

Strategy approval report



A great place to live, work & play

Authority Strategy Reference

Defra CPW Number

Promoting Authority

Strategy Name



Date

Version

CONTENTS

iii **Approval History Sheet**

v **Scheme of Delegation Cover Sheet**

1	EXECUTIVE SUMMARY	1
1.1	Introduction and Background	1
1.2	Problem.....	2
1.3	Options.....	2
1.4	Recommended Strategy	3
1.5	Economic Case and Outcome Measures.....	3
1.6	Environmental and Social Considerations.....	4
1.7	Risks	4
1.8	Implementation	4
1.9	Contributions and Funding	5
1.10	Status.....	5
1.11	Recommendations	5
1.12	Director's Briefing Paper	6
1.13	Key Plan.....	7
2	BUSINESS CASE.....	8
2.1	Introduction and Background	8
2.2	Problem.....	11
2.3	Options Considered	16
2.4	Cost of Options	19
2.5	Benefits of Options.....	22
2.6	Environmental and Social Assessment.....	25
2.7	Choice of Preferred Option	32
2.8	Other Considerations	40
3	STRATEGY PLAN.....	41
3.1	Outline of Plan	41
3.2	Programme	41
3.3	Procurement	41
3.4	Risk Schedule	41

TABLES

Table 1	Economic summary and outcome measures for proposed strategy
Table 2	Risks and mitigation
Table 3	Strategy costs (£k)
Table 4	Households at risk of erosion under No Active Intervention
Table 5	Likely Failure Mechanisms & Residual Life under NAI
Table 6	Options selected for detailed evaluation
Table 7	Summary of costs for preferred strategy (£k)
Table 8	Communications and consultations
Table 9a	Key impacts summary
Table 9b	Environmental enhancement summary
Table 10a	Economic summary for each management unit
Table 10b	Factors effecting option choice for each management unit
Table 11	Summary of preferred strategy options (£k)
Table 12	Residual risk management
Table 13	Strategy cash expenditure profile

APPENDICES

- APPENDIX A - Supporting tables and figures
- APPENDIX B - Strategy technical report
- APPENDIX C - Economic appraisal
- APPENDIX D - Risk register
- APPENDIX E - Environmental report
- APPENDIX F - NRG briefing notes and coastal management units
- APPENDIX G - Natural England letter of support
- APPENDIX H - Outcome measures
- APPENDIX I - Carbon calculator
- APPENDIX J - List of reports available and references
- APPENDIX K - Indicative landscape plans
- APPENDIX L - Scarborough Borough Council Procurement Strategy
- APPENDIX M - Environment Agency SMP2 approval letter

Appendix A Tables

- A1 Details of coastal slope conditions and probabilities of coastal landslides
- A2 Summary of technical screening process for options
- A3 Damages, benefits and outcome measure scores for all options
- A4 Preliminary scheme prioritisation, programme and indicative costs

APPROVAL HISTORY SHEET			
To be completed by Promoting Authority			
Authority: Scarborough Borough Council		Authority Project Code: E519	
Strategy Title: Scarborough Coastal Defence Strategy Review – Holbeck to Scalby Mills		Date of StAR: May 2008	
Consultant Project Manager: M Cali		Consultant: Halcrow	
REVIEW			
Position	Name	Signature	Date
“I have reviewed this document and confirm the strategy meets our quality assurance requirements, satisfies all the required environmental obligations and meets Defra investment appraisal criteria”			
Authority Project Manager	C Matthews		
“I confirm that all internal approvals have been completed for this strategy and strategic risks considered and recommend submission to the Environment Agency for approval”			
Authority Project Executive	J Riby		
“I have reviewed this document and confirm that it complies with the current PAR / StAR guidelines”			
StAR Reviewer	A Parsons		
“I confirm the project is ready for submission to NRG”			
Area Flood Risk Manager	P Holmes		
PAB – Project Assessment Board		NRG – National Review Group	
(Strategies less than £2 million)		(Strategies greater than £2 million)	
(Delete as appropriate)			
Date of Meeting:		Chairman:	StAR Amendment No:
Presenter(s):			
Detailed record of any comments/actions required/additional information provided, to be appended to the StAR for onward transmission			
Recommended for approval: In the sum of £:		Date:	
STRATEGY APPROVAL			
AGENCY	Officers in accordance with the Agency’s SoD: Specified Officer; Regional Director; Director of Operations; Chief Executive or Director of Finance: Agency Board		
StAR Submitted		Date:	
Strategy Approval	By: In the sum of: £	Date:	
Defra or WAG APPROVAL (Projects above £250 million)			
Submitted to Defra / WAG or Not Applicable (as appropriate)		Date: Not Applicable	
StAR Amendment No. (if different):			
Defra/ WAG Approved by: N/A On behalf of Secretary of State		Date: Not Applicable	

FINANCIAL SCHEME OF DELEGATION (FSoD) COVERSHEET

1. Project name	Scarborough Coastal Defence Strategy Review – Holbeck to Scalby Mills			Start date	2008
				End date	2014
Business unit	Scarborough BC / EA North East Region	Programme	Capital Programme for North East Region / Scarborough BC		
Project ref.	CPW 1707	Regional FSoD ref.	N/A	Head Office FSoD ref.	-

2. Role	Name	Post Title
Project Sponsor	Peter Holmes	Area FRM
Project Executive	John Riby	Scarborough BC Head of Service
Project Manager	Chris Matthews	Scarborough BC Project Manager

3. Outline Risk Assessment (ORA) Category	Low	<input type="checkbox"/>	Medium	<input checked="" type="checkbox"/>	High	<input type="checkbox"/>
--	------------	--------------------------	---------------	-------------------------------------	-------------	--------------------------

4. FSoD schedule	Description	Delegation	
		Regional – up to	Environment Agency – up to
A1	<input type="checkbox"/> Non FRM project	£5m	£5m
A2	<input type="checkbox"/> FRM project within approved strategy	£5m capital	£100m WLC Defra/£5m capital NAW
A3	<input type="checkbox"/> FRM project outside of approved strategy	£5m capital	£100m WLC Defra/£5m capital NAW
A5	<input type="checkbox"/> Consultancy project	£300k	£500k
A9	<input checked="" type="checkbox"/> FRM Strategy	£500k	£250m WLC Defra/£5m capital NAW
O1	<input type="checkbox"/> IS/IT project	--	£5m
T2	<input type="checkbox"/> Purchase or lease of land and buildings	£40k purchase/£10k pa lease	£5m

5. FSoD value	£k
Preparation costs for FRM Strategy	150
Project costs in first 5 years	23,000
Whole Life Costs (WLC) of FRM Project or Strategy	221,000

6. Required level of Environmental Impact Assessment (EIA)	N/A	Low	Medium	High
	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

7. FSoD approver name	Post title	Signature	Date
Paul Leinster	Director of Operations		
FSoD consultee name	Post title	Signature	Date
Ken Allison	PAB/NRG Chair	RED <input type="checkbox"/> AMBER <input type="checkbox"/> GREEN <input type="checkbox"/>	
Peter Holmes	Area Flood Risk Manager		

8. Form G	Form G value (£k)	Regional FSoD ref.	Head Office FSoD ref.	Latest FSoD authorised cost (£k)
1			-	
2				

1 EXECUTIVE SUMMARY

Submission to obtain strategy approval

Region: North East
Strategy title: Scarborough Coastal Defence Strategy Review –
Holbeck to Scalby Mills
Approval Value: £221 million (Whole life cash cost)

Sponsor: Jim Dillon - Chief Executive, Scarborough Borough Council

APPROVAL ROUTE

Section A9 of the Financial Scheme of Delegation states that, for whole life costs in a Flood Risk Management Strategy, Environment Agency Board approval is required in excess of £50,000,000.

Route: National Capital Programme Manager	Miles Jordan
National Review Group	Ken Allison
Regional Director	Toby Wilson
Director of Operations	David Jordan
Director of Finance	Nigel Reader
Chief Executive	Paul Leinster
Board	
Defra	Not Applicable
Treasury	Not Applicable

1.1 Introduction and Background

1.1.1 The study area is within the North East Shoreline Management Plan 2 (SMP2) - River Tyne to Flamborough Head. At 6.9km, Scarborough with a population of over 52,000, has the longest defended frontage on the Yorkshire Coast. This submission seeks approval for a revised strategy for flood and coastal erosion risk management [FCERM] for Scarborough. The purpose of the strategy is to set a framework for management of the coastal risks relating to coastal erosion, wave overtopping, flooding and consequential cliff instability over the next 100 years.

1.1.2 We (Scarborough Borough Council), adopted SMP2 in July 2007. This supersedes SMP1, but makes no changes to the 'hold the line' policy for the Scarborough frontage, as agreed by Defra and the Environment Agency in 1997. SMP2 was formally approved by the Environment Agency in July 2009.

1.1.3 Following recommendations in SMP1, we developed a FCERM strategy in 1999 for Scarborough which was agreed by Defra in 2001. The most urgent scheme required under the 1999 strategy was the East Pier to the Holms around the Castle Headland. This coast protection scheme was implemented between 2002 and 2004.

1.1.4 A review of the strategy was undertaken during 2004 and 2005 to ensure that the FCERM strategy was updated to comply with revised national and local policies and guidelines. Following a period of public consultation the strategy review was adopted by Scarborough Borough Council in 2007. We are now seeking approval of the updated strategy and, in order to prepare this submission, we have undertaken further studies to ensure changes to guidance and policy since 2005 are taken into account.

Title	Scarborough Coastal Defence Strategy Review – Holbeck to Scalby Mills		
Version 3.1	Status: Final	Issue Date: Oct 09	Page 1

1.1.5 The coastline is dominated by the Castle Headland (78mAOD) and the two wide sandy bays, North and South Bay. The recently completed East Pier to the Holms coast protection scheme is expected to provide adequate level of protection to the Castle Headland over the next 50 years. The focus of the FCERM activities is therefore divided between the North and South Bays.

1.1.6 The 1999 strategy sub-divided the frontage into coastal management units that take account of detailed geomorphological mapping of cliff behaviour units and past defence practice. These management units (MUs) have been retained for the strategy review and are shown on the key plan.

1.1.7 Our elected members adopted the review of the Scarborough Coastal Defence Strategy in 2007 confirming commitment using our permissive powers under the Coast Protection Act (1949) to implement the strategy.

1.2 Problem

1.2.1 Scarborough is one of the premier seaside resorts in the UK with over 3.5 million visitors attracted each year by its unique combination of sandy beaches, Victorian gardens and promenades, heritage sites and entertainment venues. However, over 1700 households, 200 commercial properties and much of the town's tourist infrastructure is predicted to be destroyed by coastal erosion over the next 100 years if a No Active Intervention (NAI) strategy were adopted.

1.2.2 The existing coastal defences are a key factor in maintaining the sustainability of the local community and its economy. However, some of the older coastal defence structures are over 100 years old and approaching the end of their serviceable life. In order to achieve the SMP 'hold the line' policy urgent major improvements are required.

1.2.3 The main problems associated with the coastal defences include limited residual life of the sea wall structures, severe wave overtopping, flooding due to low crest elevations, low foreshore elevations and landslide risks.

1.2.4 The deteriorating condition of the sea walls will be further accelerated by the predicted effects of sea-level rise, climate change and in places the continued lowering of the foreshore.

1.2.5 The current and projected wave overtopping rates far exceed recognised safe rates (in terms of safety of the public and damage) of 0.1 l/s/m (EurOtop 2007). Example of current overtopping rate is 18 l/s/m for a 1 in 10 yr event. This increases to 29 l/s/m and 77 l/s/m for a 1 in 10 yr event in 2058 and 2108 respectively.

1.3 Options

1.3.1 A strategic long-term approach to dealing with the problem is required because there are inter-linked benefits and coastal processes but also variability in existing defence condition and risk of failure.

1.3.2 Due to the socio-economic value of the assets at risk, both SMP1 and SMP2 set the generic policy of 'hold the line' to the already defended frontage. In developing the updated strategy we have considered strategic options to hold the line in each Management Unit as described below.

1.3.3 Do Nothing (NAI) – the significant socio-economic damages associated would prevent adoption of this option which is the base case for do-something options.

Title	Scarborough Coastal Defence Strategy Review – Holbeck to Scalby Mills		
Version 3.1	Status: Final	Issue Date: Oct 09	Page 2

1.3.4 Do Minimum – this would involve maintaining the defences and repairing breaches / storm damage. For some locations this will be unsustainable over the 100-years due to rising sea levels and foreshore scour, but it is likely to form a significant part of the strategy.

1.3.5 Improve defences – Justification of capital improvements have been tested against do-minimum and do-nothing.

1.3.6 Do Minimum followed by improve when Do Minimum is no longer sustainable.

1.4 Recommended Strategy

1.4.1 The preferred erosion risk management options delay coastal erosion due to defence failure by adopting a management strategy such that breaches would be repaired before the initiation of consequential erosion and cliff failures.

1.4.2 The strategy review has identified schemes required within the short term (0 to 10 years), medium term (10 to 50 years) and long term (50 to 100 years). Refer to Table 1 below. The proposals include the use of rock armour on parts of the foreshore and raising the height of the sea walls. This strategy also makes allowance for further studies and project appraisals.

1.4.3 Taking into account the condition of the sea walls, the risk of failure and the consequences should the defences fail, upgrading the defences along The Spa frontage is considered a priority.

1.4.4 It should be recognised that due to the poor condition of the existing defences, provision is made within the strategy to undertake emergency works. Since 2000 we have undertaken emergency works at the Holms, South Cliff Gardens and Rose Gardens due to the displacement and breach of the sea walls at these locations.

1.5 Economic Case and Outcome Measures

1.5.1 Table 1 summarises the proposed strategy. The appraisal period is 100 years and the total strategy PV costs including optimism bias = £96.2 million. Whilst it is accepted that the benefit cost ratios (BCRs) and Outcome Measures scores may be marginal to attract grant aid, they support the current SMP2 policy to ‘hold the line’ and we will continue to maintain the defences using our (SBC) limited annual maintenance budget. In many locations the strategy is a ‘do-minimum’ and will not address wave overtopping issues and we may therefore have to consider alternative options in future strategy reviews.

Table 1 Economic summary and outcome measures for proposed strategy

Benefit Cost Ratios (BCR) and Outcome Measures (OM) Scores	Sea Life Centre	North Bay Cliffs	Clarence Gardens North	The Holms & Castle Headland	West Pier/Harbour	Foreshore Rd and St Nicholas Cliff	Spa Chalet	The Spa	Rose Gdns South Cliff Gdns South Bay Pool	Holbeck Gardens	Holbeck Cliff	Wheatcroft Cliff
Proposed year of construction	11 - 20	6 - 10	6 - 10	50 - 100	20 - 30	6 - 10	20-30	1 - 5	6 - 10 *	11-20 *	50 - 100	
Proposed SoP	Hold the line, with 1:100 to 1:200 standard for structural stability & 1:10 year for wave overtopping											
PV Costs inc 60% Opt Bias (£k)	4,780	5,110	18,300	13,000	2,330	6,410	4,740	14,100	96,200	8,250	979	
PV Benefits (£k)	7,600	20,300	48,500	43,200	426	51,700	22,600	68,200	23,500	8,190	511	
Net Present Value (£k)	2,820	15,200	30,300	30,200	-1,900	45,300	17,800	54,100	5,260	-55	-470	
BCR	1.6	4.0	2.7	3.3	0.2	8.1	4.8	4.8	1.3	1.0	0.5	
Cost Per Residential Prop (£k)	531	341	65	22	no props	82	75	37	73	317	70	
OM1: Economic benefits	1.6	4.0	2.7	3.3	0.2	8.1	4.8	4.8	1.3	1.0	0.5	
OM2: Households (No.) with lowered risk	0	15	280	0	0	47	26	148	251	26	0	
OM2b: Households (No.) moved from sig/high to mod/low risk	0	15	280	0	0	0	26	148	243	26	0	
OM3: Household (No.) in deprived communities	0	0	0	0	0	0	0	0	0	0	0	
OM4: SSSI (ha)	0	0	0	0	0	0	0	0	0	0	0	
OM5: BAP habitat (ha)	0	0	0	0	0	0	0	0	0	0	0	
OM Total Score	0.43	1.15	2.42	0.90	0.05	2.25	1.44	1.60	0.72	0.36	0.14	

* It should be noted that for these locations maintenance and possibly emergency repairs will be required to extend the residual life of the existing defences to the proposed improvement scheme construction year.

