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Strategy Appraisal Report

Authority scheme reference	SBC E664
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Defra/WAG LDW number	CPW 1865
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Promoting authority	Scarborough Borough Council
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Strategy name	Robin Hoods Bay Coastal Strategy Study (Whitby Abbey Cliff to Hundale Point)
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Large sea wall in the southern section of Robin Hood's Bay

Date	December 2012
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Version	4.0
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For technical approval of the business case

Scarborough Borough Council:

Project name: Robin Hood's Bay Coastal Strategy Study
(Whitby Abbey Cliff to Hundale Point)

Approval Value: £10,490k

Sponsoring Director: David Archer **Strategic Director**

Non-financial scheme of delegation

Part 11 of the Non-financial scheme of delegation states that approval of FCERM Strategies/Complex Change Projects, following recommendation for approval from the Large Projects Review Group, is required from the Regional Director or Director, Wales and Director of Operations.

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Approval history sheet

APPROVAL HISTORY SHEET (AHS)			
1. Submission for review (to be completed by team)			
Project Title: Robin Hood's Bay Coastal Strategy Study (Whitby Abbey Cliff to Hundale Point)		Project Code: CPW 1865	
Project Manager: Robin Siddle		Date of Submission:	
Lead Authority: Scarborough Borough Council		Version No:	
Consultant Project Manager: Nick Cane (Mouchel) & Nick Cooper (Royal HaskoningDHV)		Consultant: Mouchel (CSS) & Royal HaskoningDHV (StAR)	
<i>The following confirm that the documentation is ready for submission to PAB or LPRG. The Project Executive has ensured that relevant parties have been consulted in the production of this submission.</i>			
Position	Name	Signature	Date
Project Executive	Chris Bourne		14.12.12
	Job Title:	Projects Manager	
2. Review by: Large Projects Review Group (LPRG)			
Date of Meeting(s):		Chairman:	
Recommended for approval: In the sum of £:		Date:	Version No:
3. Environment Agency NFSoD approval <i>Officers in accordance with the NFSoD.</i>			
Version No:		Date:	
Project Approval	By: In the sum of: £	Date:	
4. Defra or WAG approval <i>(Delete as appropriate)</i>			
Submitted to Defra / WAG or Not Applicable (as appropriate)		Date:	
Version No. (if different):			
Defra/ WAG Approval: or Not applicable (as appropriate)		Date:	
Comments:			

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

1. Project name	Robin Hood's Bay Coastal Strategy Study (Whitby Abbey Cliff to Hundale Point)		Start date	August 2012
			End date	August 2102
Business unit		Programme		
Project ref.		Regional SoD ref.	Head Office SoD ref.	-

2. Role	Name	Post Title
Project Sponsor	Rachel Glossop	Senior Advisor (Yorkshire and North East)
Project Executive	Chris Bourne	Projects Manager
Project Manager	Robin Siddle	Senior Coastal Officer

3. Risk Potential Assessment (RPA) Category	Low	<input checked="" type="checkbox"/>	Medium	<input type="checkbox"/>	High	<input type="checkbox"/>
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4. NFSoD value	
Whole Life Costs (WLC) of Complex Change Project / Strategic Plan	£10,490k

5. Required level of Environmental Impact Assessment (EIA)	N/A <input type="checkbox"/>	Low <input type="checkbox"/>	Medium <input type="checkbox"/>	High <input checked="" type="checkbox"/>
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6. NFSoD approver name	Post title	Signature	Date
	Regional Director/Director Wales		
	Director of Operations		
NFSoD consultee name	Post title	Signature	Date
	LPRG Chair		

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1 Executive summary

1.1 Introduction and Background

Location and background

- 1.1.1 This Strategy Appraisal Report (StAR) presents the Flood and Coastal Erosion Risk Management (FCERM) ‘business case’ for investment in a strategic programme of future capital schemes and coastal management activities between Abbey Cliff and Hundale Point in North Yorkshire. The overall aim is to enable sustainable management of the risks to people and the developed, natural and historic environments from coastal erosion and coastal slope instability over the next 100 years. There is no identified risk from sea flooding.
- 1.1.2 The StAR builds from the findings and recommendations of the River Tyne to Flamborough Head Shoreline Management Plan 2 (formally approved by the Environment Agency in 2009) and the Robin Hood’s Bay Coastal Strategy Study (CSS) produced in 2012.
- 1.1.3 The Study Area covers 24km of North Yorkshire’s coastline between Whitby’s Abbey Cliff and Hundale Point, incorporating Robin Hood’s Bay village. The Study Area has been sub-divided into three Management Units (Key Plan 1) consistent with the SMP2.
- 1.1.4 The Study Area is highly renowned for its dramatic coastal setting, especially the picturesque Robin Hood’s Bay, and sits within the North York Moors National Park and Cleveland Heritage Coast.
- 1.1.5 Considerable tourism and amenity value is associated with the seascape and landscape character of the Study Area, reflected in the number of caravan parks. Whilst most of the Study Area is subject to agricultural land uses on natural, undefended sheer cliffs and steep coastal slopes, there is a scattering of commercial and residential properties between smaller settlements and the largest coastal community resides in Robin Hood’s Bay village.
- 1.1.6 There are important heritage assets within the Study Area, including three Scheduled Ancient Monuments that are at risk of erosion over the next 100 years.
- 1.1.7 The study area contains one European environmentally designated site, namely Beast Cliff-Whitby (Robin Hood’s Bay) Special Area of Conservation (SAC). The site comprises an east coast complex of hard and soft cliffs. The combination of geology, topography and plant communities found on the site are unique and it is one of the best examples of vegetated sea cliffs on the north-east coast of England. The study area also contains a total of four Sites of Special Scientific Interest (SSSI), the majority of which are designated for their geological interest (or a combination of geological and biological interest).
- 1.1.8 We [Scarborough Borough Council] plan to implement the recommended capital works and coastal management activities arising from the Robin Hood’s Bay CSS in a prioritised manner using our permissive powers under the Coast Protection Act (1949).

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History of erosion and instability

- 1.1.9 Coastal erosion and coastal slope instability (landslips) remain natural and ongoing processes across most of the Study Area. Coastal defences are only present along the southern section of Robin Hood's Bay village.
- 1.1.10 Due to the topography of the coastline, there is no identified risk of sea flooding within the Study Area.

1.2 Problem

- 1.2.1 The principal problems in the Study Area are associated with: (i) coastal erosion and coastal slope instability along undefended sections; and (ii) the condition of existing coastal defences within the southern section of Robin Hood's Bay village.
- 1.2.2 If no further investment was made in managing the risks of coastal erosion or slope instability within the Study Area the ongoing processes would continue unabated in presently undefended areas (Management Areas 24.1, 25.1 and the northern part of 25.2). The rates of recession are likely to increase in the future compared to historic rates due to the consequences of climate change.
- 1.2.3 As a consequence of these natural processes of coastal change, there are a small number of properties at discrete locations within Management Areas 24.1 and 25.1 that would become affected by erosion within the 100 year lifespan of the CSS, including 3 Scheduled Ancient Monuments (SAMs).
- 1.2.4 Continued recession within the undefended section of Management Area 25.2, at the northern section of Robin Hood's Bay village, would result in the loss of 18 residential properties over the next 100 years. The first losses are predicted at around year 30-33 based on long term average recession rates.
- 1.2.5 Where existing defences are present within Management Area 25.2, along the southern part of Robin Hood's Bay village, they would deteriorate in condition over time under a Do Nothing scenario due to the absence of maintenance. Ultimately, the defences would fail and processes of coastal erosion and slope instability would recommence. As a consequence, some 44 properties in this location would become affected by coastal erosion over the next 100 years under a Do Nothing scenario.
- 1.2.6 In recognition of these risks to people and the developed, natural and historic environments from coastal erosion and coastal slope instability over the next 100 years, the aim of the CSS is to manage the risks in a sustainable manner.
- 1.2.7 In pursuance of this aim, the specific objectives are:
- To ensure that the risks from coastal erosion and coastal slope instability are identified and fully understood over the next 100 years. [There are no risks from sea flooding].
 - To ensure that a full range of management options has been considered, at appropriate levels of detail, to address these risks, taking on board latest guidance and advice on appraisal and selection of options.
 - To ensure that the preferred management options are technically feasible, environmentally and socially acceptable, and economically viable and represent a robust and sustainable investment strategy for the Study Area.

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- To ensure that there is appropriate organisational and public consultation on the findings and recommendations of the Strategy and that feedback is appropriately considered.
- To ensure that, where possible, opportunities for environmental and economic enhancement have been considered.
- To ensure that opportunities to attract third party funding are identified and pursued in support of the partnership funding approach.

1.3 Options Considered

1.3.1 From a longer list of options, the following were taken forward for further consideration:

1.3.2 Management Area 24.1 (Abbey Cliffs to Saltwick Nab) and Management Area 25.1 (Saltwick Nab to Hundale Point):-

- Option 1a: No Active Intervention;
- Option 1b: No Active Intervention [with H&S];
- Option 2: Adaptive Management [Property Roll Back Scheme]; and
- Option 3: Active Intervention Improve [Rock Armour at cliff toe in areas where property is at risk].

1.3.3 Management Area 25.2 (Robin Hoods Bay Village):-

- Option 1a: No Active Intervention;
- Option 1b: No Active Intervention [but with Health & Safety management];
- Option 2: Adaptive Management/Active Intervention Maintain [Property Roll Back Scheme in Northern Village and Capital Improvement to Coastal Defence Assets in the Southern Village];
- Option 3: Active Intervention Maintain [Northern village drainage Investigation and remedial works with deep rooted vegetation slope stabilising Capital Improvement to Coastal Defence Asset in the Southern Village];
- Option 4: Active Intervention Maintain [Capital Improvement to Coastal Defence Asset in the Southern Village];
- Option 5: Active Intervention Maintain/No active intervention [Coastal slope remedial and stabilisation works in the north, no active intervention in the south];
- Option 6: Active Intervention Improve [Soil nailing and horizontal drainage installation with a Capital Improvement scheme to existing defence assets];
- Option 7: Active Intervention Improve [Contiguous bored pile wall with a Capital Improvement scheme to existing defence assets]; and,
- Option 8: Action Intervention Improve [Rock armour to the base of the cliff fronting Mount Pleasant in the north and Capital Improvements to Coastal Defence Assets in the Southern Village].

1.4 Preferred Options

Description

Management Areas 24.1 and 25.1:

1.4.1 An Adaptive Management strategy will be adopted for the long term. This is the most sustainable option that reacts to the changing conditions at the coast and allows communities and individuals to adapt.

1.4.2 Continued inspection/monitoring of the cliff should be undertaken to ensure public safety and appropriate timing of adaptation (e.g. property 'roll-back') schemes. Any adaptation

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would be delivered in partnership between the North York Moors National Park Authority and Scarborough Borough Council if deemed feasible.

