

Project appraisal report

Authority scheme reference

SBC8

National project number

YOS351C/001A/011A

Authority applying for a grant

Scarborough Borough Council

Scheme name

Runswick Bay Coastal Protection Scheme



A great place to live, work & play



Runswick Bay Village seawall on 17th December 2013 showing damage to blockwork following the storm surge incident of 5th December 2013

Date (DD/MM/YYYY)

8/1/2016

Version

Final 2.1

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Glossary and Acronyms

Benefit Cost Ratio (BCR): used to identify the relative worth of one approach over another. It is the ratio of the PV benefits to the PV costs for each option.

Coastal Defence Asset: Any structure with the prime purpose to provide flood defence or erosion protection e.g. seawalls, groynes, beach.

Defra: Department for Environment, Food and Rural Affairs.

Do Minimum: An option where the Operating Authority takes the minimum amount of action necessary to maintain an asset. For many places, this means patch and repair works of existing defences with no replacement should the defences fail.

Do Nothing: An option used in appraisal to act as a baseline against which all other options are tested. It assumes that no action whatsoever is taken. In the case of existing works, it assumes for the purposes of appraisal that Risk Management Authorities cease all maintenance, repairs and other activities immediately. In the case of new works, it assumes that there is no intervention, and natural and other external processes are allowed to take their course.

Environmental Impact Assessment (EIA): The aim of EIA is to protect the environment by ensuring that the local planning authority, when deciding whether to grant planning permission for a project which is likely to have significant effects on the environment, does so in the full knowledge of the likely significant effects, and takes this into account in the decision making process. The process of EIA is governed by the Town and Country Planning (Environmental Impact Assessment) Regulations 2011 (as amended).

Environmental Report (ER): The output from an Environmental Impact Assessment (EIA).

Flood & Coastal Erosion Risk Management Grant in Aid (FCRM GiA): Government money allocated to Risk Management Authorities (Environment Agency, Local Authorities, Internal Drainage Boards) for capital works which manage and reduce flood and coastal erosion risk.

Flood and Coastal Erosion Risk Management Appraisal Guidance (FCERM-AG): Defra guidance to Risk Management Authorities on the process for appraising flood and coastal defence projects to ensure best use of public money.

Habitats Regulations Assessment (HRA): Formal assessment process that all European Union Member States are required to adhere to, where a project or plan may affect a site that has been protected under the Habitats Directive or the Birds Directive. Sites protected ('designated') under the Habitats Directive are called Special Areas of Conservation (SACs) and those designated under the Birds Directive are called Special Protection Areas (SPAs). HRA also applies to sites protected under the Ramsar Convention, although this is not always specified in law. These sites are designated because of their high value in terms of nature conservation, meaning that they contain rare and highly valued habitats or species, and often both.

Heritage Coast: These represent stretches of the most attractive, undeveloped coastline, which are managed to conserve their natural beauty and, where appropriate, to improve accessibility for visitors. They are 'defined' rather than designated, as there is no statutory designation process like that associated with National Parks and AONBs.

Incremental Benefit Cost Ratio (iBCR): In economic assessment, the ratio of the additional benefit to the additional cost, when two options are compared.

Joint Probability: The probability of two separate events occurring at the same time.

LiDAR: Light Detection and Ranging. This is a remote sensing method used to survey the surface of the Earth, usually from the air.

Multi-coloured Manual (MCM): The MCM provides techniques and data that can be used in benefit assessments for flood and coastal erosion risk management appraisals.

NE: Natural England.

Net Present Value (NPV): Stream of all benefits net of all costs for each year of the project life discounted back to the present date.

NYMNP: North York Moors National Park. This area was designated as a National Park in 1952, due to its diverse landscape of moorland, dales, woodland and coast. National Parks are protected by law. The NYMNP Authority is the statutory planning authority for the National Park.

Outcome Measure (OM): The Department for Environment, Food and Rural Affairs sets Outcome Measures to ensure that the Environment Agency and other risk management authorities achieve the aims of government FCERM policy through targeted investment of FCERM grant in aid. There are currently six Outcome Measures including "OM 1 - benefit cost" and "OM 3 - households with reduced risk of erosion".

Project Appraisal Report (PAR): A business case including a programme of works that supports a recommendation to implement a scheme.

Present Value (PV): Monetary value of ongoing or future costs, discounted using standard rates specified by HM Treasury to provide equivalent present day costs.

PV Benefits (PVb): The present day lifetime total of economically quantifiable benefits that a project will produce over its lifetime.

PV Costs (PVc): The present day lifetime cost for implementation of a project.

PV Damage Avoided: The economic damages avoided once an option has been implemented.

