SoD ref.**	-

2.	**Role**	**Name**	**Post Title**
	Project Sponsor	Andrew Gilham	Area Flood & Coastal Risk Manager
	Project Executive	Samina Khan	ncpms Project Team Manager
	Project Manager	Richard Townson	ncpms Project Manager

3.	**Outline Risk Assessment (ORA) Category**	**Low** ☐	**Medium** ☐	**High** ☒

4.	**NFSoD value**	**£k**
	Whole Life Costs (WLC) of Complex Change Project / Strategic Plan	~~114,000~~ 113,000 RS, 22/10/12

5.	**Required level of Environmental Impact Assessment (EIA)**	**N/A** ☐	**Low** ☐	**Medium** ☐	**High** ☒

6.	**NFSoD approver name**	**Post title**	**Signature**	**Date**
	David Jordan	Director of Operations		1/7/13
	Howard Davidson	Regional Director		21/10/12
	NFSoD consultee name	**Post title**	**Signature**	**Date**
	Ken Allison	LPRG Chair		22/10/12
	Miles Jordan	Head of ncpms		21/7/11
	Andrew Gilham	Area Flood & Coastal Risk Manager		27/7/11

1 Executive Summary

1.1 Purpose of this Report

1.1.1 The report presents a strategy for managing coastal flood and erosion risk for the 27km coastal frontage between Portchester Castle and Emsworth (Hampshire). The frontages cover four Local Authorities; Fareham Borough Council, Portsmouth City Council, Havant Borough Council and Chichester District Council.

1.1.2 The Strategy area covers the northern boundaries of Portsmouth Harbour, Langstone Harbour and Chichester Harbour. The harbours are environmentally designated and are an important part of the Solent-wide network of habitat sites. Chichester Harbour is an Area of Outstanding Natural Beauty (AONB). The frontages are not exposed to severe wave action due to the sheltered nature of the harbours. Refer to the Key Plan.

1.1.3 This Strategy has been progressed in parallel with the review of the North Solent Shoreline Management Plan (SMP). This process has enabled the strategy preferred options and SMP policies to be consistent.

1.1.4 The objective of this strategy is to recommend coastal flood and erosion risk management options that :

a) reduce risk to life.

b) protect property (commercial and residential) and existing infrastructure.

c) protect and enhance biodiversity, cultural heritage and landscape.

d) inform local communities of their current risk of flooding, the choices they have and the financial support they can expect from Government when deciding on local priorities.

1.2 Problem

1.2.1 The 27km frontage is managed by a range of operating authorities and private landowners. A consistent, strategic approach is required to manage the coastal flood and erosion risk. A visual condition survey has indicated that many of the existing defences are in poor condition (some with residual life of 10 years), and the resulting protection offered by the defences is variable. The communities at Portchester, Paulsgrove, Langstone and Emsworth are at very significant risk, with greater than 5% annual exceedance probability (aep) of flooding by overtopping of defences.

1.2.2 Portsmouth, Havant, Fareham and Gosport councils have a combined East Solent Coastal Partnership team, who also work very closely with Chichester council. The recommended schemes can be implemented by an individual authority now that we have considered the wider strategic impacts and issues. The Environment Agency will assist Local Authorities through the FDGiA application process and ongoing links established through the coastal teams and the Regional Flood and Coastal Committee.

1.2.3 The strategy includes areas of urban development, with 901 residential and 178 commercial properties currently at risk of flooding for a 0.5% annual probability flood event. Also at flood risk are critical infrastructure assets including; the A3023 highway, South Coast Rail line, and a major Southern Water sewage treatment works (Budds Farm) which serves approximately 400,000 people in and around Portsmouth, Havant and surrounding areas.

1.2.4 The designated harbours risk losing saltmarsh due to coastal-squeeze, three landfill sites are at risk of eroding into the harbours and damaging the internationally

protected terrestrial/freshwater habitat and open green-spaces are at risk of flooding. Portchester Castle Scheduled Monument, the M27/A27 transport infrastructure and 102 properties in Emsworth are at risk from erosion over the next 100 years. The South East River Basin Management Plan has identified possible mitigation measures along the coast to help achieve the objectives of the Water Framework Directive (WFD).

1.2.5 Farlington Marshes is an area of high conservation value, designated as a Special Protection Area (SPA), Ramsar site, Site of Special Scientific Interest (SSSI) and a Local Nature Reserve. It covers an area of 121 hectares. The statutory authorities are currently unable to determine the least-damaging environmental option without further work to evaluate the specific compensation requirements of holding the line or realigning the coastal defences. In addition to the wildlife interest, Farlington Marshes provide an important amenity asset, providing one of the two significant public open spaces for the city of Portsmouth.

1.2.6 Rising sea levels in combination with holding the defence line is leading to coastal squeeze, causing loss of internationally protected coastal habitats within the Solent. The harbours are heavily modified water bodies, however there are few opportunities to realign the defences to replace these losses locally given the high density of urban areas, major infrastructure, contaminated land, defence estates or internationally protected freshwater habitats. The Medmerry Managed Realignment Project, east of Chichester Harbour, is providing the inter-tidal compensatory habitat for the Strategies and Schemes in the North Solent SMP, in coordination with the Regional Habitat Creation Programme.

1.2.7 There are three landfill sites with defences at risk of failure from erosion. To comply with the Habitat Regulations there is a requirement to prevent pollution of the surrounding designated sites.

1.3 Options Considered

1.3.1 The strategy frontage has been divided into seven discrete reaches using natural flood risk area boundaries. A list of options for each reach has been considered. These include Do Nothing, Do Minimum, Maintain, Sustain, various Improve options and Managed Realignment where appropriate.

1.4 Preferred Options

1.4.1 The preferred option for each reach was selected in accordance with FCERM-AG, ensuring strategic compatibility with neighbouring reaches and coastal processes.

1.4.2 The key benefits of delivering the preferred options are:

a) Reduced flood risk to 901 residential and 178 commercial properties for 2020, increasing to 4,257 residential and 433 commercial properties by 2110

b) Reduced flood risk from typically 5% (1 in 20) to 1.33% (1 in 75) aep, sustained for 100 years.

c) Improved flood risk and erosion protection to M27, A3(M), the South Coast Rail Link, 102 properties in Emsworth at both erosion risk and flood risk over the next 100 years and other key infrastructure such as landfill sites and the Budds Farm wastewater treatment works.

d) Improved flood risk protection for numerous heritage and recreation sites and features such as Portchester Castle.

e) Farlington Marshes, South Moor, Warblington and Conigar Point - maintain existing defences for the next 20 years. This will provide sufficient time to develop the long-term management options for the sites and establish

compensatory habitat as required. Selection of a preferred long-term option requires further detailed studies to be completed over the next 3-5 years to confirm the optimum balance of habitat requirements across the estuary to support the designated features and species, and plan to establish any compensatory habitat. This work will inform the next SMP and Strategy review in approximately 10 years' time.

1.5 Environmental and Social Considerations

1.5.1 The Strategy area supports large areas of coastal habitats designated within the Natura 2000 network. A Strategic Environmental Assessment (SEA) has been prepared to inform the selection of the preferred options.

1.5.2 Our Habitat Regulations Assessment concludes that the preferred 'hold the line' options are likely to have an adverse effect on the integrity of the European Sites, but that they also represent the least damaging environmental solutions for the area given the economic, social and environmental constraints. It has been demonstrated that there are no alternatives to the preferred solutions where adverse effect is concluded, and that there are imperative reasons of overriding public interest (and public safety) for the schemes to be progressed. An Appendix 20 (statement of case) has been accepted by Defra.

1.5.3 Consultation has been undertaken throughout the preparation of this Strategy, including three public exhibitions at Portchester, Langstone and Emsworth. The risk of flooding was described and resistance & resilience measures were promoted. The need to explore additional sources of funding was explained. Feedback has been positive with support for the improve options presented.

1.6 Risks

1.6.1 The key risks with the implementation of the strategy are identified in Table 1.1

Table 1.1 Risk and mitigation

Risk	Key Mitigation
1. Funding from central FDGiA for some reaches is uncertain due to the relatively low Outcome Measure scores. **Risk = High**	Additional sources of funding will need to be investigated including levy funding and partnership funding if the preferred options for these frontages are going to be progressed in the short term. . **Residual risk = Medium**
2. Provision of suitable compensatory habitat in advance of strategy improvement options at Portchester and other reaches. **Risk = High**	The Region Habitat Creation Programme is delivering the compensatory habitat requirements identified in this strategy. Funding for the creation of the compensatory habitat has been identified as part of the cost of the preferred options where appropriate. **Residual risk = Medium**
3. Major storm event could occur before implementation, leading to additional costs or change in option. **Risk = Medium**	Aim to implement strategy as soon as funding availability is confirmed. Undertake further detailed study at Farlington Marshes to identify best long-term management of habitat across site and impacts on wider estuary. Continue stakeholder engagement. **Residual risk = medium**

1.7 Implementation

1.7.1 The implementation cost of the preferred options for the next 10 years is presented in Table 1.2 below.

Table 1.2 Project Costs (£k)

Item	Reach 1 Portchester Castle to Paulsgrove	Reach 2 Horsea Island	Reach 3 M27 & Farlington Marshes (FM)	Reach 4 Brock-hampton Quay	Reach 5 Langstone & South Moor (SM)	Reach 6 Warbl'ton & Conigar Point	Reach 7 Emsworth	Total
Preferred Option	Improve 1.33% (1 in 75)	Maintain	M27: Sustain (<0.1%) FM: Maintain for 20 years (20%)	Sustain Yr 10, 1% (1 in 100)	Improve yr 10, 1.33% (1 in 75)	Maintain for 20 years (20%)	Improve Yr 10, 1.33% (1 in 75)	
Responsible Authority	EA / FBC	PCC / MoD /	HA / PCC / EA	HBC / SW	EA / HBC	EA / HBC	EA / HBC / CDC /	
Implementation period (years)	0-5	0-20	0-20	10	10	0-20	10	
Total capital cost including inflation	***8,360***	***0***	***1,810***	***5,660***	***4,860***	***0***	***19,400***	
Whole life cash cost (excluding inflation)	23,900	19,300	14,200*	20,200	6,400	85*	28,900	113,000

EA = Environment Agency, FBC = Fareham Borough Council, PCC = Portsmouth City Council, MoD = Ministry of Defence, HA = Highways Agency, HBC = Havant Borough Council, CDC = Chichester District Council, EH = English Heritage, SW = Southern Water, HCC = Hampshire County Council

* Preferred Option for Farlington Marsh and Warblington & Conigar Point is Maintain for 20 years – Whole life cost stated accordingly.

1.7.2 The Flood and Coastal Resilience Partnership Funding model has been applied to the schemes recommended in this Strategy. Table 1.3 below provides the key Outcome Measure Data and shows the amount of FDGiA available for each Capital Improvement Scheme. Contributions will be required for schemes at Portchester, Langstone and Emsworth, refer to section 1.8 Contribution and Funding.

1.7.3 Existing defences will continue to be maintained (using Revenue Budget) whilst contributions are pursued for the Improvement schemes recommended in this Strategy.

Table 1.3 Flood and Coastal Resilience Partnership Funding: Improvement schemes

	Reach 1 Portchester Castle to Paulsgrove	Reach 3 Farlington & Drayton culverts	Reach 5 Langstone & South Moor	Reach 7 Emsworth
PV Cost (for duration of benefits) £k	7,800	250	3,950	14,500
PV Benefit (for duration of benefits) £k	50,000	1,120	8,430	41,300
Cash Cost of next phase £k	**7,730**	**195**	**2,720**	**9,990**
Duration of Benefits (years)	30	20	50	50
OM2 households better protected against flood risk	359	250	43	194
OM3 households better protected against coastal erosion	0	0	0	0
OM4 statutory environmental obligations met	0	0	0	0
FDGiA contribution	**3,360**	**451**	**563**	**2,650**
OM score (%)	**43**	**180**	**14**	**18**
Contribution required for OM of 100%	**4,440**	**-**	**3,387**	**11,800**

** Reaches 2, 4 & 6 do not require Capital Investment based on Outcome Measures, so have not been presented

1.8 Contribution and Funding

1.8.1 There are a number of different owners and operators of the existing flood defence assets within the strategy frontage. The Partnership for Urban South Hampshire (PUSH) was formed in 2003 and is a partnership of the unitary authorities of Portsmouth and Southampton; Hampshire County Council and district authorities of Eastleigh, East Hampshire, Fareham, Gosport, Havant, Test Valley and Winchester. PUSH in collaboration with local partners and government agencies continue to work to deliver sustainable, economic-led growth and regeneration. PUSH is addressing the funding mechanisms required to manage the short, medium and long-term flood and coastal erosion risks. This includes the use of Community Infrastructure Levies, Local Levies, Developer Contributions and promoting resistance and resilience measures.

1.8.2 Potential contributions have been discussed with developers at Portchester and Drayton (Reaches 1 and 3). We have no formal agreements yet, but there is interest in contributing to these schemes. These are being pursued further by the Environment Agency's Area staff.

1.8.3 The erosion defences at the landfill sites owned by the local authorities (PCC and HBC), will require periodic capital maintenance in addition to revenue repairs. Moderation evidence will apply to comply with the legal requirements to prevent pollution to Natura 2000 sites, and FDGiA funding should therefore be considered.

1.9 Status

1.9.1 The North Solent SMP2 has now been approved. The Portchester Castle to Emsworth Strategy recommends options that match the SMP2 policies, particularly at the environmentally sensitive sites of Farlington, South Moor, Warblington and Conigar Point.

1.9.2 A Water Framework Directive Compliance Statement was completed as part of the strategy appraisal. It concluded that there is a potential to cause a decline in Saltmarsh due to coastal squeeze, however the decline is unlikely to cause deterioration to the waterbodies' status in the short term (0-20 years) as it represents less than 5% reduction in total saltmarsh area within each waterbody. This conclusion is supported by the hydromorphological leads within the Environment Agency.

1.9.3 Natural England have provided a letter of support for the Strategy agreeing with the Habitat Regulations Assessment conclusions. Defra support the Habitat Regulations assessment, which justifies options that have an "adverse effect" on Natura 2000 sites.

1.10 Recommendations

1.10.1 It is recommended that the Portchester Castle to Emsworth Coastal Flood and Erosion Risk Management Strategy is approved under A9 scheme of delegation, at a whole life cost (excluding inflation) of £113m.

1.10.2 Future reviews of the SMP and the Strategy should be timed to incorporate the findings of the studies recommended by the SMP2 Action Plan and this Strategy.

1.10.3 Community-led contributions plans should be developed to secure funding ahead of implementing the individual schemes recommended in this Strategy.

1.10.4 Undertake a Solent-wide study to identify species-specific impacts and mitigation from potential future policies of: Managed Realignment at Farlington Marshes and South Moor, and Do Minimum at Warblington and Conigar.