Title	Scarborough Coastal Defence Strategy Review – Holbeck to Scalby Mills
Version 3.1 Status: Final	Issue Date: Oct 09 Page 3

1.6 Environmental and Social Considerations

1.6.1 A Preliminary Environmental Appraisal was prepared in 2005 and a Strategic Environmental Assessment (SEA) of the updated strategy has been undertaken in April 2008.

1.6.2 There are no internationally protected sites within or adjacent to the area potentially impacted upon by the strategy. Therefore there is no requirement to undertake an Appropriate Assessment under the habitat regulations.

1.6.3 The strategy area falls within the wider Humber River Basin District established under the Water framework Directive (WFD). Specific objectives for the area have not yet been set. The default generic objectives are considered to be aligned to those of this strategy.

1.6.4 The public consultation on the draft strategy raised concerns with regard to the potential impact on both the natural and man-made environment, particularly at the Sealife Centre, where works have now been deferred until later in the programme due to the objections raised and also the poor economic case. Therefore, a key element of the strategy is the proposal to undertake further studies, ecological surveys, ground and condition surveys within the first five years of the programme. These will quantify potential impacts of options and also establish the level of risk with greater confidence and inform the review of the future strategy priorities.

1.7 Risks

Table 2 Risks and mitigation

Category	Risk	Key Mitigation
Technical	Defence failures before schemes are implemented	Monitoring, routine maintenance and emergency works
Political	No statutory duty for Council to undertake work using permissive powers	Council have adopted both SMP and strategy
Environmental	Objection from Natural England/refuse planning permission	Letter of comfort from Natural England obtained for Strategy. Undertake further surveys/consider alternative options for schemes
Social	Refuse planning permission to increase height of sea walls	Quantify risk and develop options through Public Consultation on specific schemes
Financial	Compensation to tourist businesses during construction	Consultation. Agree programme /working hours. Allow for compensation in risk budgets

1.8 Implementation

1.8.1 PAR submissions for funding approval will be required for capital schemes in the strategy. We plan to commence preliminary studies to develop a PAR for the first priority scheme (The Spa), in 2009/10. Subject to consents and funding approvals, construction is programmed to commence in summer 2011. Within the first five years further environmental/modelling studies, topographic/hydrographic surveys and site investigations (ie. preliminary costs) are required for the Sealife Centre, North Bay Cliffs and Clarence Gardens North. The strategic risk contingency is based on 60% Optimism Bias, apart from the priority scheme at the Spa, where a Monte Carlo risk analysis was undertaken.

1.8.2 It is anticipated that the priority scheme will be designed by a Scarborough Borough Council framework consultant and constructed in accordance with both Scarborough Borough Council and European procurement requirements. The further studies will be undertaken by a framework consultant. A breakdown of the costs for the first five years of the strategy and the overall costs of the strategy over the 100 year appraisal period are shown in Table 3.

Title	Scarborough Coastal Defence Strategy Review – Holbeck to Scalby Mills		
Version	3.1	Status:	Final
Issue Date:	Oct 09	Page	4

Table 3 Strategy costs (£k)

Item	The Spa *	Sealife Centre Further studies	North Bay Cliffs Further studies	Clarence Gardens North Further studies	Emergency Repairs & maintenance	Future/ Other MU Costs	Strategy Total
Costs Pre-PAR							
Council costs	47	10	5	5	3	407	477
Preliminary costs	425	90	45	45	27	3,660	4,300
Consultant fees	1,070				78	9,910	11,100
Construction costs	7,130				561	72,200	79,900
Environmental Enhancement	233					2,360	2,590
Maintenance	250	75	206	292	2,240	36,500	39,500
Sub Total	9,155	175	256	342	2,909	125,037	137,867
Contingency (represents 60% of project)	5,493	105	154	205	1,745	75,022	82,720
Inflation @ 5% per annum	2,193	21	34	43	177		
Total costs (yrs 1 to 5)**	16,841	300	444	591	4,831		
Future construction costs							163,559
Future maintenance cost over period of strategy							36,500
Whole life cash cost (including maintenance but without inflation)							220,587[^]

* Priority scheme

** Total for first 5 years = £23,000k (rounded to 3 significant figures)

[^] Whole life cash cost (100 years) = £221,000k (rounded to 3 significant figures)

1.9 Contributions and Funding

1.9.1 Maintenance to the coastal defences and the cliffs will continue to be funded through our Revenue funding stream. Capital Schemes will require Coast Protection Grant Aid.

1.9.2 Schemes with potential to attract contributions are the Sealife Centre, Foreshore Road and St Nicholas Cliff, Spa Chalet and The Spa. We have identified and undertaken initial investigations with potential partners and significant beneficiaries into possible contributions at this strategy review stage. All have indicated that once the strategy review is approved they will be willing to engage with Scarborough Borough Council to explore the detailed solutions and possible financial contribution towards these solutions. We would obtain commitment in principle and agree terms for possible contributions prior to tender stage, with the provision of securing contributions prior to commissioning the works.

1.10 Status

1.10.1 The proposals comply with the recommendations of the SMP 'hold the line' policy.

1.10.2 The preferred option is to replace or refurbish defences as they reach the end of their effective lives with improvements allowing for sustaining protection in line with sea level rise (climate change). The strategy will reduce the probability of erosion, removing 220 households from the short term risk band and 518 from the medium term risk bands.

1.11 Recommendations

1.11.1 Approval in principle is sought for the updated Scarborough Coastal Defence Strategy - Holbeck to Scalby Mills (years 0-100) with an estimated whole life cash cost of £221 million.

1.11.2 The costs for the implementation of the strategy over the first 5 years are estimated as £23,000k.

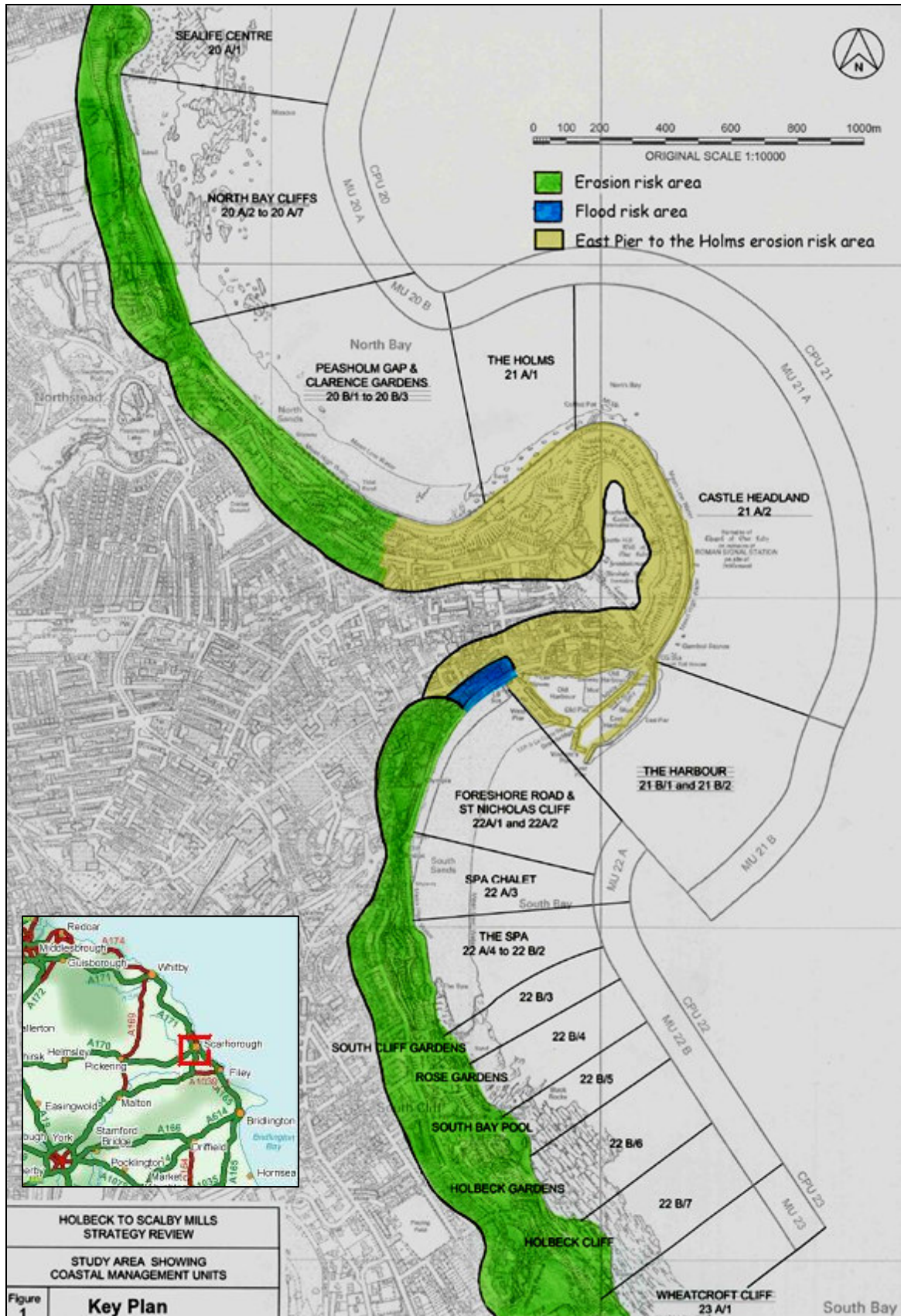
Title	Scarborough Coastal Defence Strategy Review – Holbeck to Scalby Mills		
Version	3.1	Status: Final	Issue Date: Oct 09 Page 5

1.12 Director's Briefing Paper

Region:	Scarborough BC / EA North East Region		Project Executive:	John Riby	
Function:	Coast Protection		Project Manager:	Chris Matthews	
Strategy Title:	Scarborough Coastal Defence Strategy Review – Holbeck to Scalby Mills		Code:	E519	
NEECA Consultant:	SBC Framework	NCF Contractor:	TBA	Cost Consultant:	TBA
The Problem:	The main problems associated with the sea defences include limited residual life of the sea wall structures, severe wave overtopping, flooding due to low crest elevations, low foreshore elevations and landslide risks.				
People at risk: Probability of exposure: Consequence of exposure:	The current and projected wave overtopping rates far exceed, in terms of safety of the public and damage, the recognised safe rates (0.1 l/s/m, EurOtop 2007) for pedestrians and buildings. Example of current overtopping rate is 18 l/s/m for a 1 in 10 yr event (Spa Chalet). This increases to 29 l/s/m in 2058 and 77 l/s/m in 2108.				
Environmental resources at risk: Probability of exposure: Consequence of exposure:	There are no internationally protected sites within or adjacent to the area potentially impacted upon by the strategy.				
Assets at risk from flooding: Probability of exposure: Consequence of exposure:	1711 households (220 in the short term), 200 commercial properties and much of the town's tourist infrastructure is predicted to be destroyed by coastal erosion over the next 100 years if a No Active Intervention (NAI) strategy were adopted. The OM scores range from 2.42 (Clarence Gardens North) to 0.05 (West Pier/Harbour). The overall OM score for the strategy is 1.3.				
Description of proposed strategy:	Schemes required within the short term (0 to 10 years), medium term (10 to 50 years) and long term (50 to 100 years). The proposals include the use of rock armour on parts of the foreshore and raising the height of the sea walls. Strategy also makes allowance for further studies and emergency works.				
Outcome for people at risk:	Improved standard of protection against wave overtopping and flooding.				
Outcome for environmental resources at risk:	Sustaining the local economy which is heavily reliant on tourism.				
Outcome for assets at risk:	Improved standard of protection against wave overtopping and flooding.				
Costs (PVC): (100 year life inc. maintenance)	£k 96,200	Benefits: (PVb)	£k 295,000	Ave. B: C ratio: (PVb/PVc)	3.1
NPV:	£k 198,000	Incremental B: C ratio:	1.5	Whole life cost (cash value):	£k 221,000
Choice of Preferred Option:	The Spa - Rock revetment in front of existing sea wall, sea wall repairs and slope stabilisation. Further studies at Sealife Centre, North Bay Cliffs and Clarence Gardens.				
Total cost for which approval is sought:			£221 million (incl. £82.7 million contingency)		
Delivery programme:	PARs to be submitted for Construction of The Spa in year 3. Further studies at Sealife Centre, North Bay Cliffs and Clarence Gardens in years 1 to 3.				
Are funds available for the delivery of this programme?			Yes, identified in Medium Term Plan		
External approvals:	Not applicable for strategy. Capital works for each management unit will be appraised for economic robustness with a fall back 'do-minimum' option for marginal frontages being adopted.				
Defra approval:	Not applicable				

Title	Scarborough Coastal Defence Strategy Review – Holbeck to Scalby Mills				
Version 3.1 Status: Final	Issue Date:	Oct 09	Page 6		

1.13 Key Plan



HOLBECK TO SCALBY MILLS STRATEGY REVIEW

STUDY AREA SHOWING COASTAL MANAGEMENT UNITS

Figure 1 Key Plan

2 BUSINESS CASE

2.1 Introduction and Background

2.1.1 Introduction

2.1.1.1 The Scarborough Coastal Defence Strategy Review - Holbeck to Scalby Mills, sets out our plan to manage coastal risks to Scarborough Town over the next 100 years. This submission, which summarises the key risks and our plans to manage them, seeks approval to the updated strategy.

2.1.1.2 Following recommendations in the Shoreline Management Plan, we developed a flood and coastal erosion risk management (FCERM) strategy in 1999 for Scarborough which was agreed by Defra in 2001. The most urgent scheme required under the 1999 strategy was the East Pier to the Holms around the Castle Headland. This coast protection scheme was implemented between 2002 and 2004.

2.1.1.3 A review of the strategy was undertaken during 2004 and 2005 to ensure that the FCERM strategy was updated to comply with revised national and local policies and guidelines. Following a period of public consultation the strategy review was adopted by Scarborough Borough Council (SBC) in 2007. We are now seeking approval of the updated strategy and, in order to prepare this submission, we have undertaken further studies to ensure changes to guidance and policy since 2005 are taken into account.

2.1.1.4 We [Scarborough Borough Council] plan to implement the recommended works using our permissive powers under the Coast Protection Act (1949).

2.1.2 Description of Strategy Frontage

2.1.2.1 Scarborough is one of the UK's premier seaside resorts and is the principle seaside destination in the North East. The unique combination of sandy beaches, promenades, Victorian gardens, heritage sites and entertainment venues attract over 3.5 million visitors each year. Scarborough's tourism income makes it a key economic centre for the region.

2.1.2.2 This strategy covers the entire developed urban frontage of Scarborough Town, between Holbeck in the south and Scalby Mills in the north. The strategy frontage and sub-division into coastal management units is illustrated on the key plan in Section 1.13.

2.1.2.3 The coastline is dominated by the Castle Headland (78 metres AOD) and the two wide, sandy bays, North Bay and South Bay. The harbour and the original part of the town of Scarborough are sited south of the headland, sheltered from the north and east and overlooking South Bay. Beyond Scalby Ness, at the northern end of the strategy area, is open farmland extending inland from the cliff tops where the adjacent 'Hundale Point to Scalby Ness' strategy study has recommended monitoring of the undefended cliffs with No Active Intervention. At Wheatcroft, at the southern end of the study area, the cliff tops are backed by open land and used mainly for recreation.

2.1.2.4 Apart from a short area at the southern boundary, the whole of the study frontage is presently protected from erosion, principally by ageing defences dating from the Victorian period. Behind the defences the coastal cliffs, which were over

Title	Scarborough Coastal Defence Strategy Review – Holbeck to Scalby Mills		
Version	3.1	Status:	Final
Issue Date:	Oct 09	Page	8

steepened by historical coastal erosion before the defences were constructed support substantial Victorian properties that typify Scarborough.

2.1.2.5 The coastal frontage is of high environmental quality and interest. Although there are no internationally designated sites, there are national and regional designations including Sites of Special Scientific Interest (SSSI), Sites of Importance for Nature Conservation (SINC), Geological Conservation Review (GCR) sites, Scarborough Conservation Area, Heritage Coast, a number of listed buildings and sites of archaeological interest.