Management Area 25.2:

- 1.4.3 Option 2 will be implemented, involving a hybrid of Adaptive Management in the northern section of the village and Active Intervention Maintain in the southern section. This has a favourable BCR and complies with the intent of the SMP2 policy 'to sustain the community of Robin Hood's Bay'. This option will allow present defences in the southern Village to be maintained for 60 - 90 years (Capital Improvement scheme around 30yr intervals), with extension of defence provision not proposed for the northern section. As part of the Adaptive management approach, study and works to improve the drainage in the northern undefended section will be addressed in order to reduce the effect of surface water eroding the cliff edge.

Environmental Considerations

- 1.4.4 Although not a statutory requirement, Defra and Environment Agency guidance strongly recommends that a Strategic Environmental Assessment (SEA) is undertaken for Flood and Coastal Erosion Risk Management Strategies, in accordance with European Directive 2001/42/EC. In recognition of this, environmental assessment and consultation has been integral to the identification, short-listing and appraisal of options as the StAR has been developed.
- 1.4.5 As part of the SEA process, a Scoping Report was issued in July 2009 to a number of key stakeholders. Scoping responses from these organisations, where provided, were then incorporated into the development of the SEA Environmental Report and Addendum Report. An Indicative Landscape Plan has also been produced.
- 1.4.6 Key mitigation/enhancement measures recommended by the SEA include construction of properties on previously developed land (where possible), undertaking works outside of the peak tourism season, implementation of an Emergency Action Plan, protecting biodiversity by undertaking further studies, where necessary and to adhere to best practice and pollution prevention guidance when undertaking Capital Improvement works. Specific measures were also identified to avoid and/or mitigate any adverse effects on the historic environment, including additional assessment of the areas affected by the Strategy in accordance with national, regional and local policies.

Benefits

- 1.4.7 The economic damages to people and the developed, natural and historic environments arising from coastal erosion and slope instability associated with an option of Do Nothing have been assessed across the Study Area. The economic benefits resulting from implementation of various options across the Study Area have then been derived as the damages avoided under that specific option.
- 1.4.8 The original benefits arising from the CSS were reviewed in light of Environment Agency Appraisal Guidance published in 2010 and subsequently revised by Dr John Chatterton to include only allowable national benefits associated with the options.
- 1.4.9 The benefits arising from each option (using the revised assessments by Dr John Chatterton) are provided in Table 1.1 alongside the economic decision-making criteria, such as BCR.

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Table 1.1 Present Value damages (PVd) across the Study Area

	MA24.1	MA25.1	MA25.2
Do Nothing Present Value damages (£k)	160	467	9,171
Present Value benefits of preferred option (£k)	152	442	8,694
Benefit-Cost Ratio	0.68	1.80	3.36

Costs

1.4.10 Cost estimates have been developed for each of the short-listed options within each Management Unit. These have been built up as whole life cost estimates over a 100 year appraisal period to incorporate:

- capital scheme costs for any coastal defences or coastal slope works;
- surveys, studies and investigations;
- design and environmental studies;
- construction supervision;
- inspection and monitoring; and
- maintenance.

1.4.11 The cost estimates have been informed by a range of information sources, including:

- SPON'S Civil Engineering and Highway Works Price Book;
- Environment Agency unit cost database;
- Defra's National Appraisal of Defence Needs and Costs;
- Medium Term Plans;
- discussions with drainage investigating contractors;
- discussions with ground engineering contractors;
- discussions with slope stability contractors; and
- previous similar schemes and options.

1.4.12 After discounting the above elements to Present Value costs (PVc) an optimism bias of 60% has been applied.

Economic summary, outcome measures and priority

1.4.13 The projected cash expenditure profile for capital costs (FCERM-eligible) and non-capital costs over the next 5 years are provided in Table 1.2 to inform Medium Term Planning.

Table 1.2 Projected cash expenditure profile on capital and non-capital projects

Management Area 24.1

Cost	2012/13 (£K)	2013/14 (£K)	2014/15 (£K)	2015/16 (£K)	2016/17 (£K)	Future Year (£K)	Total (£K)
Capital	0	70	0	0	0	6.7	76.7
Non-Capital	17.7	1.4	1.5	1.5	1.6	824	847.7
Total	17.7	71.4	1.5	1.5	1.6	830.7	924.4

Management Area 25.1

Cost	2012/13 (£K)	2013/14 (£K)	2014/15 (£K)	2015/116 (£K)	2016/17 (£K)	Future Year (£K)	Total (£K)
Capital	0	70.7	14	0	0	56.1	140.8
Non-Capital	18	1.4	1.5	1.5	1.7	837.9	862
Total	18	72.1	15.1	1.5	1.7	894	1,002.8

Management Area 25.2

Cost	2012/13 (£K)	2013/14 (£K)	2014/15 (£K)	2015/116 (£K)	2016/17 (£K)	Future Year (£K)	Total (£K)
Capital	145	978	0	0	0	6,608.6	7,731.6
Non-Capital	17.7	1.4	1.5	1.5	1.5	824	847.6
Total	162.7	979.4	1.5	1.5	1.5	7,432.6	8,579.2

1.4.14 Outcome measure scores are provided in Table 1.3 for Management Area 25.2 (FDGiA calculator provided in Appendix D3). Flood Defence Grant in Aid (FDGiA) funding will not be sought for the preferred Adaptive Management measures for Management Areas 24.1 and 25.1, therefore outcome measures have not been presented for these areas.

Table 1.3 Outcome measures for Management Area 25.2

Outcome Measures		Number	Qualifying Benefits	FDGiA Contribution
OM1 (Economic Benefit)			6,441	358
OM2 (Households better protected against flooding)	20% most deprived areas			
	21-40% most deprived areas			
	60% least deprived areas			
OM3 (Households better protected against coastal erosion)	20% most deprived areas			
	21-40% most deprived areas		1,010	303
	60% least deprived areas			
OM4 (Statutory Environmental Obligations Met)				
TOTAL FDGiA Contribution				661
Raw OM Score				66.55%
Cost saving and/or external contribution required				332
Scheme Contributions Secured				41
Adjusted OM Score				70.68%

Funding and contributions

1.4.15 Funding from Scarborough Borough Council, via the Environment Agency administered FDGiA, has allowed for the development of the Robin Hood's Bay CSS and this StAR.

1.4.16 FDGiA will not be sought for Management Areas 24.1 and 25.1. The works for Management Area 25.2 will be funded through a combination of FDGiA and third party contributions. The drainage investigation works in the northern section of the village will not apply for FDGiA funding, SBC will seek funding contributions from the interested parties. Contributions will be sought during the next stages of the scheme development and agreement in principles to contribute will be obtained prior to submission of a Project Appraisal Report for the scheme.

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Key delivery risks

1.4.17 The principal risks to delivery of the preferred options and recommended actions, together with proposed risk management activities, are shown in Table 1.4.

Table 1.4 Key delivery risks and their management

Delivery Risk		Risk Management
1	Non-approval or delayed approval of the business case and recommendations presented in this StAR by the Environment Agency's Large Projects Review Group (LPRG)	<ul style="list-style-type: none"> Completion of the StAR in accordance with latest Environment Agency procedures and guidance.
2	Non-approval or delayed approval of the business case and recommendations presented in subsequent Project Appraisal Report by the Environment Agency's Regional Project Approvals Board (PAB)	<ul style="list-style-type: none"> Completion of the PARs in accordance with latest Environment Agency procedures and guidance.
3	Need for funding contributions in addition to FDGiA to deliver Capital Improvement schemes	<ul style="list-style-type: none"> Early discussions with potential contributory funders during development of PAR
4	Objection from statutory bodies to proposals	<ul style="list-style-type: none"> Engagement with statutory bodies throughout the development of the CSS, including formal consultation through the SEA process. Comfort Letter from Natural England agreed in principle based on CSS outputs and to be provided once StAR revisions have been reviewed.
5	Lack of public acceptance of the proposed solutions	<ul style="list-style-type: none"> Public consultation undertaken on the preferred options at CSS stage and again to follow for Robin Hood's Bay village southern section during PAR
6	Deterioration or failure of defences before schemes are implemented	<ul style="list-style-type: none"> Inspection and maintenance/ repair of storm damage
7	Deterioration or failure of coastal slopes before schemes are implemented	<ul style="list-style-type: none"> Inspection and maintenance/ repair of slips and drains
8	Need for alternative funding sources to deliver the most recommendations due to low Outcome Measures	<ul style="list-style-type: none"> Investigate alternative funding sources Long term budgetary planning for increased future budgets from in-house funding sources.

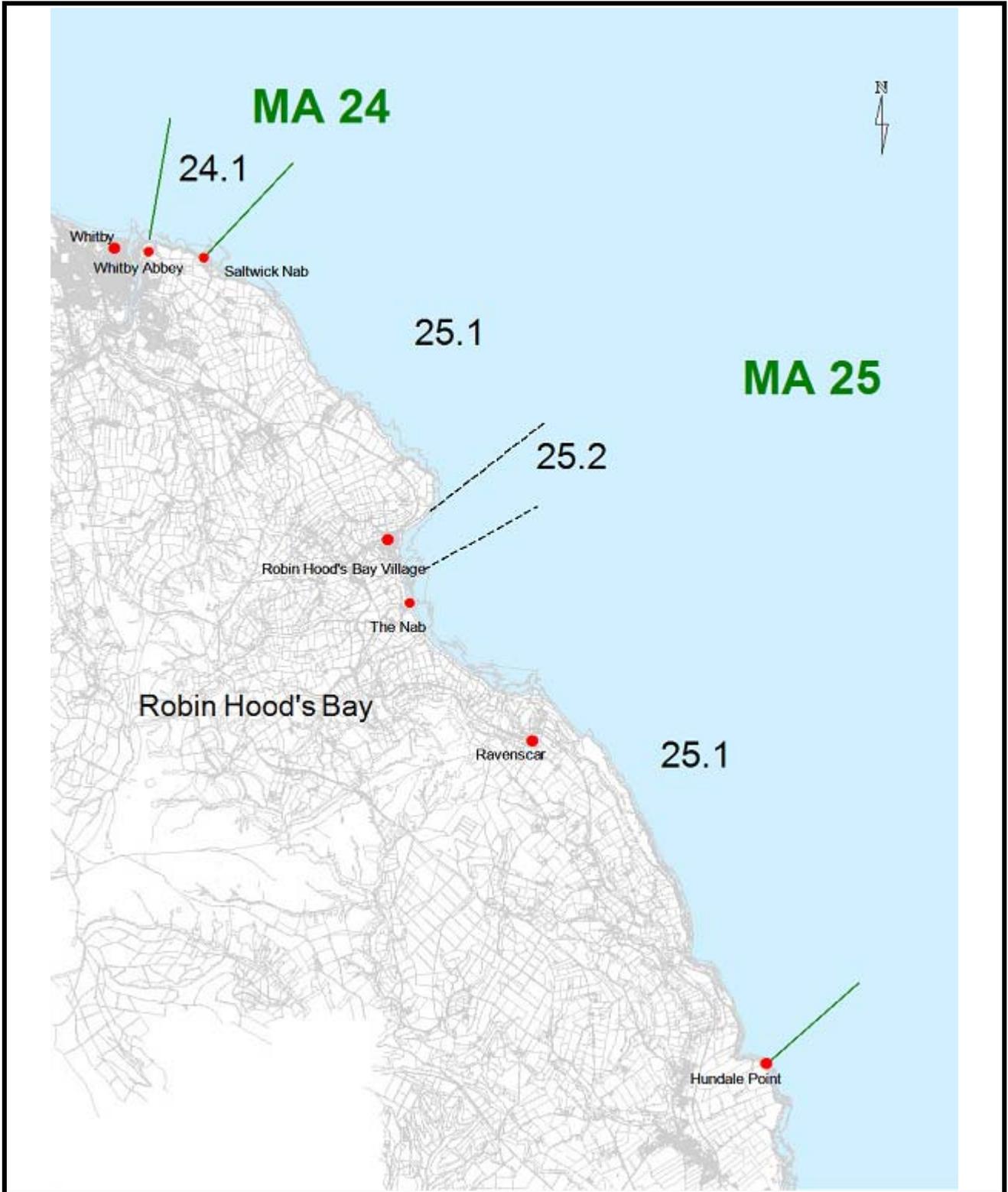
1.5 Recommendation

1.5.1 The recommended strategy for managing the risks to people and the developed, natural and historic environment from coastal erosion and slope instability is to deliver the series of preferred options and Action Plan recommendations outlined in this StAR.