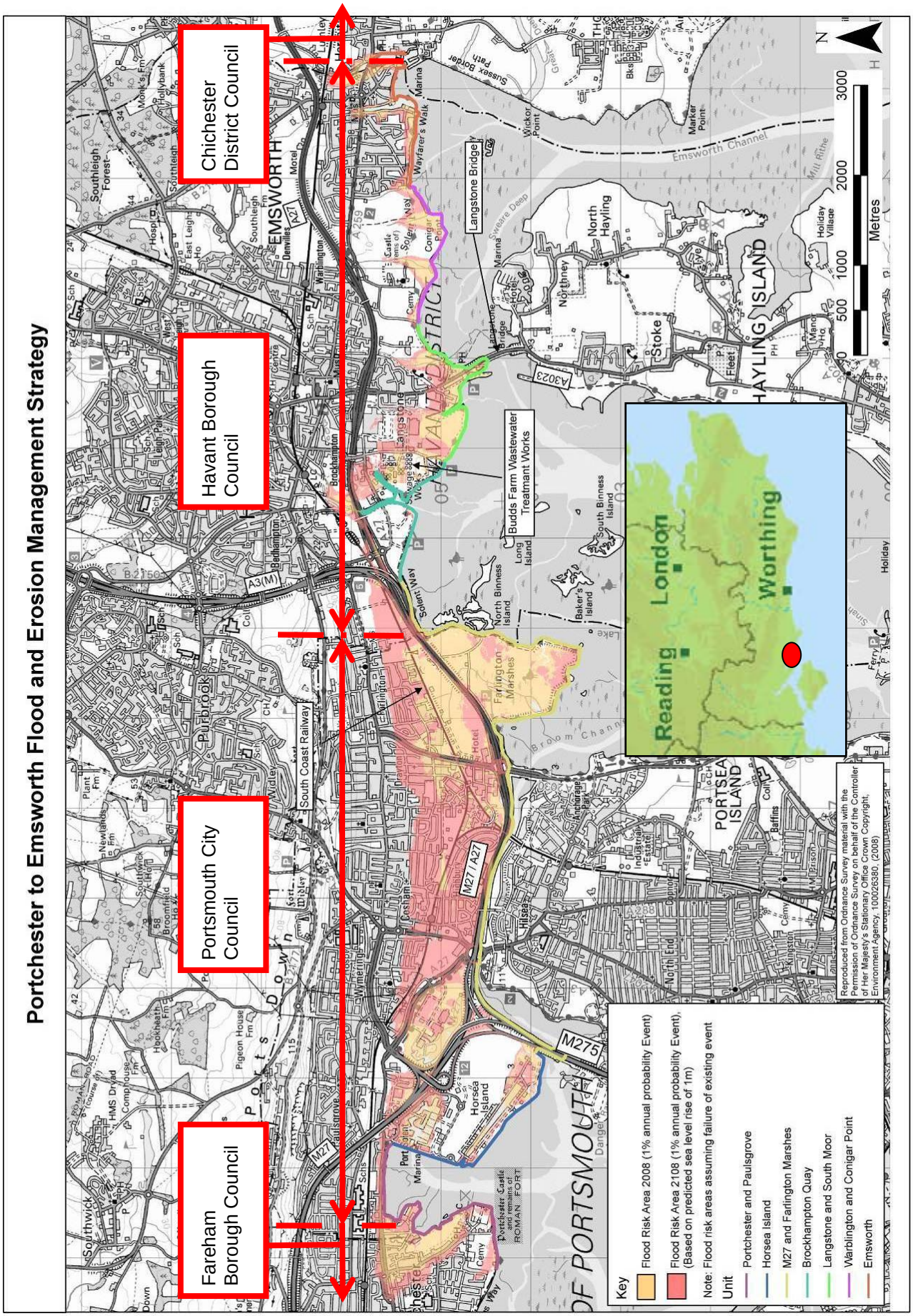
Director's Briefing Paper

Region:	South East			**Project Executive:**	Samina Khan
Function:	Flood Risk Management			**Project Manager:**	Richard Townson
Project Title:	Portchester Castle to Emsworth Coastal Flood and Erosion Risk Management Strategy			**Code:**	IMSO000556
NEECA Consultant:	Halcrow Group Ltd	**NCF Contractor:**	Nuttall	**Cost Consultant:**	n/a
The Problem:	The protection offered by the flood and erosion defences is variable, with a low standard of protection (100% in places) and many parts in poor condition (residual life 10 years). Coastal squeeze is causing loss of internationally protected coastal estuary habitats.				
Assets at risk from flooding and erosion:	901 residential properties, 178 commercial properties, the M27/A27, the South Coast Rail link, 3 landfill sites, Internationally protected freshwater habitat, Portchester Castle Scheduled Monument (Roman Castle).				
Existing standard of flood protection:	Varies: 100% to <0.5% annual probability	**Proposed standard of flood protection:**	Generally 1.33% (1 in 75) annual probability, sustained for 100 years.		
Description of proposed scheme:	The Strategy recommends a range of schemes across the coastal cells as follows: • Maintain, Sustain and Improve existing flood defences to reduce flood risk to urban areas. • Maintain existing defences at Farlington Marshes, South Moor and Warblington to Conigar Point in the short-term. Perform detailed studies to inform the long-term option (managed realignment or sustain). WFD mitigation measures included.				

Costs (PVc): **(100 year life inc. maintenance)**	£44.8m	**Benefits: (PVb)**	£813m	**Ave. B: C ratio: (PVb/PVc)**	18.1
NPV:	£768m	**Incremental B: C ratio:**	n/a	**Whole life cost (cash value):**	£113m

Choice of Preferred Option:	A combination of Improve, Sustain and Maintaining existing defences. Perform detailed studies to assess the potential for managed realignment at some locations.
Total cost for which approval is sought:	**£113m whole life cost (including £43m contingency)**
Delivery programme: **Strategy Programme up to Year 10:**	**Year 1-5:** Farlington & Drayton – local culvert improvement works to reduce tidal flood risk to properties. Farlington Marshes, South Moor, Warblington to Conigar Point – detailed study to assess the impact on high-tide roost sites of potential managed realignment or do minimum options, and determine the necessary compensatory habitat requirements. Portchester Castle to Paulsgrove – Improve 1.33% (1 in 75) aep, external contribution required. **Year 8-10:** Brockhampton Quay – Sustain 1% (1 in 100) aep – prevent landfill site contaminating harbour. Langstone – Improve 1.33% (1 in 75) aep, external contribution required. Emsworth – Improve 1.33% (1 in 75) aep, external contribution required.
Are funds available for the delivery of this project?	See Exec Summary Table 1.2
External approvals:	All maritime councils and Secretary of State for the Environment (Habitat Regulations Assessment concluded adverse effect on Natura 2000 sites).
Defra approval:	Needed for Habitat Regulations Assessment.

Key Plan


Portchester to Emsworth Flood and Erosion Management Strategy
Chichester District Council
Havant Borough Council
Portsmouth City Council
Fareham Borough Council
Budds Farm Wastewater Treatment Works
Langstone Bridge
Emsworth Channel
Farlington Marshes
Portchester Castle and remains of ROMAN FORT
Reading
London
Worthing
Metres
Key
Flood Risk Area 2008 (1% annual probability Event)
Flood Risk Area 2108 (1% annual probability Event), (Based on predicted sea level rise of 1m)
Note: Flood risk areas assuming failure of existing event
Unit
Portchester and Paulsgrove
Horsea Island
M27 and Farlington Marshes
Brockhampton Quay
Langstone and South Moor
Warblington and Conigar Point
Emsworth
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2 Introduction and Background

2.1 Purpose of this Report

2.1.1 This Strategy Appraisal Report (StAR) seeks approval for the Portchester Castle to Emsworth coastal flood and erosion risk management strategy.

2.1.2 This strategy addresses long term flood and coastal erosion risk management issues for the 27km mainland coastline of Portsmouth, Langstone and Chichester Harbours(Key Plan).

2.1.3 The Strategy identifies appropriate management options in the form of a 10-year programme of works within the context of a 100-year overall plan. The Strategy considers the longer-term implications of coastal change, climate change and sea level rise. This strategy enables the Environment Agency, local authorities and interested parties to understand the various technical environmental and financial constraints when making local choices. Following Strategy approval, scheme Project Appraisal Reports (PARs) will be developed in line with the 10-year programme

2.1.4 The appraisal has been undertaken in accordance with the Defra FCDPAG series of documents and the "Supplementary Notes to Operating Authorities", and updated with FCERM-AG.

2.2 Background

Strategic and Legislative Framework

2.2.1 The North Solent Shoreline Management Plan 2011 (SMP2) covers this strategy frontage, and has been developed in parallel with this strategy. Information developed for this strategy has assisted the policy making process for SMP2, which has then been adopted by the strategy.

2.2.2 The preferred policy from SMP2 is generally "Hold the Line" for the whole strategy frontage. However it notes that there are potential "Managed Realignment" opportunities for some Policy Unit frontages, including Farlington Marshes, South Moor, Warblington and Conigar Point. These are identified for potential implementation in Epoch 2 or 3 (Years 20-50 and 50-100), subject to further detailed environmental studies. This Strategy recommends 20-year options for these locations until these studies are completed and are used to inform the next SMP and Strategy review. The South East River Basin Management Plan has identified possible mitigation measures along the coast to help achieve the objectives of the Water Framework Directive (WFD).

2.2.3 Works identified by this Strategy will be implemented using powers under Section 165 of the Water Resources Act 1991 and the Coast Protection Act, 1949. Schemes will be subject to the Town and Country Planning regulations and Land Drainage regulations where required.

Previous Studies

2.2.4 Various coastal defence management strategies and sectoral strategies have been completed or are being developed in the adjacent areas. These studies have been taken into account whilst producing this strategy. These studies include:

- The Portchester Castle to Hoeford Lake Shoreline Defence Strategy (Fareham Borough Council 2005) and the emerging River Hamble to Portchester Coastal Flood and Erosion Risk Management Strategy
- Portsea Island Coastal Strategy (Portsmouth City Council 2010)

2.2.5 There are also various sectoral strategies and studies on Hayling Island including:

- Hayling Island North Appraisal Study (2009, former Sectoral Strategy),
- Eastoke Peninsula Sectoral Strategy (2005),
- Selsmore to Mengham Sectoral Strategy (2001, not approved)

2.2.6 The area is extensively designated for its international ecological importance. The Solent Coastal Habitat Management Plan (CHaMP, English Nature et al, 2003) was developed to provide an overview of potential habitat loss and habitat creation opportunities within the Solent and its neighbouring harbours.

2.2.7 The Solent Dynamic Coastline Project (SDCP, New Forest District Council et al, 2008) was developed to build on the CHaMP and to provide more detailed information for the SMP2. The SDCP project involved detailed quantification of losses and opportunities to enable coordination of coastal habitat management within the Solent across operating authorities and different designated sites. Coastal squeeze losses and potential inter-tidal habitat creation sites identified during the development of this strategy have been confirmed against the SDCP analysis. The Environment Agency's Regional Habitat Creation Programme (RHCP) is taking the lead on providing compensatory habitat and has been informed by the findings of this Strategy.

Social and Political Background

2.2.8 The strategy area (see Key Plan) covers the 27km mainland coastal frontage from Portchester Castle to Emsworth in east Hampshire, extending across four Local Authorities (Fareham Borough Council, Portsmouth City Council, Havant Borough Council and Chichester District Council). Havant, Portsmouth, Fareham and Gosport have formed a Coastal Defence Partnership, with close links to Chichester Coastal team. They have all participated in the preparation of this Coastal Strategy.

Location and Designations

2.2.9 The study area spans the designated Portsmouth, Langstone and Chichester Harbours. The area includes the main population centres of Portchester, Cosham, Drayton, Farlington, Langstone and Emsworth. Portsea Island and Hayling Island are not included as separate strategies or studies are being developed for these areas. The eastern and western limits are bounded by high land which constrain flood risk.

2.2.10 The majority of the coastal frontage is recognised for its international nature conservation value. The sites and designations present in the study area are :

- Solent Maritime Special Area of Conservation (SAC)
- Solent and Isle of Wight Lagoons (SAC);
- Portsmouth Harbour Special Protection Area (SPA) and Ramsar site;
- Chichester and Langstone Harbour (SPA) and Ramsar site.
- Portsmouth Harbour Site of Special Scientific Interest (SSSI);
- Langstone Harbour SSSI;
- Chichester Harbour SSSI;
- Warblington Meadow SSSI;
- The study area also includes Langstone and Emsworth Conservation Areas and numerous Sites of Importance for Nature Conservations (SINC).

2.2.11 The inter-tidal coastline contains many known archaeological sites and locations where items of archaeological interest have been found. The following key historic features can also be found in the study area:

- Portchester Castle Scheduled Monument;
- Langstone Conservation Area (of importance for historic heritage);

- Emsworth Conservation Area (of importance for historic heritage).
- Chichester Harbour Area of Outstanding Natural Beauty (AONB).

History of Flooding and Erosion

2.2.12 Due to existing defences, there has been limited flooding within the strategy frontage. In addition, there have been no significant tidal surge events in recent years. However, the reducing residual life of existing flood defence assets combine with sea level rise will increase the number of property assets at risk of flooding.

2.2.13 During the public exhibitions local members of the public provided photographic evidence of the 1916 flood event at Portchester when many residential properties were flooded. It has not been possible to identify the number of properties and magnitude of the event.

2.2.14 Annual flooding of four residential properties typically occurs along Langstone High Street (photograph on front cover of this report). There are potentially 29 properties at risk for a 20% (1:5) annual exceedance probability (aep) event.

2.2.15 There is overtopping annually causing damage to the base of the walls of Portchester Castle Scheduled Monument. In addition there is an ongoing requirement for annual works to repair sections of the defences surrounding Farlington Marshes in order to prevent tidal inundation of the freshwater habitat.

2.2.16 The M27 highway embankment frontage comprises 5.5km of concrete block revetment. A major repair and refurbishment programme has recently been completed by the Highways Agency.

2.2.17 Overtopping and flooding of the A27 Southampton Road at Paulsgrove typically occurs every 10 years. The most recent recorded incident causing local traffic delays occurred in 1995 when water covered the road, estimated to be a 10% (1:10) to 6.7% (1:15) aep event.

2.2.18 Historic rates of coastal erosion along the strategy frontage have been low due to the low wave energy within the harbours and existing defence structures. However there are three landfill sites with defence structures at risk of erosion. Failure of these structures and release of the landfill material would cause very significant and damaging pollution of the designated estuaries. There are no recorded erosion losses of property in the strategy area.

2.3 Current Approach to Flood and Erosion Risk Management

Measures to Manage the Probability of Flood and Erosion Risk

2.3.1 The flood defences along the frontage have been developed over time by a range of bodies, operating authorities and riparian owners.

2.3.2 Defences are owned and maintained by a range of organisations including English Heritage (EH), Fareham Borough Council (FBC), Environment Agency (EA), Southern Water (SW), Portsmouth City Council (PCC), Ministry of Defence (MoD), Highways Agency (HA), Network Rail (NR), Hampshire and Isle of Wight Wildlife Trust (HWT), Havant Borough Council (HBC), Hampshire County Council (HCC) and private landowners.

2.3.3 As a result of the range of owners the defence system has been built to various levels and standards of flood protection. The level of maintenance is also variable, resulting in a wide range of defence conditions.

2.3.4 The Highways Agency is responsible for maintenance of the M275/ M27/ A27 highway corridor including the revetted embankments that effectively act as flood and erosion defences. The Highways Agency has a maintenance programme in place and has recently completed a major refurbishment programme. These structures will be maintained throughout the Strategy period to protect this element of critical national transport infrastructure.

2.3.5 In order to structure the analysis of flood and erosion risk management options for the Strategy, the coastal frontages have been divided into seven cells (see Key Plan). The seven cells have been identified based on the natural contours. Each reach has no hydraulic or asset linkage to other reaches. The reaches are listed below and are shown on the Key Plan:

- Reach 1 Portchester Castle to Paulsgrove;
- Reach 2 Horsea Island;
- Reach 3 M27 & Farlington Marshes;
- Reach 4 Brockhampton Quay;
- Reach 5 Langstone & South Moor;
- Reach 6 Warblington & Conigar Point;
- Reach 7 Emsworth.

2.3.6 The M27 and Farlington Marshes have been combined into one reach since the flood compartments merge into a single area. The A27 highway embankment provides a partial flood boundary, but with a current flood route through a vehicle access culvert. Towards the end of the strategy's 100-year appraisal period the A27 embankment could be overtopped during extreme events.

2.3.7 Table 3.1 summarises the nature of the existing defences at each reach. Further information is included in Technical Appendix 2 (Option Appraisal) and Technical Appendix 9 (Condition Inspection)

Measures to Manage the Consequences of Flood and Erosion Risk

2.3.8 The Environment Agency's Flood Warning system covers the Strategy area. The adoption of this service was promoted through the exhibitions during the public consultation along with guidance on measures homeowners can take to increase the flood resilience of their properties.

2.3.9 Management of flood risk though Development Control will continue to regulate development in the floodplain to avoid putting new assets at risk in accordance with National Planning Policy Framework (NPPF).

2.3.10 Emergency planning is a vital part of managing the risks to coastal communities and the relevant authorities constantly update their procedures to account for changing circumstances. It will be necessary to ensure the strategy outcomes and identified risks are fed into the local emergency planning system.

3 Problem Definition and Objectives

3.1 Outline of the Problem

3.1.1 The hinterland between Portchester Castle and Emsworth is predominantly a low-lying highly developed urban area. A large number of assets are currently at a significant level of flood and erosion risk. This information is presented in table 3.1, with the responsible authorities shown in tables 1.2, 6.9 and 7.2.

3.1.2 The lowest standard of protection (on-set of flooding) is located at Langstone, where there are 4 properties at flood risk from 100% aep (1 in 1 year). Across the wider study area the typical standard of protection is 5% (1 in 20 year), for which there are 499 residential properties and 98 non-residential properties at risk. If defence assets are maintained at the same standard of service (level) this will increase to 4,224 and 431 residential and commercial properties due to sea level rise over the next 100 years.

3.1.3 Property assets at risk for a 0.5% (1 in 200) aep flood event include 901 residential and 178 commercial properties. This will increase to 4,257 and 433 respectively due to sea level rise over the next 100 years.

3.1.4 Other assets at risk include:

- Erosion risk to strategic infrastructure (M275, M27, A27 and A3(M) strategic highway corridor.
- Flood risk to A27 near Paulsgrove, and the A27 & A2030 road junctions with the M27 providing the access routes onto Portsea Island (Portsmouth).
- Flood risk to A3023 highway providing the only vehicle access to Hayling Island.
- Flood risk to the South Coast Rail Link (Brighton to Southampton route and Portsmouth spur).
- Flood and erosion risk to Budds Farm wastewater treatment works (servicing approximately 400,000 people in and around Portsmouth, Havant and surrounding areas).
- Erosion risk to the three waste landfill sites (Horsea Island, Broadmarsh, and land south of Budd's Farm).
- Flood risk to 131ha of internationally designated sites (Farlington Marshes, South Moor) and supporting sites (Warblington, Conigar Point).
- At Warblington and Conigar Point there are important local recreation features, a cemetery and 4ha of farmland, which is partly owned by Havant BC.

3.2 Consequences of Doing Nothing

3.2.1 Table 3.1 summarises the seven reaches, the probability of flood risk and residual life of the defence assets for Do Nothing for a 0.5% (1:200) aep event. All seven reaches are at risk of flooding. Typically the lowest probability or shortest residual life for any defence asset within the reach has been used. Due to climate change and sea level rise, the probability of flooding or overtopping increases throughout the strategy period. This increase is also illustrated for 2110 for the Do Nothing scenario. Further detail on this assessment is included in Technical Appendix 2 – Option Appraisal and the property affected in Technical Appendix 6 – Economic Assessment.