2.1.2.6 The history of the town as an important coastal location is exemplified by the principal area of archaeological interest on the Castle Headland, where there is evidence of human habitation from 6th Century BC, a 4th Century AD Roman signal station and an early Christian chapel within the castle ruins, all of which are scheduled ancient monuments.

2.1.3 The Strategic Context

2.1.3.1 The Shoreline Management Plan (SMP) for Coastal Cell 1d that includes Scarborough was completed in 1997. The three SMPs covering the North East Coastal Group (NECAG) coastline were reviewed together during 2005/6 and the resulting second round SMP2 has been adopted during 2007/8 as policy by the Local Authority partners. SMP2 was formally approved by the Environment Agency in July 2009 (refer to Appendix M). The original and current SMPs both recommended a long term “Hold-the-line” policy for the already defended urban frontage of Scarborough Town.

2.1.3.2 The Scarborough coastal defence system can be sub-divided into sections based on discrete defence lengths and coastal cliff behaviour units as shown in the key plan. However, there are coastal process and economic benefit interactions and dependencies between the units that need to be accounted for during appraisal of FCERM approaches. This necessitates a strategic approach.

2.1.3.3 Following recommendations in SMP1, we developed a FCERM strategy in 1999 and it was agreed by Defra in 2001. The most urgent scheme required under the 1999 strategy, the East Pier to The Holms coast protection scheme, was implemented between 2002 and 2004.

2.1.3.4 After approval of the East Pier to the Holms scheme, Defra advised that the Strategy should be reviewed before seeking approval for further capital projects. We therefore undertook a strategy review during 2004 and 2005. The aim of the review was to ensure that the FCERM Strategy was updated to comply with revised national and local policies and guidelines.

2.1.3.5 The strategy review report was completed in draft in July 2005 and finalised following a period of public consultation between October and December 2005.

2.1.3.6 We are now seeking approval of the strategy, so that we can begin to implement the recommendations. In order to prepare this submission we have had to undertake additional studies to ensure that the appraisal takes account of changes to guidance and policy requirements since 2005.

Title	Scarborough Coastal Defence Strategy Review – Holbeck to Scalby Mills		
Version	3.1	Status:	Final
Issue Date:	Oct 09		Page 9

2.1.4 Methodology

2.1.4.1 Our approach to developing the Holbeck to Scalby Mills FCERM Strategy is in accordance with the Defra's Flood and Coastal Defence Project Appraisal Guidance (FCDPAG) series of documents. It considers the need for works over a 100-year appraisal period, taking into account the effects of predicted sea level rise and climate change.

2.1.4.2 The 1999 strategy sub-divided the frontage into coastal management units that take account of detailed geomorphological mapping of cliff behaviour units and past defence practice. These management units (MUs) have been retained for the strategy review and are shown on the key plan.

2.1.4.3 The updated strategy now incorporates results of studies, investigations, monitoring, maintenance, emergency repairs and capital schemes undertaken since the development of the original Strategy. As required by Defra, the benefit / cost analysis has been updated to take account of the changes to appraisal rules introduced with the Treasury's New Green Book in 2003, and taken due account of the significantly increased costs of the East Pier to the Holms scheme compared to the estimates in the original strategy.

2.1.4.4 The main strategy report was prepared in 2005 and the data within it is therefore generally to a 2005 baseline. Therefore, in order to prepare this StAR submission, a further update to the analysis underpinning the strategy has taken place. The strategy costs and benefits have been updated to a Q3 2008 baseline; the October 2006 revised climate change / sea level rise guidance has been taken into account. The updated 2005 Middlesex University 'Multi-coloured Manual' has been referenced during the update to the appraisal.

2.1.4.5 Although SEA is not a statutory requirement for FCERM Strategies, we have recognised that Defra and Environment Agency policy guidance has changed since the strategy review was undertaken in 2005 and now recommends that SEA statutory requirements are followed. Accordingly, we have developed an SEA report for this submission.

2.1.5 Technical, Environmental, and Socio-economic Objectives

2.1.5.1 We have adopted targets for the Strategy review based on both national and local objectives. These targets reflect national FCERM Outcome Measures, such as delaying expected loss of households, as well as our day to day activities of coastal defence management. They incorporate issues such as the environment, sustainability and climate change in order to help create a better place.

2.1.5.2 A strategic approach to FCERM activities is considered to be critical to maintaining the sustainability of the local community and its economy and the significant contribution Scarborough makes to the national economy. The proposals also safeguard the important architectural heritage of the town's frontage from damage by the sea by reducing the risks to the various material assets that would be seriously affected should the present coastal defences be allowed to become ineffective.

2.1.5.3 The complex cliff geology and history of largely Victorian development in the erosion risk zone requires an integrated approach to management of FCERM and land stability issues.

Title	Scarborough Coastal Defence Strategy Review – Holbeck to Scalby Mills		
Version	3.1	Status:	Final
Issue Date:	Oct 09	Page	10

2.1.5.4 The strategy has sought a balanced and sustainable approach through striving to work with natural coastal processes. This includes aiming to soften the existing sea walls, which are generally vertical, and thus reduce both the wave overtopping and wave reflection. This has the joint aims of improving public safety; reducing the impacts on the natural environment from the defences and helping to manage beach levels. However, implementation of more wave absorbent defences has also to consider encroachment onto the rock foreshore SSSI's, SINC's and the beach and public safety.

2.1.6 Outcome Measures

2.1.6.1 We have considered new Outcome Measures while establishing preferred options and plans for implementation of potential capital projects within the strategy. Outcome Measures (OM) are being developed for FCERM prioritisation, and we have provided details of the contributions in Appendix H. However, we recognise further appraisal of these projects will be needed once the strategic approach has been agreed, in order to confirm the details of the schemes and gain necessary consents and funding PAR approvals for their implementation.

2.2 Problem

2.2.1 Coastal Erosion Risks

2.2.1.1 Historical land use development along the Scarborough coastline paid scant regard to long-term coastal erosion risks. The coastal slopes consist of over-steepened complex former sea-cliffs of highly varying geology that were protected from toe erosion around 100 years or more ago. Development has generally taken place up to the cliff edge. There are also locations where there are significant assets constructed on reclaimed land at the cliff toe, eg. The Spa in MU22A/4 and Sealife Centre in MU20A/1. Once the defences fail rapid erosion would be expected in these areas. In some locations, eg. landward of Foreshore Road, the steep coastal slope itself has been extensively developed. A summary of the numbers of households at risk (OM parameter), under a No Active Intervention (NAI) policy, is given in Table 4.

2.2.1.2 The range of potential problems varies along the coastline, according to the nature and condition of the defences, the exposure to wave attack and the geological setting. The assessment of the risks from coastal erosion following failure of the defences has been assessed based on expert assessment of historical records of erosion. This includes assessment of the potential extent of slips on the presently intact coastal slopes based on experience from the major landslide that resulted in loss of the Holbeck Hall in 1993.

Table 4 Households at risk of erosion under No Active Intervention (NAI)

Management Unit	Location	Short term within 10 years	Short-medium term 10 to 20 years	Medium term 20 to 50 years	Long term 50 to 100 years	Total to 100 years
20 A/1	Sea Life Centre				9	9
20 A/2 - 20 A/7	North Bay Cliffs		15			15
20 B/1 - 20 B/3	Clarence Gardens North		280			280
21 A/1 - 21 A/2	The Holms & Castle Headland				595	595
21 B/1 - 21 B/2	West Pier/Harbour					0
22 A/1 - 22 A/2	Foreshore Rd and St Nicholas Cliff *			78		78
22 A/3	Spa Chalet		26		37	63
22 A/4 - 22 B/2	The Spa	148			232	380
22 B/3 - 22 B/5	South Cliff Gdns, Rose Gdns & SB Pool	72	171	8		251
22 B/6	Holbeck Gardens		26			26
22 B/7	Holbeck Cliff				14	14
23 A/1	Wheatcroft Cliff					0
20 A/1 - 23 A/1	TOTAL Households	220	518	86	887	1711

* At risk due to cliff erosion (47) and flooding (31)

2.2.1.3 The existing coastal defence structures are critical to preventing erosion of the cliff toe which is essential for the continued stability of the cliff. Many of the defences are approaching the end of their serviceable life and are in urgent need of major improvements.

2.2.1.4 If the defences were allowed to fail and toe erosion re-commenced, major losses of assets are predicted over the 100-year strategy horizon. The area considered at significant risk from defence failure, coastal erosion and consequent land sliding over the strategy period is indicated on the key plan.

2.2.1.5 The erosion risk area includes many large Victorian properties that have been converted into flats. Additionally there are hotels, entertainment / amenity venues, promenades, cliff gardens and parks. If a walk-away approach were adopted and nothing were done to manage the defences, a total of 1,711 households and about 200 commercial properties are considered to be at significant risk of loss due to coastal erosion over the strategy period.

2.2.2 Wave Overtopping and Flood Risk

2.2.2.1 At a number of locations along the frontage wave overtopping forms a significant risk to people, vehicles, the promenade and associated infrastructure. Severe wave overtopping results from the generally low crest elevations of the near vertical defences (refer to the table at the end of Appendix F 'NRG briefing notes on coastal management units, Revision 2, August 2009' for a summary of the overtopping estimates).

2.2.2.2 The wave overtopping problems result in significant risks to life. As in many coastal resorts, safe management of public access to the coastal defences during storm conditions is a significant challenge. Almost every year there are reports of people being swept off or nearly swept off the sea walls and promenades by waves.

2.2.2.3 In places, the existing annual maximum wave overtopping discharge already exceeds recommendations for structural integrity of the defences. With mean sea level expected to rise by some 0.85m over the 100-year appraisal period, wave overtopping problems are expected to increase significantly if nothing is done to manage the defences.

2.2.2.4 The 33 commercial properties and the road along the Foreshore Road frontage in MU22A/1 & 2 presently experience flooding on approximately an annual basis. This frontage is sheltered from wave action in the prevailing north and north-easterly storms by the East Pier, but currently floods on roughly an annual basis during high tides and surges due to the low defence and property threshold levels. Although flood risks here are currently managed through flood warnings and temporary / sand bag defences, we do not consider this is a sustainable approach for the long term due to the predicted impacts of climate change on sea level rise.

2.2.3 History of Flooding and Erosion

2.2.3.1 Several significant coastal defence failures have occurred during the period 1999-2004:

2.2.3.2 **The Holms (MU21 A/1)**; lateral displacement of the sea wall by 200mm occurred during November 2000. The movement was caused by reactivation of The Holms pre-existing landslide. A rapid risk assessment identified that the

Title	Scarborough Coastal Defence Strategy Review – Holbeck to Scalby Mills		
Version	3.1	Status:	Final
Issue Date:	Oct 09	Page	12

displacements presented a significant threat to the integrity of the coastal defences and the assets they protect. As a result, a programme of Preventative Emergency Works was undertaken in 2000-2001, this was intended to 'buy time' pending implementation of the coast protection scheme for East Pier, Castle Headland and The Holms which commenced in 2002 and was completed in 2005.

2.2.3.3 South Cliff Gardens (MU22 B/5); a breach of the sea wall (over a 17m length) occurred during storms in October 2002. Erosion of the breach continued at each high tide, threatening adjacent defence sections and cliff top assets until emergency repair works were undertaken.

2.2.3.4 Rose Gardens (MU22 B/4); a breach of the sea wall occurred as a result of a combination of high seas and spring tides in early April 2005, over a length of approximately 30-40 metres. Emergency repair works were undertaken to ensure the breach did not expand and cause widespread deterioration of the defences.

2.2.4 Condition of Existing Defences

2.2.4.1 The full 6.9km length of the study frontage is currently protected by defences, many of which are showing signs of distress and, in most places, will not provide an adequate level of protection against erosion, wave overtopping, flooding or consequential cliff instability over the next 100 years. The majority of the defences were constructed close to 100 years ago.

2.2.4.2 Visual condition inspections of the coastal defences were undertaken in 2000, 2002 and 2005. Further details of defence condition, and estimated failure probabilities are given in the 2005 strategy report in Appendix B. For most management units, apart from the location of the new Castle Headland [East Pier to Holms] scheme, there has not been a significant change to the defence condition since the 1999 Strategy study. However, conditions are believed to have deteriorated along parts of the Clarence Gardens North defences in (MU 20B/1 to 20B/3).

2.2.4.3 Based on the inspections, the existing coastal defences can be sub-divided into two broad groupings based on their structural performance. These are:

- a) defences that will provide an adequate level of protection over the next 50 years; i.e. East Pier, Castle Headland, The Holms and southern section of Clarence Gardens where a capital scheme has recently been completed, and the Holbeck Cliff section, where a rock revetment and slope stabilisation scheme was constructed in 1993/94 following the Holbeck Hall landslide. These defences had a planned 60 year design life and so capital schemes are not proposed until the second 50-years of the strategy.
- b) defences that will not provide an adequate level of protection over the next 50 years; many of the more important coastal defence structures in both North Bay and South Bay are approaching the end of their serviceable life, showing obvious signs of distress, and will require major improvements within the first 50 years of the strategy.

2.2.5 Land Sliding and Coastal Slope Instability

2.2.5.1 The erosion damages considered within this Coast Protection strategy relate to loss of assets located behind the defences, on the coastal slopes and cliff tops as a consequence of failure of the coastal defences and subsequent erosion either

Title	Scarborough Coastal Defence Strategy Review – Holbeck to Scalby Mills		
Version	3.1	Status:	Final
Issue Date:	Oct 09	Page	13

reactivating or initiating coastal landslides. Typically the area at risk includes a zone of around 100m wide set back from the cliff edge. Significant areas of this land could be lost in a single major landslide event, as occurred in the 1993 Holbeck Hall landslide, which took out 50m of land in one failure. Erosion of the cliff toe destabilises the cliff rendering it vulnerable to large scale failures. If the toe is left unprotected the cliff will continue to regress in the long term.

2.2.5.2 In 2007 Defra indicated to Coast Protection authorities that Coast Protection funding should be used solely for activities related to managing coastal erosion risk and that funding from this source should not be allocated to schemes dealing with land instability. It is therefore important to recognise that on this coastline both shallow and deep landslides can and do occur due to causes other than coastal defence failure and erosion. For example, high ground water levels resulting from heavy rainfall, inadequate or damaged drainage can initiate slips on the steep coastal slopes that have been over steepened by former erosion.

2.2.5.3 The damage estimates supporting the benefit cost analysis for the 1999 strategy and the 2005 update considered all sources of asset loss related to both coastal erosion and coastal land sliding. This has been revised for this StAR submission such that the analysis only includes losses directly related to coastal erosion. The damage estimates were updated by removing damages related to shallow slides, minor / major reactivation of instability and rear cliff failures. This retains damages related to major landslides that are consequential on sea wall failure. However, there remains a need for us to manage risks to assets on the coastal slopes by co-ordination and management including an integrated coastal and cliff monitoring programme by SBC and by inspections/dealing with minor surface slides (to prevent the problems escalating) and enforcement action on property owners. Whilst whole life costs of enforcement actions are difficult to quantify, the costs of monitoring activities are included.

2.2.5.4 Widespread landslide activity was recorded in Scarborough, particularly in North Bay following a period of heavy rainfall in the winter months of 2000-2001:

- a) the reactivation of the deep-seated Holms, MU21/A1, landslide system occurred during 2000-2001. Although this caused extensive damage to footpaths and cracking of the sea wall, the movements were relatively minor, with ground displacements of the main landslide body probably in the order of tens of centimetres. Monitoring revealed a sea wall displacement of 200mm between 10th and 27th November 2000.
- b) in Clarence Gardens, MU20B/3, tension cracks opened on the footpaths immediately behind the cliff top and numerous shallow first-time slides occurred on the steep rear cliff. There was also reactivation of pre-existing relatively large, shallow landslides.

2.2.5.5 Some localised slope improvements [not funded from Coast Protection grants] were undertaken in response to the landslide activity in the wet winter of 2000/2001 at Clarence Gardens and The Spa. However, visual inspections in 2000, 2001 and 2004 have indicated that the condition of the coastal slopes has deteriorated since 1999, in the following locations:

- a) Clarence Gardens (North; Management Unit 20B/1; defence code 6543); here it has been judged that there has been a 50% increase in the probability

Title	Scarborough Coastal Defence Strategy Review – Holbeck to Scalby Mills		
Version	3.1	Status:	Final
Issue Date:	Oct 09	Page	14

of both major failure and shallow landslides. This reflects observations made in the North Clarence Gardens Rapid Risk Assessment (High-Point Rendel August 2001). No improvement works have been undertaken in this area since the reported ground movement in 2000/2001;

- b) Holbeck Gardens (Management Unit 22B/6; defence code 6557); observations made in the Holbeck Gardens Rapid Risk Assessment (High-Point Rendel August 2001) suggest a doubling of the likelihood of major landsliding.