1.5.2 The strategy is recommended for Approval in Principle for £10,490k, including optimism bias of 60%, over the whole life of the Strategy. This includes £993k of FDGiA eligible expenditure over the first five years.

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1.6 Key Plans



Key Plan 1 – Management Areas

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2 Introduction and background

2.1 Purpose of this report

- 2.1.1 This Strategy Appraisal Report (StAR) presents the Flood and Coastal Erosion Risk Management (FCERM) 'business case' for investment in a strategic programme of future capital schemes and management activities to manage the risks to people and the developed, natural and historic environments from coastal erosion and coastal slope instability over the next 100 years. [There is no identified risk of significant sea flooding within the Study Area over this period].
- 2.1.2 The StAR summarises the key risks in the Study Area from these sources and is seeking approval from the Environment Agency's Large Projects Review Group (LPRG) for our plans to manage them. Once approval of the StAR has been received, we shall begin to implement the recommendations.
- 2.1.3 The StAR has been undertaken in accordance with latest Environment Agency Flood and Coastal Erosion Risk Management Appraisal Guidance and associated Environment Agency policies and procedures.
- 2.1.4 We [Scarborough Borough Council] plan to implement the recommended capital works arising from the StAR using our permissive powers under the Coast Protection Act (1949).

2.2 Background

Strategic and legislative framework

- 2.2.1 The original Shoreline Management Plan (SMP) covering the Study Area was completed in 1997 and duly noted by MAFF. This was updated in 2007 as part of the River Tyne to Flamborough Head Shoreline Management Plan 2 which was formally approved by the Environment Agency in July 2009.
- 2.2.2 The SMP2 recognised the importance of allowing natural processes to continue throughout the Study Area, but equally recognised the importance of sustaining the existing coastal communities and in particular the function and entity of Robin Hood's Bay village.
- 2.2.3 Arising from the recommendations of the SMP2, the Robin Hood's Bay Coastal Strategy Study (CSS) was begun in 2009. The aims of the CSS are to:
- Provide an assessment of the risks from coastal erosion and slope instability to people and the developed, natural and historic environments
 - Identify and assess various options for managing these risks over the next hundred years
 - Consult with the public and other interested bodies on those options, leading to identification of a preferred set of management options across the Study Area
 - Develop a long term plan for future investment in sustainable coastal management activities across the Study Area

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Previous studies

- 2.2.4 In addition to the work undertaken for both the original SMP and the SMP2, the CSS benefited from beach topographic surveys, cliff top position surveys, bathymetric survey, aerial photography and walkover inspections of the condition of the coastal defences and natural assets (cliffs, slopes and beaches) collected as part of the wider Cell 1 Regional Coastal Monitoring Programme since 2008.
- 2.2.5 As part of the CSS, a Ground Investigation was undertaken in the northern, undefended, section of Robin Hood's Bay village. This comprised four boreholes and four window samples, with inclinometers and piezometers installed that remain part of the monitoring system for the frontage.
- 2.2.6 Heritage assets at the coast are vulnerable to the effects of natural coastal change and to the impacts of coastal management schemes. English Heritage has initiated a national Rapid Coastal Zone Assessment programme, which involves Phase 1 (desk based assessment) and Phase 2 (field assessment involving a rapid walk over survey to verify records from Phase 1 and locate/characterise site types not visible from the air).

Location and designations

- 2.2.7 The Study Area covers approximately twenty-four kilometres of North Yorkshire's coastline between Whitby's Abbey Cliff and Hundale Point. For the purposes of developing the CSS, the Study Area has been sub-divided into a number of Management Areas, consistent with the SMP2 (see Key Plan 1).
- 2.2.8 The Study Area is highly renowned for its dramatic coastal setting, especially the picturesque Robin Hood's Bay with its wide sweeping sandy beach. The vast majority of the Study Area is subject to agricultural land uses (arable and pasture) on natural, undefended, sheer sea cliffs or steep coastal slopes which front extensive rocky shore platforms. There is a scattering of private commercial and residential properties across the Study Area between smaller village settlements, but existing coastal defences are confined to protecting parts of the largest coastal community, located in the village of Robin Hood's Bay.
- 2.2.9 Considerable tourism and amenity value is associated with the seascape and landscape character of the Study Area, reflected in the number of caravan parks. Once home to an important fishing industry, crab fishing remains important Robin Hood's Bay. Alum mining and mineral extraction has also been an industrial activity at a number of locations within the Study Area.
- 2.2.10 The majority of the study area is located within the North York Moors National Park. In addition, the study area is also designated as Heritage Coast, reflecting the important nature of the existing landscape. The study area also contains areas of National Trust land.
- 2.2.11 The study area contains one European environmentally designated site, namely Beast Cliff-Whitby (Robin Hood's Bay) Special Area of Conservation (SAC). The site comprises an east coast complex of hard and soft cliffs. The combination of geology, topography and plant communities found on the site are unique and it is one of the best examples of vegetated sea cliffs on the north-east coast of England. The study area also contains a total of four Sites of Special Scientific Interest (SSSI), the majority of which are designated for their geological interest (or a combination of geological and biological interest). The SSSI's within the study area comprise Whitby-Saltwick, Robin Hood's Bay – May Wyke to Beast Cliff, Hayburn Wyke and Iron Scar and Hundale Point to Scalby Ness.

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- 2.2.12 The study area contains a number of scheduled monuments (including parts of the Saltwick Nab Alum Quarry, Stoupe Brown Alum Works and Peak Alum Works). There is an enormous range of historic information contained within the North Yorkshire Moors and North Yorkshire County Council Historic Environment Records and additional information found by English Heritage in the Rapid Coastal Zone Assessment. There are several listed buildings present within the study area, most of which are located within the defended section of Robin Hood's Bay village.
- 2.2.13 The Cleveland Way strategic footpath runs along the entire length of the coast within the study area. It provides connectivity from Whitby in the north to Scarborough and Filey to the south. It also connects the coast to the North York Moors National Park and is used extensively by walkers, cyclists and horse riders for recreation and access.

History of erosion and instability

- 2.2.14 Coastal erosion and coastal slope instability (landslips) remain natural and ongoing processes across most of the Study Area, including the northern, undefended, section of Robin Hood's Bay village, with recession rates and mechanisms dictated by the strength of the underlying solid geology, which mostly originates from the Jurassic Period, and the overlying deposits, such as Glacial till.
- 2.2.15 Within the southern section of Robin Hood's Bay village, erosion has largely been arrested due to the construction of coastal defences, primarily in the form of a large vertical concrete sea wall, with sections of rock revetment extending beyond either end. In places, however, instability still occurs higher up the cliff above the defences.
- 2.2.16 Due to the topography of the coastline within the Study Area, there is no significant risk from sea flooding, even when sea level rise is considered over the next 100 years.

2.3 Current approach to erosion risk management

Measures to manage the probability of erosion risk

- 2.3.1 Throughout much of the Study Area coastal erosion and slope instability is not actively managed, other than for reasons of public safety. The cliffs are visually inspected at appropriate intervals and trends in behaviour are recorded.
- 2.3.2 Existing defences, where present in the southern part of Robin Hood's Bay, are inspected at appropriate intervals and, when necessary, maintenance works are undertaken.

Measures to manage the consequences of erosion risk

- 2.3.3 Due to particular concerns about coastal erosion and slope instability within Robin Hood's Bay village, cliff-top position monitoring at thirteen locations has been incorporated within the Cell 1 Regional Coastal Monitoring Programme to provide early indication of cliff movements.
- 2.3.4 In addition, inclinometers have been installed in the slopes along the northern, undefended, section of Robin Hood's Bay village to enable mass movements in the slopes to be identified and appropriate remedial or evacuation action to be undertaken.

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3 Problem definition and objectives

3.1 Outline of the problem

3.1.1 The principal problems in the Study Area are associated with: (i) coastal erosion and coastal slope instability along undefended sections; and (ii) the condition of existing coastal defences within the southern section of Robin Hood's Bay village.

3.1.2 Along undefended sections, the processes of coastal erosion in the cliffs and/or instability in the coastal slopes are ongoing. Recession rates across most of the Study Area are projected to remain relatively low (typically 0.1 – 0.2m/year), but there are local exceptions at Saltwick Nab (0.7m/year) and the northern, undefended, section of Robin Hood's Bay village (0.3m/year). Failure mechanisms vary depending on the cliff geology, ranging from local rock falls in harder strata (e.g. at Abbey Cliff) through to deep-seated landslips in softer materials (e.g. northern section of Robin Hood's Bay). More detailed assessment of coastal processes and cliff behaviour are presented in Appendix E2.

3.1.3 The results from a Ground Investigation undertaken in the northern, undefended, part of Robin Hood's Bay village has revealed that there is the potential for deep-seated movement of the coastal slopes, and some movement at depth has been recorded. However, these instabilities are primarily caused by poor drainage rather than through coastal erosion at the toe. Further technical detail is provided in Appendix E2. Where coastal defences are present, in the southern section of Robin Hood's Bay village, they comprise:

- Rock armour near the Victoria Hotel, which is in a fair to good condition with evidence of only minor defects
- Large vertical sea wall, which acts as both a retaining wall and a coastal defence structure, which is in a fair to poor condition, with several visible defects and undercutting at the toe. There is also potential for outflanking at its western end where it adjoins a short section of exposed cliff.
- Seawall in front of the Bay Hotel, which has an exposed toe with evidence of large cracks at its southern end.

3.1.4 There are no problems associated with sea flooding within the Study Area.

3.2 Consequences of doing nothing

3.2.1 If no further investment was made in managing the risks of erosion or instability within the Study Area the following outcomes would arise.