Regional Coastal Monitoring Programme (RCMP): A suite of survey and monitoring activities undertaken along the coast including topographic surveys, walkover inspections and aerial photography. The Cell 1 Regional Coastal Monitoring Programme covers approximately 300km of the north east coastline, from the Scottish Border (just south of St. Abb's Head) to Flamborough Head in East Yorkshire.

Runswick Bay Rescue Boat (RBRB): since 1982 the rescue boat (supported by the RNLI) has operated from the lifeboat station house at Runswick Bay.

Scheduled Monument (SM): To protect archaeological sites for future generations, the most valuable sites may be "scheduled". Scheduling means nationally important sites and monuments are protected by law by being placed on a list, or 'schedule'.

Scoping Report: A report prepared as part of the EIA process with a view to consult with statutory bodies, identify issues that have been 'scoped in' and 'scoped out', outline the methodology for undertaking the EIA, report on partnership working opportunities and provide a formal record of the scoping stage. The Scoping Report in this PAR has been prepared to follow the format of the Environment Agency's **Preliminary Environmental Information (PEI)** report.

Site of Special Scientific Interest (SSSI): Sites notified under the Wildlife and Countryside Act 1981 (as amended by the Countryside and Rights of Way (CROW) Act 2000) for their flora, fauna, geological or physiographical features. Notification of a SSSI includes a list of activities that may be harmful to the special interest of the site. Section 28 of the Wildlife and Countryside Act 1981 (provisions relating to SSSIs) has been replaced by a new Section 28 in Schedule 9 of the CROW Act.

Shoreline Management Plan (SMP): A Shoreline Management Plan is a long term, high level assessment of the risks associated with both coastal erosion and tidal (sea) flooding at the coast. It offers a vision for how the coast is to be managed in the future in a sustainable manner. SMPs are non-statutory but set out a framework for action. The original SMPs have now been updated by second round SMPs (SMP2). For the length of coastline covered by this strategy the relevant SMP2 is the River Tyne to Flamborough Head Shoreline Management Plan, completed in 2007.

Special Area of Conservation (SAC): An internationally important site for habitats and/or species, designated as required under the European Community 'Habitats Directive' (92/43/EEC). SACs are protected for their internationally important habitat and non-bird species. SACs also receive SSSI designation under The Countryside and Rights of Way (CROW) Act (2000) and The Wildlife and Countryside Act (1981) (as amended).

Special Protection Area (SPA): A site of international importance for birds, designated as required by the EC Birds Directive. The Government has to consider the conservation of SPAs in all its planning decisions. SPAs receive SSSI designation under The Countryside and Rights of Way (CROW) Act 2000 and The Wildlife and Countryside Act 1981 (as amended).

Strategic Environmental Assessment (SEA): A process set out in European and domestic legislation that must be followed to ensure that significant environmental effects arising from policies, plans and programmes are identified, assessed, mitigated, communicated to decision-makers, monitored and that opportunities for public involvement are provided.

Strategy Appraisal Report (StAR): A business case including a programme of works that supports a recommendation to implement a management plan. The plan is approved by the Environment Agency under the Non-Financial Scheme of Delegation from Defra and does not confer any financial authorisation. The plan is supported by technical appendices.

United Kingdom Climate Impacts Programme (UKCIP): A body set up to help organisations, sectors and governments adapt to the changing climate through practice-based research, and to provide support and advice.

United Kingdom Climate Projections 2009 (UKCP09): These projections provide climate information designed to help those needing to plan how they will adapt to a changing climate. UKCP09 is the fifth generation of climate change information for the UK.

Water Framework Directive (WFD): A European Directive to help to protect and enhance the quality of surface freshwater (including lakes, streams and rivers), groundwaters, groundwater dependant ecosystems, estuaries and coastal waters out to one nautical mile from low-water. European Community Directive (2000/60/EC) on integrated river basin management. The WFD sets out environmental objectives for water status based on: ecological and chemical measures; common monitoring and assessment strategies; arrangements for river basin administration and planning; and a programme of measures to meet the objectives.