3.2.2 Property assets will continue to be at flood risk as identified in 3.1.2 & 3.1.3. Following any event which caused a breach, the defence would not be repaired under the do-nothing scenario and regular tidal flooding would rapidly establish. Approximately 100 properties by Year 20 would be flooded or damaged too frequently to be habitable. This increases to 600 properties by Year 100.

3.2.3 The residual life of the revetment protecting the M275/M27/A27/A3(M) transport link from erosion is estimated to be 50 years following the recent refurbishment. Once the integrity of the revetment is lost the highway embankment would erode, potentially leading to closure of the transport routes to normal traffic.

3.2.4 The A27 and A2030 road junctions providing access routes onto Portsea Island are above current flood risk level but with sea level rise will become at risk from about Year 50, increasing to a 10% (1:10) aep risk level by Year 100.

3.2.5 The A3023 highway through Langstone providing access to Hayling Island is currently at 2% (1:50) aep flood risk. This would increase to 50% (1:2) a.e.p by Year 50 and regular daily flooding by Year 100. Effective access to Hayling Island would be prevented from about 2070 onwards, causing severe disruption to its residents

3.2.6 The South Coast railway is at a flood risk within the M27 & Farlington Marsh flood cell. The railway embankment track level is above current flood risk level, but sea level rise will bring the risk to approximately 5% (1:20) aep by Year 50 for the Portsmouth spur bridge crossing to Portsea Island, and regular tidal inundation for the whole route by Year 100.

3.2.7 Parts of Budds Farm wastewater treatment works ground levels are currently at about a 1% (1:100) aep. Sea level rise will increase this risk to 10% (1:10) aep by Year 50, and regular tidal inundation by Year 100. Without flood risk investment it is estimated the site will cease to operate viably by 2060.

3.2.8 The erosion protection defences surrounding landfill sites are in variable condition, with the worst locations within the Brockhampton reach where residual life is about 10 years. Exposure of the landfill to the designated estuary would cause a significant pollution and breach of environmental legislation. The Outcome Measure score will not be high enough to attract FDGiA, so "moderation evidence" should be provided to promote the scheme, based on the legal requirement to prevent pollution of designated harbour.

3.2.9 Emsworth Mill Pond is tidal, with water levels controlled by a sluice. The wall between the pond and the harbour has a crest level of 3.05 to 3.15mOD. There are 15 properties, mainly residential, around the Mill Pond with a threshold level at or below 3.1mOD. These properties are at risk of flooding when the wall is overtopped. Extreme still water levels in Chichester Harbour would currently overtop this wall during a 20% (1 in 5) to 10% (1 in 10) aep event, with wave overtopping occurring on a 50% (1 in 2) to 20% (1 in 5) event. Some of these properties are the sailing club buildings at each end of the wall. The other residential properties around the Mill Pond are slightly elevated above the mill pond. The road running around the pond is at about 3.1mOD, and properties are all set back behind (above) the road. A 0.5% (1 in 200) tidal flood event would currently result in flooding to 80 residential properties and 8 commercial properties behind the Mill Pond. This sea wall is currently maintained by Havant BC as an amenity structure only and not as a coastal flood or erosion defence.

3.2.10 Defences protecting the international designations at Farlington Marsh and South Moor would breach, causing significant alteration in the habitat and consequential impact to the features of the designation.

Table 3.1 Summary of Existing Defences and Assets at Risk

Reach	Existing Defences	Photo	Assets at Risk (2010) number of properties at risk for a 0.5% aep event				Assets at Risk (2110) number of properties at risk for a 0.5% aep event			
			SoP % / Resid Life (yrs)	Res. Props	Comm. Props	Other Key Assets	SoP %	Res. Props	Comm . props	Other Additional Key Assets
1 - Portchester Castle to Paulsgrove	Mixture of concrete wall, concrete bagwork wall, revetted embankment and sheet piling. Good to fair condition, typically 10+ year residual life		5-10% 10 Yrs	392	66	Portchester Castle. Informal recreation ground.	100%	685	93	Primary school
2 - Horsea Island	Concrete block revetment at Port Solent. Gabion wall surrounding MoD Diving School and landfill site Very good to good condition		<0.5% 30 yrs plus	0	1	Landfill site (erosion risk)	2-1%	0	1	MoD HMS Excellent Diving school Port Solent Marina
3 - M27 & Farlington Marshes	Concrete block revetment for entire frontage M27: Refurbishment works recently completed - condition now good. Farlington: Condition generally poor, regular overtopping and repair maintenance required annually. Vehicle culvert under A27 provides flood route to Farlington.	 	<0.1% 50 Yrs 20% 10-20 Yrs	259	98	M27/A27 highway embankments (erosion) South Coast railway  Farlington Marshes SPA	100%	3,102	321	A3 and A2030 highway infrastructure links onto Portsea Island

Reach	Existing Defences	Photo	Assets at Risk (2010) number of properties at risk for a 0.5% aep event				Assets at Risk (2110) number of properties at risk for a 0.5% aep event			
			SoP % / Resid Life (yrs)	Res. Props	Comm. Props	Other Key Assets	SoP %	Res. Props	Comm. props	Other Additional Key Assets
4 - Brockhampton Quay	Mixture of concrete block revetment, sheet piling, gabion wall, rock revetment and earth embankment Condition generally good to fair, but poor & failed in some places		1% 10 Yrs	0	1	Landfill sites Budds Farm STW	100%	0	2	Other commercial premises
5 – Langstone & South Moor	Mixture of concrete wall, concrete block revetment and masonry quay wall Langstone: Mostly fair condition South Moor: Poor condition	 	100% 10 Yrs	56	3	A3023 highway providing access to Hayling Island Landfill site to west side of South Moor South Moor designated site and services infrastructure to Hayling Island	100%	81	5	Commercial premises
6 - Warblington to Conigar Point	Combination of gabion wall concrete & masonry seawall and revetment Fair condition generally, however poor for most of Conigar Point		100% 10 Yrs	0	0	Warblington Cemetery Warblington Meadow SSSI Nore Barn Woods SNCI	100%	0	0	
7 - Emsworth	Mixture of stone revetment, concrete seawall, masonry seawalls, and embankments Condition good to fair, poor section at Slipper Mill Pond		5% 10 Yrs	194	9	Mill Pond recreational path and feature	100%	389	11	There are 102 properties in Emsworth at both erosion risk and flood risk over the next 100 years.
Total Strategy				**901**	**178**		**100%**	**4,257**	**433**	

3.3 Strategic Issues

3.3.1 A strategic approach has been adopted for Portchester to Emsworth for the following reasons:

- Several smaller problems can be tackled in an integrated way
- Effects of any works, including environmental impacts, are likely to extend over a wide area.

3.3.2 In addition, the responsibility of managing the existing flood and erosion defence assets are held by different organisations (Environment Agency, English Heritage, Fareham Borough Council, Portsmouth City Council, Havant Borough Council, Chichester District Council, MoD, Highways Agency and Hampshire & Isle of Wight Wildlife Trust). A joint and committed approach by all these stakeholders is required to promote any works from this strategy. This Strategy has been developed with the involvement of these organisations and through public consultation to identify the preferred approach to manage flood and erosion risk cost effectively to the benefit of the local communities.

3.3.3 This Strategy will assist local planning teams in their assessment of future development and land use change applications

3.3.4 This Strategy has informed and been informed by the North Solent SMP2 which has now been approved, and included sign off by the Secretary of State for adverse effect on the natura 2000 sites.

3.3.5 Land within this Strategy boundary has an important High Tide Roost Function across the Solent, which prevents realignment options being confirmed until a wider study concludes their importance.

3.4 Key Constraints

3.4.1 The Government is committed to maintaining the integrity of the Natura 2000 network of European Sites under the Habitats Directive. If through a process of 'Habitats Regulations assessment' the strategy is deemed to have adverse effects on the integrity of the European site(s) then schemes can only progress if:

- There are no reasonable alternatives, and
- There are imperative reasons of overriding public interest, and
- Compensation (usually in the form of habitat creation) is successfully provided prior to scheme implementation.

3.4.2 The constraints due to the Natura 2000 sites at Farlington Marsh and South Moor are complicated further since there are designations both seaward and landward of the current defences. Coastal squeeze is causing loss of the seaward (SAC, SPA and Ramsar) designation.

3.4.3 Obtaining the necessary consents and permissions to implement the preferred strategic options (e.g. planning permission and Marine Consents) may delay schemes.

3.4.4 The Indicative Landscape Plan illustrates the key environmental constraints and opportunities. The following provides a summary of the key environmental issues, constraints and opportunities within the Strategy area. Table 6.1 summarises the environmental compliance of the options for each reach.

3.4.5 *Population and human health* - Safety, security and well-being for humans living in the floodplain within the urban areas of Portchester, Paulsgrove, Port Solent,

Highbury, Cosham, Drayton, Farlington, Langstone and Emsworth. There are no deprived wards at risk of flooding within the strategy area. The potential for flooding can affect human health. The uncertainty regarding protection from flooding can cause flood risk-related anxiety for local residents, while property owners in an area at risk of flooding may either be unable to obtain insurance or pay particularly high premiums. All options which provide at least the 1.3% aep (1 in 75 year) risk level of protection are therefore likely to have a beneficial impact on human health in this respect.

3.4.6 *Biodiversity, Flora and Fauna* - Portsmouth, Langstone and Chichester Harbours are designated internationally (SAC/SPA/Ramsar site) and nationally (SSSI) for their nature conservation importance; there are also local and international designations landward of the existing defences.

3.4.7 Whilst holding the existing line of defence will reduce the risk of flooding and erosion to the hinterland, it will also result in coastal squeeze of the designated intertidal habitats. The strategy area includes two potential sites for the creation of compensatory intertidal habitat (Farlington, South Moor).

3.4.8 Realignment across Farlington and South Moor will cause an adverse effect to internationally designated freshwater habitat which is important for high tide roosts. The lack of high tide roosts within the Solent esturaries are the limiting factor for the wading bird population and are a essential component to the functioning of the network of sites within the Solent.

3.4.9 *Land Use* - Land is used for a combination of urban housing, 4ha agriculture and recreational facilities such as boating marinas and coastal paths. Much of this land is protected from coastal erosion and tidal flooding by existing defences. Landfill sites at Horsea Island, Broadmarsh and Budds Farm need continued protection from erosion.

3.4.10 *Fisheries* - The harbours are a classified shellfish production area and designated under the Shellfish Waters Directive. Langstone and Chichester Harbours are also designated sea-bass nursery areas. Fish production and nursery habitats will improve through the realignment schemes, although the schemes may affect these habitats through changes in sediment movement.

3.4.11 *Cultural Heritage and Archaeology* - The coastline is rich in terms of its cultural heritage and archaeological remains. Portchester Castle would be adversely affected by a local managed realignment. Raising of local defences can also have an adverse effect on their setting. There is also a medium risk that strategy implementation will be affected by 'unknown' or buried archaeological remains.

3.4.12 *Landscape and Visual Amenity* - The eastern end of the frontage falls within the Chichester Harbour Area of Outstanding Natural Beauty (AONB); at a local level there is the potential for schemes to bring about landscape changes (e.g. managed realignment could result in agricultural land reverting to intertidal habitat). The study area also contains five conservation areas where any improvement work will need appropriate detailed design.

3.4.13 *Recreation* - There are a significant number of formal and informal recreational and tourism-related facilities at Portchester, Paulsgrove, Horsea Island, Farlington Marshes, Langstone and Emsworth. Options should seek to maintain and, where possible, enhance these facilities, including the coastal footpaths, moorings and slipways. Where footpaths are lost due to 'Do Nothing' or 'Managed Realignment', opportunities to re-align the footpaths will need to be identified.

3.4.14 *Traffic and Transport* - The M275, M27, A27 and A3(M) highway corridor extends along the frontage from Portchester Castle in the west, heading inland at Brockhampton Quay. The South Coast mainline railway is also located landward of the M27 / A27. The A3023 at Langstone Bridge provides the only access to Hayling Island. These road and railway links provide a strategic transport corridor for the region and will require ongoing protection from flooding.

3.5 Objectives

3.5.1 The strategy aims to promote and encourage long term sustainable and strategic management of flood and erosion risk. The Strategy provides a plan for the implementation of capital projects, routine maintenance, further studies, surveys and investigations. The Strategy will help the Environment Agency and Local Authorities prioritise their day-to-day activities whilst ensuring the best use of public funds.

4 Options for Managing Coastal Flood & Erosion Risk

4.1 Potential FCERM Measures

4.1.1 The long-list of options considered Hold the Line and Managed Realignment. Wider estuary options such as tidal barriers at the estuary mouths were not considered viable in the SMP2 and would impact on a considerably wider area than this strategy study area.

4.1.2 Advance the Existing Line has not been considered since it would not be environmentally acceptable due to the international environmental designations of the inter-tidal areas.

4.2 Long List of Options

4.2.1 A long list of coastal flood and erosion risk management options was identified for each reach and appraised against technical, economic and environmental factors. Further details of the options are included in the Technical Appendix 2 – Option Appraisal

4.2.2 Long-list of options considered for Hold the Line include:

a) Do Minimum (reactively maintain defence until end of residual life),

b) Maintain (proactively maintain defences at same standard of service)

c) Sustain (maintain existing standard of protection to adapt to sea level rise, typically by raising defence levels in Year 1 and Year 50)

d) Improve (raise existing defence levels, allowing for future sea level rise)

4.2.3 Managed Realignment has been included at non-urban reaches or sections within a single reach where appropriate.

4.3 Options Rejected at Preliminary stage

4.3.1 The strategic environmental appraisal for Farlington Marshes, South Moor and Warblington to Conigar Point frontages indicated that 'improve' options on the current line of defences would cause coastal squeeze. This would not be environmentally acceptable and so these options were not short-listed.

4.4 Options Short-listed for Appraisal

4.4.1 The long-list of options were reviewed to formulate a short-list for detailed appraisal based on the technical criteria of delivering the desired indicative range.

4.4.2 Options were formulated combining Improve and Managed Realignment where locally appropriate. For some reaches (e.g. Langstone) the Maintain and Sustain options were not short-listed since the existing standard is particularly low and there are no specific flood risk management assets to maintain. Improve options were not short-listed for reaches where the existing standard of protection is already particularly high (e.g. Horsea Island, M27).

4.4.3 The short-listed options for each of the strategy frontages are tabulated for each unit below (Tables 4.1 to 4.7) with a brief description of the options. The proposed SoP for Improve options are typically 1.33% to 0.3% aep.

Table 4.1 Reach 1: Portchester Castle to Paulsgrove
SMP2 policy: Hold the Line
Nature of area at risk: Urban development

Option	Description/Suitability	SoP (% annual prob.)			
		2010	2035	2060	2110
Do Nothing	Baseline option	10% - 5%	100%	Failed	Failed
Do Minimum	Maintain existing defences until the end of their residual life (Portchester – Year 10, Paulsgrove – Year 50), then 'do-nothing'	10% - 5%	100%	Failed	Failed
Sustain	Raise existing defence crest levels now to provide 10% SoP at end of Year 50, and raise again to provide 10% SoP at Year 100	0.4%	1.3%	10%	10%
Improve A	Improve Portchester and Paulsgrove defences now. Range of standards of protection	<0.1%	0.25% 0.2% 0.1% <0.1%	1.3% 1.0% 0.5% 0.3%	1.3% 1.0% 0.5% 0.3%
Improve B	Same as Improve A, except delay improving Paulsgrove defences until Year 30 Range of standards of protection	<0.1%	0.25% 0.2% 0.1% <0.1%	1.3% 1.0% 0.5% 0.3%	1.3% 1.0% 0.5% 0.3%
Improve C	Same as Improve A, except at Portchester Castle (scheduled ancient monument) and Sailing Club where there will be an inland secondary line of defence. This option would leave Portchester Castle at risk of wave damage and is not acceptable, and therefore this option is not considered further. Range of standards of protection	<0.1%	0.25% 0.2% 0.1% <0.1%	1.3% 1.0% 0.5% 0.3%	1.3% 1.0% 0.5% 0.3%
Improve and Managed Realignment D	Same as Improve A, except with minor Managed Realignment at Portchester Recreation Ground. Range of standards of protection	<0.1%	0.25% 0.2% 0.1% <0.1%	1.3% 1.0% 0.5% 0.3%	1.3% 1.0% 0.5% 0.3%

4.4.4 Maintain was not short-listed for Portchester since the current SoP would fall to 100% aep within 25 years.

Table 4.2 Reach 2: Horsea Island
SMP2 policy: Hold the Line (Erosion risk)
Nature of area at risk: Urban development & Landfill

Option	Description/Suitability	SoP (% annual prob.) (against over topping)			
		2010	2035	2060	2110
Do Nothing	Baseline option	<0.1%	<0.1%	Failed	Failed
Do Minimum	Maintain existing erosion defences until the end of their residual life (30 years) then 'do-nothing'	<0.1%	<0.1%	Failed	Failed
Maintain	Maintain existing erosion defences by continued maintenance and replacement (Year 30)	<0.1%	<0.1%	1%	1%

4.4.5 Maintaining the erosion defences against overtopping remains at an appropriate level by the end of the strategy period. Including a Sustain option within the short-listed options was therefore not considered necessary.