3.2.2 Ongoing processes of erosion and slope instability would continue unabated in presently undefended areas (Management Areas 24.1, 25.1 and the northern part of 25.2). The rates of recession are likely to increase in the future compared to historic rates due to the consequences of climate change. This has been taken into account in development of erosion lines within the CSS, which largely draws from previous work that has been reported in Futurecoast, the SMP2 and the Environment Agency's National Coastal Erosion Risk Mapping project, supplemented where available with more detailed local monitoring and Ground Investigation results.

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- 3.2.3 As a consequence of these natural processes of coastal change, there are a number of properties at discrete locations within Management Areas 24.1 and 25.1 that would become affected by erosion within the 100 year lifespan of the CSS, according to erosion projections over this timescale. At Whitestone Point (between Saltwick Nab and Ness Point) the old Whitby Fog Station and Whitby ‘High Light’ Lighthouse would be affected. Elsewhere, other affected assets include a small number of properties, farm storage structures, caravan sites, coast guard structures, a foul sewer and agricultural land. Three scheduled ancient monuments (Saltwick Nab Alum Quarry, Stoupe Brown Alum Works and Peak Alum Works) would also be lost in the long term through erosion.
- 3.2.4 Continued recession within the undefended section of Management Area 25.2 at the northern section of Robin Hood’s Bay village would result in the loss of 18 residential properties over the next 100 years. The first losses are predicted at around year 30-33 based on long term average recession rates, but the recession mechanism is likely to be through a deep-seated failure in the coastal slope that would affect an extensive area of land in a single event and the timing of such an event is difficult to predict.
- 3.2.5 In all areas where erosion occurs, the release of materials from the cliffs or coastal slopes would have environmental benefit in allow natural processes to continue unabated and releasing a proportion of beach-building material to the coastal system.
- 3.2.6 Where existing defences are present within Management Area 25.2, along the southern part of Robin Hood’s Bay village, they would deteriorate in condition over time due to the absence of maintenance under the Do Nothing scenario. Ultimately, the defences would fail and processes of coastal erosion and slope instability would recommence. Due to the present condition of some sections of defence, it is estimated that failure would occur in 15-20 years from the present day. Over the long term, it is assumed that erosion rates following defence failure would stabilise to similar long term average values as those currently observed along the northern, undefended, section of the village (0.3m/year). The consequence of this is that 44 properties would become affected by coastal erosion over the next 100 years.

3.3 Strategic issues

- 3.3.1 The River Tyne to Flamborough Head Shoreline Management Plan 2 (published in 2007) provides high level shoreline management policy for the coastal frontage within the Study Area.
- 3.3.2 The present Study Area mostly falls within Policy Development Zone (PDZ) 9 ‘Saltwick Nab to Hundale Point’ of the SMP2. The principal objective of the SMP2 across this PDZ is to allow natural processes to continue. This objective equally applies to the short section of undefended frontage between Abbey Cliff and Saltwick Nab that is slightly outwith PDZ9.
- 3.3.3 However, the SMP2 also states that it is equally important, specifically in relation to Robin Hood’s Bay village, to sustain the existing coastal community. Within this context it defines that any defence in this area should be based on the aim of sustaining the village’s function as a single entity community, which is what the existing defences aim to achieve, rather than extending existing defences to address the need of specific individual properties.
- 3.3.4 With these objectives in mind, the management policy recommended by the SMP2 for Management Areas MA24.1 and MA25.1 is No Active Intervention across all future epochs. This means that coastal erosion and slope instability is not actively managed, other than for reasons of public safety. It is noted, however, that local level private works may be proposed within MA25.1 since they are unlikely to have major strategic

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impact on the management of the coast, but they would have to be individually viewed by regulators in the context of an overall policy for NAI.

3.3.5 Within Management Area MA25.2, covering Robin Hood's Bay village, the SMP2 policy of Hold the Line across all future epochs is a local exception to the general policy for the wider Study Area. This policy is intended to involve continued reliance on existing defences for protection against erosion and instability, although the SMP2 explicitly states that extension of existing defences northwards to address the need of specific individual properties would not be felt to be appropriate to the area in the context of the broader objective of allowing natural processes to continue. This means that some properties to the northern, currently undefended, end of the village within MA25.2 are likely to be lost to erosion during the next 100 years.

3.4 Key constraints and opportunities

3.4.1 There is uncertainty relating to future erosion rates, especially in relation to the effects of climate change and sea level rise and in areas that are more susceptible to landslip events, such as Robin Hood's Bay. The CSS has been based upon best available knowledge and information in respect of this topic, informed by outputs from Futurecoast, the SMP2 and the National Coastal Erosion Risk Mapping project. This information has been supplemented with data from local monitoring of changes in cliff top position across the whole of Robin Hood's Bay and specific Ground Investigations within the northern section of the village to reduce uncertainties as far as practicable.

3.4.2 The main environmental constraints within the Study Area are:

- The SEA has identified that the study area contains a number of heritage features including scheduled monuments and listed buildings, located along the frontage.
- The study area contains four SSSI's and one SAC. Any options must be sensitive to these environmentally designated sites. A Habitats Regulations Assessment Screening Report has been produced (Mouchel, 2010) which concluded that there will be no impact on the European designated sites screened into the assessment, and therefore an Appropriate Assessment is not considered necessary.
- The study area is of very high amenity and cultural value and attracts a large number of day-visiting and longer stay tourists. Any options must be sensitive to these amenity and cultural values placed on the study area frontage by residents and tourists. There are also a number of amenity and leisure facilities such as the Cleveland Way National Trail long distance public footpath, Whitby Caravan Park and the many businesses within the village of Robin Hood's Bay.
- The majority of the study area lies within the boundary of the North Yorkshire Moors National Park. In addition, the study area is classified as Heritage Coast.

3.4.3 The main environmental opportunities associated with the CSS (identified throughout the SEA process) include:

- Enhancement of the economic income to the town of Whitby through the re-positioning of commercial properties at risk of coastal erosion at Robin Hood's Bay.
- Potential to enhance access to the coastal frontage during implementation of the Strategy.
- Potential to reduce the risk of contamination release along the frontage during implementation of the Strategy.
- Opportunities to enhance the existing footpath network within the wider area through connecting to the other footpaths which are present.

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3.5 Objectives

3.5.1 The aim of this StAR is to manage the risks to people and the developed, natural and historic environments from coastal erosion and coastal slope instability over the next 100 years in a sustainable manner.

3.5.2 In pursuance of this aim, the specific objectives are:

- To ensure that the risks from coastal erosion and coastal slope instability are identified and fully understood over the next 100 years. [There are no risks from sea flooding].
- To ensure that a full range of management options has been considered, at appropriate levels of detail, to address these risks, taking on board latest guidance and advice on appraisal and selection of options.
- To ensure that the preferred management options are technically feasible, environmentally and socially acceptable, and economically viable and represent a robust and sustainable investment strategy for the Study Area.
- To ensure that there is appropriate organisational and public consultation on the findings and recommendations of the Strategy and that feedback is appropriately considered.
- To ensure that, where possible, opportunities for environmental and economic enhancement have been considered.

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4 Options for managing erosion risk

4.1 Potential FCERM measures

- 4.1.1 The risks to people and the developed, natural and historic environments from coastal erosion and coastal slope instability can be managed by various approaches, or various combinations of approaches. These can be grouped generally as either measures to manage the probability of the risk or as measures to manage the consequence of the risk. Measures can be delivered as either a high level, strategic solution applied across all or much of the Study Area, or as a solution across a small sub-section of the Study Area, such as an individual Management Unit.

4.2 Long list of options

- 4.2.1 Having understood the particular characteristics, attributes, problems and opportunities within the Study Area, a long-list of management options was established (Table 4.1).

Table 4.1 Long list of management options

Option	Description
No Active Intervention	Walk-away and undertake no further management
No Active Intervention (with H&S management)	Walk-away and undertake no further management, other than for public safety
Active Intervention – Maintain Defences	Defences, where present, are maintained but risks increase over time due to climate changes
Active Intervention – Sustain Defences	Defences, where present, are maintained and raised/strengthened in line with climate changes to keep risks at present-day levels
Active Intervention – Improve Defences	Defences, where present, are maintained and improved or, where not present, are newly constructed to reduce risks below present-day levels
Advance the Line	New defences are constructed seaward of presently undefended frontages
Managed Realignment	Realigning or removal of existing defences
Adaptive Management	Monitoring undefended cliffs and coastal slopes and adapt to changes (e.g. emergency plans and property roll-back)

4.3 Options rejected at preliminary stage

- 4.3.1 The long list of options was subjected to consideration by the Client Steering Group and in all cases, Advance the Line and Managed Realignment were rejected at the preliminary stage from further considerations on environmental and economic grounds.
- 4.3.2 There are presently no defences within Management Areas MA24.1 and MA25.1, and therefore Active Intervention (Maintain) and Active Intervention (Sustain) were not applicable options for these frontages.

4.3.3 Within MA25.2, the frontage is presently characterised by a northern (presently undefended) section and a southern (presently defended) section of Robin Hood's Bay village. In addition to considering each of the long listed options alone, a combination of Adaptive Management (in the north) and Active Intervention (in the south) was considered as a hybrid option.

4.4 Options short-listed for appraisal

4.4.1 An initial option screening process was undertaken to evaluate the remaining options within each Management Area against engineering, economic and environmental criteria. A number of options were rejected at this options screening stage (the screening process is presented in full in Appendix E4).

4.4.2 The remaining options that became short-listed for full appraisal in accordance with FCERM Appraisal Guidance are presented in detail in Appendix E5 and are summarised below:

4.4.3 Management Area 24.1 – Abbey Cliffs to Saltwick Nab:-

- Option 1a: No Active Intervention;
- Option 1b: No Active Intervention [with H&S];
- Option 2: Adaptive Management [Property Roll Back Scheme]; and
- Option 3: Active Intervention Improve [Rock Armour at cliff toe in areas where property is at risk].

4.4.4 Management Area 25.1 – Saltwick Nab to Hundale Point:-

- Option 1a: No Active Intervention;
- Option 1b: No Active Intervention [with H&S];
- Option 2: Adaptive Management [Property Roll Back Scheme]; and
- Option 3: Active Intervention Improve [Rock Armour at cliff toe in areas where property is at risk].

4.4.5 Management Area 25.2 – Robin Hoods Bay Village:-

- Option 1a: No Active Intervention;
- Option 1b: No Active Intervention [with H&S];
- Option 2: Adaptive Management/Active Intervention Maintain [Property Roll Back and drainage Scheme in Northern Village and Capital Improvement works to Coastal Defence Assets in the Southern Village];
- Option 3: Active Intervention Maintain [Northern village drainage Investigation and remedial works with deep rooted vegetation slope stabilising Capital Improvement to Coastal Defence Asset in the Southern Village];
- Option 4: Active Intervention Maintain [Capital Improvement to Coastal Defence Asset in the Southern Village];
- Option 5: Action Intervention Maintain/No active intervention [Coastal slope remedial and stabilisation works in the north, no active intervention in the south];
- Option 6: Active Intervention Improve [Soil nailing and horizontal drainage installation with a Capital Improvement scheme to existing defence assets];

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- Option 7: Active Intervention Improve [Contiguous bored pile wall with a Capital Improvement scheme to existing defence assets]; and,
- Option 8: Action Intervention Improve [Rock armour to the base of the cliff fronting Mount Pleasant in the north and Capital Improvement to Coastal Defence Assets in the Southern Village].