2.2.5.6 Details of coastal slope conditions and estimated probabilities of coastal landslides under NAI (extracted from appendix F of the strategy report), are given in Table A1 in Appendix A. Residual landslide risk is strongly linked to the integrity of the coastal defences. As the defences deteriorate and become more likely to fail, so the chance of a major landslide event increases. The slopes have been sub-divided into three groups on the basis of potential for failure as follows:

- a) coastal slopes with minimal residual landslide risk due to defence failure, i.e. the Holms, MU21A/1, where Emergency Works were constructed in 2000/2001 and combined with the East Pier, Castle Headland and the Holms Coastal Protection Scheme (design life >50 years) and Holbeck Cliff, MU22B/7, where a rock revetment and stabilisation works were constructed in 1993/94 following the Holbeck Hall landslide.
- b) coastal slopes with a low to very low residual risk of major first-time landsliding. These include:
 - i) sections with low annual probability of major landsliding, i.e. Holbeck Gardens, Clarence Gardens North, Prince of Wales Cliff in the north of The Spa management unit and Rose Gardens.
 - ii) sections with very low annual probability (1 in 100 to 1 in 500) of major landsliding, i.e. North Bay Cliffs and Spa Chalet.
- c) coastal slopes with a very low to extremely low residual risk of major landslide reactivation. These sections include the South Cliff Gardens, Clarence Gardens (S), St Nicholas Cliff, The Spa and South Bay Pool.

2.2.5.7 A summary of the likely failure mechanisms for all coastal units is shown in Table 5. Refer to Appendix F for further details and photographs included within the 'NRG briefing notes on coastal management units, Revision 2, August 2009'.

Table 5 Likely Failure Mechanisms & Residual Life under NAI

Strategy Management Unit		Likely Failure Mechanism	Residual Life
20A/1	Sealife Centre	Wall toe undermining & severe overtopping	< 30 years
20A/2 - 20A/7	North Bay Cliffs	Wall cracking & major damage	< 10 years
20B/1 - 20B/3	Clarence Gardens (N)	Wall cracking, undermining & overtopping	< 10 years
21A/1 - 21A/2	The Holms & Castle Headland	Low probability of landslide reactivation	> 50 years
21B/1 - 21B/2	East Pier – West Pier / Harbour	Overtopping, wall cracking & undermining	< 30 years
22A/1 - 22A/2	Foreshore Rd & St Nicholas Cliff	Tidal flooding & low probability of landslide	< 25 years
22A/3	Spa Chalet	Wall cracking, undermining & beach erosion	< 30 years
22A/4 - 22B/2	The Spa	Wall cracking, undermining & beach erosion	2 - 5 years
22B/3 - 22B/4	South Cliff & Rose Gardens	Overtopping, undermining & beach erosion	2 - 5 years
22B/5	South Bay Pool	Overtopping, undermining & beach erosion	< 5 years
22B/6	Holbeck Gardens	Overtopping, undermining & beach erosion	< 8 years
22B/7	Holbeck Cliff	Low probability of landslide reactivation	> 50 years
23A/1	Wheatcroft Cliff	None likely within 100 years	> 50 years

2.2.5.8 Whilst the slopes have been categorised on the basis of estimated probability of failure, it should be noted that these estimates are subjective and are intended as a guide to the relative chance of different landslide events and not absolute levels of risk. Landslides are inherently difficult to predict and there is clear evidence of widespread ground movement on the coastal slopes which emphasises the importance for the need of ongoing slope monitoring and repairs to localised failures to prevent their expansion. It should be noted that probabilistic approach has been used within the damage assessment.

2.2.6 Climate Change Impacts

2.2.6.1 The October 2006 Defra climate change guidance update has been considered. Relative mean sea-level is expected to rise by 2.5mm/yr until 2025 then 7mm/yr until 2055, followed by 13mm/yr, giving 852mm over the strategy period until 2108. However, the current and projected wave overtopping rates already far exceed acceptable levels, in terms of safety of the public and structural damage caused by wave overtopping. These problems will be further compounded by the predicted effects of sea-level rise, climate change and, in places, continued foreshore lowering. These factors will combine to create greater wave loadings on the defences and increased overtopping problems.

2.2.6.2 Landslide risk will be further compounded by predicted effects of climate change. In places, accelerated foreshore lowering can reduce the toe loading and increased wave loadings on the defences increasing the probability of defence failure. The risk of reactivating relic landslides or initiating new major failures may be linked to groundwater levels which may be affected by changes in winter rainfall. However, analysis of historical records related to past major landslips including the Holbeck Hall slide in 1993 suggested that preceding winter rainfall was not exceptional so linkage to climate change predictions is not straightforward. However, the risk assessment for the 2005 strategy review has considered the latest relevant data in the UK Climate Impact Programme 2002 (UKCIP02) predictions. The latest update in the UKCIP predictions were released in June 2009 and show a new range of scenarios. The Environment Agency is developing guidance for their use in FCERM projects, and the studies/schemes following this strategy will need to account for these changes.

2.3 Options Considered

2.3.1 SMP Level Policy Setting and Overall Options

2.3.1.1 The SMP for this frontage has recently been reviewed. In accordance with national guidance the SMP reviewed the generic options of No Active Intervention, Managed Realignment, Hold the line and Advance the line, and the interaction between and impacts of such policy scenarios along the coast. Due to the socio-economic value of assets at risk and the constraints of steep coastal slopes and infrastructure behind the existing defences, the SMP2 set the generic policy of hold the line to the already defended Scarborough Town frontage.

2.3.2 Strategy Area and Coastal Management Units

2.3.2.1 As discussed earlier, the strategy frontage has been sub-divided into management units (MUs) based on the coastal cliff geomorphology and the existing defence configuration. However, there are strategic links between the MUs in terms

Title	Scarborough Coastal Defence Strategy Review – Holbeck to Scalby Mills		
Version	3.1	Status: Final	Issue Date: Oct 09 Page 16

of both benefits and coastal processes. While individual frontages require different solutions to the problems, to realise all of the benefits it is necessary to assume an overall hold the line policy for the overall frontage. However, in all cases this is always locally tested against the do-nothing scenario.

2.3.3 Long List of Alternatives Considered

2.3.3.1 The initial screening of options considered whether, on protected MUs, the existing defences were considered likely to be adequate for the next 50-100 years, with appropriate maintenance and repairs. For MUs where this was not the case, the original strategy then considered a long list of options in order to assess outline feasibility before giving more detailed consideration and optimisation. The long-list included:

- a) Do nothing (ie. walk away and undertake no further FCERM activity),
- b) Do minimum (repair breaches and maintain existing defences as long as feasible),
- c) beach recharge, with and without beach control structures,
- d) sea wall reconstruction on existing line,
- e) advance the line with new sea wall in front of reclamation,
- f) reinforcement of the existing wall with revetments,
- g) crest raising with reconstruction,
- h) offshore breakwaters / rock berms,
- i) set-back flood walls,
- j) development control and flood warning, and
- k) relocation of commercial and residential properties.

2.3.3.2 Note that for all options other than do-nothing, cliff management and maintenance works including drainage and repairs to minor surface slips will be necessary in order to realise the benefits of the coastal defences. Costs have been allowed for undertaking this work although it is recognised that it will not be funded from FCERM capital resource.

2.3.4 Options Rejected

2.3.4.1 A number of options were scoped out of the appraisal at an early stage as they were considered not to be viable for technical, socio-economic or environmental reasons. These included:

- a) Managed realignment. Although local realignment of defences will be appropriate for consideration especially where detailed design can save costs by simplifying the defences or shortening the overall length, there is in general insufficient room between the defences and the assets that they protect to make managed realignment a strategically feasible option.
- b) Development control and flood warning. There are already flood warnings for high tides allowing predictions of dangerous wave overtopping and it is assumed this will continue in advance of any capital works that will reduce the flood risks. Development control is clearly important on this frontage, but this strategy focuses on the management of the existing risks so it is not a strategic option for dealing with the current situation.
- c) Relocation of commercial and residential properties has not been considered in general as the properties on the sea front are considered to be strategically important to the economic well-being of the coastal resort.

2.3.5 Options Selected for Detailed Analysis

2.3.5.1 The long list of alternatives was considered for each MU and those that were considered not to be feasible on either technical, or environmental basis in that location were removed from the list for further assessment. This gave short lists of options for further analysis in each MU. A summary of the technical screening process is presented in Table A2 in Appendix A. The options evaluated in more detail are listed in Table 6 below.

Table 6 Options selected for detailed evaluation

Strategy Management Unit		Strategy Options	
20A/1	Sealife Centre	Option 1	Do Nothing/ No Active Intervention
		Option 2	Minimal Intervention
		Option 3	Rock berm & sea wall repairs
		Option 4	Rock revetment and sea wall repairs
		Option 5	Stepped concrete revetment
		Option 6	Defer rock revetment & sea wall repair by 15 years
20A/2 - 20A/7	North Bay Cliffs	Option 1	Do Nothing/ No Active Intervention
		Option 2	Minimal Intervention
		Option 3	Sea wall repairs & slope stabilisation
		Option 4	Sea wall repairs, slope stabilisation & beach recharge
20B/1 - 20B/3	Peasolm Gap & Clarence Gardens (N)	Option 1	Do Nothing/ No Active Intervention
		Option 2	Minimal Intervention
		Option 3	Rock revetment, sea wall repairs & slope stabilisation
		Option 4	Rock revetment, sea wall repairs, beach recharge & slope stabilisation
21A/1 & 2 - 21B/1	The Holms & Castle Headland	Option 1	Do Nothing/ No Active Intervention
		Option 2	Minimal Intervention -upgrade / replace structures at end of residual life
21B/2	West Pier / Harbour	Option 1	Do Nothing/ No Active Intervention
		Option 2	Minimal Intervention
		Option 3	Upgrade structures at end of residual life
22A/1 - 22A/2	Foreshore Rd and St Nicholas Cliff	Option 1	Do Nothing/ No Active Intervention
		Option 2	Minimal Intervention
		Option 3	Hold line - Upgrade wall & slope stabilisation
		Option 4	Advance line - new wall & slope stabilisation
22A/3	Spa Chalet	Option 1	Do Nothing/ No Active Intervention
		Option 2	Minimal Intervention
		Option 3	Hold line- rock revetment, sea wall repairs & slope stabilisation
		Option 4	Advance line - new wall, revetment & slope stabilisation
		Option 5	Rock berm, wall repairs and slope stabilisation
		Option 6	Rock revetment, wave return wall & slope stabilisation
		Option 7	Concrete stepped revetment & slope stabilisation
		Option 8	Rock revetment, wave return wall & slope stabilisation. 20 year delay
		Option 9	Concrete stepped revetment & slope stabilisation - 20 year delay
22A/4 - 22B/2	The Spa	Option 1	Do Nothing/ No Active Intervention
		Option 2	Minimal Intervention
		Option 3	Hold line- rock revetment, sea wall repairs & slope stabilisation
		Option 4	Advance line - new wall, revetment & slope stabilisation
		Option 5	Rock revetment and wave return wall and slope stabilisation
		Option 6	Concrete stepped revetment
		Option 7	Rock berm and sea wall repairs
22B/3, 22B/4 & 22B/5	South Cliff Gdns, Rose Gdns & South Bay Pool	Option 1	Do Nothing/ No Active Intervention
		Option 2	Minimal Intervention
		Option 3	Rock berm, sea wall repairs & slope stabilisation
		Option 4	Rock revetment, sea wall repairs & slope stabilisation
22B/6	Holbeck Gardens	Option 1	Do Nothing/ No Active Intervention
		Option 2	Minimal Intervention
		Option 3	Rock berm, sea wall repairs & slope stabilisation
		Option 4	Rock revetment, sea wall repairs & slope stabilisation
22B/7	Holbeck Cliff	Option 1	Do Nothing/ No Active Intervention
		Option 2	Minimal Intervention
23A/1	Wheatcroft Cliff	Option 1	Do Nothing/ No Active Intervention
		Option 2	Minimal Intervention

2.3.6 Design Standard and Over Design Events

2.3.6.1 The options that have been considered for this strategy are intended to defer the onset rather than slow the rate of coastal erosion. Although some defence forms could slow rather than halt erosion, eg. offshore breakwaters or beach recharge without cliff toe protection, such options would not be suitable on a developed frontage with complex cliffs such as Scarborough. Therefore, the design standard is the same for the entire do-something options that have been considered. Although breaches and damage to the defences may occur during storms, it is assumed that these would be repaired before the onset of significant erosion and the appraisal makes allowances for this (refer to the Emergency Intervention section of Appendix L, Scarborough Borough Council's procurement strategy). [Note that this is unlike analysis of flood defences where the damage avoided is frequently a function of the height of the defences or the volume of flood storage provided]. The design standard against structural failure and wave overtopping will need to be considered in more detail, through physical modelling and/or flume tests, at the scheme specific project appraisals. This standard is expected to fall within the indicative 100 to 200 year standard for structural stability of armour and 1 in 10 year standard for wave overtopping limited to 0.1 l/s/m (EurOtop 2007 / HRW report EX3782), taking account of climate change and sea level rise allowances.

2.3.6.2 For the Spa frontage, the first major project of the strategy, optimisation calculations for structural design standard and wave overtopping have been undertaken, refer to the PAG3 Project Summary Sheet (inc Option 5 Optimisation) in Appendix C. The assessment indicates that incremental BCRs alone would not clearly justify a higher standard than indicated above, but this will need to be reconsidered along with public safety issues at scheme PAR stage.

2.4 Cost of Options

2.4.1 Introduction

2.4.1.1 The appraisal period adopted for the Strategy is 100 years.

2.4.1.2 The costs have been built up on a management unit basis under a series of different elements. These include capital costs, studies and design, maintenance costs for both the defences and slopes, monitoring and inspections plus other management costs such as future reviews and updates to the overall strategy. Table A3 in Appendix A includes costs and benefits all options and Present Value (PV) costs are also given in Table 10 below. Further details, including cash costs, with and without Optimism Bias allowances can be found within Appendix C in the summary of economics spreadsheet.

2.4.1.3 The number of options costed varies in each management unit, reflecting the need for works and the range of potentially feasible options.

2.4.1.4 The cost estimates are strategic level assessments rather than site specific detailed estimates. A large number of assumptions have been made during their preparation. For example, cost estimates are for conceptual coast protection and related slope stabilisation options rather than detailed schemes. When detailed scheme level analysis is undertaken there will need to be further investigations and surveys, costs have been included for these. Estimates assume no change in assets, and infrastructure on the cliffs, or access restriction changes to either coastal slopes

Title	Scarborough Coastal Defence Strategy Review – Holbeck to Scalby Mills		
Version	3.1	Status:	Final
Issue Date:	Oct 09	Page	19

or defences. Capital costs assume construction will be undertaken largely during the summer months.

2.4.2 Capital Costs

2.4.2.1 The capital cost estimates have been developed based on an assessment of material quantities and unit cost rates. Cost rates were generally derived from a consideration of recent scheme experience. The estimates take into account the significant increases in cost compared to original estimates of the Castle Headland scheme. The estimates developed in the 2005 strategy review document have been revised and updated to an October 2008 baseline. The unit rates used were cross-checked against the Environment Agency unit cost database and in general are significantly higher, reflecting the exposed nature of the Scarborough coastline.

2.4.3 Preliminary and Delivery Costs

2.4.3.1 Allowances have been made for further topographic and hydrographic surveys, site investigations, design and environmental studies (including physical modelling where appropriate) and construction supervision. Allowances are also included for coastal monitoring, and maintenance of the cliffs and coastal defences.

2.4.3.2 Cost inflation has not been allowed for in the economic appraisal. However, inflation is included in the estimate of implementation costs in the first 5 years.