Table 4.3 Reach 3: M27 & Farlington Marshes

SMP2 policy: M27: Hold the Line; Farlington: Hold the Line with potential future Managed Realignment in Year 20-100 (subject to further detailed studies)

Nature of area at risk: Urban development. Farlington Marshes – Natura 2000 designated site

Option	Description/Suitability	SoP (% annual prob.)			
		2010	2035	2060	2110
Do Nothing	Baseline option	1% 20%	20% Failed	Failed Failed	Failed Failed
Do Minimum	Maintain existing erosion defences until the end of their residual life (20 years at Farlington Marshes) then 'do-nothing'	1% / 20%	20% Failed	Failed Failed	Failed Failed
Maintain	M27: Maintain existing defences by continuing maintenance & address flood risk route to Farlington and Drayton at the Farlington Marshes vehicle culvert. Farlington: Maintain defences, replace revetment in Year 20. By Year 60 site becomes frequently inundated due to sea level rise	<0.1% 20%	<0.1% 50%	0.3% 100%	20% 100%
Sustain	M27 – maintain existing defences now, undertake Sustain (improvement) works in Year 50 to address sea level rise Farlington: Sustain existing defences (works start in year 20)	<0.1% 20%	<0.1% <0.1%	0.3% 0.1%	0.1% 20%
M27: Sustain Farlington: Managed Realignment Yr 20+	M27 – maintain existing defences now, undertake Sustain (improvement) works in Year 50 to address sea level rise Farlington: Maintain defences for 20 years. Full Managed Realignment in Year 20 (new defence line adjacent to the A27 embankment, with pumping station to prevent potential for upstream fluvial flooding during periods of high tide). A Partial Realignment is also viable, and has been investigated further by the Farlington Marshes Study. See 4.4.6 below.	<0.1% 20%	<0.1% 100%	0.3% 100%	0.5% 100%
M27: Sustain Farlington: Managed Realignment Yr 50+	M27 – maintain existing defences now, undertake Sustain (improvement) works in Year 50 to address sea level rise Farlington: Maintain defences for 20 years, undertake improvements In Year 20 to provide residual life for a further 40 years. Full site Managed Realignment in Year 50. A Partial Realignment is also viable, and has been investigated further by the Farlington Marshes Study. See 4.4.6 below.	<0.1% 20%	<0.1% 20%	0.3% 100%	0.5% 100%

4.4.6 According to the Farlington Study the options for the route of any future managed realignment at Farlington Marshes will need to be considered in a further detailed study that will regard Solent-wide issues, recreation and amenity of the site, alternative high-water roost sites for birds, the economic benefits to the local, regional and national economy and the North Solent SMP action plan.

Table 4.4 Reach 4: Brockhampton Quay

SMP2 policy: Hold the Line (Flood risk and erosion risk)

Nature of area at risk: Southern Water Treatment Works and landfill sites

Option	Description/Suitability	SoP (% annual prob.) Overtopping			
		2010	2035	2060	2110
Do Nothing	Baseline Option	1%	Failed	Failed	Failed
Do Minimum	Maintain existing erosion defences until the end of their residual life in year 10, then 'do-nothing'	1%	Failed	Failed	Failed
Maintain	Maintain existing erosion defence by continued maintenance and replacement	1%	4%	20%	100%
Sustain	Sustain existing erosion defences to 1% SoP. Undertake remedial works now, with continued maintenance and replacement of defences	<0.1%	<0.1%	0.3%	1%
Sustain Yr 10	Sustain existing erosion defences to 1% SoP. Undertake remedial works (Year 10), with continued maintenance and replacement of defences	1%	<0.1%	0.3%	1%
Improve	Improve existing defences now Range of standards of protection	<0.1%	<0.1%	0.5% 0.3%	0.5% 0.3%

Table 4.5 Reach 5: Langstone and South Moor

SMP2 policy: Langstone - Hold the Line. South Moor - Hold the Line with potential future Managed Realignment in Year 20-100, subject to further detailed studies on the significance of South Moor and its interest features to the system function of the Harbour.

Nature of area at risk: Langstone - urban development. South Moor – Chichester and Langstone Harbour SPA, including A3023 to Hayling Island

Option	Description/Suitability	SoP (% annual prob.)			
		2010	2035	2060	2110
Do Nothing	Baseline option	100%	100%	100%	100%
Do Minimum	Maintain existing defences (where present) until the end of their residual life in 10 years then 'do-nothing'.	100%	100%	100%	100%
Improve	Improve existing defences (include new defences at east Langstone to tie into high ground) Range of standards of protection	<0.1%	0.25% 0.2% 0.1% <0.1%	1.3% 1.0% 0.5% 0.3%	1.3% 1.0% 0.5% 0.3%
Improve and Managed Realignment	Improve existing defences and Manage Realign coastline at South Moor (extent of realignment may vary depending on detail site conditions) Range of standards of protection	<0.1%	0.25% 0.2% 0.1% <0.1%	1.3% 1.0% 0.5% 0.3%	1.3% 1.0% 0.5% 0.3%

4.4.7 Maintain and Sustain have not been short-listed because the existing standard of protection for Langstone (east) is 100% annual probability – therefore maintain and sustain would not provide any flood risk improvement with respect to Do Minimum

Table 4.6 Reach 6: Warblington & Conigar Point

SMP2 policy: Hold the Line with potential future Managed Realignment in Year 20-100 subject to further detailed studies on the significance of these sites and their interest features to the system function of the Harbour

Nature of area at risk: Mixed value agricultural land, woodland and cemetery

Option	Description/Suitability	SoP (% annual prob.)			
		2010	2035	2060	2110
Do Nothing	Baseline option	20%	100%	100%	100%
Do Minimum	Maintain existing defences reactively until the end of their residual life in year 10, then 'do-nothing'. This will require a short low bund to protect the lowest corner of the nearby cemetery.	20%	100%	100%	100%
Managed Realignment	Implement Managed realignment at Warblington Meadow SSSI and Conigar Point, with local bund at cemetery	100%	100%	100%	100%
Sustain	Sustain existing defences by continued maintenance and replacement	1%	4%	20%	20%

4.4.8 Maintain has not been short-listed because the existing standard of protection is only 20% annual probability – due to sea level rise maintain would not provide any flood risk improvement with respect to Do Minimum

Table 4.7 Reach 7: Emsworth

SMP2 policy: Hold the Line

Nature of area at risk: Urban development

Option	Description/Suitability	SoP (% annual prob.)			
		2010	2035	2060	2110
Do Nothing	Baseline option	5%	20%	100%	100%
Do Minimum	Maintain existing defences reactively until the end of their residual life in 10 years, then 'do-nothing'	5%	20%	100%	100%
Maintain	Maintain existing defences by continued maintenance and replacement	5%	20%	100%	100%
Sustain	Sustain existing defences by continued maintenance and replacement to provide current SoP Manage outflanking flood risk of to the west of Maisemore Gardens.	<0.1%	1%	5%	5%
Improve	Improve existing defences Range of standards of protection Manage outflanking flood risk of to the west of Maisemore Gardens.	<0.1% <0.1% <0.1% <0.1%	0.25% 0.2% 0.1% <0.1%	1.3% 1.0% 0.5% 0.3%	1.3% 1.0% 0.5% 0.3%

5 Options Appraisal and Comparison

5.1 Technical Issues

5.1.1 Holding the line through Maintaining, Sustaining or Improving the existing defences will achieve the strategic objectives (subject to appropriate standard of protection). There are no specific engineering issues with implementing any of these options.

5.1.2 Any future managed realignment options will need to be considered in a further detailed study with regard to Solent-wide issues, recreation and amenity of the site, alternative high-water roost sites for birds, the economic benefits to the local, regional and national economy and the North Solent SMP action plan. Detailed analysis of fluvial drainage as well as potential habitat creation and the need to establish compensatory habitat prior to implementation of any scheme will also be required.

5.2 Environmental Assessment

5.2.1 The Environmental Assessment of Plans and Programmes Regulations 2004 (the Strategic Environmental Assessment (SEA) Regulations) do not formally require a Strategic Environment Assessment (SEA) of flood risk management strategies. However, in accordance with the Environment Agency and Defra policy and best practice, a non-statutory SEA has been prepared (included as Appendix 12)

5.2.2 Eight strategic environmental objectives were developed to aid environmental appraisal of alternative flood risk management options. In outline, the environmental objectives are as follows

- avoid and enhance where possible effects on safety, health and population;
- protect, and where possible, provide opportunities for economic development and employment;
- protect and where possible enhance recreational interests;
- protect and where possible enhance biodiversity;
- protect and where possible enhance landscape character;
- protect and where possible enhance existing land uses;
- protect and enhance cultural heritage features
- protect existing infrastructure.

5.2.3 Following consultation with Natural England it was agreed that a Habitat Regulations Assessment (HRA) under Regulation 48 of the Conservation (Natural Habitats &c) Regulations 1994 was required as there was the potential for the strategy to have significant impacts on Natura 2000 designated sites. The HRA (refer to SEA Appendix 5) explains how the integrity of the European sites within and adjacent to the strategy area will be impacted. It concluded an adverse affect on site integrity for each of the European designated sites.

5.2.4 Natural England (NE) have signed-off the HRA and provided a letter of support for the Strategy. The following paragraphs describe the process that enabled NE to make this decision.

5.2.5 For all sites there will be intertidal losses due to coastal squeeze losses and small/direct losses as a result of 'hold the line' options. If, in the future, managed realignment is implemented at Farlington Marshes and South Moor, then there will be freshwater/terrestrial losses to the Chichester and Langstone Harbours SPA and Ramsar, Solent Maritime SAC, and Solent and Isle of Wight SAC.

5.2.6 The HRA demonstrates that there are 'no alternatives' to the preferred solutions where adverse effect on integrity is concluded. There are also imperative reasons of overriding public interest (IROPI) and public safety for the schemes to be progressed. Before the Strategy can be formally agreed and implemented, the Environment Agency, as the Competent Authority, must refer the Strategy to Defra Wildlife for approval of IROPI by the Secretary of State.

5.2.7 The water bodies of Chichester, Langstone and Portsmouth Harbours are heavily modified, their current over all potential is moderate. In order to achieve good ecological potential by 2027 a series of mitigation measures need to be put into place. The key mitigation measure for this strategy being managed realignment of coastal defences.

5.2.8 The Water Framework Directive Compliance Statement concluded that there is a potential to cause a decline in Saltmarsh due to coastal squeeze, however the decline is unlikely to cause deterioration to the waterbodies status in the short term as it represents less than 5% reduction in total saltmarsh area within each waterbody. This conclusion is supported by the hydromorphological leads within the Environment Agency. In the long term the aim is to potentially realign at Farlington marshes, Coniqar and Warblington to offset coastal squeeze losses and to achieve the water bodies good ecological potential. Realignment will only be possible if it will cause no impact to high level roosts for key bird species.

5.2.9 The preferred options represent the 'least damaging' environmental solutions for the area given the economic, social and environmental constraints. However, the HRA concludes that they are likely to have an adverse effect on the integrity of the European Site(s). This adverse effect is as a result of losses due to coastal squeeze and/or direct losses from the scheme footprint.

5.2.10 Table 5.1 summarises the habitat losses of the preferred options.

Table 5.1 Habitat Loss Summary

Reach	**Preferred Option**	**LOSS** **Total habitat area loss (ha)**	
		Intertidal (due to coastal squeeze over 100 yrs)	Freshwater/ terrestrial
Portchester & Paulsgrove	Improve	13.5	0
Horsea Island	Maintain	3.3	0
M27 & Farlington Marshes	M27: Sustain	7.0	0
	Farlington Marshes: Maintain for 20 years	6.0	0
Brockhampton Quay	Sustain	1.4	0
Langstone & South Moor	Langstone: Improve	1.1	0
	South Moor: Maintain for 20 years	0.2	0
Warblington & Conigar Point	Maintain for 20 years	1.5	0
Emsworth	Improve	1.5	0
	Total	**35.5**	**0**

5.2.11 At Farlington Marshes, any potential managed realignment route will be determined following further study, data collection and appraisal. This study has already started and includes input from Havant/Portsmouth Coastal Team and Hampshire Wildlife Trust. If Managed Realignment is considered acceptable, the exact area of freshwater loss and inter-tidal habitat gain would be determined on completion of this appraisal.

5.2.12 The cost of providing compensatory habitat for the potential loss of freshwater/terrestrial habitat has been incorporated in the appropriate proposed option costings. The provision of the intertidal habitat will be managed through the Regional Habitat Creation Programme (RHCP). The RHCP draws on the recommendations from the CHaMP, various coastal risk management strategies and the Solent Dynamic Coastline Study.

5.2.13 The nature and scale of compensatory habitat provision will be agreed with Natural England in advance of implementation of any schemes which represent 'adverse effect'. The RHCP have confirmed provision of 20 years worth of intertidal compensatory habitat through schemes currently being implemented. The approved business case submitted by the RHCP for the land purchase at Medmerry was based on the compensatory habitat requirements within the North Solent SMP2.

5.2.14 Consultation was undertaken with statutory and other stakeholders in the strategy and comprised letters, meetings, public exhibitions and workshops. In addition formal consultation has been undertaken as part of the strategic environmental assessment process. A full programme of the consultation undertaken has been included in the SEA. The main issues arising from the consultation were:

- Concerns that central Government funding was unlikely for most of the Reaches, due their low priority nationally. Defra's Future Funding Arrangements should provide clarity on the allocation of Flood Defence Grant in Aid (FDGiA).
- Concern over the long-term future of Farlington Marshes which has European Environmental Designations, but is costly to defend. Holding the line will cause a gradual loss of the designated inter-tidal habitat within Langstone harbour as sea levels rise.
- Any defences at Langstone and Emsworth will need to consider carefully the impact on the conservation area.
- Access to the harbours for sailing clubs and other users needs to be maintained, along with access to the harbours via coastal footpaths.

Table 5.2 Key Environmental Impacts, Mitigation and Opportunities

Key Positive Impacts	Key Negative Impacts	Mitigation/ Enhancement Opportunity
Reach 1: Portchester Castle to Paulsgrove		
Do Nothing		
Potential for habitat creation[1]	Uncontrolled flooding to residential properties	
Do Minimum		
Potential for habitat creation[1]	Uncontrolled flooding to residential properties at end of defences residual life	
Hold the Line – Improve		

Key Positive Impacts	Key Negative Impacts	Mitigation/ Enhancement Opportunity
People and property protected. Portchester Castle SAM and recreation area also protected. High water roost function maintained.	Loss of intertidal habitat due to coastal squeeze	Potential use of dredged material on Charlie's Island to enhance high level roosts. Shingle placement on back face of seawall to encourage growth of microfauna. Additional seating and recreational enhancements e.g. improved access
Hold the Line – Improve with Managed Realignment		
Potential for habitat creation[1]	Flooding of SAM and recreational area	
Reach 2: Horsea Island		
Do Nothing		
Potential for habitat creation[1]	Uncontrolled flooding to landfill sites, a marina and HMS Excellent. Erosion of landfill leaching contaminants into designated harbour.	
Do Minimum		
Potential for habitat creation[1]	Uncontrolled flooding to landfill sites, a marina and HMS Excellent at end of defences residual life. Erosion of landfill leaching contaminants into designated harbour.	
Hold the line Maintain		
No contamination of designated sites from pollution. High water roost function maintained.	Loss of intertidal habitat due to coastal squeeze	Potential use of stepped revetment to increase habitat diversity.
Managed Realignment		
Removal of contaminated land to provide an area of intertidal habitat.	Flooding of HMS Excellent and a Marina. Potential loss of high water roost function.	
Reach 3: M27 & Farlington Marshes		
M27 frontage		
Do Nothing		
Potential for intertidal habitat creation[1]	Uncontrolled flooding of natura 2000 sites, major road and rail links and people and property	
Do Minimum		
Potential for intertidal habitat creation[1]	Uncontrolled flooding of natura 2000 sites, major road and rail links and people and property at end of defences residual life	
Hold the Line – Sustain		
People and property protected. Protection of existing terrestrial natura 2000 habitats, road and rail infrastructure and people and property. High water roost function maintained.	Loss of intertidal habitat due to coastal squeeze.	
Managed Realignment with a combination of hold the line options		

Key Positive Impacts	Key Negative Impacts	Mitigation/ Enhancement Opportunity
People and property protected. Potential for intertidal habitat creation[1]	Loss of playing fields North of M27 which support large numbers of Brent Geese. Uncontrolled flooding of major road and rail links and people and property at end of defences residual life.	
Farlington Marshes frontage		
Do Nothing		
Creation of large area of intertidal habitat	Loss of a large area of Natura 2000 designated wader roosts, which would affect the integrity of the Solent SPA.	
Do Minimum		
Eventual creation of large area of intertidal habitat	Eventual loss of a large area of Natura 2000 designated wader roosts, which would affect the integrity of the Solent SPA.	
Hold the Existing Line		
People and property protected. Protection of wader high level roosts initially.	Loss of intertidal habitat due to coastal squeeze. Impact to terrestrial habitat from increased freshwater influence.	
Managed Realignment		
Creation of large area of intertidal habitat	Loss of a large area of Natura 2000 designated wader roosts, which would affect the integrity of the Solent SPA.	Potential use of dredged material on Langstone Harbours Island's to enhance high level roosts. Access management to reduce disturbance
Reach 4: Brockhampton Quay		
Do Nothing		
Potential for intertidal habitat creation[1]	Uncontrolled flooding of former landfill sites. Erosion of landfill leaching contaminants into designated harbour.	
Do Minimum		
Eventual potential for intertidal habitat creation[1]	Eventual uncontrolled flooding of former landfill sites. Erosion of landfill leaching contaminants into designated harbour.	
Hold the Existing Line		
People, property and Cross Harbour Sewage Infrastructure protected. Protection to Natural 2000 site from contamination	Loss of intertidal habitat due to coastal squeeze	Use of stepped revetment to increase habitat diversity.
Managed realignment		
People, property and Cross Harbour Sewage Infrastructure protected. Potential for intertidal habitat creation. Removal of contaminated land could provide an increased area of intertidal habitat.	Flooding of former landfill sites.	