4.4.6 For each of the Management Areas, the No Active Intervention option has been taken forward to the appraisal stage to act as a baseline 'do-nothing' condition against which the benefits of other options can be compared.

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5 Options appraisal and comparison

5.1 Technical issues

Management Areas 24.1 and 25.1:

- 5.1.1 Within these presently undefended areas, erosion would continue unabated under either Option 1a - No Active Intervention or Option 1b - No Active Intervention with H&S Management. This will impact on a small number of disparately located assets over the medium and longer term which will become destructed and lost as they fall into the sea.
- 5.1.2 Option 2 - Adaptive Management would not involve works to directly stop or reduce erosion, but instead would enable existing assets to be demolished and/or relocated landwards as part of adaptation involving 'roll-back'. In all cases, this would involve forward planning so that roll-back can occur and to this end would need to be informed by up-to-date understanding of coastal erosion rates and mechanisms.
- 5.1.3 Option 3 - Active Intervention Improve would involve the placement of rock armour at the cliff toe but is more complex to deliver across these Management Areas due to their geographical extent, covering several tens of kilometres and foreshore access constraints for construction plant. Furthermore, erosion is caused by marine processes at the cliff toe acting in combination with both weathering processes on the cliff face and drainage processes from the cliff top which would not be addressed under this option as presently defined. Therefore due to scale and technical complexity, this option is not feasible across the whole length of each Management Area (nor is it technically required across such a scale due to the low level of the risks presented). However, the option could potentially be used locally to protect individual assets shortly before they become affected by erosion, although this is not required until several future decades from the present day.

Management Area 25.2:

- 5.1.4 Under Option 1a – No Active Intervention and Option 1b - No Active Intervention with H&S Management, approximately 62 properties (44 in the southern section of the village and 18 in the northern section) would be affected by coastal erosion over the next 100 years). Erosion would continue at a long term average rate of approximately 0.3m/year, although due to the nature of the failure mechanism involving deep-seated landslips there could be several years of inactivity followed by a single large-scale event.
- 5.1.5 Option 2 for this Management Area is a hybrid option involving Adaptive Management in the northern section of the village and Active Intervention Maintain in the southern. There would be no new defences built along the coastline but existing defences would be maintained through an initial Capital Improvement scheme involving concrete patching, facing work, etc. With climate change this means that although the defences would continue to be present, the standard of service provided by the defences would progressively reduce over time. The risks to people and property in the undefended northern section of the village would be managed initially through cliff top and foreshore monitoring and drainage and ground investigations. The investigations would need to consider the effects of exfiltration and the surface water drainage outfalls on coastal erosion. The diversion of surface water that is outfalling at the cliff could potentially delay erosion to the 18 properties in the northern part of the village. At an appropriate future time, contingent upon findings of the monitoring and investigations, a property roll back scheme would be implemented. This would ultimately involve abandonment of up to 18 properties over the next 100 years and allow for replacement buildings on the

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property owners' land or further land that can possibly be released by The National Park Authority in liaison with Scarborough Borough Council, subject to further feasibility studies and long-term adaptation plans.

- 5.1.6 Option 3 – Active Intervention Maintain would apply to both the northern and southern sections of the village and involve coastal slope remedial and stabilisation works along the northern part and Capital Improvement of existing defences in the southern part (as for Option 2). Before any slope works in the northern section, there would need to be a series of investigations undertaken to map the location and ownership status of the drainage network, assess its present condition and design suitable refurbishment or replacement works. Also, as part of this option, deep-rooted vegetation would be planted on the coastal slope to aid stabilisation.
- 5.1.7 Option 4 – Active Intervention Maintain would apply to the southern section of the village only and involve Capital Improvement of existing defences (as for Option 2). There would be No Active Intervention in the northern part.
- 5.1.8 Option 5 – Active Intervention Maintain would apply to the northern section of the village only and involve the coastal slope remedial and stabilisation works (as for Option 3). There would be No Active Intervention in the southern part.
- 5.1.9 Option 6 – Active Intervention Improve would apply to both the northern and southern sections of the village and involve soil nailing and horizontal drainage installation along the northern part and Capital Improvement of existing defences in the southern part (as for Option 2). Given the potential for deep seated failure in the coastal slope in the northern section, it is anticipated that the nails would need to be long (in excess of 20m) and spaced typically at 2m horizontal spacing and 1m vertically, giving a minimum of 1500 nails/100m length of slope treated. The nails would need to be galvanised to resist the marine environment. It is likely that significant vegetation clearance and some reprofiling will be required to facilitate access to the slope for this process. The nails are anchored at the surface by a pattress plate and the entire surface would be meshed/netted. The use of long nails, possibly extending beneath the houses, will require way-leaves to be signed by the landowners. This option would benefit from installation of horizontal drainage wells to relieve the water pressure within the laminated clay and at rock head and would slow down the rate of regression and reduce the potential for large scale instability of the clay mass, but not eliminate the risk entirely. The water from the wells would need to be collected. Economics: Soil nailing would require significant amounts of public funding, however the horizontal drainage could be completed with the same equipment saving mobilisation costs.
- 5.1.10 Option 7 – Active Intervention Improve would apply to both the northern and southern sections of the village and involve a contiguous bored pile wall along the northern part and Capital Improvement of existing defences in the southern part (as for Option 2). This option would prevent further recession of the upper slope on the landward side of the wall. The wall would be constructed on top of the slope. The land on the seaward side of the wall would continue to degrade and there would be a reduction in lateral support in the long term. It would therefore be necessary to drill the piles in to the rock and install anchors through the capping beam. A preliminary calculation indicates an embedment length of 44m for the piles where the clay slope is 31m high (depth to bedrock 31m) and 22m where the clay slope is 12m high (depth to bedrock 12m). A long construction period is anticipated. Vibration and loading during the works may trigger further movement of the slope. Restricted access to the coastal slope, for the large plant needed to construct the wall, could be problematic. At the north east end of the village the area between the house and the top of the slope is only 4-5m wide which would prove difficult for the construction of a wall.

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- 5.1.11 Option 8 – Active Intervention Improve would involve rock armour to the base of the cliff fronting the Mount Pleasant area in the northern section of the village and Capital Improvement of existing defences in the southern part (as for Option 2). Rock installed at the base of the cliff would be need to be a minimum of 8 to 12 tonne rock size to provide a level of stability to the slope and to also protect against coastal marine processes. The rock armour structure would also need to be considerably high, possibly up to 10 to 15 m, to provide any safe level of stability.
- 5.1.12 The options identified above were considered further with regard to engineering, economics and environment issues. Options 5 and 8 were not taken forward to the detailed appraisal stage based on the initial high level assessments.

5.2 Environmental assessment

- 5.2.1 Although not a statutory requirement, Defra and Environment Agency guidance strongly recommends that a Strategic Environmental Assessment (SEA) is undertaken for Flood and Coastal Erosion Risk Management Strategies, in accordance with European Directive 2001/42/EC.
- 5.2.2 In recognition of this, environmental assessment and consultation has been integral to the identification, short-listing and appraisal of options as the Robin Hood's Bay Coastal Strategy has been developed.
- 5.2.3 This has involved initial consultation both during and following production of the SEA Scoping Report. The draft Strategy was also consulted on during a three month period to gain feedback on the draft preferred options.
- 5.2.4 Consultation has been a key activity within this strategy study. Public consultations events along with information leaflets were held and distributed within Robin Hoods Bay and the surrounding area. The consultation evenings were very well attended have allowed the local community to input into the development of both the preferred options and the strategy as a whole. Appendix F details how public feedback was incorporated within the strategy.
- 5.2.5 Information distribution and partnership working through the projects steering group has been vital to informing the public and disseminating the details of the preferred options and in particular the adaptive management approach. The Parish Council and Local Councillor have played a key role in this and continue to do so using such tools as the Bayfair Magazine (a local village information magazine) and Parish Council meetings.
- 5.2.6 The adaptive management approach has public support especially as within the preferred option there is identified a need to increase the longevity of properties by addressing the coastal erosion cliff recession rates. The cost implications of the adaptive management approach have been clearly explained to the public along with the responsibility of costs and possible contributions to make the option economically viable. Parish Council meetings have been held that have discussed the need for contributions and the future predicted loss of properties and how we can work with the planning authority to seek suitable areas for future development. There has been a general consensus of agreement and support for this option by public and consultees alike.
- 5.2.7 On-going communication and awareness of the strategy and the preferred options will be disseminated to the public and other stake holders through the local councillor and Parish council meetings. During the development of the PAR and detailed design the project steering group will recommence and allow information to be communicated on a wider scale. The strategy study will also be available for public download via the Scarborough Borough Council website.

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- 5.2.8 The Environmental Assessment of Plans and Programmes Regulations identify environmental receptors that must be initially considered for all SEAs. These include:
- population and human health, including critical infrastructure and material assets;
 - biodiversity, flora and fauna;
 - air and climatic factors;
 - water;
 - landscape and seascape;
 - historic environment; and,
 - soil.
- 5.2.9 It is also necessary to consider the interactions between the above receptors.
- 5.2.10 For each of the Policy Units, the feasible management options were appraised against a set of SEA assessment criteria. The magnitude of the impact and the sensitivity of the receptor were considered to determine the likely significance of the impact. The classifications ranged from beneficial to negative.
- 5.2.11 This assessment identified an environmentally preferred option for each Policy Unit within the Study Area to inform selection of an overall preferred option, and to assess the overall environmental impacts (positive and negative) of the preferred Strategy approaches.

5.3 Social and community impacts

- 5.3.1 The study area contains a range of isolated properties scattered along the frontage, with the main concentration of properties located within the village of Robin Hood's Bay (particularly within the southern section of the village). The southern section of the village is defended, however there are a number of properties at risk of coastal erosion within the northern section of the village (and elsewhere along the frontage) which is currently undefended. The facilities present within the village of Robin Hood's Bay are likely to draw a significant number of tourists to the area and contribute to the strong community feel. It is considered likely that if the existing defences within the southern section of Robin Hood's Bay were to decline and eventually fail, then the sense of community would be significantly reduced and people would likely visit less often, or not at all. Such reduced visitor numbers could significantly impact upon the local and regional economy.
- 5.3.2 Such impacts were considered within the SEA process, through the assessment of options against the SEA objectives identified during the scoping stage.

5.4 Option costs

- 5.4.1 Cost estimates have been developed for each of the short-listed options within each Management Unit. These have been built up as whole life cost estimates over a 100 year appraisal period to incorporate:
- capital scheme costs for any coastal defences or coastal slope works;
 - surveys, studies and investigations;
 - design and environmental studies;
 - construction supervision;
 - inspection and monitoring; and
 - maintenance.