Approval History sheet

1 Review			
Project title	Runswick Bay Coastal Protection Scheme		
Authority project code	SBC8	Date of PAR	6 Jan 2016
Lead authority	Scarborough Borough Council		
Consultant	CH2M (Halcrow)	Version number	2.1
Job title	Name	Signature	Date
Consultant Project Manager	Marcello Cali	M Cali	8 Jan 2016
'I have reviewed this document and confirm that this project meets our quality assurance requirements, all of the required environmental obligations and Defra investment appraisal conditions. I confirm that all internal approvals, including member approval, have been completed for this project and recommend we apply to the Environment Agency for a capital grant of £ 1,040,000'.			
Authority Project Executive	Stewart Rowe		
'I have reviewed this document and confirm that it meets the current PAR guidelines for local authority and Internal Drainage Board applications.'			
PAR reviewer			
'I confirm that I have consulted with the Director of Business Finance and that we are ready to send the project for assurance.'			
Area Flood Risk Manager			
NPAS Assurance <input checked="" type="checkbox"/> Projects <£10m (Tick the appropriate box)		Large project review group (LPRG) <input type="checkbox"/> Projects >£10m	
Recommended for approval (Lead Assurer or NPAB Chair)		Date	Version number
Capital grant of £			
2 Project approval			
Financial Scheme of Delegation (FSoD approval):			
Limit		Approval	
Over £20m		Chief Executive in consultation with Executive Director of Operations and Director of Business Finance	
Up to £20m		Executive Director of Operations and Director of Business Finance	
Up to £10m		Director of Operations and Director of Business Finance	
Up to £1m		Area Manager and Director of Business Finance	
Up to £100k of combined FCERM GiA and Local Levy expenditure (and with a total project value below £1m)		Area FCRM Manager even if the project value is greater than £100k (but less than £1m) including contributions from other parties	
Name		Date	
Name		Date	
Name		Date	
3 Defra approval			
Date sent to Defra (or write N/A)		Version number (if different)	
Date approved by Defra (or write N/A)			
Comments			

1 Executive summary

1.1 Introduction and background

Location and background

- 1.1.1 Runswick Bay (the Bay) is located on the North Yorkshire Coast. The Bay is within the North Yorkshire Moors National Park (NYMNP), contains Runswick Bay Village (the Village) and is adjacent to the smaller settlements of Port Mulgrave, to the North, and Kettlewell, to the South.
- 1.1.2 Runswick Bay Village originated as a fishing village. The lack of harbour facilities, in addition to a steady decline of the fishing industry since its peak in the 19th century, meant that Runswick Bay Village is no longer a viable port. However, inshore fishing, especially for crustaceans and smaller species of line-caught fish, still takes place within Runswick Bay and there are a number of fishing vessels which still operate out of the bay, utilising pots, small nets and lines.
- 1.1.3 The extent of the works required for Runswick Bay was initially defined in accordance with the overarching River Tyne to Flamborough Head Shoreline Management Plan (SMP) Policies for Management Area (MA) 21. This showed that the only Policy Unit (PU) within MA 21 for which the Policy of Hold The Line (HTL) was proposed, was for Runswick Bay Village. Therefore, Runswick Bay Village is the only area that requires any coast protection intervention. The proposed policy for all other areas is either No Active Intervention (NAI) or Retreat or Realignment (R).
- 1.1.4 This was further confirmed with the work undertaken for the Runswick Bay Coastal Strategy (RBCS) 2015, which looked at a number of potential Strategic Coastal Defence Options, mainly focussed on protecting Runswick Bay Village.
- 1.1.5 All previous research, data gathering and coastal defence decisions have been based on a thorough knowledge of local coastal erosion and existing land use. Runswick Bay Village has previously been identified through both the SMP and the RBCS as requiring active intervention. This is due to the fact that the village is backed by soft cliffs, formed from glacial sediments that have historically been subject to toe erosion and landslides, typically associated with sustained and intense rainfall.

History of coastal erosion (Runswick Bay Village)

- 1.1.6 The original Village of Runswick Bay lay slightly to the north, on the north side of Runswick Beck, but a landslip in 1682 caused the majority of the Village to slide into the sea. The settlement was subsequently re-built with cottages constructed on the north and south of Runswick (or Lingrow) Beck. 20th Century expansion of the Village involved construction of new houses and hotels on the cliff top in an area known as Runswick Bank Top.
- 1.1.7 Although a major slope stabilisation scheme was completed in 2000 just south of the village (comprising drainage, piling and earthworks), there is evidence that on-going ground movement still occurs. However it is now considered that the amount of displacement is low and that scheme does significantly reduce risk to the village in the short term. It was therefore considered within the RBCS (and for this Coastal Protection Scheme) that both the on-going risk related to the natural geology of Runswick Bay and future risks associated with climate change (sea level rise) would need to be addressed. Works would need to minimise any potential risks to the public and coastal assets focusing on active intervention measures in Runswick Bay.