Key Positive Impacts	Key Negative Impacts	Mitigation/ Enhancement Opportunity
Reach 5: Langstone and South Moor		
Do Nothing		
Potential for intertidal habitat creation	Uncontrolled flooding of former landfill sites. Erosion of landfill leaching contaminants into designated harbour.	
Do Minimum		
Eventual potential for intertidal habitat creation	Eventual uncontrolled flooding of former landfill sites. Erosion of landfill leaching contaminants into designated harbour.	
Hold the Existing Line		
People, property and A3023 protected. Protection to Natural 2000 site from contamination.	Loss of intertidal habitat due to coastal squeeze.	
Managed Realignment		
People, property and A3023 protected. Potential for intertidal habitat creation	Flooding of former landfill sites. Erosion of landfill leaching contaminants into designated harbour. Potential loss of high water roost function.	Opportunity for local setback where landfill doesn't exist e.g. South Moor. Removal of weir at Langbrook to improve water quality and fish passage.
Reach 6: Warblington & Conigar Point		
Do Nothing		
Potential for intertidal habitat creation	Uncontrolled flooding of SSSI, SAM, cemetery and potential high-tide roost site.	
Do Minimum		
Eventual potential for intertidal habitat creation	Eventual uncontrolled flooding of SSSI, SAM, cemetery and potential high-tide roost site.	
Hold the Existing Line		
Protection of SSSI, SAM, cemetery and potential high-tide roost site.	Loss of intertidal habitat due to coastal squeeze.	
Managed Realignment		
Creation of intertidal habitat, protection of cemetery	Potential flooding of agricultural land, SSSI, SAM, cemetery and potential loss of high-tide roost site.	Footpath improvements. Roll back of SSSI north to offset terrestrial habitat losses and high-tide roost site. Minor inland defence of cemetery needed.
Reach 7: Emsworth		
Do Nothing		
Potential for creation of intertidal habitat[1]	Uncontrolled flooding of recreational and amenity assets and residential properties	
Do Minimum		
Eventual creation of intertidal habitat when defences fail	Eventual uncontrolled flooding of recreational and amenity assets and residential properties	
Hold the Existing Line		

Key Positive Impacts	Key Negative Impacts	Mitigation/ Enhancement Opportunity
Protection of recreational and amenity assets and residential properties	Loss of intertidal habitat due to coastal squeeze	
Managed Realignment		
Potential for creation of intertidal habitat[1]	Flooding of recreational and amenity assets and residential properties	

1) The large majority of the area is urban and the actual value of 'habitat' that would be created is considered negligible given it would not be natural, but a poor quality, polluted hard landscape.

5.3 Social and Community Impacts

5.3.1 Do Nothing and Do Minimum options will cause flooding to populations at Portchester, Paulsgrove, Cosham, Drayton, Farlington, Langstone and Emsworth. This would lead to loss of properties, recreational and amenity assets, road links onto Portsea Island and Hayling Island as well as the eventual loss of the Budds Farm wastewater treatment works.

5.3.2 The Sustain and Improve options would reduce the flood and erosion risk impact to the community. However, this Strategy has identified that the likelihood of securing government funding for capital schemes is low, due to low Outcome Measure scores. These communities will need to work in partnership with their Local Authority, Environment Agency and other partners to identify other potential funding sources which will improve the chance of receiving government funds. The Environment Agency will continue to provide Flood Warnings, advice and support to local communities and will assist the Local Authorities in the application for Government funding.

5.4 Option Costs

5.4.1 Cost estimates for all options have been prepared using 2010 Q4 prices. The costs include for future operation, maintenance and repair costs for a 100 year appraisal period. These are presented as a Present Value (PV) cost.

5.4.2 An Environment Agency framework contractor (Nuttall) was engaged for early contractor involvement in order to provide expert advice on appropriate construction cost rates and the buildability of options. Allowances of 10% for general items and 20% for preliminaries were applied to all costs. Professional fees and compensation costs for the construction phase have been estimated based on the nature of the works.

5.4.3 Maintenance requirements and costs the various strategic options have been discussed and agreed with operating authorities and have been included in the whole life present value costs. Costs are also included for options where future works are required to enable the option to adapt for climate change. For example, 50 years of precautionary sea level rise is included for Sustain and Improve options. Further works in Year 50 are included to improve the quoted design standard to the design level for the second half of the century

5.4.4 An Optimism Bias of 60% has been used on all costs (scheme development, construction, operation and maintenance, and future works for climate change as required).

5.4.5 For options resulting in loss of Natura 2000 sites, costs for providing compensatory habitat are included. The cost per hectare has been based on values for three

different habitat types provided by the Regional Habitat Creation Programme, at £75k/ha for inter-tidal habitat and £35k/ha for freshwater/.terrestrial habitat. These values include for land purchase and habitat creation and associated costs.

5.4.6 Further detail on the costing of options is included in Technical Appendix 6 – Economic Appraisal.

5.4.7 Table 5.3 summarises the Scheme Capital Cost (where appropriate), Whole Life Cost and Present Value Cost (including optimism bias)for all options. Present Values have been determined using discount rates in accordance with Treasury guidelines. The preferred option (refer to Section 6) has been highlighted. Whole life costs and Present Value costs are for the 100 year period of appraisal, this has been applied to all Options.

Table 5.3 Option Cost Summary

	Option (SoP quoted at end of appraisal period)	**Total Scheme Cost Yr 1-10 (£k)**	**Whole Life Cost (£k)**	**PV Cost (£k)**
Reach 1 Portchester Castle to Paulsgrove	Do Minimum	0	336	243
	Sustain 10%	6,456	23,264	9,503
	Improve A 1%	8,422	24,644	11,513
	Improve B 1.3%	7,726	23,914	10,919
	Improve B 1% Yr 10	7,790	24,061	11,000
	Improve B 0.5%	7,917	24,356	11,164
	Improve B 0.33%	7,981	24,503	11,245
	Improve D 1%	10,276	27,078	13,205
Reach 2 Horsea Island	Do Minimum	0	744	465
	Maintain	0	19,342	5,345
Reach 3 M27 & Farlington Marshes	Do Minimum	0	5,808	1,109
	Maintain	1,721	14,928	9,343
	Sustain	1,721	47,570	14,787
	Sustain & MR Yr 20	7,889	18,374	7,936
	Sustain & MR Yr 60	1,721	27,398	11,440
Reach 4 Brockhampton Quay	Do Minimum	0	256	200
	Maintain	4,198	7,622	4,909
	Sustain 1% Yr 0	4,420	20,186	7,947
	Sustain 1% Yr 10	4,420	20,186	6,012
	Improve 0.5%	4,642	20,609	8,222
	Improve 0.3%	4,864	21,032	8,497
Reach 5 Langstone & South Moor	Do Minimum	0	162	48
	Improve 1.3%	3,797	7,043	4,724
	Improve 1%	3,962	7,374	4,918
	Improve 0.5%	4,293	8,035	5,304
	Improve 0.3%	4,514	8,477	5,562
	Improve & MR 1.3%	3,332	6,169	4,184
	Improve & MR 1%	3,465	6,436	4,340
	Improve & MR 0.5%	3,732	6,968	4,651
	Improve & MR 0.3%	3,909	7,324	4,859

	Option (SoP quoted at end of appraisal period)	Total Scheme Cost Yr 1-10 (£k)	Whole Life Cost (£k)	PV Cost (£k)
	Improve &MR 1.3% Yr 10	0	6,404	2,992
Reach 6 Warblington to Conigar Point	Do Minimum	0	85	67
	Managed Realignment	729	1,213	850
	Sustain	7,100	7,585	7,033
	Sustain Yr 10	7,100	7,585	5,028
Reach 7 Emsworth	Do Minimum	0	504	417
	Maintain	0	6,386	3,458
	Sustain 5%	11,724	27,345	16,059
	Improve 1.3%	12,650	27,730	16,654
	Improve 1%	12,987	28,808	17,037
	Improve 0.5%	13,486	29,170	17,607
	Improve 0.3%	13,899	29,944	18,079
	Improve 1.3% (Year 10)	12,650	28,994	13,126

5.5 Options Benefits (Damages Avoided)

Methodology

5.5.1 Flood damages have been calculated using the Multi Coloured Manual (MCM) (Middlesex Flood Hazard Research Centre (FHRC) 2003) and the Green Book (HM Treasury, 2003). These documents have been used in combination with the Defra FCDPAG series and Supplementary Guidance Notes (Defra, March 2003, July 2004 and October 2006) and updated to FCERM-AG (2010).

5.5.2 Residential and non-residential property market values were obtained from the Land Registry for 2010. Threshold levels were obtained from LiDAR data. Where information was not available for a few commercial properties, the mean value for warehouses was adopted from the Multi-coloured Manual (FHRC, 2005). These values were used to cap recurrent flood damages, such that the sum of PV damage over time did not exceed the market value of the asset. A similar capping mechanism was applied to agricultural land and environmental assets.

5.5.3 An asset value of £110m was provided by Southern Water in respect of Budds Farm waste water treatment works.

5.5.4 In line with Appraisal guidance, the economic value of assets such as strategic transport infrastructure and assets (M27/A27, South coast railway & Portchester Castle) have been calculated using the "least cost proxy method – the least cost of either a permanent diversion, replacement, or in-situ local defence. For the M27/A27 highway this was estimated to be £24.5m based on the cost of in-situ local defence (maintaining the revetment over a 100 year period). For the South coast railway it was estimated that 5km of railway embankment would need to be raised above risk level at a cost of £50m.

5.5.5 Traffic disruption to the A27 at Paulsgrove has been determined based on the MCM methodology to determine diversion costs for traffic. Traffic disruption on minor roads has not been quantified since traffic would typically be able to take alternative local routes outside the floodplain.

5.5.6 Existing designated habitats which would be damaged by saline intrusion have been broadly valued based on data from the Environmental Economics Handbook – using a typical value of £700/ha per year. This has been applied to Farlington Marshes and South Moor (Do Nothing and Do Minimum options).

5.5.7 The loss of the Farlington Marsh footpath as an amenity recreational asset has been based on annual visitor numbers (estimated by Hampshire and Isle of Wight Wildlife Trust to be 40,000 visits per year) and a 'Willingness to Pay' value of £3 per visit, given the proximity of other local similar footpaths. This has been applied for Do Nothing, Do Minimum, Maintain and Managed Realignment options from the year of loss of the footpath.

5.5.8 In accordance with the MCM and guidance, property damages have included the following other factors:

- Emergency services – 10.7% increase on direct property damages has been included. Impact of coastal flooding to Emergency Services has been considered to be slightly worse than fluvial flooding, with access required across many communities on the south coast on a major surge event. Reduction of factor to 5.6% does not have an impact on the final decisions.
- Additional Electricity costs – an additional indirect damage of £775 per property <0.1m depth and £1,380 per property >0.1m depth has been included
- Alternative accommodation costs – An additional indirect damage of £1,718 has been included for all properties flooded to >0.3m depth
- A saline water factor of 3.8% has been added to residential and commercial property damages
- Human Related Intangible Impacts (HRII) have been included using Defra Supplementary Guidance Note July 2004.
- A Socio-economic equity multiplier based on the social class group statistics for the study area has been used based on Defra Supplementary Guidance Note July 2004. (refer to Technical Appendix 6 Section 3.2.1) This had little effect on the damage calculation and no impact on the option choice
- Risk to life has been assessed in accordance with recent guidance and included within the analysis. Valuation was based on fatalities in accordance with the guidance. A value per fatality of £1.3m was used. The present values for the Do Nothing and Do Minimum options were determined assuming 20 years of potential fatalities due to the typical residual life of existing assets of between 10 and 20 years. The additional damages from the Risk to Life calculations have contributed up to 1.5% of the total damages, but have not affected the business case in the decision of option selection

Damages

5.5.9 Present Value damages and benefits for each option are summarised in Section 6. Detailed information is included in Technical Appendix 6

Flood Frequency and Erosion Rate

5.5.10 For each reach the flood risk was considered at each of Years 0, 10, 50 and 100, in order to take account of both rising sea levels and degrading defence condition.

5.5.11 Assets were written off either when the frequency of flood damage was more than once per year or if total present value damages exceeded the current market value.

5.5.12 Due to existing defences, there is an absence of historical coastal erosion records for the strategy frontage. An undefended rate of 0.5m/yr has been adopted, as this reflects the upper bound of likely rates along the strategy frontage (source: Havant,

Portsmouth and Gosport Coastal Defence Partnership, based on known sites on Hayling Island). This erosion rate is applied from the year of failure of any fronting hard defence, which has been assumed to occur when the residual life has been reached.

5.5.13 There are about 100 properties in Emsworth at both erosion risk and flood risk for Do Nothing option over the course of the next 100 years. Damages have been determined avoiding double counting by removal of flood risk damages to properties lost to erosion. The proposed Improve scheme provides protection against both risks. If the rate of erosion is less than 0.5m/yr, flooding will still result in damages in the same order of value. A sensitivity test using a zero rate of erosion is included in Section 6.2.10.

5.5.14 There are three landfill sites located on the coast (Horsea Island, Broadmarsh and land south of Budds Farm) at risk of erosion. To comply with the Habitat Regulations Assessment there is a legal requirement to prevent any failure of the erosion defences that protect the landfill sites which could otherwise lead to pollution and significant negative impact on the surrounding Natura 2000 designated sites

Gains not quantified

5.5.15 Traffic disruption to the A3023 access to Hayling Island at Langstone has not been quantified since the highway is at a greater risk level on Hayling Island. There are plans to improve the defences on Hayling Island to the same SoP as currently provided at Langstone, and hence there is no added value to improve the defences for the mainland section of the A3023.

5.5.16 Pollution of the estuaries as a result of erosion failure of the existing coastal defences at the landfill sites has not been quantified. A broad brush estimate of the minimum cost of relocating a landfill site is £50m - £100m. In practice such an operation is unlikely to be technically possible since it is unlikely that there is a potential site that could accommodate the large volumes of waste for relocation.

5.5.17 The economic value of inter-tidal habitat creation for the Do Nothing options has not been included. The large majority of the area is urban and the actual value of 'habitat' that would be created is considered negligible given it would not be natural, but a poor quality, polluted hard landscape. Given the level of pollution from the urban landscape it could arguably be more of a damage than a benefit. The loss of the existing freshwater habitat under the Do Nothing options (Farlington Marshes) has been included.

Price base for benefits

5.5.18 To bring MCM data to the 2011 Q1 price date, a Consumer Price Index (CPI) value of 1.07 has been applied.

6 Selection and Details of the preferred option

6.1 Selecting the Preferred Option

6.1.1 The assessment of options for each reach was undertaken as follows:

- The technical viability of alternative options was considered and the long-list of options reduced to provide a short-list (refer to Section 2.3.2);
- Comparison with strategic environmental objectives was considered in the Strategic Environmental Assessment using an evaluation matrix. Consideration of alternative options and compliance with the Habitats Regulations was undertaken during the Appropriate Assessment process;
- The economic consequences of each short-listed option were established and tabulated using FCERM-AG spreadsheets.

6.1.2 A summary of the strategic environmental objective evaluation matrices for each reach is included in Table 6.1. Options have been assessed based on a 7 point scale (major negative, moderate negative, minor negative, neutral, minor positive, moderate positive, major positive). The preferred option has been shaded. Further detail of the impact on each objective is included in the SEA (Technical Appendix 3).

Table 6.1 Environmental Objective Compliance Summary

Reach	**Option & Impact Summary**			
	Do Nothing	Do Minimum	As indicated	As indicated
1- Portchester & Paulsgrove	Moderate negative	Moderate negative	Improve Moderate positive	Improve & Managed Realignment Neutral
2- Horsea Island	Moderate negative	Moderate negative	Maintain Moderate positive	Managed Realignment Neutral
3 – M27 & Farlington Marshes	Moderate negative	Moderate negative	Sustain Moderate positive	M27:Sustain Farl' Marshes: Managed Realignment Moderate positive
4 – Brockhampton Quay	Moderate negative	Moderate negative	Sustain Moderate positive	Improve Moderate positive
5a – Langstone & South Moor	Moderate negative	Moderate negative	Langstone: Improve South Moor: MR Moderate positive	Langstone & South Moor: Managed Realignment Moderate negative
6 – Warblington & Conigar Point	Moderate negative	Moderate positive	Sustain Minor positive	Managed Realignment Moderate positive
7 – Emsworth	Moderate negative	Moderate negative	Maintain Moderate negative	Improve Moderate positive

6.1.3 Table 6.2 to 6.8 illustrate the damages, benefit cost ratio and incremental benefit cost ratio. The preferred option is highlighted in each case.