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5.4.2 The cost estimates have been informed by a range of information sources, including:

- SPON'S Civil Engineering and Highway Works Price Book;
- Environment Agency unit cost database;
- Defra's National Appraisal of Defence Needs and Costs;
- Medium Term Plans;
- discussions with drainage investigating contractors;
- discussions with ground engineering contractors;
- discussions with slope stability contractors; and
- previous similar schemes and options.

5.4.3 After discounting the above elements to Present Value costs (PVC) an optimism bias of 60% has been applied.

5.4.4 The costs for the options short-listed in each Management Unit are provided in the economic appraisal sheets provided in Appendix D1 and are summarised in Table 5.1.

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Table 5.1: Summary of Options Present Value (PV) Costs (£k)

MA 24.1

Element	Option 1 (£k)	Option 1b (£k)	Option 2 (£k)	Option 3 (£k)
Initial implementation cost (Year 0-5)				
Capital	0	0	70	1,956
Non-capital	0	8	24	0
Sub Total	0	8	93	1,956
Future Costs (Year 6-100)				
Capital	0	0	7	0
Non-capital	0	824	824	0
Sub Total	0	824	831	0
Total PV Cost	0	141	223	1,899

MA 25.1

Element	Option 1 (£k)	Option 1b (£k)	Option 2 (£k)	Option 3 (£k)
Initial implementation cost (Year 0-5)				
Capital	0	14	85	7,459
Non-capital	0	8	24	0
Sub Total	0	22	109	7,459
Future Costs (Year 6-100)				
Capital	0	56	56	0
Non-capital	0	838	838	0
Sub Total	0	894	894	0
Total PV Cost	0	164	246	7,241

MA 25.2

Element	Option 1 (£k)	Option 1b (£k)	Option 2 (£k) *	Option 3 (£k)	Option 4 (£k) **	Option 5 (£k)	Option 6 (£k)
Initial implementation cost (Year 0-5)							
Capital	0	0	1,122	1,666	991	7,824	5,650
Non-capital	0	8	24	10	8	8	8
Sub Total	0	8	1,146	1,676	999	7,832	5,658
Future Costs (Year 6-100)							
Capital	0	7	6,609	6,609	7	6,609	6,609
Non-capital	0	824	824	824	824	824	824
Sub Total	0	824	7,432	7,432	831	7,433	7,433
Total PV Cost	0	141	2,815	3,302	1,076	9,327	7,217

* Option 2 Capital Improvement costs likely to change subject to detailed structural condition assessment of existing defences.

** Option 4 would only provide protection for the short term (0-20 years) and would not include any improvement works to other undefended areas in the Village; therefore it is not a complete solution.

5.5 Options benefits (Damages avoided)

- 5.5.1 The economic damages to people and the developed, natural and historic environments arising from coastal erosion and slope instability associated with an option of Do Nothing have been assessed across the Study Area. The economic benefits resulting from implementation of various options across the Study Area have then been derived as the damages avoided under that specific option (see Appendix D1).
- 5.5.2 The benefit categories assessed include the loss of residential and commercial properties due to coastal erosion, tourism damages based on loss of enjoyment and additional transport resource costs for using alternative destinations, loss of agricultural land, and loss of services and plinths for static caravan parks (loss of caravans is excluded as it is assumed the caravans are relocated prior to loss).
- 5.5.3 The benefits and costs have been updated to a October 2012 base date using the Consumer Price Index.
- 5.5.4 The original benefits arising from the CSS were reviewed in light of Environment Agency Appraisal Guidance published in 2010 and subsequently revised by Dr John Chatterton to include only allowable national benefits associated with the options (see Appendix D2). In particular, the following changes were made:

Management Areas 24.1 and 25.1:

- PVd has been amended to account for many assets (and therefore their associated damages and consequential losses) not being affected by coastal erosion until after year 20 and often very much further into the future.

Management Area 25.2:

- PVd has been reduced to account for many assets (and therefore their associated damages and consequential losses) not being affected by coastal erosion until after year 20 and often very much further into the future;
 - Loss to tourism has been recalculated in accordance with the Multi-Coloured Manual Update (2010); and
 - Loss of income to village businesses and municipal car parks has been removed as these are not national losses.
- 5.5.5 The benefits arising from each option taken forward to economic appraisal stage (using the revised assessments by Dr John Chatterton) are provided in Table 5.2 alongside the economic decision-making criteria, such as BCR.

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Table 5.2: Summary of economic assessment

MA	Option	PVd (£k)	PVb (£k)	PVc (£k)		NPV (£k)	BCR
				No OB	With OB (60%)		
24.1	Option 1a: NAI	160	0	0	0	-	-
	Option 1b: NAI (with H&S)	160	0	88	141	-141	0
	Option 2: Adaptive Management	8	152	139	223	-71	0.68
	Option 3: Rock Armour	8	152	1,187	1,899	-1,747	0.1
25.1	Option 1a: NAI	467	0	0	0	-	-
	Option 1b: NAI (with H&S)	467	0	102	164	-164	0
	Option 2: Adaptive Management	24	442	154	246	196	1.8
	Option 3: Rock Armour	192	274	4,526	7,241	-6,967	0
25.2	Option 1a: NAI	9,171	0	0	0	-	-
	Option 1b: NAI (with H&S)	9,171	0	88	141	-141	0
	Option 2: Adaptive Management/Active Intervention Improvement (property roll back and drainage scheme in northern village, Capital Improvement scheme to coastal defences assets in southern village)	477	8,694	1,759	2,815	5,879	3.09
	Option 3: Active Intervention Maintain (northern village drainage investigation and remedial works with deep rooted vegetation slope stabilising, Capital Improvement scheme to coastal defence assets in southern village)	3,778	5,393	2,064	3,302	2,091	1.6
	Option 4: Active Intervention Maintain (Capital Improvement to coastal defence assets in southern village)	5,886	3,284	672	1,075	2,209	3.1
	Option 6: Active Intervention Improve (soil nailing and horizontal drainage installation with Capital Improvement scheme to existing defence assets)	477	8,694	5,829	9,327	-633	0.9
	Option 7: Active Intervention Improve: contiguous bored pile wall with Capital Improvement scheme to existing defence assets)	477	8,694	4,510	7,217	1,477	1.2

For each Management Area, the economically preferred 'option' is highlighted.

6 Section and details of the preferred option

6.1 Selecting the preferred option

- 6.1.1 In developing the preferred options, technical, environmental and economic appraisals were undertaken in accordance with Environment Agency FCERM Appraisal Guidance.
- 6.1.2 The options considered for each Management Area were also subjected to a public consultation process and comments received were reviewed before completion of this StAR. The stakeholder engagement process, covering the Client Steering Group, the statutory consultees and the wider stakeholders is documented in Appendix F.
- 6.1.3 The preferred options for coastal Management Units generally comply, in intent, with the recommendations of the SMP2, which supports a policy of No Active Intervention in Management Areas 24.1 and 25.1 and Hold the Line in Management Area 25.2, noting that this is intended to involve improvement of existing defences and not extension of defences to presently undefended sections of the frontage.
- 6.1.4 The preferred option selected for each Management Area has the most favourable benefit-cost ratio (BCR) of the options considered for each area (Table 5.3).
- 6.1.5 Although the BCRs for Management Area 24.1 are less than 1 for all options, Option 2 has the most favourable BCR and provides the most sustainable option for reacting to changes in conditions at the coast, and allows communities and individuals to adapt.

6.2 Sensitivity testing

- 6.2.1 A key sensitivity analysis undertaken was that of the splitting MA25.2 into a northern and southern section to appraise them individually and together. This sensitivity analysis identified the combination of management practices which provides the best solution.
- 6.2.2 Options were originally assessed for the Village as whole, but were broken down to northern and southern Village section. This was due to the uncertainty in larger failure mechanisms occurring along the cliff face.

6.3 Details of the preferred option

Technical Aspects

Management Areas 24.1 and 25.1:

- 6.3.1 It is recommended that an Adaptive Management strategy be adopted for the long term due to having the most favourable BCR and the uncertainty in the future recession rates of the cliffs. This is the most sustainable option that reacts to the changing conditions at the coast and allows communities and individuals to adapt. It is recommended that this option be further investigated through an Adaptation Plan.
- 6.3.2 Continued inspection/monitoring of the cliff should be undertaken to ensure public safety and appropriate timing of individual property roll back schemes. Any adaptation would be delivered in partnership between the North York Moors National Park Authority as the planning authority, and Scarborough Borough Council.

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Management Area 25.2:

- 6.3.3 It is recommended that Option 2 be implemented, involving a hybrid of Adaptive Management in the northern section of the village and Active Intervention Maintain in the southern section. This has the most favourable BCR and complies with the intent of the SMP2 policy 'to sustain the community of Robin Hood's Bay'. This option will only allow present defences in the southern Village to be maintained for 60 - 90 years (Capital Improvement schemes around 30yr intervals), with extension of defence provision not proposed for the northern section, however drainage works are envisaged as part of the adaptive management approach. In order to progress Option 2 it is recommended that the investigation into the drainage in the northern section of the village is progressed alongside the outline design of the Capital Improvement works required in the southern section of the village. A Project Appraisal Report covering the southern village section should then be prepared, building up on the investigations and preliminary design work. The drainage investigation works in the northern section of the village should be progressed concurrently by SBC and interested parties. This will ensure a robust solution for the village as a whole, implementing the policies from the Strategy and SMP2.
- 6.3.4 The preferred option is a managed approach to coastal risk management by promoting interim measures to prolong the life of the existing assets. During the development of the PAR further investigations into the structural condition of the wall will be carried out to resolve any uncertainties and develop the design of the works required. Should the amount of the works required be more significant than currently anticipated then the option costs could be redistributed within the appraisal period, as more comprehensive improvement works up front are likely to reduce or delay the need for further interventions within the appraisal period.
- 6.3.5 The condition of the existing defences (present in the southern section of Management Area 25.2) would deteriorate if the defences were not maintained, with failure predicted to occur in 15-20 years from the present day. The consequences of wall failure would be that 42 properties would become affected by coastal erosion over the next 100 years.

Environmental Aspects

- 6.3.6 The main potential environmental effects of the preferred options, as identified through the SEA process, are summarised below. Receptors where no significant effects have been identified have been omitted.

Population and Human Health

- 6.3.7 The CSS will continue to manage coastal erosion risk to populations and human health. The CSS will ensure that a strategic approach is taken to manage risks to residential and commercial properties from coastal erosion, in the face of a changing climate. Approximately 80 properties (both commercial and residential) and 150 static caravans would be lost as a result of the do nothing option along the frontage, however the adaptive management strategy would ensure that the risks to properties from coastal erosion are managed in the long term. The properties within the southern section of Robin Hood's Village would continue to be protected through Capital Improvement of the existing defences.
- 6.3.8 The CSS has potential to impact upon tourism and recreational resources, through the loss of the Cleveland Way coastal footpath and local access roads. The loss of such recreational features could impact upon human health of residents within the area and reduce visitor numbers to the area. The loss the recreational footpath could be mitigated through the creation of a coastal path in a realigned position, as part of the Adaptive Management approach.