Present Day Runswick Bay Village

- 1.1.8 Runswick Bay Village is bounded by two streams, Runswick Beck to the North and Nettledale Beck to the South and is built on slopes cut into Jurassic shales and glacial sediments that are both prone to landslide. The majority of the Village is founded on weathered shale, but the properties at the southern edge (and the Village's only access road and car parks) are founded on glacial sediments and landslide debris.
- 1.1.9 Runswick Bay is currently predominantly a holiday village of approximately 90 residences. Less than a quarter of the properties are occupied by permanent residents, and most of these are located at Runswick Bank Top. Over three quarter of the houses are used as second homes or tourist lets. As would be expected with such a destination, there are tourist and day-visitor attractions and provisions at Runswick Bay. These include a recreational bathing beach, cafes, shop facilities and a lifeboat station.

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1.2 Problem

- 1.2.1 The coastline at Runswick Bay and its surrounding area consists of unstable cliffs, which are susceptible to landslides. These cliffs are made up of soft Jurassic bed rock and weak glacial sediments. On-going erosion of these different rock types has formed the indented coastline that can be seen today, with embayments at Runswick Bay and Port Mulgrave and intervening headlands.
- 1.2.2 The primary areas of concern for Runswick Bay are the ongoing risks of seawall degradation, toe erosion and the implications for the stability of the slopes behind the deteriorating defences. Failure or loss of even part of the existing defence structures could have serious and relatively rapid implications. There are 96 residential and 17 non-residential properties which are considered to be at risk from coastal erosion.
- 1.2.3 Wave overtopping at Runswick Bay Village is also a problem, causing occasional damage to properties and slopes behind the existing seawalls.

1.3 Options considered

- 1.3.1 A long list of potential Flood and Coastal Risk Management options were initially considered for Runswick Bay through the RBCS. This long list of options included the No Active Intervention (NAI) option, as a baseline against which all other options would be compared to and thereafter referred to as the 'do nothing' option. No 'natural options' were considered, as it was not considered that there are any suitable natural options available to provide an appropriate standard of protection for Runswick Bay Village.
- 1.3.2 The long list of options (12 in all) covered various arrangements of rock armour revetments, stepped seawalls, re-nourishment, groynes, seawall buttressing, fishtail groynes and offshore breakwaters, plus combinations of these.
- 1.3.3 This long list of options was subject to an initial review and discussion with the Steering Group at a meeting held on 7th November 2013. Environmental, technical and economic factors were considered for each option. Following these deliberations, a short list of options was developed. This short list of options was as follows: - including a brief explanation of why each option was retained:
- Do nothing (Option 1) - This was not considered a viable option as the SMP Policy is 'Hold The Line'. However, it was retained as a baseline option;
 - Do minimum (Option 2) - This was not considered an ideal option due to the long term ineffectiveness, but it was retained as a do minimum baseline option;
 - Rock armour apron to seawall toe (Option 3) - This option was retained on the basis that there is already existing rock armour within the bay which has been accepted by residents of the village and this option would perform well;
 - Rock armour fillet (reduced section rock apron) (Option 6) - This option was considered to be less effective than Option 3 but also less intrusive, and was therefore retained; and
 - Reduced length rock armour fillet to seawalls with rock groyne (Options 7 and 8 combined) - These options would provide the same level of protection as Option 6 and it was therefore retained.
- 1.3.4 To determine a preferred option, the short list of options was subjected to further scrutiny and assessed against technical, environmental and socio-economic criteria by applying standard appraisal techniques including statutory consultation and public exhibition.

1.4 Preferred option

Description

- 1.4.1 The recommended strategy for Runswick Bay Village comprises the preferred option of a rock armour fillet (Option 6) and ongoing scheme maintenance - patch repairs to the seawall, rock armour re-profiling and associated annual monitoring surveys.

Environmental considerations

- 1.4.2 A Strategic Environmental Assessment (SEA) has been undertaken to appraise the potential effects arising from the strategy options, and to ensure that environmental considerations were taken into

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account during the strategy level decision-making process. The SEA is presented in the Strategy's Environmental Report (ER).

- 1.4.3 A scoping process was undertaken for the SEA at the Scoping Consultation Stage, between November 2013 and January 2014. Consultation was undertaken with Natural England, the Environment Agency and a range of other bodies. There was a further review of the scope in April 2014, when key stakeholders and the public were consulted on the Draft SEA ER which included a public exhibition. The final draft of the strategy report was available for public consultation during February and March 2015.
- 1.4.4 Natural England have provided a letter of comfort, dated 17 February 2015, for the approved strategy. It is Natural England's view that the proposals are likely to lead to an environmentally acceptable solution and that an Appropriate Assessment under the Habitats Regulations will not be required.
- 1.4.5 The development of a preferred option for Runswick Bay is likely to have a number of impacts and effects associated with it. The potential environmental effects which could result from the scheme have been assessed in outline and documented in a Scoping Report (prepared to follow the format of the Environment Agency's 'Preliminary Environmental Information' (PEI) report) (CH2M, July 2015). The Scoping Report supports the business case and will inform future detailed design phases of the project, ensuring that environmental opportunities and constraints are considered throughout. It will also provide the basis of our further EIA reporting. A Water Framework Directive (WFD) preliminary assessment has concluded that the proposed scheme will not conflict with the WFD objectives and a detailed compliance assessment is not required.