6.1.4 The appraisal has been undertaken in accordance with the Defra FCDPAG series of documents and the "Supplementary Notes to Operating Authorities", and updated to FCERM-AG.

Reach 1 – Portchester Castle to Paulsgrove

Table 6.2 Benefit Cost Summary for Reach 1 – Portchester Castle to Paulsgrove

	Do Nothing	Do Minimum	Sustain 10%	Improve A 1.3%	Improve A 1%	Improve A 0.5%	Improve B (1.3%)	Improve B (1%)	Improve B (0.5%)	Improve B (0.3%)	Improve D 1% - MR at Rec
PV Cost (£k)	-	152	5,940	7,142	7,196	7,303	6,824	6,875	6,977	7,028	8,253
Optimism Bias (£k)	-	91	3,564	4,285	4,317	4,382	4,095	4,125	4,186	4,217	4,952
Total PVc (£k)	-	243	9,503	11,428	11,513	11,684	10,919	11,000	11,164	11,245	13,206
PV damage PVd (£k)	153,874	153,185	22,932	1,204	1,106	810	1,282	1,178	863	758	1,106
PV damage avoided	-	689	130,942	152,670	152,768	153,064	152,592	152,696	153,011	153,116	152,768
Additional HRII & Env benefits (£k)	-	-	-	2,410	2,452	2,581	2,410	2,452	2,581	2,633	2,452
Total Benefits (£k)	-	689	130,942	155,080	155,221	155,646	155,002	155,148	155,593	155,750	155,221
Net PV (£k)	-	445	121,439	143,653	143,707	143,962	144,083	144,148	144,429	144,504	142,015
B/C Ratio	-	2.8	13.8	13.6	13.5	13.3	14.2	14.1	13.9	13.9	11.8
Inc B/C ratio	-	-	13.8	12.5*	1.6	2.5	17.0*	1.8	2.7	1.9	6.6*

* Inc bc ratio wrt Sustain

6.1.5 In accordance with the FCERM-AG decision rule, Improve B 1.3% is the preferred option as detailed below.

6.1.6 Improve B 1.3% has the highest benefit cost ratio. Natural England have advised that Improve D is not preferred.

6.1.7 Optimising the standard of protection for Improve B in Table 6.2 indicates that the 1.3% annual probability event is the preferred economic option since the incremental benefit cost ratio for the 1% standard is less than the required value of 3. However it is recommended that during detailed appraisal the optimisation should be refined with improved cost differential estimates.

6.1.8 The preferred strategic option is in line with the SMP2 policy to hold the line and is the preferred environmental option.

Reach 2 – Horsea Island

Table 6.3 Benefit Cost Summary for Reach 2 – Horsea Island (erosion risk)

	Do Nothing	Do Minimum	Maintain
PV Cost (£k)	-	291	3,341
Optimism Bias (£k)	-	175	2,005
Total PVc (£k)	-	465	5,345
PV damage PVd (£k)	54,089	38,344	-
PV damage avoided	-	15,744	54,089
Additional HRII & Env benefits (£k)	-	0	0
Total Benefits (£k)	-	15,744	54,089
Net PV (£k)	-	15,279	48,743
B/C Ratio	-	33.8	10.1
Inc B/C ratio	-	-	7.9

6.1.9 In accordance with the FCERM-AG decision rule, Maintain is the preferred option as detailed below.

6.1.10 Do Minimum has the highest benefit cost ratio, but when the existing defences reach the end of their residual life (estimated year 30) this would expose the landfill site and erosion of key assets.

6.1.11 Maintain provides future erosion protection, appropriate standard of flood risk protection and has an incremental benefit cost ratio greater than 1. It is therefore selected as the preferred economic option.

6.1.12 Maintain is the environmentally preferred option as it minimises the risk of contamination of the internationally designated harbour and flooding and coastal erosion of HMS Excellent Defence Diving School and the Port Solent marina, residential and commercial development.

6.1.13 The preferred strategic option is in line with the SMP2 policy to hold the line.

Reach 3 – M27 & Farlington Marshes

Table 6.4 Benefit Cost Summary for Reach 3 - M27 and Farlington Marshes

	Do Nothing	Do Minimum	Maintain	Sustain M27 <0.1%aep Farlington 20% aep	M27 Sustain <0.1% aep Farlington – MR (Yr 20)	M27 Sustain <0.1% aep Farlington – MR (Yr 50)
PV Cost (£k)	-	693	5,839	9,242	4,960	7,150
Optimism Bias (£k)	-	416	3,504	5,545	2,976	4,290
Total PVc (£k)	-	1,109	9,343	14,787	7,936	11,440
PV damage PVd (£k)	432,592	424,575	92,609	-	1,818	644
PV damage avoided	-	8,017	339,983	432,592	430,773	431,947
Additional HRII & Env benefits (£k)	-	-	-	2,625	2,625	2,625
Total Benefits (£k)	-	8,017	339,983	435,217	433,398	434,572
Net PV (£k)	-	6,908	330,640	420,429	425,463	423,133
B/C Ratio	-	7.2	36.4	29.4	54.6	38.0
Inc B/C ratio	-	-	40.3	17.5	62.3*	41.3*

* Inc bc ratio with respect to Do Minimum; MR = Managed Realignment

6.1.14 Approximately 90% of the Present Value damages are derived from the second half of the 100 year period of analysis – once sea level rise causes frequent flooding of the urban area north of the M27.

6.1.15 In accordance with the FCERM-AG decision rule, the preferred economic option based on Table 6.4 is Sustain for M27 and Managed Realignment (Year 20) for Farlington Marshes. This option has the highest benefit cost ratio and provides an appropriate standard of protection to the residential, commercial and infrastructure assets for the duration of the strategy period.

6.1.16 Selection of Managed Realignment as the long term preferred option for Farlington Marshes is, however, subject to a further detailed study that will regard Solent-wide issues, recreation and amenity of the site, alternative high-water roost sites for birds, the economic benefits to the local, regional and national economy and the North Solent SMP action plan. The need for freshwater/terrestrial habitat for roosting birds as a key estuary-wide resource may require adoption of Sustain.

6.1.17 As a result, the preferred option for Farlington Marshes is therefore Maintain until Year 20, whilst further detailed studies are completed over the next 3 years.

6.1.18 The detailed habitat studies will address the environmental and social implications and flood management issues of the site. This will need to include the network of roosting sites across the North Solent Harbours, together with more accurate determination of the extent, cost and preparation time for any necessary compensatory habitat required from a Managed Realignment or Hold The Line (Sustain) scheme.

6.1.19 The economic analysis presented in Table 6.4 is sensitive to a number of issues including: required preparation time for freshwater/terrestrial compensatory habitat, the total area required, potential funding by other schemes which require inter-tidal habitat, and cost of the compensatory freshwater/terrestrial habitat. These issues are inter-related with other schemes within the North Solent Harbours.

6.1.20 The landowner for Farlington Marshes (Portsmouth City Council) may wish to consider its wider responsibilities, as landowner and local authority, for providing open space and amenity facilities into the future, providing that this does not conflict with the legal requirements of the Habitat Regulations.

6.1.21 Sufficient funding to undertake the species specific studies and provisionally for establishment of the compensatory habitat have been included within the Implementation plan for this Strategy.

Reach 4 – Brockhampton Quay

Table 6.5 Benefit Cost Summary for Reach 4 - Brockhampton Quay

	Do Nothing	Do Minimum	Maintain	Sustain (1%)	Sustain (1%) Year 10	Improve (0.5%)	Improve (0.3%)
PV Cost (£k)	-	125	3,068	4,967	3,758	5,139	5,311
Optimism Bias (£k)	-	75	1,841	2,980	2,255	3,083	3,186
Total PVc (£k)	-	200	4,909	7,947	6,012	8,222	8,497
PV damage PVd (£k)	81,880	68,941	31,552	589	751	343	244
PV damage avoided	-	12,939	50,328	81,291	81,129	81,537	81,637
Additional HRII & Env benefits (£k)	-	-	0	0	0	0	0
Total Benefits (£k)	-	12,939	50,328	81,291	81,129	81,357	81,637
Net PV (£k)	-	12,739	45,419	73,345	75,117	73,316	73,140
B/C Ratio	-	64.6	10.3	10.2	13.5	9.9	9.6
Inc B/C ratio	-	-	7.9	10.2	11.7*	0.9**	0.4

* Inc bc ratio wrt Maintain
** Inc bc ratio wrt Sustain

6.1.22 In accordance with the FCERM-AG decision rule, Sustain (1% aep) Yr 10 is the preferred option as detailed below.

6.1.23 Do Minimum has the highest benefit/cost ratio, but the standard will fall below the 1.3% aep threshold.

6.1.24 The Maintain option has a benefit cost ratio of 10.3 and incremental benefit cost ratio of 7.9. However the standard of protection for this option will fall below the 1.3% aep threshold.

6.1.25 Sustain (1% aep) has the next highest benefit/cost ratio (for investment now) at 10.2. The incremental benefit cost ratio with respect to Maintain is 10.2; therefore this option can be selected.

6.1.26 The incremental benefit cost ratio of Improve 0.5% is 0.9 – therefore Sustain is selected as the preferred economic option.

6.1.27 Optimising the time of investment of the Sustain project by delaying until year 10 has a benefit/cost ratio of 13.5 and a NPV of 2.4% greater than Sustain now. Therefore Sustain Yr 10 is the preferred option.

6.1.28 The preferred option reduces the risk of flooding and coastal erosion, which would lead to contamination of Langstone Harbour and the loss of strategic infrastructure such as Budds Farm wastewater treatment works.

6.1.29 The preferred strategic option is in line with the SMP2 policy to Hold the Line.

Reach 5 – Langstone & South Moor

Table 6.6 Benefit Cost Summary for Reach 5 - Langstone & South Moor

	Do Nothing	Do Minimum	Improve (1.3%)	Improve (1.0%)	Improve 1.3% with MR	Improve 1.0% with MR	Improve 0.5% with MR	Improve 0.3% with MR	Improve 1.3% Yr 10 with MR
PV Cost (£k)	-	30	2,953	3,074	2,615	2,713	2,907	3,037	1,870
Optimism Bias (£k)	-	18	1,772	1,844	1,569	1,628	1,744	1,822	1,122
Total PVc (£k)	-	48	4,724	4,918	4,184	4,340	4,651	4,859	2,992
PV damage PVd (£k)	15,916	15,394	131	106	131	106	28	12	1,347
PV damage avoided	-	522	15,784	15,810	15,784	15,810	15,888	15,903	14,568
Additional HRII & Env benefits (£k)	-	-	329	341	537	549	583	600	489
Total Benefits (£k)	-	522	16,114	16,151	16,321	16,358	16,470	16,503	15,058
Net PV (£k)	-	474	11,389	11,233	12,137	12,018	11,819	11,644	12,066
B/C Ratio		10.9	3.4	3.3	3.9	3.8	3.5	3.4	5.0
Inc B/C ratio	-	-	3.3	0.2	3.8*	0.2	0.4	0.2	4.9*

* Inc bc ratio wrt Do Minimum

6.1.30 In accordance with the FCERM-AG decision rule, Improve 1.3% (delayed to year 10) with Managed Realignment at South Moor, is the preferred economic option for Reach 5 as detailed below.

6.1.31 Do Minimum has the highest benefit cost ratio, but the standard is below the 1.3% aep threshold.

6.1.32 Improve 1.3% (delayed to year 10) with Managed Realignment, has the next highest benefit/cost ratio at 5.0. The incremental benefit cost ratio with respect to Do Minimum is 4.9; therefore this option can be selected.

6.1.33 The incremental benefit cost ratio of Improve 1.0% with MR is 0.2 – therefore Improve 1.3% (delayed to year 10) with MR is selected as the preferred economic option.

6.1.34 Optimising the time of investment of the Improve 1.3% with MR in Year 10 results in a higher benefit cost ratio than undertaking the works now, but the NPV is marginally

lower. The relatively low priority of the scheme in the national programme means that the scheme is unlikely to be funded in the immediate future without a substantial contribution.

6.1.35 The preferred option would provide inter-tidal habitat at South Moor to offset coastal squeeze losses within Langstone Harbour, but at the loss of designated freshwater / terrestrial / transitional habitat, which itself would require compensation. It is proposed to implement this immediately landwards of the current freshwater/terrestrial site where suitable land is available.

6.1.36 Selection of Managed Realignment as the long term preferred option for South Moor is, however, subject to a further detailed study that will regard Solent-wide issues, recreation and amenity of the site, alternative high-water roost sites for birds, the economic benefits to the local, regional and national economy and the North Solent SMP action plan. The need for freshwater/terrestrial habitat for roosting birds as a key estuary-wide resource may require adoption of Improve.

6.1.37 As a result, the preferred option for South Moor is Maintain until Year 20, whilst further detailed studies are completed over the next 3 years.

6.1.38 The preferred strategic option is in line with the SMP2 policy to Hold the Line, and with the potential realignment site at South Moor requiring further studies.

Reach 6 – Warblington to Conigar Point

Table 6.7 Benefit Cost Summary for Reach 6 - Warblington to Conigar Point

	Do Nothing	Do Minimum	Managed Realignment	Sustain 20%	Sustain (20%) Yr 10
PV Cost (£k)	-	42	532	4,396	3,142
Optimism Bias (£k)	-	25	319	2,638	1,885
Total PVc (£k)	-	67	850	7,033	5,028
PV damage PVd (£k)	68	59	48	-	-
PV damage avoided	-	9	20	68	68
Additional HRII & Env benefits (£k)	-	69	100	0	0
Total Benefits (£k)	-	79	120	68	68
Net PV (£k)	-	11	-731	-6,965	-4,960
B/C Ratio	-	1.2	0.1	0.0	0.0
Inc B/C ratio	-	-	0.1	0.0	0.0

6.1.39 Do Minimum is selected as the preferred economic option since it has the highest benefit cost ratio, and other options do not provide a benefit cost ratio greater than 1.

6.1.40 Do Minimum provides the minimal expenditure to achieve the strategic objective to manage coastal squeeze where there is no imperative reason for over-riding public interest. As the existing defences reach the end of their residual life appropriate minimal expenditure will result in the natural realignment increasing inter-tidal habitat.

6.1.41 Selection of Managed Realignment as the long term preferred option for Warblington and Conigar is, however, subject to further detailed assessment of the designated habitat and features across the estuary. The need for freshwater/terrestrial habitat for roosting birds as a key estuary-wide resource may require adoption of Sustain.

6.1.42 As a result, the preferred option for Warblington and Conigar is Maintain until Year 20, whilst further detailed studies are completed over the next 3 years.

6.1.43 The landowner (Havant Borough Council) may decide to enable hold the line options at private expense, subject to support from Natural England. Continuing to hold the line would require compensatory habitat due to coastal squeeze. Compensatory habitat is delivered via the Regional Habitat Creation Programme, which therefore incurs public expense unless private funds contribute to cost of providing this habitat.

6.1.44 The SMP2 preferred option is to Hold the Line, with further detail studies to consider managed realignment.

Reach 7 – Emsworth

Table 6.8 Benefit Cost Summary for Reach 7 - Emsworth

	Do Nothing	Do Minimum	Maintain	Sustain (5%)	Improve (1.3%)	Improve (1%)	Improve (0.5%)	Improve (0.3%)	Improve (1.3%) Yr 10
PV Cost (£k)	-	261	2,161	10,145	10,409	10,648	11,005	11,299	8,204
Optimism Bias (£k)	--	157	1,297	6,087	6,245	6,389	6,603	6,780	4,922
Total PVc (£k)	-	417	3,458	16,232	16,654	17,037	17,607	18,079	13,126
PV damage PVd (£k)	73,942	69,377	60,615	11,929	2,083	1,392	743	516	3,762
PV damage avoided	-	4,564	13,327	62,013	71,859	72,550	73,198	73,426	70,180
Additional HRII & Env benefits (£k)	-	-	-	851	1,049	1,092	1,196	1,248	926
Total Benefits (£k)	-	4,564	13,327	62,864	72,908	73,642	74,394	74,673	71,106
Net PV (£k)	-	4,147	9,869	46,632	56,254	56,605	56,787	56,594	57,980
B/C Ratio	-	10.9	3.9	3.9	4.4	4.3	4.2	4.1	5.4
Inc B/C ratio	-	-	2.9	3.9	23.8	1.9	1.3	0.6	6.0*

* Inc bc ration wrt Maintain

6.1.45 In accordance with the FCERM-AG decision rule, Improve 1.3% in Year 10 is the preferred option as detailed below

6.1.46 The highest benefit cost ratio is Do Minimum at 10.9. This is not within the indicative range.

6.1.47 The Maintain option has a benefit cost ratio of 3.9 and incremental benefit cost ratio of 2.9, and can therefore be selected. This option is not within the indicative range.