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- 6.3.9 The village at Robin Hood's Bay is a significant tourism asset, drawing a significant number of visitors to the area. The CSS will ensure the continued provision of these assets through the capital improvement of defences in the south of the village and roll back of properties and features of interest in the north of the village.
- 6.3.10 There are potential adverse impacts to tourists and recreational users of the area associated with potential cliff falls (particularly within the northern section of Robin Hood's Bay village where there is uncertainty as to the effect of drainage exfiltration on water levels at rock head). Such cliff falls have potential to result in health and safety implications to users of the foreshore during such events. Such risks should be mitigated through the continuation of the coastal monitoring programme, in order to identify the potential for cliff failure. An Outline Emergency Action Plan has been produced as part of the ER (Appendix G of the original CSS); it is also considered that a Detailed Landslip Emergency Action Plan will need to be created if significant risk is identified during coastal monitoring.

Critical infrastructure and material assets

- 6.3.11 The CSS will continue to manage coastal erosion risks to critical infrastructure and material assets. The CSS will ensure that a strategic approach is taken to manage assets at risk of coastal erosion, in the face of a changing climate. Such assets at risk over the next 100 years will be rolled back outside of the erosion zone, or protected through Capital Improvement of the existing defences at the southern section of Robin Hood's Bay Village.
- 6.3.12 Further investigation is required in order to determine ownership of utilities within the northern section of Robin Hood's Bay village, in order to allow a scheme to be commissioned to carry out repair works (if required) and diversions, to reduce coastal erosion rates and remove the potential for reductions in water quality associated with the potential impacts on the foul drainage system at Mount Pleasant.

Biodiversity, flora and fauna

- 6.3.13 In general, the CSS will allow for the natural evolution of the coastline (with the exception of a small section in the south of Robin Hood's Bay village). Such natural erosion of the coastline would result in the erosion and inland migration of wet woodland BAP habitat and ancient woodland adjacent to Stoupe Beck, Maritime Cliff and Slope BAP habitat and potential erosion/slumping of the SSSI's along the frontage as a result of falling debris and smothering from material eroded from the coastal slopes. There is also likely to be loss of area within the Beast Cliff to Whitby SAC as the coast erodes, however this designated site is also considered likely to migrate inland.
- 6.3.14 The improvement of defences within the southern section of Robin Hood's Bay village is likely to result in the loss of a small section of intertidal habitat as a result of coastal squeeze as sea levels rise.
- 6.3.15 The net littoral transport is understood to be in a southerly direction (Appendix E2), except during certain states of the tide when material is transported northwards. It is also considered that there is little small scale interaction between embayments, due to the isolated nature of the beaches. Sand derived from erosion of the till may provide a very small contribution to the nearshore sand belt south of the bay.
- 6.3.16 Natural England stated during July 2012 that geologically designated SSSIs should be allowed to erode naturally as there is potential to expose new geological interest features, and this is viewed by Natural England as a positive impact. Stabilisation of rock outcrops is considered to have a negative impact on the SSSI. As such, the

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approach of Adaptive Management along much of the frontage is considered likely to have a positive impact on the geological interest features of the SSSIs.

- 6.3.17 Further, more detailed assessment of the potential impacts and the avoidance, mitigation or compensation measures will be required at the project level before schemes can be approved.

Habitats Regulations Assessment (HRA): Screening

- 6.3.18 The Conservation of Species and Habitats Regulations 2010 (the Habitats Regulations) implement EC Directive 92/43/EEC on the conservation of natural habitats and of wild flora and fauna (the Habitats Directive). In accordance with Section 61 of the Habitats Regulations, Appropriate Assessment (AA) is required for any plan or project, not connected with the management of a European site, which is likely to have a significant effect on the site either alone or in combination with other plans and projects. European sites comprise Special Protection Area (SPA), as designated under Council Directive 79/409/EEC (the Wild Birds Directive), or a Special Area of Conservation (SAC), as designated under the Habitats Directive. AA is also required as a matter of government policy for potential SPAs, candidate SACs and listed Ramsar sites for the purpose of considering development proposals affecting them (ODPM, 2005).
- 6.3.19 The HRA screening (Appendix G1) identified that there will no impact on any of the European designated sites and therefore it was considered that an Appropriate Assessment was not required for the CSS. Consultation with Natural England during July 2012 confirmed that this approach was acceptable, and Appropriate Assessment was not required.
- 6.3.20 Consultation with Natural England during January 2011 identified that their chief area of concern with regard to the Beast Cliff-Whitby (Robin Hood's Bay) SAC was the proposed active intervention in Policy Unit MA25.2. Natural England believed that the proposed works on the sea wall to improve the existing defence are, however, too far from the SAC to have any impact.
- 6.3.21 With regard to the Robin Hood's Bay: May Wyke to Beast Cliff SSSI, Natural England stated that they would be keen to work with us in order to produce a scheme which minimises impacts on the SSSI within Policy Unit MA25.2. Natural England did not object to the option with Policy Unit MA25.2, however it was stated that until they have seen details of the proposed works, it was not possible to say whether the works will affect the SSSI.
- 6.3.22 Consultation with Natural England during August 2012 identified that Natural England would provide a Letter of Support for the CSS, based on the information provided within the SEA Addendum Report (Appendix G3) to the original SEA Environmental Report (Appendix G2b). It was stated, however, that the Robin Hood's Bay: Maw Wyke to Beast Cliff SSSI would remain in unfavourable condition as a result of the strategy. Unit 7 of the SSSI (which Natural England specifically refer to in the Letter of Support) is in unfavourable no change condition. The condition assessment states that careful checking of the graphic log for this stratigraphic interval suggests that the new concrete and rock armour wall at Bay Town covers a critical part of the cliff so that the section is no longer complete (i.e. where there used to be a complete section through the Pyritous Shales and Ironstone Shales, there is now a section not accessible as it is behind the sea wall). A number of options which had potential to improve the condition of the SSSI were assessed (comprising do nothing, or no active intervention as a stand-alone option or a hybrid option), however the sea wall provides coastal flood and erosion protection to a significant number of properties and infrastructure, which would be lost or significantly damaged if the sea wall was allowed to degrade. The only thing that would improve the

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condition of the SSSI would be to remove the sea wall which is not considered to be economically or environmentally feasible.

Soil

6.3.23 The preferred approach along the majority of the frontage has potential to result in erosion of a number of former alum works and Stricklands Tip. Such features have potential to represent contamination sources which could impact upon the groundwater, surface water and coastal environment. There is potential for residual contamination to be present within the ground from existing properties and practices (e.g. farm buildings, woodworking factory, residential properties etc.), which could remain following demolition of such properties and roll back to areas which are not at risk of erosion. Further ground investigation with chemical laboratory analysis of such areas would be required, in order to determine the contamination risks, prior to the implementation of schemes. If contamination is encountered within the soils/ground-waters during investigation works, remedial works in the form of excavation of the source, treatment of the source or removal of the pathway between source and receptor would be required.

Water

6.3.24 The CSS will maintain the existing coastal processes along the frontage. In the development of the CSS, it was advised by the Environment Agency that there is no modelled flood data for future scenarios. The study has therefore only considered flooding from a present day 1 in 200 year coastal flooding event. Environment Agency mapping indicates that the study area is not at risk of coastal flooding, and as such, the objective of ensuring the works do not increase the risk of flooding is met as a result of the CSS.

6.3.25 The findings of the WFD assessment identified that the preferred approach is not considered to result in deterioration in water body status on the coastal, groundwater or river water bodies present within the study area. The WFD assessment within the SEA Environmental Report Addendum (Appendix G3) considered the following water bodies: Yorkshire North Coastal water body; Esk and Yorkshire Coast Ravenscar groundwater body; Derwent North Yorkshire Moors Ravenscar and four river water bodies (Hawsker Bottoms Catchment, Mill Beck/Ramsdale Beck catchment, Stoupe Beck catchment and Hayburn Beck/Thorny Beck catch).

6.3.26 The coastal groundwater body is classified as good overall potential while the groundwater bodies are classified as good overall status. The river water bodies range from poor to moderate overall status. No mitigation measures were provided within the River Basin Management Plans (RBMPs), and as such, a specific assessment of the implications of the preferred option on mitigation measures could not be undertaken. For each of the water bodies considered, the effects of the preferred strategy option on current water body status, or on the ability to achieve or maintain good status, have been considered. The surface water bodies (river and coastal) were assessed as to how the proposed preferred strategic option could potentially affect the hydromorphological, chemical, physico-chemical and biological elements of the water body. The groundwater bodies were assessed in terms of implications of the preferred strategy on quantitative and chemical quality elements.

6.3.27 A summary of the WFD assessment illustrated within the SEA Environmental Report Addendum (Appendix G3) is presented in Tables 6.1 to 6.3.

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Table 6.1 Summary of WFD assessment for river water bodies

Quality elements	Preferred strategy option
Biological	Flow of water within the river channels likely to prevent eroded coastal material (predominantly gravel materials from the mudstone and sandstone cliffs) becoming deposited within the river channels as the coastline retreats.
Impact on status	No deterioration in status
Hydromorphological	River mouths will be moved slightly further inland as the coastline retreats, however changes considered to be within the natural variability of system as no change to present day management.
Impact on status	No deterioration in status
Chemical and physico-chemical	Flow of water within the river channels likely to prevent eroded coastal material (predominantly gravel materials from mudstone and sandstone cliffs) becoming deposited within river channels as the coastline retreats.
Impact on status	No deterioration in status
Impact on water body status	No deterioration in status

Table 6.2 Summary of WFD assessment for groundwater bodies

Quality elements	Preferred strategy option
Chemical	Study area contains near vertical cliffs, which removes present day flood risk to hinterland. Impact on chemical element considered unlikely as saline water percolation into groundwater is not considered a risk.
Impact on status	No deterioration in status
Quantitative	Lack of pathway between saline water in the coastal waterbody and groundwater bodies.
Impact on status	No deterioration in status
Impact on water body status	No deterioration in status

Table 6.3 Summary of WFD assessment for coastal water body

Quality elements	Preferred strategy option
Biological	Supply of potentially contaminated sediment and waste within the foul drainage sewer to coastal waterbody, however the erosion of the coastline is a natural process and the impacts are considered relatively small scale in comparison to the size of the water body.
Impact on status	No deterioration in status
Hydromorphological	Potential loss of intertidal habitat in front of Robin Hood's Bay village as a result of coastal squeeze. Natural evolution of coastline permitted along the majority of the frontage however.
Impact on status	No deterioration in status
Chemical and physico-chemical	Supply of potentially contaminated sediment to coastal waterbody, however the supply is a natural process and is considered relatively small in scale in comparison to the size of the water body.
Impact on status	No deterioration in status
Impact on water body status	No deterioration in status

Historic environment

- 6.3.28 The CSS would result in the loss of SAMs and a listed building as the coastline retreats, however the majority of the frontage is currently undefended and as such, heritage assets would be lost naturally over time as a result of coastal erosion. The preferred approach would, however, provide protection to a number of listed buildings within the southern section of Robin Hood's Bay village through continued improvement of the existing defences.