2.4.4 Risk

2.4.4.1 In accordance with Defra guidance for strategies, we have added a 60% Optimism Bias allowance to the Present Value costs for all options. We consider this is an appropriate allowance at this stage of scheme development. This approach has been validated against a Monte Carlo / @Risk analysis for the MUs where capital schemes are proposed in the first 5 years of the strategy.

2.4.5 Maintenance Costs and Emergency Repairs

2.4.5.1 Costs for maintenance have been included in the appraisal based on an assessment of our expenditure over recent Years.

2.4.5.2 Maintenance of both the defences and the coastal slopes is funded from our Revenue budget rather than Coast Protection grant, but emergency repairs to defence failures are normally funded retrospectively through Coast Protection grant.

2.4.5.3 Under the do-minimum option major capital repairs will become necessary to continue to hold the line as the defences deteriorate. These repairs would be localised and so not generally reduce the probability of defence failure. The costs for these have been based on experience with emergency repairs following failures to the sea walls south of The Spa in 2002 and 2005.

2.4.5.4 In all cases allowances have been included for ongoing maintenance of the cliff slopes as well as the coastal defences.

2.4.6 Climate Change Adaptation

2.4.6.1 The outline designs have taken a precautionary approach to sea level rise, setting target design profiles for wave overtopping based on future sea level

Title	Scarborough Coastal Defence Strategy Review – Holbeck to Scalby Mills		
Version	3.1	Status:	Final
Issue Date:	Oct 09	Page	20

estimates at the end of the appraisal period. This will mean that the overtopping under the 1 in 10 year design conditions will be significantly below the adopted thresholds, giving enhanced public safety, but this margin would be eroded as sea level rise occurs. We have looked into this in most detail at The Spa, where to allow for increased water levels the rock revetment would need to be widened. It would not simply be the case to add armour and construct a new toe, so at outline strategic level, it would be more economic for the rock protection to be designed to allow for the water levels expected at the end of the 60 year design life and so the cost estimates are based on this. Adaptive approaches to climate change with crest wall raising have not been considered at strategy stage as the crest wall is a minor element of the scheme costs. This will need to be considered at the scheme PAR stages.

2.4.7 External Contributions

2.4.7.1 External funding towards options proposed in the strategy has not been investigated in detail at this strategy review stage, but we have identified and undertaken initial investigations with potential partners and significant beneficiaries, such as Yorkshire Forward, North Yorkshire Highways and other public utilities including Yorkshire Water, into possible contributions. All have indicated that once the strategy review is approved they will be willing to engage with SBC to explore the detailed solutions and possible financial contribution towards these solutions nearer scheme implementation. It is recognised in both the SMP and the strategy that advancing the line at The Spa and Spa Chalet would potentially have wider economic benefits to the town, but that considering FCERM issues alone the additional costs are unlikely to be justified.

2.4.7.2 There is currently an opportunity to access funding from the Commission for Architecture and the Built Environment (CABE) through their Sea Change Programme supported by the Regional Development Authority. We intend to investigate these potential contributions further during the detailed studies and prior to scheme PAR submission and we will also consider potential environmental enhancements, in partnerships with others. This is particularly relevant to the North Bay and The Spa frontages and so we will investigate these over the next 5 to 10 and 1 to 5 years respectfully. We would obtain commitment in principle and agree terms for possible contributions prior to tender stage, with the provision of securing contributions prior to commissioning the works.

2.4.8 Costs for All Strategy Options

2.4.8.1 The costs for all of the options considered are presented on Table A3 in Appendix A. Present value costs for the options are also given in Table 10.

2.4.9 Costs for Preferred Strategy

2.4.9.1 The costs for the preferred options in the first 5 years and a summary of overall costs are presented in Table 7.

Table 7 Summary of costs for preferred strategy (£k)

Item	The Spa *	Sealife Centre Further studies	North Bay Cliffs Further studies	Clarence Gardens North Further studies	Emergency Repairs & maintenance	Future/ Other MU Costs	Strategy Total
Costs Pre-StAR							
Council costs	47	10	5	5	3	407	477
Preliminary costs	425	90	45	45	27	3,660	4,300
Consultant fees	1,070	-	-	-	78	9,910	11,100
Construction costs	7,130	-	-	-	561	72,200	79,900
Environmental Enhancement	233	-	-	-	-	2,360	2,590
Maintenance **	250	75	206	292	2,240	36,500	39,500
Sub Total	9,155	175	256	342	2,909	125,037	137,867
Contingency (represents 60% of project)	5,493	105	154	205	1,745	75,022	82,720
Inflation @ 5% per annum	2,193	21	34	43	177		
Total costs (yrs 1 to 5)***	16,841	300	444	591	4,831		
Whole life cash cost (including maintenance but without inflation)							220,587[^]

* Priority scheme

** Not including emergency costs

*** Total for first 5 years = £23,000k (rounded to 3 significant figures)

[^] Whole life cash cost (100 years) = £221,000k (rounded to 3 significant figures)

2.5 Benefits of Options

2.5.1 Management Units

2.5.1.1 As indicated above, we sub-divided the strategy area into management units and the damages avoided by managing erosion risk have been derived by MU frontage.

2.5.2 Strategic Treatment of Linked Benefit Areas

2.5.2.1 Some of the benefits are strategic in that they rely on the same policy across a number of units. It is necessary to avoid double counting of damages. Clearly the same assets should not be counted as losses in more than one MU under an overall do-nothing scenario. An example is the pumping main sewer along the promenade / road in North Bay. Erosion damages for loss of this asset, which serves the whole town, have been apportioned evenly across the relevant MUs. Similarly, traffic disruption on roads that cross multiple MUs are evenly distributed.

2.5.3 FCDPAG3 Spreadsheets and Probabilistic Approach to Damages

2.5.3.1 A probabilistic approach has been used, consistent with Flood and Coastal Defence Project Appraisal Guidance (FCDPAG3). Economic evaluation spreadsheets have been compiled for each MU. These have been based on the modified spreadsheets available on Defra's web site (fcdpag32NGB and fcdpag33NGB). Further details of the economic evaluation is provided in Appendix C, with a summary of some of the key information given below.

2.5.3.2 The approach is similar to that used in the 1999 Strategy, although there have been a number of important modifications. For the 2005 review, the test discount rate, appraisal period were revised in accordance with March 2003 Defra advice following the New HM Treasury "Green Book".

Title	Scarborough Coastal Defence Strategy Review – Holbeck to Scalby Mills		
Version	3.1	Status:	Final
Issue Date:	Oct 09	Page	22

2.5.3.3 The review for the current submission has also made further updates and a key change is the removal of damages related to minor cliff land slips that are not considered to be coast protection issues.

2.5.4 Write off Values

2.5.4.1 In accordance with the Multi-Coloured Manual 2005 (MCM) we have used write off values for properties that could be lost due to erosion and consequential cliff failures under a NAI scenario. For residential properties these are based on market freehold values, not adjusted for erosion risk, from the 2005 strategy review. These have been updated to current market prices with average property prices obtained from www.upmystreet.co.uk. For full details refer to the Economics Methodology in Appendix C.

2.5.4.2 For commercial properties we have estimated write off values based on rateable values in accordance with the methodology suggested in the MCM. For our own properties such as The Spa and Town Hall we have used our declared insurance values updated to October 2008.

2.5.4.3 We have used a probabilistic approach to the derivation of damages and have checked to ensure that Present Value losses are capped at the write off values.

2.5.4.4 In addition to capital values of residential properties at write-off we have allowed for direct losses associated with the costs of evacuation and temporary re-housing of residents affected by major landslides. This was evaluated on the basis of temporary re-housing of residents for 6 months based on average rents as recommended in MCM.

2.5.4.5 The Yorkshire Water pumping station, outfall headworks and underground storm storage tanks in the Sealife Centre MU would have a very high replacement value and they are of strategic importance as they serve the whole town. Damage estimation for these assets is not straightforward as alternative sites would be at equal or greater risk of erosion. The approach adopted to damage assessment is therefore, in accordance with approaches recommended in the MCM, to adopt the least cost of protection insitu. For these assets this is considered appropriate as they are set back behind the Sealife Centre which is on reclaimed land and therefore could be protected on a set-back alignment after failure of the existing defences.

2.5.5 Potential for Loss of Life

2.5.5.1 Although as indicated in Section 2.2, there are real risks to loss of life due to wave overtopping, no economic damages have been estimated in the baseline assessment. While there is guidance for risks to people from flooding, the methodology available does not directly apply to wave overtopping risks. A sensitivity test, see Section 2.7.5.4, indicates that consideration of risk to life could justify a significantly higher defence standard. The EurOtop Manual (2007) states that a mean discharge limit of 0.1 l/s/m is safe for *“An aware pedestrian, with a clear view of the sea, not easily upset or frightened, able to tolerate getting wet, wider walkway.”* This is significantly less than the current overtopping rate calculated at for example the Spa Chalet (18 l/s/m for a 1 in 10 yr event). Due to climate change this increases to a predicted 29 l/s/m in 2058 and 77 l/s/m in 2108. Whilst there would be considerable difficulty in assessing the change in risk due to the strategic options under consideration, we have allowed for options that reduce overtopping to the guidance

Title	Scarborough Coastal Defence Strategy Review – Holbeck to Scalby Mills		
Version	3.1	Status:	Final
Issue Date:	Oct 09	Page	23

levels published. Refer to the overtopping rates, post capital scheme implementation, quoted in Appendix F.

2.5.5.2 Public safety at the defences will be further considered during the more detailed studies proposed under scheme implementation. These studies could either be progressed as part of future strategy reviews, or for the more immediately identified works, as separate scheme specific studies that will lead to the development of the project appraisals for the individual schemes. For example at 'The Spa', further studies (mathematical modelling and flume tests) are required to refine and develop the preferred option identified in the StAR. Whilst at 'Foreshore Road', the design development will need to include stakeholder consultations to help optimise the design to ensure it is compatible with the built environment, particularly access requirements to the beach.

2.5.6 Damages Avoided (benefits) of do-something options

2.5.6.1 As noted earlier all of the do-something options consider have an appraisal period of 100 years. They are all designed to hold-the-line and thus delay the onset of erosion for the appraisal period. The damages avoided are therefore the same for all options and relate to delaying the do-nothing damages by 100 years.

2.5.7 Indirect Damages

2.5.7.1 The social and economic consequences of no active intervention (i.e. a 'do nothing' scenario) are not fully captured by the direct damages calculated from direct loss of assets. The loss and degradation of the promenades, beach access, cliff gardens and associated amenity facilities are central features to Scarborough's economy as a major seaside resort.

2.5.7.2 Recreation and amenity losses have been estimated using a pre-feasibility level value of enjoyment (VOE) method, using the methodology recommended in the Multi-coloured Manual and tourist statistics. Health impact losses have been included and are based on the Health Damages section in the Multi-coloured Manual.

2.5.7.3 Losses incurred by the fisheries industry and the harbour due to an increase in sedimentation following a major landslide in South Bay were estimated from harbour dredging statistics.

2.5.7.4 Traffic disruption damages have been estimated from road closures due to wave overtopping or sea wall failure along the road landward of the Holms and Clarence Gardens promenade.

2.5.8 Recreational or Amenity Benefits

2.5.8.1 As for the 2005 strategy report, the amenity losses are estimated based on the pre-feasibility MCM approach. Value of Enjoyment (VoE) per visit is based on the results of a questionnaire survey performed for Scarborough in 1988, for the Yellow Manual which were updated in the 2003 and 2005 MCM.

2.5.8.2 Visitor number estimates were based on SBC tourism dept estimates of 3.6 million visitor days/year to Scarborough. The proportion of these considered to be enjoying benefit from the amenity facilities associated with the seafront was based on a reported 35% of the visitors that considered "resort factors" as the motivation for

Title	Scarborough Coastal Defence Strategy Review – Holbeck to Scalby Mills		
Version	3.1	Status:	Final
Issue Date:	Oct 09	Page	24

the visit. These factors will include access to and enjoyment of the beaches, rocky foreshores, promenades and cliffs.

2.5.8.3 The VoE for a visit to Scarborough was based on survey data in the MCM, which gives the March 2005 VOE per adult visitor as of £8.52 (or £9.61 at current prices) for Scarborough. It is assumed, as with the 2005 strategy update that this value applies to the present situation or all do-something (Hold the line) options. No reduction in VoE under a do nothing scenario is presented for Scarborough in MCM, so an estimate of 83% has been used based on available data for other sites in the MCM. The losses per adult visitor are therefore £7.98.

2.5.8.4 As recognised by the MCM methodology, visitors may mitigate their losses by visiting other sites. As we have not undertaken a specific survey the way that this might occur in practice is difficult to estimate. Therefore a simplistic approach is taken on the assumption that if put off by a do-nothing coast protection strategy for Scarborough, visitors decide to visit either Whitby or Filey, the nearest resorts (although it is noted that they are smaller and may not have capacity to accept the extra visitors).

2.5.8.5 The VoE losses associated with do-nothing then become the difference in VoE between the sites plus the additional cost of visiting the other site. For Filey the current VoE based on MCM data is £7.10. We have conservatively assumed that the VoE for visiting Whitby is the same as Scarborough as there is no equivalent data in the MCM. For many visitors travelling from West Yorkshire conurbations there would be no additional travel cost for visiting Filey, but approximately an extra 10km to go to Whitby. For those travelling from the north, those diverted to Whitby might have a shorter, cheaper trip, whilst others diverted to Filey longer. The mitigated reduction in VoE is therefore estimated as £2.40 for Whitby or £2.52 for Filey. The lower bound whole resort annual losses is therefore 1,257,000 adult visitors x £2.40 loss per visit = £3.02 million.

2.5.9 Distribution of do-nothing amenity losses across the strategy frontage

2.5.9.1 The strategy frontage has been split into 13 MUs (taking the Castle Headland east Pier to the Holms frontage as one). Wheatcroft Cliff, MU23A/1 currently has a no active intervention (NAI) policy but is south of South Bay, away from the amenity usage areas and the existing amenity benefits are therefore considered to relate to 12 MUs.

2.5.9.2 Although it could be considered that some MUs attract more or less of the proportion of total visitor numbers, those visiting more popular areas, eg. Foreshore Road, The Spa, Sealife Centre, will generally need to travel through other MUs to gain access. We have therefore allocated the do-nothing damages uniformly across the strategy, giving £3.02M /12 = £251,440 per management unit. Under the do-nothing options, this value should apply each year of the strategy after a major failure has occurred to that frontage.

2.6 Environmental and Social Assessment

2.6.1 Strategic Environmental Assessment Framework and Level of EIA

2.6.1.1 Although not a statutory requirement, Defra guidance strongly recommends that a Strategic Environmental Assessment (SEA) for Flood and Coastal Erosion Risk

Title	Scarborough Coastal Defence Strategy Review – Holbeck to Scalby Mills		
Version 3.1	Status: Final	Issue Date: Oct 09	Page 25

Management Strategies, in accordance with the European Directive 2001/42/EC, is prepared for this strategy.

2.6.1.2 Environmental Assessment and consultation has been integral to the development and appraisal of the strategy and has been used to evaluate the impacts of the options, consider enhancement opportunities, and mitigation measures to limit the environmental impact of implementing the strategy.

2.6.1.3 A preliminary environmental assessment (PEA) was undertaken during 2005/06 as an integral part of the strategy review. Since then the Environment Agency guidelines on the requirements for SEA have changed and so as indicated above, we have developed this into a full Environmental Report (See Appendix E), based on the Environment Agency SEA guidance, to support this submission.

2.6.1.4 The North East Coast Shoreline Management Plan 2 (SMP2) (River Tyne to Flamborough Head), the Environment Agency's Vision for 'a rich, healthy and diverse environment in England and Wales, for present and future generations', the National Environment and Rural Communities Act 2006 and Defra's Making Space for Water have all been taken into account when preparing the Environmental Report.

2.6.2 Habitats and Water Framework Directive Issues

2.6.2.1 There are no internationally protected sites (ie. SPA / SAC / RAMSAR) within or adjacent to the area potentially impacted upon by the strategy. Therefore there is no requirement to undertake an appropriate assessment under the Habitats Regulations.

2.6.2.2 Natural England has reviewed the document and has issued a comfort letter, dated 24 April 2008 (included in Appendix G), stating that the proposal is likely to lead to an environmentally acceptable solution. They also state that the proposal is not likely to require an appropriate assessment under Habitats Regulations.