6.1.48 The Sustain option has a benefit cost ratio of 3.9 and an incremental benefit cost ratio of 3.9 and can therefore be selected. However this option also does not provide the indicative range for the strategy period.

6.1.49 The Improve 1.3% option has a benefit cost ratio of 4.4 and an incremental benefit cost ratio of 23.8, and can therefore be selected. This option is within the indicative range.

6.1.50 The incremental benefit cost ratio for Improve (1.0%) option is 1.9, therefore below the threshold of 3 and Improve 1.3% remains the preferred economic option.

6.1.51 Delaying to implement the preferred option in Year 10 results in a benefit cost ratio of 5.4 and a 3% higher NPV than now. The preferred timing is therefore to delay implementation until about Year 10.

6.2 Sensitivity Testing

6.2.1 The Defra Supplementary Note – Climate Change Impacts (October 2006) increasing rates of sea level rise is incorporated into the economic analysis. The sheltered estuaries of the study area do not allow any measurable off-shore wave impact on the defences, and the sensitivity to extreme wave height of +5% and +10% is not applicable. The latest Extreme Water Levels have reduced by only 5cm to 10cm across the range of return periods. This will not alter the selection of preferred options and will not significantly alter the benefits and costs calculated in this Strategy.

6.2.2 A adaptive approach has been incorporated into all Improve options. A 50 year allowance for sea level rise has been included, resulting in the design standard being exceeded initially, and falling to the standard at Year 50. Further costs for raising the defences in Year 50 to provide the same design standard in Year 100 have been included.

6.2.3 Two general sensitivity tests have been considered for each reach; a switching analysis (a change in the costs), and variation of Optimism Bias from 60% to 20%. Details of the economic sensitivity are included in the Economic Appraisal, Appendix G. Specific sensitivity tests are also included for the A3023 at Langstone and erosion rate at Emsworth.

6.2.4 Reach 1: Portchester to Paulsgrove – option selection is not sensitive to a switching analysis, but reduction of the Optimism Bias percentage would increase the incremental benefit cost ratio for the 1% (1:100) standard to 2.4. The difference in cost is less than 1%. Given the number of properties at risk it is considered that this test should be assessed in further detail at detail project appraisal phase

6.2.5 Reach 2: Horsea Island – option selection is not sensitive. Should Defence Estates elect to abandon the site the preferred option would still be required to prevent erosion and loss of the landfill site

6.2.6 Reach 3: M27 & Farlington Marshes – option selection for M27 frontage is not sensitive to the generic option of Sustain. The sensitivity and uncertainty determining the long-term option for Farlington Marshes is assessed in Section 6.1.11 to 6.1.17.

6.2.7 Reach 4: Brockhampton Quay – option selection using the decision process is robust, and is not sensitive to a switching analysis. Optimism Bias variation to 20% increases the incremental benefit cost ratio of the Improve 0.5% option, but not sufficiently to select this higher standard option

6.2.8 Reach 5: Langstone & South Moor –The selection for Langstone of Improve 1.3% (1:75) is not sensitive to switching option. The option selection is sensitive to timing with marginal difference in NPV for undertaking the preferred option now or in 10 years. Funding availability based on scheme priority will dictate the timing of the preferred option. Variation of Optimism Bias does not vary the incremental benefit cost ratios significantly. Inclusion of the A3023 infrastructure asset (valued as a least-cost proxy method) increases the Do Nothing damages and therefore the benefit cost ratio of all options increases - the benefit cost ratio would increase to 4.0. The selection of option for South Moor is dependent on future studies and therefore no sensitivity assessment has been undertaken.

6.2.9 Reach 6: Warblington & Conigar Point – option selection is not sensitive since selection is based on minimising cost to achieve the desired environmental objectives.

6.2.10 Reach 7: Emsworth - option selection is not sensitive to switching option, but is sensitive to timing with marginal variation in NPV for undertaking the preferred option now or in 10 years. Funding availability based on scheme priority will dictate the timing of the preferred option. Optimism Bias variation from 60% to 20% increases the incremental benefit cost ratio of the Improve 1% (1:100) option, but not sufficiently to select this higher standard option. If the erosion rate for west Emsworth were zero, then the Do Nothing damages would reduce slightly, resulting in the benefit cost ratio reducing from 5.4 to 5.2.

6.3 Details of the Preferred Option

Technical and Environmental Aspects

6.3.1 The preferred options for the majority of the strategy frontage is to hold the line, with a combination of Maintain, Sustain and Improve. The works to deliver this is not anticipated to be technically challenging, given the nature of the sites and sheltered nature of the harbours. Holding the line will cause inter-tidal habitat loss (coastal squeeze) of the designated estuaries, requiring up to 71.5ha of compensatory habitat over the 100 year life time of the scheme.

6.3.2 The preferred option for Farlington Marsh is Maintain for 20 years, with further detailed studies required to determine the preferred long-term preference to either Sustain or implement a Managed Realignment scheme across some or all of the 123ha site. Any managed realignment would require compensatory habitat to be successfully established prior to realignment implementation. The potential site for this habitat (if required) has not been confirmed at this stage.

6.3.3 The preferred option for South Moor, Warblington and Conigar are similar to Farlington, with detailed studies required to assess wider environmental impacts. For South Moor, a managed realignment would require compensatory habitat to be successfully established prior to realignment implementation. It is proposed that the 10ha of compensatory habitat required will be established immediately landwards of the existing site where land has been identified as available.

Costs of the Preferred Option

6.3.4 The combined preferred option cost total for all capital schemes recommended within the first 10 years is illustrated in Table 6.9. The cost summary for Farlington Marsh includes for the potential compensatory habitat requirements in Year 3 to 5, should detail studies indicate that Managed Realignment in Year 20 is the optimum longer term solution.

Table 6.9 Preferred Option Cost Summary (£k)

Item	Reach 1 Port' Castle to Paulsgrove	Reach 2 Horsea Island	Reach 3 M27 & Farlington Marshes	Reach 4 Brock' Quay	Reach 5 Langstone & S Moor	Reach 6 Warb'ton & Conigar Point	Reach 7 Emsworth	Total (£k)
Preferred Option	Improve 1.3%	Maintain	M27:Sustain <0.1% FM: Maintain* 20% for 20 yrs	Sustain 1% Yr 10	Improve* Yr 10 1.3%	Maintain* 20% for 20 yrs	Improve 1.3% Yr 10	
Responsible Lead Authority	EA / FBC	PCC / MoD /	HA / PCC / EA	HBC / SW	EA / HBC	EA / HBC	EA / HBC / CDC /	Various
Authority costs (including surveys)	121	0	3	69	59	0	236	488
Preliminary costs	60	0	2	35	30	0	118	245
Consultants fees	302	0	8	173	148	0	591	1,222
Construction costs	3,020	0	77	2,082	1,796	0	7,374	14,347
Supervision / cost consultant fees	251	0	4	144	129	0	394	922
Construction Compensation	121	0	2	69	59	0	236	487
Environmental enhancement costs	151	0	4	86	69	0	394	704
Compensatory Habitat costs	801	0	975**	105	83	0	113	2,190**
Sub-total	***4,829***	***0***	***1,075****	***2,763***	***2,373***	***0***	***9,456***	***20,500***
Contingency (represents *60*% of project)	2,896	0	645	1,658	1,424	0	5,674	12,299
Inflation @ 2.5% per annum	635 (5 yrs)	0	87 (2 yrs)	1,238 (10 yrs)	1,063 (10 yrs)	0 (10 yrs)	4,238 (10 yrs)	
Total capital cost inc. inflation	***8,358***	***0***	***1,807***	***5,659***	***4,860***	***0***	***19,368***	
Whole life cash cost (excluding inflation)	23,914	19,342	14,183*	20,186	6,137	85*	28,894	112,741

* Preferred option for Farlington Marsh and Warblington & Conigar Point is Maintain for 20 years. Whole life costs for 20 year period only.
** Additional £4,305k would be required for freshwater / terrestrial compensatory habitat should Managed Realignment in Year 20 be selected as preferred long term option.

Contributions and Funding

6.3.5 Different organisations are responsible for flood and coastal risk management within the Strategy areas, as indicated in Table 6.9. As partners in this strategy the respective local authorities will promote their frontages, applying for FDGiA where appropriate. The Highways Agency will fund future maintenance of the M27/A27 revetment as required.

6.3.6 The Flood and Coastal Resilience Partnership Funding model has been applied to the schemes recommended in this Strategy. Table 7.4 provides the key Outcome Measure Data and shows the amount of FDGiA available for each Capital Improvement Scheme. Contributions will be required for schemes at Portchester, Langstone and Emsworth.

6.3.7 Existing defences will continue to be maintained (using Revenue Budget) whilst contributions are pursued for the Improvement schemes recommended in this Strategy.

6.3.8 A property developer has recently acquired the former Vosper Thorneycroft boat building commercial site in Portchester. Initial discussions with the Development

Control team has identified that they are willing to contribute to the proposed Improve scheme as part of the site development. Further negotiations are required to confirm commitment and the level of contribution.

6.3.9 There may also be potential developer contributions for the proposed Farlington Marsh vehicle culvert improvements. Further negotiations are required to confirm commitment and level of contribution.

6.3.10 The total Outcome Measure scores for Portchester & Paulsgrove and M27 & Farlington Marshes are not high compared with other projects competing for Flood Defence Grant In Aid (FDGiA). This situation might improve under Defra's proposed Future Funding Arrangements, which might provide a proportion of the funding required according to the outcomes delivered by the project.

6.3.11 The Outcome Measure scores for Langstone & South Moor and Emsworth are both relatively low, and are unlikely to receive FDGiA support in the short term to commence the next appraisal phase. An alternative funding mechanism will be required if these schemes are to be progressed now. The preferred option for Emsworth is to implement the preferred option in about 10 years. Both schemes have therefore been included in the Implementation Plan for Years 8-10. The Environment Agency will continue to work with the Local Authorities and local communities to identify and secure alternative funding sources.

6.3.12 The Outcome Measure score of 3.6 for Brockhampton Quay may not secure FDGiA funding - although the Sustain works at Budds Farm Treatment works would be primarily funded by Southern Water and not FDGiA. However the presence of landfill sites at both Horsea Island, Broadmarsh and south of Budds Farm, owned by the local authorities (PCC and HBC), will require periodic capital maintenance in addition to revenue repairs. At Broadmarsh capital maintenance is anticipated in about 10 years. It is proposed that moderation will apply to comply with the legal requirements, and funding would therefore be provided with FDGiA support.

Construction and Safety

6.3.13 Health and safety elements form a key consideration in design development. At this stage the options are not sufficiently developed to allow a comprehensive assessment of all the health and safety issues. However, the following generic risks have been considered as part of the option appraisal process:

6.3.14 Flood Risk – the majority of the strategy area is low lying with a flat topography and extreme water levels will lead to rapid progression.

6.3.15 Tidal inundation – under certain managed realignment scenarios, local access ways may be at risk of being inundated during extreme tides. This could require appropriate warning systems and signage. Consideration of these changes will need to be included within emergency arrangements and the emergency plans modified.

6.3.16 Defence structures – these are often open to public access and appropriate design and signage will be required to alert members of the public to the local hazards.

6.3.17 Access over defences – steep embankments and sea walls can create difficulties with access. Consideration should be given during the design of the structures for appropriate access and any signage arrangements required.

Sustainable Construction

6.3.18 A fundamental criteria of option development has been to identify and achieve integrated engineering, environmental and sustainable solutions. This approach will be further developed within the future scheme detailed appraisal development and subsequent detail design stages.

6.4 Summary of Preferred Strategy

Table 6.10 Summary of Preferred Strategy

	Reach 1 Portchester & Paulsgrove	Reach 2 Horsea Island	Reach 3 M27 & Farlington Marshes	Reach 4 Brock'ton Quay	Reach 5 Langstone & South Moor	Reach 6 Warblington & Conigar	Reach 7 Emsworth	**Total**
Preferred Option & SoP	Improve 1.3%	Maintain	M27: Sustain <0.1% FM: Maintain* 20% for 20yrs	Sustain 1%	Improve* Yr 10 1.3%	Maintain* for 20 years 20%	Improve 1.3% (Yr 10)	
Total PV Cost (£k)	10,919	5,345	4,610	6,012	4,724	67	13,126	44,804
PV Benefits (£k)	155,002	54,089	435,217	81,129	16,114	79	71,106	812,734
Average BC Ratio	14.2	10.1	94.4	13.5	3.4	1.2	5.4	18.1
Capital Scheme Cost	7,726	0	1,721	4,420	3,797	0	15,306	32,970
Future Capital cost (£k)	14,572	16,918	11,119	14,150	2,680	32	12,487	71,958
Revenue cost (£k)	1,616	2,424	1,344	1,616	566	53	1,202	8,820
Whole Life Cost (£k)	23,914	19,342	14,183	20,186	6,137	85	28,994	112,741

* Preferred option for Farlington Marsh is Maintain for 20 years. Whole life costs for 100 year period not determined.

7 Implementation

7.1 Project Planning

Phasing and Approach

7.1.1 The strategy aims to promote and encourage long term sustainable and strategic management of flood risk. As well as planning for the implementation of capital projects, further studies, surveys and investigations, the strategy will help with targeting and prioritisation of day-to-day activities.

7.1.2 The national flood and coastal erosion risk management strategy for England, *"Understanding the risks, empowering communities, building resilience"*, section 5.3 describes how the maintenance of asset systems is carried out using a risk-based approach so that investment is made where activities contribute most towards reducing the potential for damage, and where it is economically and environmentally justified.

7.1.3 Future investment in maintenance will continue to be prioritised by using asset inspections, the National Flood and Coastal Defence Database (NFCDD) and System Asset Management Plans. Table 7.2 below presents an Implementation Programme for the entire Strategy frontage for the next 100 years.

7.1.4 Engagement with communities and stakeholders will need to continue in order to manage the risk and consequences of flooding. All parties who are responsible for the maintenance of defences, including private landowners, will need to be encouraged to monitor and maintain their defences whilst contributions are pursued for the Improvement schemes recommended in this Strategy. Resilience measures should continue to be promoted.

7.1.5 Operating Authorities should keep the issue of loss of life under review and update their risk assessments in line with any change to the defence structures or through climatic variability.

Action Plan

7.1.6 The key actions recommended by this strategy are presented in Table 7.1, which identifies the outline programme for the next 5 years. Projects at Brockhampton Quay, Langstone and South Moor and Emsworth have low prioritisation scores as derived from the Outcome Measure contributions and have therefore assumed to be delayed until Year 8-10, unless funding is made available from sources in addition to FDGiA.

7.1.7 The Environment Agency will continue to work with the Local Authorities, other partners, riparian owners and local communities to identify and secure alternative funding sources to provide contributions wherever possible.

Table 7.1 Outline Programme for next 5 years

Activity	Dates
Portchester Castle to Paulsgrove scheme	
Commence detailed appraisal	2013
Construction start	2015
Construction completion	2016
Farlington Marsh Culverts – reduce risk to Farlington and Drayton	
Commence detailed appraisal	2011
Construction start	2012
Construction completion	2013
Solent-wide high-tide roost management strategy	
Commence strategy	2012
Complete strategy	2013
Farlington Marshes – identify and secure compensation requirements	
Commence study	2013
Complete study	2015

Programme and Spend Profile

7.1.8 The strategy proposes a 100-year capital investment and maintenance programme to reduce the risks of coastal erosion and flooding from the sea. Implementation of the strategy will depend upon the availability of funding. To deliver this work requires the Environment Agency to continue working with partners, operating authorities, land owners and potential contributors to secure the necessary funds.

7.1.9 The 100-year Implementation programme is presented in Table 7.2 and has been split into 3 epochs, to match the SMP policy periods: years 1-20, 20-50 and 50-100. The responsible authorities have been listed against each reach.