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6.3.29 Additional archaeological assessments of the areas affected by the preferred options are likely to be required with the aim of producing site specific mitigation strategies, in accordance with national, regional and local policy guidelines and with all relevant national and regional archaeological research agendas. Continued consultation with English Heritage and the County Archaeologist should be undertaken to ensure that the assessments and mitigation strategies are appropriate. It is considered that additional assessments such as full archaeological recording and potential excavation and re-construction of the listed building within a defended section of the coastline could be undertaken in order to mitigate against the loss of such features.

Landscape

6.3.30 Overall, the preferred approach is considered to have a positive effect on the landscape. The landscape within the Study Area is made up of sheer cliffs and steep coastal slopes, fronting rocky shore platforms and picturesque villages. No additional construction works are required other than in areas which are already defended, and as such, the CSS would not impact on the present day management of the coast. The natural evolution of the coastline would be permitted along the majority of the frontage, which would maintain the local character of the area. Coastal erosion would result in the loss of Heritage Coast, however, it is considered that Heritage Coast is likely to migrate inland with sea level rise.

6.3.31 The degradation of property as the coastline retreats would be considered a negative impact on the existing landscape, however this could be avoided through removal of the properties and re-construction landward, prior to the properties becoming degraded as a result of coastal erosion.

6.4 Summary of preferred strategy

6.4.1 Table 6.4 summarises the preferred strategy for each Management Area.

Table 6.4: Recommended strategic options for 100 years

Management Area	Epoch		
	Short Term (0-20 years)	Medium Term (20-50 years)	Long Term (50-100 year)
MA24.1	Option 2 - Adaptive Management		
MA25.1	Option 2 - Adaptive Management		
MA25.2	Option 2 - Adaptive Management (northern village) & Active Intervention Maintain (southern village)		

7 Implementation

7.1 Project planning

Phasing and approach

7.1.1 Delivery of the preferred options to manage risks to people and the developed, natural and historic environments from coastal erosion and slope instability have been broken down into short term (0-20 years), medium term (20 – 50 years) and long term (50 – 100 years) actions and an Action Plan has been developed (presented in Appendix E6).

7.1.2 In summary, the principal actions over the short term (0-20 years) involve:

Management Areas 24.1 and 25.1:

- Monitoring / inspection of cliffs and coastal slopes to assist in identification of timing for property roll back;
- Adaptation Plan by National Park Authority, assisted by Scarborough Borough Council; and
- Safety signs and fencing for unsafe sections of cliff (arising from monitoring).

Management Area 25.2:

- Project Appraisal Report (PAR) to seek funding for investigations, design and delivery of Capital Improvement scheme in southern section of Robin Hood's Bay village;
- Investigations of structural condition of existing defences
- Delivery of Capital Improvement works to existing defences;
- Monitoring / inspection of cliffs and coastal slopes to assist in identification of timing for property roll back;
- Investigation of ownership, location and condition of drainage in northern section of Robin Hood's Bay village, and PAR for improvements works;
- Adaptation Plan by National Park Authority, assisted by Scarborough Borough Council; and
- Safety signs and fencing for unsafe sections of cliff (arising from monitoring).

Programme and spend profile

7.1.3 The projected cash expenditure profile for capital costs (FCERM-eligible) and non-capital costs over the next 5 years are provided in Table 7.1 to inform Medium Term Planning.

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Table 7.1 Projected cash expenditure profile on capital and non-capital projects

Management Area 24.1

Cost	2012/13 (£K)	2013/14 (£K)	2014/15 (£K)	2015/116 (£K)	2016/17 (£K)	Future Year (£K)	Total (£K)
Capital	0	70	0	0	0	6.7	76.7
Non-Capital	17.7	1.4	1.5	1.5	1.6	824	847.7
Total	17.7	71.4	1.5	1.5	1.6	830.7	924.4

Management Area 25.1

Cost	2012/13 (£K)	2013/14 (£K)	2014/15 (£K)	2015/116 (£K)	2016/17 (£K)	Future Year (£K)	Total (£K)
Capital	0	70.7	14	0	0	56.1	140.8
Non-Capital	18	1.4	1.5	1.5	1.7	837.9	862
Total	18	72.1	15.1	1.5	1.7	894	1,002.8

Management Area 25.2

Cost	2012/13 (£K)	2013/14 (£K)	2014/15 (£K)	2015/116 (£K)	2016/17 (£K)	Future Year (£K)	Total (£K)
Capital	145	978	0	0	0	6,608.6	7,731.6
Non-Capital	17.7	1.4	1.5	1.5	1.5	824	847.6
Total	162.7	979.4	1.5	1.5	1.5	7,432.6	8,579.2

Outcome measures and funding contributions

- 7.1.4 Funding from Scarborough Borough Council, via the Environment Agency administered FDGiA, has allowed for the development of the Robin Hood's Bay CSS and this StAR.
- 7.1.5 Funding for the preferred options for Management Areas 24.1 and 25.1 will not be sought from FDGiA, therefore outcome measures have not been presented within the StAR for these units. Funding to help with removal of damaged or imminently at risk properties will be sought on behalf of the homeowners through the Coastal Erosion Assistance Grant at the appropriate time where applicable.
- 7.1.6 Funding for the preferred option for Management Area 25.2 will be sought from FDGiA. Outcome measure scores for Management Area 25.2 are provided in Table 7.2. The FDGiA funding of £661k would result in a raw OM score of 67%. Contributions in the region of £332k from third parties will also be required for the scheme in order for it to progress (to reach 100% OM score). Contributory funding will be sought from yet to be confirmed third parties. The following organisations will be approached for contributions, either monetary or contributions in kind; Scarborough Borough Council, North Yorkshire County Council, Yorkshire Water, North York Moors National Park, service providers, local businesses who benefit, and the parish council. No advances have currently been made to secure the contributions, however the need for contributions has been communicated and discussed during consultation on the Strategy. Contributions will be

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sought during the next stages of the scheme development and agreement in principles to contribute will be obtained prior to submission of a Project Appraisal Report for the scheme.

7.1.7 Scarborough Borough Council will be responsible for the maintenance of the coast defence assets in Management Unit 25.2 and will therefore be contributing the estimated £41k improvement costs over the benefit period.

7.1.8 The funding for the drainage investigation works in the northern section of the village will be provided by SBC and other interested parties. SBC will seek contributions from those organisations that have drainage interests in the area as well as the beneficiaries. This will include North Yorkshire County Council, Yorkshire Water, National Trust, residential property owners, and Local Levy. In addition the possibility of promoting this novel adaptive approach to Defra as a pilot project will be investigated. Failure to obtain funding from alternative sources to undertake the proposed approach in the northern section of the village should not jeopardise the proposed scheme in the southern part of the village.

Table 7.2 Outcome measures for Management Area 25.2

Outcome Measures		Number	Qualifying Benefits	FDGiA Contribution
OM1 (Economic Benefit)			6,441	358
OM2 (Households better protected against flooding)	20% most deprived areas			
	21-40% most deprived areas			
	60% least deprived areas			
OM3 (Households better protected against coastal erosion)	20% most deprived areas			
	21-40% most deprived areas		1,010	303
	60% least deprived areas			
OM4 (Statutory Environmental Obligations Met)				
TOTAL FDGiA Contribution				661
Raw OM Score				66.55%
Cost saving and/or external contribution required				332
Scheme Contributions Secured				41
Adjusted OM Score				70.68%

7.2 Procurement strategy

7.2.1 The procurement of Consultant services to develop a Project Appraisal Report for investigations and outline design of a Capital Improvement scheme in the southern section of Robin Hood's Bay village and to assist in developing Adaptation Plans elsewhere within the Study Area will be through the YorConsult Framework, which covers the Yorkshire and Humber region and includes specialist services under a 'Coastal Lot'.

7.2.2 The procurement of Contractors to design and construct a Capital Improvement scheme in the southern section of Robin Hood's Bay village will be through the YorCivils Framework, which covers the Yorkshire and Humber region.

7.2.3 Our [Scarborough Borough Council] procurement philosophy and approach entails a partnership approach based upon the principles of Latham's *Constructing the Team* and Egan's *Rethinking Construction* reports, as enshrined in the philosophy of the New Engineering Contract.

7.2.4 Where appropriate, we will adopt Early Contractor Involvement (ECI) and tend to favour Design and Build contracts so that lines of liability are clearly defined between the Client and Designer/Contractor.

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7.3 Delivery risks

7.3.1 The principal risks to delivery of the preferred options and recommended actions, together with proposed risk management activities, are shown in Table 7.3.

Table 7.3 Principal delivery risks and risk management

Delivery Risk		Risk Management
1	Non-approval or delayed approval of the business case and recommendations presented in this StAR by the Environment Agency's Large Projects Review Group (LPRG)	<ul style="list-style-type: none"> Completion of the StAR in accordance with latest Environment Agency procedures and guidance.
2	Non-approval or delayed approval of the business case and recommendations presented in subsequent Project Appraisal Report by the Environment Agency's Regional Project Approvals Board (PAB)	<ul style="list-style-type: none"> Completion of the PARs in accordance with latest Environment Agency procedures and guidance.
3	Need for funding contributions in addition to FDGiA to deliver Capital Improvement schemes	<ul style="list-style-type: none"> Early discussions with potential contributory funders during development of PAR
4	Objection from statutory bodies to proposals	<ul style="list-style-type: none"> Engagement with statutory bodies throughout the development of the CSS, including formal consultation through the SEA process. Comfort Letter from Natural England agreed in principle based on CSS outputs and to be provided once StAR revisions have been reviewed.
5	Lack of public acceptance of the proposed solutions	<ul style="list-style-type: none"> Public consultation undertaken on the preferred options at CSS stage and again to follow for Robin Hood's Bay village southern section during PAR
6	Deterioration or failure of defences before schemes are implemented	<ul style="list-style-type: none"> Inspection and maintenance/ repair of storm damage
7	Deterioration or failure of coastal slopes before schemes are implemented	<ul style="list-style-type: none"> Inspection and maintenance/ repair of slips and drains
8	Need for alternative funding sources to deliver meet most recommendations due to low Outcome Measures	<ul style="list-style-type: none"> Investigate alternative funding sources Long term budgetary planning for increased future budgets from in-house funding sources.

7.4 Recommendation

7.4.1 The recommended strategy for managing the risks to people and the developed, natural and historic environment from coastal erosion and slope instability is to deliver the series of preferred options and Action Plan recommendations outlined in this StAR.

7.4.2 The strategy is recommended for Approval in Principle for £10,490k, including optimism bias of 60%, over the whole life of the Strategy. This includes £993k of FDGiA eligible expenditure over the first five years.

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