2.6.2.3 It is understood that the strategy area falls within the wider Humber River Basin District (RBD) established under the Water Framework Directive (WFD) and that specific objectives for the coastal waters within the strategy area have not yet been set. Plans such as this strategy need to contribute to objectives of the WFD by not proposing policies likely to cause deterioration of water quality, or by setting policies to directly contribute towards achievement of good environmental condition or potential. The default generic objectives are considered to be aligned with those developed for the SSSIs within or adjacent to the strategy frontage.

2.6.3 Key Environmental and Social Constraints and Opportunities

2.6.3.1 The Environmental Report in Appendix E identifies key strategic issues, constraints and opportunities under the following headings:

- a) Population, Human Health and Economy
- b) Flora, fauna, Biodiversity and Geology
- c) Landscape and Land Use
- d) Archaeology and Cultural Heritage
- e) Recreation and Amenity
- f) Material Assets
- g) Water

Title	Scarborough Coastal Defence Strategy Review – Holbeck to Scalby Mills		
Version 3.1	Status: Final	Issue Date: Oct 09	Page 26

2.6.3.2 Following appraisal of the constraints and opportunities the following key environmental objectives were established:

- a) Maintain an appropriate level of coastal defence protection for people and their property, in partnership with opportunities identified in other Strategies and Plans and through consideration within the context of PPS25.
- b) Maintain and, where possible, improve tourism, amenity and recreational value of the beaches and associated coastal facilities.
- c) Protect designated features, such as biological and geological SSSIs.
- d) Protect ecologically valuable inter-tidal rocky shore habitats.
- e) Prevent disturbance to sea birds.
- f) Maintain and, where possible, improve access to seafront.
- g) Conserve visual appearance of coastline.
- h) Prevent damage to fisheries.
- i) Maintain water quality in order to achieve the requirement for all coastal waters to reach “good status” by 2015 under the Water Framework Directive.
- j) Ensure that the Coastal Defence Strategy takes account of climate change.

2.6.3.3 Based on existing information about the strategy area, the issues we identified as most important are listed below:

- a) Safety, security and social/physical well being for people living within coastal erosion and flood risk areas;
- b) Risks to the population and properties adjacent to the coast;
- c) Vulnerability of the properties along the whole frontage from erosion, wave action, tidal inundation and flooding;
- d) Broad economic base associated with tourism and the sea front;
- e) The Spa, the Harbour and the Sealife Centre, amenities of vital importance to the Town;
- f) Three SSSIs are located within the study area;
- g) The area is of geological and geomorphological importance;
- h) Maintenance and, where possible, enhancement of the interest features of SSSIs through the proposed options, and the promotion of biodiversity wherever possible;
- i) Opportunities to promote self-sustaining fisheries should be sought where possible;
- j) The dominant landscape features are the Castle Headland, South Bay and North Bay;
- k) The majority of the frontage is urbanised and comprises of recreational and leisure tourism facilities;
- l) Southern boundary of the North Yorkshire Heritage Coast is situated at the northern extent of the study area;
- m) Many built heritage features within the study area;
- n) Numerous areas of archaeological interest;
- o) Local community is reliant upon revenues and employment benefits of tourism;
- p) Vast majority of study area associated with recreation, local amenity and tourism uses;
- q) Numerous infrastructure assets at risk, including sea walls, public sewers and buildings;

- r) Potential risks to cliff top infrastructure through undermining;
- s) Regeneration: The Sands North Bay;
- t) Exceptional water quality within North Bay;
- u) Water quality levels need to be maintained and, where possible, improved; and
- v) Groundwater contributions to the history of instability in the area.

2.6.4 Key Environmental risks

2.6.4.1 If there were no long term strategy for coastal defence, key environmental risks would include:

- a) Pollution from erosion damage to the Yorkshire Water infrastructure would probably contravene Bathing Waters, Urban Waste Water treatment and Water Framework Directives.
- b) Loss of opportunities to add value to the economic development of Scarborough as a sustainable UK based holiday destination.
- c) Loss of coastal defences through erosion leading to ultimate destruction of cliff top infrastructure and properties.

2.6.5 Consultation

2.6.5.1 During the 2005 review of the strategy, there was extensive consultation with a list of stakeholders that extended to over 230 organisations and representatives. A summary of consultation responses is included in the SEA Environmental Report in Appendix E. Table 8 summarises the consultation process to date.

Table 8 Communications and consultations

Description	Date
Initial communications with stakeholders	2004
Individual liaison with key stakeholders	2005 - ongoing
Consultation on Draft Strategy & Preliminary Environmental Report	October to December 2005
Updated Environmental Report sent to Natural England	March 2008

2.6.5.2 The 2008 strategy review has included updating the economics, consideration of alternative options in order to mitigate stakeholder concerns and the inclusion of the new climate change guidance. The revised Environmental Report was forwarded to key consultees. Although there were minor changes to the environmental impacts assessed, the preferred option did not change significantly and therefore, no further consultations were undertaken.

2.6.5.3 Following consultation on the draft strategy it was adopted as policy by us during May 2007. Following approval of the Strategy by the Environment Agency, an updated letter will be issued to stakeholders informing them of progress.

2.6.5.4 We propose to engage further with stakeholders during strategy implementation to determine whether partnerships can be developed and additional benefits realised through the implementation of the strategy.

2.6.6 Key Impacts and Management

2.6.6.1 Table 9a summarises the key positive and negative impacts and whether management of these impacts is required.

Table 9a Key impacts summary

Option	Key Positive Impacts	Key Negative Impacts	Management Options Yes/No
Do Nothing	None	Loss of sea defences leading to ultimate losses of seafront and cliff top infrastructure and properties.	No
		Detrimental impacts upon SSSIs through coastal processes and erosion rates increasing at a much higher rate.	No
		Loss of foraging and roosting areas for bird species of conservation concern through inundation.	No
		The Cleveland Way may need to be diverted away from the coast further inland.	No
		Pollution from erosion damage to the Yorkshire Water infrastructure would probably contravene Bathing Waters, Urban Waste Water treatment and Water Framework Directives.	No
20A/1 - Sealife Centre: Do minimum and defer rock revetment & sea wall repair by 15 years.	Significant improvements in public safety.	Potential short term physical impacts on the rocky foreshore during repair works.	No
	No direct long term impact on SSSI.	Adverse effects on fish stock movement (migration into Scalby Beck) or behaviour during any mid-long term permanent works.	Yes - Design development of more environmentally acceptable solution following monitoring of fish movements and migration habits pre (incl. environmental assessment), during and post construction.
	No long term adverse impacts upon the Heritage Coast and National Trail.		Not required.
	Positive effects on tourism.	Loss of suitable foraging and roosting sites either during construction or post-implementation to ensure no disturbance to birds of conservation concern.	Yes - Scheme specific monitoring regimes, pre (incl. environmental assessment), during and post construction.
Protection of the Sealife Centre.	Not required.		
20A/2 to 20A/17 - North Bay Cliffs: Wall repairs (subject to beach behaviour) and slope stabilisation.	Improved public safety.	Physical impact on the rocky foreshore during repair works.	Yes - Construction techniques.
20B/1 to 20B/3 - Peasholm Gap and Clarence Gardens: Sea wall repairs, a 1:3 rock revetment and slope stabilisation and further studies in the first 5 years of the Strategy implementation.	Improved public safety.	None.	Not required.

Option	Key Positive Impacts	Key Negative Impacts	Management Options Yes/No
22A/1 to 22A/2 - Foreshore Road and St. Nicholas Cliff: 1.2m rise in promenade level at seaward edge of the promenade footway, with improved road drainage and slope stabilisation.	Improved public safety.	None.	Not required.
22A/3 - Spa Chalet 22A/4 to 22B/2 - The Spa: Rock revetment in front of sea wall, slope stabilisation and emergency works to rebuild as existing following failures prior to revetment construction.	Improved public safety.	Potential negative impact upon the Cayton, Cornelian and South Bays SSSI and the SINC through works.	Yes - Construction techniques.
22B/3 - South Cliff Gardens, 22B/4 - Rose Gardens, 22B/5 - The former South Bay Pool, 22B/6 - Holbeck Gardens and 22B/7 - Holbeck Cliff: 1:2 or 1:3 rock revetment over lower promenade, crest height ~ 6.5m OD, ~ 3m crest width, access to the former South Bay Pool through gardens and slope stabilisation. Capital scheme in year 5, with repairs and emergency works as necessary before implementation.	Improved public safety.	Potential negative impact upon the Cayton, Cornelian and South Bays SSSI and the SINC through works.	Yes - Construction techniques.

2.6.7 Environmental Mitigation

2.6.7.1 A detailed environmental assessment will be undertaken prior to any proposed improvement schemes under the strategy. It will also be ensured that consideration for fisheries (numbers, distribution, migration, etc.) will be included to develop a baseline to be developed prior to any potential scheme/project. This will include liaison with Environment Agency Fisheries Officers, fish movement and species surveys and monitoring and mitigation proposals, if it is deemed likely that there will be a significant effect.

2.6.7.2 Consideration for birds (numbers, distribution, species etc) will be also included in any scheme or project arising from the Strategy, including post construction monitoring, to gauge bird's response to the new structure(s). This will include liaison with Environment Agency biodiversity officers, over-wintering surveys and monitoring and mitigation proposals (such as alternative roosting sites, provision of artificial foraging areas, compensatory habitat provision in the case of the depletion of large foraging areas etc) if it is deemed that there will be a likely significant effect. We have also requested data from Filey Bay Ornithology Group, which will be used to inform surveys and monitoring at project EIA level.

2.6.7.3 Landscape and aesthetic monitoring will additionally be undertaken by qualified landscape architects for schemes or projects following the Strategy adoption, to ensure that due consideration of landscape impacts are included within the assessment. Liaison will also occur with the Cleveland Way Officer at the North York Moors National Park Authority with regards to any potential changes to the route of the Cleveland Way at scheme or project stage.

2.6.8 Environmental Enhancement

2.6.8.1 Specific Environmental and social enhancements have not been developed at the strategy level, but will be considered with stakeholders and taken into account at the more detailed implementation and EIA stage. We anticipate that the type of enhancements that could be provided as part of capital schemes could be, for example, localised landscape improvements, improvements to beach access, provision of interpretative information for ecological and geological SSSIs, provision of street furniture/lighting enhancements and potentially public art. We have added 3.4% to the capital costs for major schemes to allow for potential enhancement additions. Table 9b summarises suggested proposals from the Environmental report.

Table 9b Environmental enhancement summary

Strategic objective	Potential enhancements sought	Approach	Expenditure profile
To maintain and, where possible, improve tourism, amenity and recreational value of the beaches, promenades and associated coastal facilities.	(i) Increase in coastal tourism as a direct result of implementation of schemes. (ii) An increase in the total number/ extent of coastal recreational assets.	Scheme specific changes in asset and amenity potential.	<u>Year 4</u> The Spa £233k <u>Years 5-10</u> Clarence Gardens (N) £359k Foreshore Road £100k SCG, RG & SBP £310k
Protect designated features, such as biological and geological SSSIs.	Where possible enhance the condition status of the designated sites.	Scheme specific changes for any option overlapping or adjacent to designated site.	<u>Years 10-20</u> Sealife Centre £77k North Bay Cliffs £70k Holbeck Gardens £188k
Protect ecologically valuable inter-tidal rocky shore habitats.	Develop new areas of key habitats and expand populations of key species (e.g. birds).	Scheme specific assessments of potential for contributions to BAP targets.	<u>Years 20-30</u> West Pier £37k Spa Chalet £122k <u>Years 50-100</u> The Holms & Castle Headland £1,063k Holbeck Cliff £32k
Prevent disturbance to sea birds.	Potential provision of off site roosting and artificial foraging areas for birds of conservation concern during construction.	Scheme specific monitoring regimes, pre, during and post construction.	
Maintain and, where possible, improve access to seafront.	(i) Increase in coastal tourism as a direct result of implementation of the scheme. (ii) An increase in the total number/ extent of coastal recreational visits.	Scheme specific changes in access potential.	
Conserve visual appearance of coastline.	Overall improvement in landscape character.	Scheme specific landscape assessments at PAR stage.	
Prevent damage to fisheries.	Improved habitats for fish.	Scheme specific changes.	

2.6.9 Environmental Compliance

2.6.9.1 The SEA Environmental Report is compliant with planning policy at all levels. Natural England has advised that the proposed strategy is likely to lead to an environmentally acceptable solution, and that an Appropriate Assessment under the Habitats Regulations is not required; refer to Appendix G for standard format "letter of comfort".

2.7 Choice of Preferred Option

2.7.1 Appraisal Summary

2.7.1.1 Environmental, socio-economic and technical aspects were considered in developing preferred options for each Management Unit. Generally, option choice is driven by lowest PV costs, providing technical and environmental criteria are satisfied. The FCDPAG3 decision rule relating to indicative standards is not applicable to coastal erosion, but incremental benefit cost ratios compared to the do-minimum were used to guide option choice. The preferred options comply with the generic SMP “hold the line” policy, generally through improving the defences as they reach the end of their lives.

2.7.1.2 All do-something options will contribute to Outcome Measure 2 by delaying property losses due to coastal erosion.

2.7.2 Health and Safety Considerations

2.7.2.1 The primary concerns with regard to health and safety relate to (i) issues during construction of replacement defences and (ii) risks to the public on or near the defences, particularly during storms such as from wave overtopping near vertical sea walls. These are risks that we manage on a routine basis already. The new strategy will address the overtopping issues where capital schemes are implemented.

2.7.3 Economic Assessment and Decision Rule

2.7.3.1 As indicated earlier the do-something options considered all delay erosion over the strategy period. The FCDPAG3 economic decision rule cannot therefore be used to distinguish between them. However, in accordance with the Defra Outcome Measure requirements we have considered incremental benefit-cost ratios for moving between the do-minimum option and the options that propose improvements to the defences. It should be noted that the numbers of households protected do not vary for do-something options because all do-something “hold the line” options virtually halt erosion. The assumption is that damage to defences will be repaired before properties are lost, so the appraisal essentially looks for the most cost effective, environmentally sound and technically viable approach to deliver the SMP policy to hold the line.

2.7.3.2 The economic summaries for each management including average and incremental BCRs for all options are shown in Tables 10a and 10b with the selected preferred options (not always on economic grounds) and proposed year of construction highlighted.

2.7.3.3 The only sections of the strategy frontage that do not appear to meet FCDPAG3 investment criteria are West Pier and Holbeck Cliff. More detailed investigations may highlight further benefits but neither of these two frontages are expected to require major capital works for 30 to 50 years. Even then, non implementation on these frontages would not be expected to compromise the wider strategy due to the residual functionality remaining through the gradual deterioration of the structures. It is not possible to suggest where alternative funding might be obtained for West Pier 30 years into the future. However, assuming the harbour is still operational at the time it may be that some funding could come from commercial

harbour users or harbour dues. It is also expected that the strategy will be reviewed several times over the intervening period.

2.7.3.4 The South Cliff Gardens, Rose Gardens and South Bay Pool frontage has a marginal benefit cost ratio for even minimal intervention. Capital works are not proposed until years 6-10, after the strategy is reviewed again. During years 1-5 further studies are proposed associated with The Spa sea wall proposals. These include for environmental and modelling studies, bathymetric and beach surveys and routine monitoring of the piezometers and inclinometers of the South Bay. This additional information, together with records of actual expenditure on 'do-minimum' repairs and maintenance will help with the re-evaluation of residual life, costs and benefits as part of the next strategy review. The remaining frontages have more robust economics. In the meantime SBC will continue to explore regeneration options for these areas with Yorkshire Forward (Regional Development Agency) which could incorporate improvements to or possibly bring contributions towards the coastal defences.

2.7.3.5 If funding is constrained and the schemes that have been shown to be economically justified cannot be progressed then the fall-back position for the strategy will be the 'do-minimum' option which is to maintain the existing defences and undertake emergency repairs to breaches or major damage. SBC currently has an annual budget of £250,000 covering its coastal frontages in North Yorkshire. It is recognised that this will not address the overtopping issue and therefore we will need to review public safety with a view to implementing procedures for closing off the areas at risk. It is also recognised that the 'do-minimum' option, whilst appropriate in the short term, is not sustainable over the lifetime of the strategy (mainly due to climate change) and consequently it will be necessary at future reviews of the strategy to consider alternative options. With the adoption of SMP2 and other strategies it is evident that there are several locations outside this strategy frontage on the North Yorkshire Coast where properties are at risk, (Flat Cliffs Filey, Cayton Bay, Scalby Ness and others). SBC will therefore be reviewing its evacuation response plan at a broader scale than this strategy, to ensure procedures are in place to evacuate coastal properties in an emergency.