Table 7.2 Implementation Programme

Short Term (Year 1-20)		
Reach	**Element**	**Responsible Authorities**
1 – Portchester Castle to Paulsgrove	**Year 1-5:** a) Improve 1.3% aep scheme – raise defences from Portchester Castle to Paulsgrove. Detailed appraisal to consider optimising SoP with improved cost certainty, contributions and the potential to include Paulsgrove now rather than Year 30 (ie Option Improve A)	EA / EH / FBC
2 - Horsea	**Year 1-20:** a) Maintenance of revetment and seawalls as required	PCC / MoD / HCC
3 – M27 & Farlington Marshes	**Year 1-5:** a) Maintenance of Farlington revetment & provision of Farlington Marsh vehicle culvert flood gate or bund. b) Solent-wide study to identify species specific impacts from Sustain and MR at Farlington on the wider estuary, potential mitigation and compensatory habitat requirements **Year 5-10:** c) Pending outcome of b), procure land to provide future compensatory habitat – to suit selection of Sustain or Managed Realignment as long-term preferred option. Initiate works to start to establish required habitat quality. **Year 11-20:** a) Maintenance of M27 revetment. b) Maintenance of Farlington Marsh revetment c) Develop required quality of compensatory habitat initiated in Year 5-10 (if MR selected)	EA EA / PCC / HWT EA / PCC / HWT
4 – Brockhampton Quay	**Year 10:** a) Embankment raising at Budds Farm WTW b) Capital Maintenance of sea walls at landfill site(s)	SW HBC
5 – Langstone & South Moor	**Year 1-5:** a) Solent-wide study to identify species specific impacts from Sustain and MR at South Moor on the wider estuary, potential mitigation and compensatory habitat requirements **Year 5-10:** b) Improve 1.3% aep scheme – raise defences (embankments and walls) at Langstone c) Pending outcome of a), procure land to provide future compensatory habitat to suit selection of Sustain or Managed Realignment as the long term preferred option. Initiate works to start to establish required habitat quality.	EA / HBC EA / HBC EA / HBC
6 – Warblington to Conigar	**Year 1-5:** a) Solent-wide study to identify species specific impacts from Do Minimum (natural realignment) at Warblington & Conigar on the wider estuary. **Year 11 to 20:** a) Pending outcome of detailed studies in Year 1-5, implement either Sustain or Do Minimum until defences fail and revert to Do nothing (withdrawal of maintenance), managing residual H&S risks, local embankment to cemetery and recreational footpath.	EA / HBC HBC
7 - Emsworth	**Year 5-10:** a) Improve 1.3% aep scheme – raise defences (embankments and walls)	HBC / EA

Medium Term (Year 20 - 50)		
Reach	**Element**	**Responsible Authorities**
1 – Paulsgrove	**Year 30:** a) Improve 1.3% aep at Paulsgrove (if not previously incorporated into Year 1-5 improvement scheme)	EA / PCC
2 - Horsea	**Year 20:** a) Maintenance of revetment and seawalls as required	PCC / MoD / HCC
3 – M27 & Farlington Marshes	**Year 20:** d) Pending outcome of detailed studies in Year 1-5, either Sustain existing alignment with major improvement works at Farlington Marshes, or undertake Managed realignment, with appropriate compensatory habitat as required. **Year 21-50:** e) Maintenance of M27 revetment. f) Install flood gates at subway under M27, west of train line. g) Maintenance of Farlington Marsh revetment or Managed Realignment revetment and habitat establishment	HA EA EA / HWT / PCC HA EA / PCC / HWT
Other reaches	Monitor and maintain as required	

Long Term (Year 50-100)		
Reach	**Element**	**Responsible Authorities**
1 – Portchester Castle to Paulsgrove	**Year 50-100:** a) Sustain standard with maintenance and raising of defence crest level in about Year 55 to allow for future sea level rise.	EA / EH / FBC / PCC / Landowner
2 – Horsea Island	**Year 50-100:** a) Maintain current defences with replacement, refurbishment and general repair works as required.	PCC / MoD / HCC
3 – M27 & Farlington Marshes	**Year 50-60:** a) Raise level of embankments adjacent to A2030/M27 and A27/M27 junctions to sustain SoP to critical infrastructure. b) defend train line to/from Portsmouth as it passes under M27. c) Pending outcome of detailed studies in Year 1-5, undertake Managed realignment at Farlington Marshes or continued maintenance of revetment. **Year 50-100:** d) Maintenance of M27 and Farlington revetments.	HA / HBC NR / PCC / EA EA / PCC / HWT HA / EA / PCC / HWT
4 – Brockhampton Quay	**Year 50-100:** a) Sustain standard with maintenance and raising of defence crest level in about Year 50 to allow for future sea level rise.	HBC / SW /
5 – Langstone & South Moor	**Year 50-100:** a) Sustain standard with maintenance and raising of defence crest level in Year 60 to allow for future sea level rise. b) Local managed realignment at Langstone Mill Pond.	EA / HBC / HCC / EA / HBC /
6 – Warblington & Conigar Point	**Year 50-100:** Maintain cemetery and footpath if sustainable and economically viable.	HBC / Landowner
7 – Emsworth	**Year 50-100:** a) Sustain standard with maintenance and raising of defence crest level in about Year 60 to allow for future sea level rise.	HBC / EA / CDC and Property owners

PCC – Portsmouth City Council, MoD – Ministry of Defence, HA – Highways Agency, EA – Environment Agency, HWT – Hampshire Wildlife Trust, HBC – Havant Borough Council, HCC – Hampshire County Council, EH – English Heritage, FBC – Fareham Borough Council, SW – Southern Water, NR – National Rail, CDC – Chichester District Council.

7.1.10 The spend profile in Tables 7.3 shows the cash costs for the recommended short term actions. The costs include Optimism Bias.

Table 7.3 Spend Profile Summary

Element	Total cost to Year 10 (£k)	Year 1 2011/12	Year 2 2012/13	Year 3 2013/14	Year 4 2014/15	Year 5 - 2015/16	Year 6-10 2016/21	Year 11-20 2021/31
1 – Portchester & Paulsgrove	7,726	-	-	483	483	6,760	0	0
2 – Horsea Island	0	-	-	-	-	-	-	2,800
3 – M27 & Farlington Marshes	1,721 4,305*	161	160	1,400	-	0	4,305*	4,074 to 8,326**
4 – Brockhampton Quay	4,420	-	-	-	-	-	4,420	0
5 – Langstone & South Moor	3,797	-	-	-	-	-	3,797	665
6 – Warblington & Conigar	0	-	-	-	-	-	0	32 to 7,109**
7 – Emsworth	15,306	-	-	-	-	-	15,306	0
Inflation @ 2.5% pa	9,250	4	8	145	50	888	8,155	Excl.
Total (inc. inflation)	**46,525**	**165**	**168**	**2,028**	**533**	**7,648**	**35,983**	**7,571 to 18,900**

* Additional cost identified for Farlington Marshes for establishing freshwater/terrestrial compensatory habitat, if required as part of a Managed Realignment in year 20
****** Year 11-20 costs dependent on selection of preferred option

Outcome Measures

7.1.11 Outcome measure scores are detailed in Table 7.4, together with a derived total combined score to assist prioritisation for reaches with Improve or Sustain as the preferred option. Delivery of these contributions will depend on the timing of implementation for each project.

7.1.12 The negative net BAP habitat scores have not been incorporated into the total outcome measure score since compensatory habitat costs are included in the scheme costs.

Table 7.4 Flood and Coastal Resilience Partnership Funding: Improvement schemes

	Reach 1 Portchester Castle to Paulsgrove	Reach 3 Farlington & Drayton culverts	Reach 5 Langstone & South Moor	Reach 7 Emsworth
PV Cost (for duration of benefits) £k	7,800	250	3,950	14,500
PV Benefit (for duration of benefits) £k	50,000	1,120	8,430	41,300
Cash Cost of next phase £k	**7,730**	**195**	**2,720**	**9,990**
Duration of Benefits (years)	30	20	50	50
OM2 households better protected against flood risk	359	259	43	194
OM3 households better protected against coastal erosion	0	0	0	0
OM4 statutory environmental obligations met	0	0	0	0
FDGiA contribution	**3,360**	**451**	**563**	**2,650**
OM score (%)	**43**	**180**	**14**	**18**
Contribution required for OM of 100%	**4,440**	**-**	**3,387**	**11,800**

** Reaches 2, 4 & 6 do not require Capital Investment based on Outcome Measures, so have not been presented

7.2 Procurement Strategy

7.2.1 Table 7.5 summarises the key staff involved in the preparation of the Portchester Castle to Emsworth Flood and Coastal Erosion Risk Management Strategy. The Project Board included representatives from all four Local Authorities, the Area Flood Risk Manager, NEAS Unit Manager (South), ncpms (Project Executive) and the NEECA2 consultant project Director.

Table 7.5 Key Staff

Environment Agency		**Framework Suppliers**	
Client		**NEECA2 Team** - Halcrow	
Project Sponsor (Area Flood Risk Manager)	Andy Gilham	Project Director	Imran Bukhari
Business User	Ian Tripp	Project Manager	Adam Schofield
Project Executive	Samina Khan	Environmental Consultant	Robert Kleinjan
Project Manager	Richard Townson	**NCF**	Nuttall-Hynes
NEAS Officer	Anthony Bishop	**NSIF**	Not required
Fareham Borough Council		**Portsmouth City Council**	
Coastal Engineer	David Watkins Scott Mills	Coastal Defence Partnership	Bret Davies, Kirsty Klepacz Lyall Cairns
Havant Borough Council		**Chichester District Council**	
Coastal Defence Partnership	Lyall Cairns, Kirsty Klepacz, Bret Davies	Coastal Engineer	David Lowsley Gavin Holder

7.3 Delivery Risks

7.3.1 The key risks with the implementation of the strategy are identified in Table 7.6

Table 7.6 Risk and mitigation

Risk	**Key Mitigation**
1. Funding from central FDGiA for some reaches is uncertain due to the relatively low Outcome Measure scores. **Risk = High**	Additional sources of funding will need to be investigated including levy funding and partnership funding if the preferred options for these frontages are going to be progressed in the short term. **Residual risk = Medium**
2. Provision of suitable compensatory habitat in advance of strategy improvement options at Portchester and other reaches. **Risk = High**	The Region Habitat Creation Programme is delivering the compensatory habitat requirements identified in this strategy. Funding for the creation of the compensatory habitat has been identified as part of the cost of the preferred options where appropriate. **Residual risk = Medium**
3. Major storm event could occur before implementation, leading to additional costs or change in option. **Risk = Medium**	Aim to implement strategy as soon as funding availability is confirmed. Undertake further detailed study at Farlington Marshes to identify best long-term management of habitat across site and impacts on wider estuary. Continue stakeholder engagement. **Residual risk = Medium**

Appendix A Project Appraisal Report Data Sheet

Entries required in clear boxes, as appropriate.

GENERAL DETAILS

Authority Project Ref. (as in forward plan):	IMSO 000556
Project Name (60 characters max.):	Portchester Castle to Emsworth Coastal Flood and Erosion Risk Management Strategy
Promoting Authority: Defra ref (if known)	
Name	
Emergency Works:	No (Yes/No)
Strategy Plan Reference:	n/a
River Basin Management Plan	n/a
System Asset Management Plan	n/a
Shoreline Management Plan:	North Solent
Project Type:	Strategy Plan

Shoreline Management Study/ Preliminary Study/ Strategy Plan/Prelim. Works to Strategy/ Project within Strategy/Stand-alone Project/ Strategy Implementation/Sustain SOS. Coast Protection/Sea Defence/Tidal Flood Defence/Non-Tidal Flood Defence/Flood Warning Tidal/Flood Warning - Fluvial/Special

CONTRACT DETAILS

Estimated start date of works/study:	2012
Estimated duration in months:	On-going
Contract type*	

(*Direct labour, Framework, Non Framework, Design/Construct)

COSTS

	APPLICATION (£000's)
Appraisal:	?
Costs for Agency approval:	£113m (Whole Life Cost)
Total Whole Life Costs (cash):	£113m

For breakdown of costs see Table in Section 2.4

CONTRIBUTIONS

Windfall Contributions:	none
Deductible Contributions:	none
ERDF Grant:	None
Other Ineligible Items:	None

LOCATION - to be completed for all projects

EA Region/Area of project site (all projects):	South-East
Name of watercourse (fluvial projects only):	n/a
District Council Area of project (all projects):	Fareham BC, Portsmouth CC, Havant BC & Chichester CC
EA Asset Management System Reference:	Varies
Grid Reference (all projects):	SU 6260 0453

(OS Grid reference of typical mid point of project in form ST064055)

DESCRIPTION

Specific town/district to benefit:	Portchester,

Brief project description including essential elements of proposed project/study
(Maximum 3 lines each of 80 characters)

Strategy recommends a range of schemes across the coastal cells as follows:

- Portchester to Paulsgrove – Improve 1.3% SoP
- Horsea Island – Maintain
- M27 frontage (Cosham) – Sustain
- Farlington Marshes – Maintain for next 20 years pending further studies
- Brockhampton – Sustain
- Langstone & South Moor – Improve in year 10, 1.3% SoP with Managed Realignment at South Moor (Yr 20+)
- Warblington & Conigar Point – Do Minimum for 20 years
- Emsworth – Improve 1.3% in Year 10 SoP

DETAILS

Design standard (chance per year):	1 in 75 for Portchester, Langstone & Emsworth	yrs
Existing standard of protection (chance per year)	Typically 1 in 20	yrs
Design life of project:	100	yrs
Fluvial design flow (fluvial projects only):	n/a	m^3/s
Tidal design level (coastal/tidal projects only):	3.5 to 3.7mOD	m
Length of river bank or shoreline improved:	8600	m
Number of groynes (coastal projects only):	0	
Total length of groynes* (coastal projects only):	0	m
Beach Management Project?	No	Yes/No
Water Level Management (Env) Project?	No	Yes/No
Defence type (embankment, walls, storage etc)	Walls and embankments	

* i.e. total length of all groynes added together, ignore any river training groynes

ADDITIONAL AGREEMENTS:

Maintenance Agreement(s):	n/a	Not Applicable/Received/Awaited
EA Region Consent (LA Projects only):	n/a	Not Applicable/Received/Awaited
Non Statutory Objectors:	n/a	Yes/No
Date Objections Cleared:		
Other:	n/a	Not Applicable/Received/Awaited

ENVIRONMENTAL CONSIDERATIONS

Natural England (or equivalent) letter:	Received	Not Applicable/Received/Awaited
Date received		

SITES OF INTERNATIONAL IMPORTANCE
(Answer Y if project is within, adjacent to or potentially affects the designated site)

Special Protection Area (SPA):	Y	Yes/No
Special Area of Conservation (SAC):	Y	Yes/No
Ramsar Site	Y	Yes/No
World Heritage Site	No	Yes/No
Other (Biosphere Reserve etc)	Yes	Yes/No

SITES OF NATIONAL IMPORTANCE (Answer Y if project is within, adjacent to or potentially affects the designated site)

Environmentally Sensitive Area (ESA):	Yes	Yes/No
Site of Special Scientific Interest (SSSI):	Yes	Yes/No
National/Regional Landscape Designation:	No	Yes/No
National Park/The Broads	No	Yes/No
National Nature Reserve	Yes	Yes/No
AONB, RSA, RSC, other	No	Yes/No
Scheduled Ancient Monument	Yes	Yes/No
Other designated heritage sites	No	Yes/No

OTHER ENVIRONMENTAL CONSIDERATIONS

Listed structure consent	No	Not Applicable/Received/Awaited
Water Level Management Plan Prepared?	No	Yes/No
FEPA licence required?	Yes	Not Applicable/Received/Awaited
Statutory Planning Approval Required	No	Yes/No/Not Applicable

COMPATIBILITY WITH OTHER PLANS

Shoreline Management Plan	Yes	Yes/No/Not Applicable
River Basin Management Plan	n/a	Yes/No/Not Applicable
Catchment Flood Management Plan	n/a	Yes/No/Not Applicable
Water Level Management Plan	n/a	Yes/No/Not Applicable
Local Environment Agency Plan	Yes	Yes/No/Not Applicable

SEA/ENVIRONMENTAL IMPACT ASSESSMENT

SEA	Statutory required	Statutory required/Agency voluntary/not applicable
EIA	Yes	Yes (schedule 1); Yes (schedule 2); SI1217; not applicable
SEA/EIA status	SEA prepared	Scoping report prepared/draft/draft advertised/final

Other agreements

Detail	Result

(Not Applicable/Received/Awaited for each)

Costs, benefits & scoring data

(Apportion to this phase if part of a strategy)

Local authorities only: For projects done under Coast Protection Act 1949, please separately identify: FRM = Benefits from reduction of asset flooding risk; CERM = Benefits from reduction of asset erosion risk

Benefit type (DEF: reduces risk (contributes to Defra SDA 27); CM: capital maintenance; FW: improves flood warning; ST: study; OTH: other projects) | DEF |

LAND AREA

Total area of land to benefit:			Ha
of which present use is:	FRM	CERM	
Agricultural:			Ha
Developed:			Ha
Environmental/Amenity:			Ha
Scheduled for development			Ha

PROPERTY & INFRASTRUCTURE PROTECTED

	Number		Value (£'000s)	
	FRM	CERM	FRM	CERM
[1]Residential	901			
Commercial/industrial	178			
Critical Infrastructure	Yes (see below)			
Key Civic Sites				
Other (description below):				
Description:	M27/A27 highways, Budds Farm WTW			

costs and Benefits

[1]Present value of total project whole life costs (£'000s):	£44.8m	
Project to meet statutory requirement? *Y/N*	N	

	Value (£'000s)	
	FRM	CERM
Present value of residential benefits:		
Present value of commercial/industrial benefits:		
Present value of public infrastructure benefits:		
Present value of agricultural benefits:		
Present value of environmental/amenity benefits:		
[1]Present value of total benefits (FRM & CERM)	£813m	
Net present value:	£768m	
Benefit/cost ratio:	18.1	

Base date for estimate:		
PAG Decision Rule stage 3 applied	Yes	Yes/No
PAG Decision Rule stage 4 applied	Yes	Yes/No

OTHER OUTCOME MEASURE SCORING DETAILS

Super Output Area No*: **varies** Indicate if deprived: No Yes/No

(*as ranked by Indices of Multiple Deprivation)

Risk: VH, H or N/A

	Wetland	Saltmarsh/ Mudflat	
Net gain of BAP habitat:	0	-71	Ha

SSSI protected:	123	Ha
Other Habitat:		Ha
Heritage Sites:		“I or II” , “II or other” or “N/A”

Exemption Details (if exempt from OM scoring system)

Exempt from Scoring:		Yes/No

Reason (max 100 chars):