2.7.3.6 The current SMP2 policy is to 'hold the line' which under the present circumstances has been shown to be economically worthwhile and cost effective in terms of the timing and costs of intervention. We believe that we have robust 'do minimum' maintenance and emergency repair costs in the economic appraisal which relate to the failure probabilities (based on previous costs of emergency schemes). We have included for increases in maintenance allowances into the near future but as discussed previously this will become unsustainable in the medium to long term as overall defence condition deteriorates due to the effect of climate change. These costs are all captured in the economic summary tables.

Table 10a Economic summary for each management unit

Strategy Management Unit		Strategy Options		Proposed year of construction	PV Cost With OB £k	Cash Cost With OB £k	Damages £k	PV Benefits £k	Net Present Value £k	BCR	Incremental BCR
20A/1 - 23A/1		Total Preferred Strategy		variable	96,200	221,000	23,300	295,000	198,000	3.1	1.5
20A/1	Sea Life Centre	Option 1	Do Nothing/ No Active Intervention				7,720				
		Option 2	Minimal Intervention - repeated repairs for 100 years	1 - 5	3,780	16,500	1,520	6,200	2,410	1.6	0.2
		Option 3	Rock Berm & seawall repairs - scheme in year 3	1 - 5	12,700	15,700	53	7,670	-5,048	0.6	0.2
		Option 4	Rock revetment and sea wall repairs - scheme in year 3	1 - 5	5,540	7,490	53	7,670	2,130	1.4	0.8
		Option 5	Stepped Concrete Revetment - scheme in year 3	1 - 5	13,400	16,500	53	7,670	-5,752	0.6	0.2
		Option 6	Defer rock revetment & sea wall repair by 15 years	11 - 20	4,780	8,470	123	7,600	2,820	1.6	1.4
20A/2 - 20A/7	North Bay Cliffs	Option 1	Do Nothing/ No Active Intervention				22,500				
		Option 2	Minimal Intervention	ongoing	2,710	15,700	8,840	13,700	10,900	5.0	-
		Option 3	Seawall repairs & slope stabilisation	6 - 10	5,110	10,900	2,220	20,300	15,200	4.0	2.8
		Option 4	Seawall repairs, slope stabilisation & beach recharge	6 - 10	9,810	29,100	2,220	20,300	10,500	2.1	0.9
20B/1 - 20B/3	Clarence Gardens (N)	Option 1	Do Nothing/ No Active Intervention				52,400				
		Option 2	Minimal Intervention	ongoing	4,560	17,600	24,000	28,400	23,800	6.2	-
		Option 3	Rock revetment, seawall repairs & slope stabilisation	6 - 10	18,300	28,900	3,870	48,500	30,300	2.7	1.5
		Option 4	Rock revetment, seawall repairs, beach recharge & slope stabilisation	6 - 10	22,800	46,800	3,870	48,500	25,800	2.1	1.1
21A/1 & 2 - 21B/1	The Holms & Castle Headland	Option 1	Do Nothing/ No Active Intervention				44,400				
		Option 2	Minimal Intervention -upgrade / replace structures at end of residual life	50 - 100	13,000	76,700	1,180	43,200	30,200	3.3	-
21B/2	West Pier / Harbour	Option 1	Do Nothing/ No Active Intervention				780				
		Option 2	Minimal Intervention	20 - 30	1,570	6,300	557	223	-1,352	0.1	-
		Option 3	Upgrade / replace structures at end of residual life	20 - 30	2,330	5,520	354	426	-1,909	0.2	0.3
22A/1 - 22A/2	Foreshore Rd and St Nicholas Cliff	Option 1	Do Nothing/ No Active Intervention				60,100				
		Option 2	Minimal Intervention	ongoing	3,070	11,500	24,400	35,700	32,700	11.6	-
		Option 3	Hold Line - Upgrade wall & slope stabilisation in Year 7	6 - 10	6,410	11,400	8,340	51,700	45,300	8.1	4.8
		Option 4	Advance Line - new wall & slope stabilisation in Year 7	6 - 10	12,200	18,700	7,000	53,100	40,900	4.4	1.9
		Option 5	Hold Line - Upgrade wall & slope stabilisation in Year 1	1 - 5	7,350	11,000	3,550	56,500	49,200	7.7	5.1
		Option 6	Hold Line - Upgrade wall & slope stabilisation in Year 15	11 - 20	5,680	12,000	13,000	47,100	41,400	8.3	0.9
22A/3	Spa Chalet	Option 1	Do Nothing/ No Active Intervention				24,600				
		Option 2	Minimal Intervention	ongoing	1,780	6,850	4,060	20,500	18,700	11.5	-
		Option 3	Hold Line- Rock Revetment, seawall repairs & slope stabilisation	1 - 5	8,380	11,800	807	23,800	15,400	2.8	0.5
		Option 4	Advance Line - New wall, revetment & slope stabilisation	1 - 5	17,800	22,200	807	23,800	5,980	1.3	0.2
		Option 5	Rock Berm, Wall Repairs and slope stabilisation	1 - 5	15,200	19,300	807	23,800	8,610	1.6	0.2
		Option 6	Rock Revetment, Wave Return Wall & Slope Stabilisation	1 - 5	7,730	11,100	807	23,800	16,100	3.1	0.5
		Option 7	Concrete Stepped Revetment & Slope stabilisation	1 - 5	15,300	19,400	807	23,800	8,500	1.6	0.2
		Option 8	Rock Revetment, Wave Return Wall & Slope Stabilisation - 20 Year Delay	20-30	4,740	10,300	2,020	22,600	17,800	4.8	0.7
		Option 9	Concrete Stepped Revetment & Slope stabilisation - 20 Year Delay	20-30	8,810	18,600	2,020	22,600	13,800	2.6	0.3
22A/4 - 22B/2	The Spa	Option 1	Do Nothing/ No Active Intervention				70,800				
		Option 2	Minimal Intervention	ongoing	6,840	31,900	47,800	23,000	16,200	3.4	-
		Option 3	Hold Line- Rock Revetment, seawall repairs & slope stabilisation	1 - 5	13,700	17,900	2,660	68,200	54,400	5.0	6.5
		Option 4	Advance Line - New wall, revetment & slope stabilisation	1 - 5	27,500	33,200	2,660	68,200	40,600	2.5	2.2
		Option 5.1	Rock revetment and wave return wall and slope stabilisation - 1 in 100 Structural SoP - 1 in 10 Overtopping SoP	1 - 5	14,100	18,300	2,660	68,200	54,100	4.8	6.2
		Option 6	Concrete stepped revetment	1 - 5	18,400	23,100	2,660	68,200	49,700	3.7	3.9
		Option 7	Rock Berm and sea wall repairs	1 - 5	16,300	20,800	2,660	68,200	51,900	4.2	4.8
22B/3, 22B/4 & 22B/5	South Cliff Gdns, Rose Gdns & South Bay Pool	Option 1	Do Nothing/ No Active Intervention				25,500				
		Option 2	Minimal Intervention	ongoing	8,130	34,300	15,900	9,530	1,400	1.2	-
		Option 3	Rock Berm, seawall repairs & slope stabilisation	6 - 10	16,000	27,300	1,970	23,500	7,460	1.5	1.8
		Option 4	Rock Revetment, seawall repairs & slope stabilisation	6 - 10	18,200	30,200	1,970	23,500	5,260	1.3	1.4
22B/6	Holbeck Gardens	Option 1	Do Nothing/ No Active Intervention				8,650				
		Option 2	Minimal Intervention	ongoing	2,770	11,600	3,700	4,950	2,180	1.8	-
		Option 3	Rock Berm, seawall repairs & slope stabilisation	11 - 20	7,910	14,500	454	8,190	290	1.0	0.6
		Option 4	Rock Revetment, seawall repairs & slope stabilisation	11 - 20	8,250	15,000	454	8,190	-55	1.0	0.6
22B/7	Holbeck Cliff	Option 1	Do Nothing/ No Active Intervention				558				
		Option 2	Minimal Intervention -upgrade / replace structures at end of residual life	50 - 100	979	4,810	47	511	-468	0.5	-
23A/1	Wheatcroft Cliff	Option 1	Do Nothing/ No Active Intervention	NAI			30				
		Option 2	Minimal Intervention	NAI	302	1,020	30	0	-302	0.0	-

Note: All incremental BCR's are compared to minimal intervention (Option 2)

Table 10b Factors affecting option choice for each management unit

Strategy Management Unit	Strategy Options	Proposed year of construction	Net Present Value £k	BCR	Incremental BCR	No of Households Protected	Outcome Measures Score		
20A/1 - 23A/1	Total	variable	198,000	3.1		1711	1.29	Factors affecting option choice	
20A/1	Sea Life Centre	Option 1				-	-	Options 2 and 6 have the highest BCRs of equal value. The preferred option is 6 based on the need to reduce overtopping from the very high values predicted in the future. The incremental BCR of 1.4 is robust. Although the proposed form of the rock revetment is not considered environmentally acceptable at present, design refinements in the future may be more acceptable. The SEA found that the do minimum option performs well against all of the environmental objectives in the short term. Option 6 is compatible with this and has therefore been selected.	
		Option 2	1 - 5	2,410	1.6	0.2	9		0.44
		Option 3	1 - 5	-5,048	0.6	0.2	9		0.16
		Option 4	1 - 5	2,130	1.4	0.8	9		0.37
		Option 5	1 - 5	-5,752	0.6	0.2	9		0.15
		Option 6	11 - 20	2,820	1.6	1.4	9		0.43
20A/2 - 20A/7	North Bay Cliffs	Option 1				-	-	Option 3 has been selected as it has a robust BCR and the highest incremental BCR 2.8.	
		Option 2	ongoing	10,900	5.0	-	15		1.51
		Option 3	6 - 10	15,200	4.0	2.8	15		1.15
20B/1 - 20B/3	Clarence Gardens (N)	Option 1				-	-	Option 3 has been selected as it the viable option that reduces the severe overtopping problem, particularly when beach levels are low.	
		Option 2	ongoing	23,800	6.2	-	280		8.51
		Option 3	6 - 10	30,300	2.7	1.5	280		2.42
21A/1 & 2 - 21B/1	The Holms & Castle Headland	Option 1				-	-	Option 2 has been selected as defences have recently been constructed.	
		Option 2	50 - 100	30,200	3.3	-	595		0.90
21B/2	West Pier / Harbour	Option 1				-	-	Although the BCR of option 3 is less than unity it has been chosen because West Pier provides protection to other units by sustaining the beach levels. This is not a priority scheme and therefore detailed appraisal of these benefits has not been carried out. It will be a complex process to include the benefits provided to other frontages without double counting strategy wide benefits.	
		Option 2	20 - 30	-1,352	0.1	-	-		0.04
		Option 3	20 - 30	-1,909	0.2	0.3	-		0.05
22A/1 - 22A/2	Foreshore Rd and St Nicholas Cliff	Option 1				-	-	Foreshore Road and St Nicholas Cliff have different problems, surge tide flooding and cliff stability respectfully. Option 3 has been selected as it allows for development of the currently designed scheme in order to get agreement with local stakeholders and has an incremental BCR greater than 3.	
		Option 2	ongoing	32,700	11.6	-	78		3.30
		Option 3	6 - 10	45,300	8.1	4.8	78		2.26
		Option 4	6 - 10	40,900	4.4	1.9	78		1.22
		Option 5	1 - 5	49,200	7.7	5.1	78		2.14
		Option 6	11 - 20	41,400	8.3	0.9	78		2.32
22A/3	Spa Chalet	Option 1				-	-	Option 8 selected as it is the most viable option with the highest BCR based on the need to reduce overtopping from the high values predicted in the future.	
		Option 2	ongoing	18,700	11.5	-	63		3.52
		Option 3	1 - 5	15,400	2.8	0.5	63		0.85
		Option 4	1 - 5	5,980	1.3	0.2	63		0.40
		Option 5	1 - 5	8,610	1.6	0.2	63		0.47
		Option 6	1 - 5	16,100	3.1	0.5	63		0.93
		Option 7	1 - 5	8,500	1.6	0.2	63		0.47
		Option 8	20-30	17,800	4.8	0.7	63		1.44
		Option 9	20-30	13,800	2.6	0.3	63		0.77
22A/4 - 22B/2	The Spa	Option 1				-	-	Option 5 selected as it is the most viable option, highest BCR option based on the need to reduce overtopping from the high values predicted in the future. The incremental BCR is robust being greater than 3. Also taking into account the condition of the sea walls, the risk of failure and the consequences should the defences fail, upgrading the defences along The Spa frontage is considered a priority.	
		Option 2	ongoing	16,200	3.4	-	380		1.51
		Option 3	1 - 5	54,400	5.0	6.5	380		1.64
		Option 4	1 - 5	40,600	2.5	2.2	380		0.82
		Option 5.1a	1 - 5	54,100	4.8	6.2	380		1.60
		Option 6	1 - 5	49,700	3.7	3.9	380		1.22
		Option 7	1 - 5	51,900	4.2	4.8	380		1.38
22B/3, 22B/4 & 22B/5	South Cliff Gdns, Rose Gdns & South Bay Pool	Option 1				-	-	Option 4 has been selected over option 3 because although the BCR and the incremental BCR is lower, the defence footprint is approximately half the area therefore reducing the environmental impact of the scheme which is adjacent to a SSSI.	
		Option 2	ongoing	1,400	1.2	-	251		1.16
		Option 3	6 - 10	7,460	1.5	1.8	251		0.82
		Option 4	6 - 10	5,260	1.3	1.4	251		0.72
22B/6	Holbeck Gardens	Option 1				-	-	Option 4 has been selected over Option 3 because although the BCR and the incremental BCR values are similar, the defence footprint is approximately half the area therefore reducing the environmental impact of the schemewhich is adjacent to a SSSI.	
		Option 2	ongoing	2,180	1.8	-	26		0.74
		Option 3	11 - 20	290	1.0	0.6	26		0.37
		Option 4	11 - 20	-55	1.0	0.6	26		0.36
22B/7	Holbeck Cliff	Option 1				-	-	Option 2 has been chosen as defences have recently been constructed.	
		Option 2	50 - 100	-468	0.5	-	14		0.14
23A/1	Wheatcroft Cliff	Option 1	NAI			-	-	Option 1 has been chosen as the minimal intervention option produces a benefit cost ratio of 0.	
		Option 2	NAI	-302	0.0	-	-		-

Note: All incremental BCR's are compared to minimal intervention (Option 2)

2.7.4 Sensitivity tests on option choice and economic appraisal

2.7.4.1 Our findings may be sensitive to changes in certain key parameters used in the appraisal. We have considered changes to such parameters and how this could influence the selection of the preferred options as described below.

2.7.4.2 In Appendix H we have reported on contributions to Outcome Measures. The strategy contributes towards OM1 (benefits and costs), OM2 (Probability of Households in risk areas being directly affected) risk reduction to households) and OM3 (Households in Deprived Communities). For all do-something options the OM2 delivery remains constant. Benefits in OM1 are also constant for hold-the-line options, so provided sustainable options are chosen; those with the lowest PV costs will provide best delivery of OM1.

2.7.4.3 Changes in residential property or commercial property values would have a simple direct impact on the PV benefits, and while this would change the BCR and may well influence funding viability it would not impact on option choice, which is driven primarily by choice of the most cost effective environmentally acceptable hold the line option. The BCR for the overall preferred strategy is 3.1. If the values of the cliff top properties fell by 50%, we estimate that the BCR for the overall strategy would reduce from 3.1 to 2.3 and so still be robustly greater than 1.

2.7.4.4 The sensitivity of damages to changes in the probability of defence or cliff failure has been investigated. Doubling the failure probabilities would increase the strategy BCR from 3.1 to 3.8 and The Spa scheme from 4.8 to 5.1. For the South Bay MUs, the BCR increases from 1.3 to 1.6 for the Rose Gardens to South Bay Pool, from 1.0 to 1.1 for Holbeck Gardens and from 0.5 to 0.8 for Holbeck Cliff. However, the numbers of residential households at risk and their social ranking do not change significantly as the same area is still at erosion risk.

2.7.4.5 Sensitivity of option choice to inclusion of economic damages due to risk to life from wave overtopping and flooding has been investigated for the Foreshore Road and Spa frontages. The methodology is not strictly applicable to these cases, so the analysis should be considered indicative. At the Spa inclusion of risks to life due to wave overtopping should help justify a higher standard of protection. Based on the very broad assumptions made in the analysis which considered standards between 1 in 10 and 1 in 200, the preferred option would be 1 in 50. This should be considered further at the PAR stage. At Foreshore Rd, as expected the benefits of the improve option increase and the delay options perform less well than earlier implementation.

2.7.4.6 From the review of the likely failure mechanisms and residual lives of each MU, refer to section 2.2.5.7, we have also carried out a sensitivity test to examine how combining a number of MUs into larger work lengths affects the viability of the schemes. It is evident from Table 5 and the appraisal summary that North Bay Cliffs and Clarence Gardens (N) could be combined into a single unit as the failure mechanisms and residual lives are similar. Similarly The Spa, South Cliff Gardens, Rose Gardens, South Bay Pool and Holbeck Gardens could be combined (South Cliff Gardens, Rose Gardens and South Bay Pool had already been combined). The Harbour (ie. West Pier), Foreshore Road, St Nicholas Cliff and the Spa Chalet, although having different failure modes, have similar residual lives and so could also be combined. This leaves the Sealife Centre, The Holms & Castle Headland, Holbeck Cliff and Wheatcroft Cliff (NAI) as unique frontages within the strategy area. The results of the combination of the MUs are shown in Table 10c (see highlighted rows) and these include allowances for changing the timings of certain works (ie. bringing forward capital costs increases the PV costs) and potential design/mobilisation/demobilisation savings of 10% by combining works into larger blocks.

Table 10c Economic summary for combined management units

Strategy Combined Management Units		Strategy Preferred Options for Combined Units		Proposed year of construction	PV Cost With OB £k	Cash Cost With OB £k	Damages £k	PV Benefits £k	Net Present Value £k	BCR	Households Protected	Outcome Measures Score
20A/1 - 23A/2		Total Preferred Strategy for Combined Units (3 sig fig)		variable	94,900	205,000	25,200	295,000	199,000	3.1	1711	1.31
20A/1	Sea Life Centre	Option 6	Defer rock revetment & sea wall repair by 15 years	11 - 20	4,780	8,470	123	7,600	2,820	1.6	9	0.43
20A/2 - 20B/3	North Bay Cliffs & Clarence Gardens (N)	Option 3	Rock revetment, seawall repairs & slope stabilisation	6 - 10	21,069	35,820	6,090	68,800	45,500	3.3	295	2.38
21A/1 & 2 - 21B/1	The Holms & Castle Headland	Option 2	Minimal Intervention -upgrade / replace structures at end of residual life	50 - 100	13,000	76,700	1,180	43,200	30,200	3.3	595	0.90
22A/1 - 22A/3	Harbour West Pier, Foreshore Rd, St Nicholas Cliff & Spa Chalet	Options 3, 6 & 8	Hold Line - Upgrade wall & slope stabilisation in Year 15 Rock Revetment, Wave Return Wall & Slope Stabilisation - 20 Year Delay	15 - 25	12,132	21,627	12,690	74,726	61,191	6.2	141	1.73
22A/4 - 22B/6	The Spa, South Cliff Gdns, Rose Gdns, South Bay Pool & Holbeck Gardens	Options 5.1a & 4	Rock Revetment, seawall repairs & slope stabilisation	1 - 5	42,989	57,150	5,084	99,890	59,305	2.3	657	0.90
22B/7	Holbeck Cliff	Option 2	Minimal Intervention -upgrade / replace structures at end of residual life	50 - 100	979	4,810	47	511	-468	0.5	14	0.14
23A/1	Wheatcroft Cliff	Option 1	Do Nothing/ No Active Intervention	NAI			30			0.0	-	-

2.7.4.7 The results of this sensitivity test show that whilst the whole life cash costs decrease from £221,000k to £205,000k, the PV costs remain similar to before. This is due to bringing certain elements of work forward to match the timings of the priority scheme within the combined unit and maintain work continuity. The overall BCR remains the same at 3.1 assuming that the overall benefits remain the same. Interestingly if this sensitivity were adopted the total cash costs for the first 5 years would rise from £23,000k (mainly for The Spa) to £62,000k (mainly for The Spa, South Cliff Gardens, Rose Gardens, South Bay Pool and Holbeck Gardens).

2.7.5 Environmental and Social Assessment

2.7.5.1 At the Sealife Centre, MU20A/1, do-something options that involved encroachment onto the foreshore were not considered environmentally acceptable by consultees. The do-minimum option (sea wall repairs) has therefore been selected in the short term (15 years) with the option of capital works in the longer term, if an environmentally acceptable solution can be found. This will require a full review of future options in years 11 – 20, with ongoing monitoring and modelling studies required to inform the review. Options that do not involve loss of, and potentially enhance foreshore habitat need to be developed. The SEA found that the do Minimum option performs well against all of the environmental objectives in the short term, as there will be no direct adverse impacts on the sensitive environmental features of the inter-tidal rocky foreshore in front of the Sealife Centre.

2.7.5.2 For North Bay Cliffs and Clarence Gardens (North), MU20A/2 to MU20B/3 the preferred economic options were considered in the SEA to perform well in the long term, in relation to people, assets and climate change, due to the works providing significant benefits of reduced risks of erosion to people and communities and a better protection for assets. The selected option, sea wall repairs with slope stabilisation, including a rock revetment at Clarence Gardens has neutral effects on potential disturbance of birds of conservation concern, public access, visual amenity,

fisheries and water quality. However, the option displays either moderate or minor adverse impacts on tourism amenity and recreation opportunities in the long term.

2.7.5.3 The economically preferred option for Foreshore Road and St Nicholas Cliff, MU22A/1 to 22A/2 is to upgrade the wall by raising the promenade. However, although economically well justified the solution is perceived to reduce public access between the road and the beach. The businesses located along the road have adapted to the flood risk through deployment of sand bag temporary defences in response to flood warnings and so there is presently little appetite for implementation of the scheme in the short term, hence capital works are programmed for years 6 to 10. The driver for the works is not beach lowering as the beach is stable and is accreting at the northern end. The defences are not in good condition and there are structural issues, hence the 11% initial APF assigned. The main economic and social driver for managing the defences at Foreshore Road is the high value properties on St Nicholas Cliff, the highway and the flood risk at the northern end of the defence.

2.7.5.4 For the majority of south bay, between Spa Chalet, MU22A4 and Holbeck Cliff, MU22B/7, the economically preferred options generally comprise rock revetment works and slope stabilisation. These options were considered in the SEA to perform well in the long term in relation to people, assets and climate change. This is because the coastal defence works will have significant benefits of reduced flood and coastal erosion risks to people and communities, and protection of assets. Both options also have neutral effects on fisheries and water quality. However, both options display potential major, moderate or minor adverse impacts on tourism amenity and recreation opportunities, potential disturbance of birds of conservation concern, public access and visual amenity.

2.7.6 Key political and social concerns

2.7.6.1 **Foreshore Road (MU22A1/2):** Previous proposals for a flood risk reduction scheme at Foreshore Road have been considered controversial due to potential restrictions on pedestrian movement between the beach and the shops. It is recognised that while the benefit cost ratio for this MU justifies a scheme in the short term, it will take time to develop the most appropriate approach with stakeholders.

2.7.6.2 **Sealife Centre (MU20A/1):** In the draft strategy the preferred option was a 50m rock berm. During the public consultation there were significant environmental objections from a number of parties. The preferred option for this location has now been changed to do-minimum with further studies and delayed capital works which would be more environmentally acceptable.

2.7.6.3 **Spa Chalet (MU22A/3):** The strategy studies and the SMP recognise the amenity benefits for the town in advancing the line at Spa Chalet and the potential to improve access to the facilities at the Spa. However, this would require contributions from an alternative funding stream as the additional coast protection benefits related to advancing the line are small. Although the preferred option for the coast protection strategy is to improve the defences in 20 to 30 years, there is political will to advance the line prior to this.

Title	Scarborough Coastal Defence Strategy Review – Holbeck to Scalby Mills		
Version	3.1	Status:	Final
Issue Date:	Oct 09	Page	38

2.7.7 Preferred Option Selection

2.7.7.1 For all management units, apart from Wheatcroft Cliff, the preferred solution in the strategy is to delay the onset of coastal erosion by maintaining the defences and repairing breaches prior to the initiation of erosion and consequential cliff failures.

2.7.7.2 The strategy has taken account of socio-economic, technical, and environmental considerations in developing the preferred approach for each management unit. A summary of the preferred solution for each MU is given below in Table 11.

Table 11 Summary of preferred strategy options

Location/ Management Unit Name	Preferred Solution	Proposed Year of Construction	Budget Estimate Cash Costs £k (inc 60% opt bias)	Outcome Measures Score
Sealife Centre	1 – 10 years: Do-minimum, maintenance & repairs; full review of options and capital works years 11 – 20.	11 - 20	8,470	0.43
North Bay Cliffs	Sea wall repairs and slope stabilisation	6 - 10	10,900	1.15
Peasholm Gap & Clarence Gardens	Rock revetment in front of existing sea wall, sea wall repairs and slope stabilisation; [studies required in 1 st 5 years]	6 - 10	28,900	2.42
The Holms & Castle Headland	Minimal Intervention -upgrade / replace structures at end of residual life	50 - 100	76,700	0.90
West Pier & Harbour (Excluding East Pier)	Upgrade / replace structures at end of residual life	20 - 30	5,520	0.05
Foreshore Road & St Nicholas Cliff	Hold Line - Upgrade wall & slope stabilisation [inc Raise height of existing wall/promenade (~1.2m), drainage improvement to Foreshore Rd and slope stabilisation]	6 - 10	11,400	2.26
Spa Chalet	Rock revetment in front of existing sea wall, sea wall repairs & Slope Stabilisation - 20 Year Delay	20 - 30	10,300	1.44
The Spa	Rock revetment in front of existing sea wall, sea wall repairs and slope stabilisation	1 - 5	18,300	1.60
South Cliff Gardens Rose Gardens South Bay Pool	Rock revetment in front of existing sea wall, sea wall repairs and slope stabilisation	6 - 10 *	30,200	0.72
Holbeck Gardens	Rock revetment in front of existing sea wall, sea wall repairs and slope stabilisation.	11 - 20 *	15,000	0.36
Holbeck Cliff	Minimal Intervention -upgrade / replace structures at end of residual life	50 -100	4,810	0.14
Wheatcroft Cliff	No Active Intervention	-	-	-

* It should be noted that for these locations the proposed implementation is beyond the currently predicted residual life of the defences under no active intervention (as indicated in Table 5). At these locations maintenance, repairs and emergency works will be required to extend the life of the existing defences. The precise implementation timing for the capital schemes will require further reviews depending on actual performance of the defences.

2.7.8 Management of key residual risks

2.7.8.1 The strategic residual risks with proposed risk management are shown in Table 12.

Title	Scarborough Coastal Defence Strategy Review – Holbeck to Scalby Mills		
Version 3.1	Status: Final	Issue Date: Oct 09	Page 39

Table 12 Residual risk management

	Residual Risks	Management
1	Damage to assets and defences due to land sliding due to processes other than coastal erosion.	Ongoing coastal slope management: cliff monitoring and maintenance,
2	Impacts of climate change could increase risk of wave overtopping, defence failure and cliff instability more than anticipated.	Strategy takes account of current Defra recommendations. Review updates in future strategy reviews. NECAG coastal monitoring programme to consider links to climate monitoring.
3	Defence failures before schemes are implemented. Depending on storm occurrence and defence deterioration there may well be significant failures. Sufficient funding for emergency repairs will be required.	The do-minimum option of maintaining and repairing storm damage to the defences will be applied to throughout. Allowances have been included in the strategy, but should be updated from experience in annual Medium Term Programme returns.
4	Wave overtopping risks to people and property will increase until capital schemes are implemented.	Ongoing warnings and management of access. Consideration of closures to sections / additional sections of promenade based on flood warnings.
5	No statutory duty for Council to undertake work using permissive powers.	The Council has adopted both the SMP and strategy and continue to implement its permissive powers under the Coast Protection Act (1949) for the whole of the Borough.
6	Objection from Natural England/refuse planning permission.	Letter of comfort from Natural England obtained for Strategy. Undertake further surveys/consider alternative options in scheme EIAs.
7	Refuse planning permission to increase height of sea walls.	Quantify risk and develop options through Public Consultation on specific schemes
8	Compensation to Tourist Businesses during construction.	Consultation. Agree programme /working hours. Allow for compensation in risk budgets.

2.7.9 Recommendation

2.7.9.1 The recommended coast protection strategy is to hold the line in accordance with the SMP and the previously adopted strategy by implementing the solutions described in Table 11 above. The whole life cash cost, including Optimism Bias is £221 million. The strategy is recommended for Approval in Principle for expenditure of £23 million over the first five years.

2.8 Other Considerations

2.8.1 Public Safety

2.8.1.1 The recommended strategy assumes that flood warnings and procedures for management of Public Safety, particularly in relation to wave overtopping, will continue as at present. The aim is to ensure that reasonable precautions are taken to prevent people, from being exposed to risk of injury. A consequence of the proposed capital schemes is that wave overtopping would be reduced at those locations.

2.8.2 Non-construction Actions

2.8.2.1 Allowances for ongoing monitoring and inspection of defences and cliffs have been included within the economic appraisal, although it is assumed that the monitoring work will be delivered through the regional strategic monitoring programme.

Title	Scarborough Coastal Defence Strategy Review – Holbeck to Scalby Mills		
Version	3.1	Status:	Final
Issue Date:	Oct 09	Page	40

3 STRATEGY PLAN

3.1 Outline of Plan

3.1.1 The objective of the strategy is to define preferred approaches for managing flood and coastal erosion risks along the developed shoreline of Scarborough Town. The studies for the strategy have confirmed that the hold-the line of existing defence policy established in the broader scale SMP can be justified at a more local level.

3.1.2 The management approach we propose in this strategy is to undertake defence repairs, maintenance and replacements as they reach the end of their functional and economic life.

3.1.3 The preferred erosion risk management options delay coastal erosion due to defence failure by adopting a management strategy such that breaches would be repaired before the initiation of consequential erosion and cliff failures.

3.1.4 The environmental impacts and sustainability considerations of the proposed strategy has been identified in the Environmental Report (Appendix E). Upon approval of the strategy for implementation, an Environmental Action Plan will be developed to manage environmental impacts and risks using mitigation measures outlined in the Environmental Report.

3.2 Programme

3.2.1 Preliminary scheme costs excluding maintenance and emergency works are presented in Appendix A, Table A4. Table 13 presents the strategy cash expenditure profile with the costs for the first 5 years.

Table 13 Strategy cash expenditure profile

Cash* Expenditure Profile (£k)	Year					Future	TOTAL	First 5 Years Total
	2008/9	2009/10	2010/11	2011/12	2012/13			
Preliminary costs		236	336		100	4,100	4,770	672
Consultant Fees		214	214	642		9,990	11,100	1,070
Construction costs		143		7,130	146	72,700	80,200	7,420
Environmental Enhancement				233		2,360	2,590	233
Maintenance **	354	355	1,200	906	629	35,800	39,200	3,450
TOTAL	354	948	1,750	8,910	874	125,000	138,000	12,800

* = cash costs *not* including Optimism Bias or contingency

** Including emergency works

3.3 Procurement

3.3.1 The procurement of consultancy services to develop schemes proposed within the strategy will be through our established coastal consultancy framework, refer to Appendix L for Scarborough Borough Council's procurement strategy.

3.3.2 Procurement of construction contracts is expected to be on an individual basis in accordance with both Scarborough Council and European Procurement requirements, refer to Appendix L.

3.4 Risk Schedule

3.4.1 Detailed risk registers for each management unit are included in the Strategy technical report in Appendix B. Risk assessments for options on individual MUs with BCR > 3 are included in Appendix D, together with a risk register for the overall strategy. Key strategic risks are identified in Table 12 above.