Benefits

- 1.4.6 The assessment of damages includes residential and non-residential properties. The inclusion of infrastructure has been limited to the Yorkshire Water pumping station. In addition an assessment of recreational loss has been made based on annual visitor numbers.

Costs

- 1.4.7 The economic assessment is developed from the strategy and includes the derivation of capital, maintenance and other costs for each of the Runswick Bay Village protection options, along with maintenance costs for the southern defences. Ongoing inspection and monitoring costs are also included. Costs include an Optimism Bias factor of 30%. Damages and costs have been adjusted to a base date of March 2015.
- 1.4.8 The following table summarises the project costs for the preferred option considered for Runswick Bay. Costs take account of anticipated cash and in-kind contributions of £300k (excluding 30% optimism bias), refer to 1.4.11 and 1.4.12 below.

Table 1.1 Project costs (£ rounded)

	Economic appraisal	Whole-life cash cost	Approval
Costs up to PAR (outline design)	Does not apply – sunk costs	22,000	
Costs after PAR			
SBC staff costs	49,200	50,000	50,000
Consultants' fees	54,300	55,000	55,000
Early Contractor Involvement (ECI)	0	0	0
Cost consultants' fees	Incl.	Incl.	Incl.
Site investigation and survey	48,600	50,300	50,300
Construction	486,000	503,000	503,000
Environmental mitigation	Incl.	Incl.	Incl.
Environmental enhancement	36,400	37,700	37,700
Site supervision	36,400	37,700	37,700

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	Economic appraisal	Whole-life cash cost	Approval
Compensation	0	0	0
Yorkshire Water service diversion	193,000	200,000	200,000
Risk contingency			
95%ile (represents 38% of project FSoD approval)			390,000
50%ile (£41k)	Use Opt. Bias	Use Opt. Bias	
Optimism Bias 30% (incl. future costs)	357,000	635,000	
Inflation (2%)	Does not apply	Does not apply	14,700
Future costs (construction + maintenance)	(PV)	(Cash)	Does not apply
	288,000	1,180,000	
Other	0	0	0
Contributions (Runswick Bay Coastal Protection Trust (£100k) & Yorkshire Water (£200k excluding 30% optimism bias))			-300,000
	(1)	(2)	(3)
Total	1,550,000	2,770,000	1,040,000

Economic summary and Outcome Measures

1.4.9 The contributions to Outcome Measures (OMs) relate to the economic benefits, and the protection of properties from erosion. The scheme is scheduled to be completed in 2016/17 and the benefits are assessed to accrue in that year.

Table 1.2 Defra outcome measures and score

Contributions to outcome measures	
Outcome 1 – Ratio of whole-life benefits to costs	
Present value benefits (£ thousands)	21,100
Present value costs (£ thousands) (excluding contributions)	1,550
Benefit:cost ratio (excluding contributions)	14 to 1
Outcome 2 – Households at reduced flood risk (number – nr)	
2b – Households moved from very significant or significant risk to moderate or low risk (nr)	0
2c – Proportion of households in 2b that are in the 20% most deprived areas (nr)	0
Outcome 3 – Households with reduced risk of erosion (nr)	
3b – Proportion of those in 3 protected from loss within 20 years (nr)	96
3c – Proportion of households in 3b that are in the 20% most deprived areas (nr)	92
Outcome 4 – Water framework directive	
4a – Hectares of water-dependent habitat created or improved (ha)	0
4b – Hectares of intertidal habitat created (ha)	0
4c – Kilometres of river protected (km)	0
Raw Partnership Funding score (%)	206
Non-Flood Coastal Erosion Risk Management Grant in Aid (FCRM GiA) contributions towards the scheme's whole-life costs excluding OB (£ thousands)	300
Adjusted Partnership-Funding score (%)	235

1.4.10 It estimated that 92 residential properties will be lost from the lower village in the medium term and a further 4 properties in the long term in a 'do nothing' scenario. These 96 properties are all in the 21–

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40% most deprived areas band. Additional residential properties in the upper village are at a much lower risk of loss, and consequently have not been included in the OM assessment.

Funding and contributions

- 1.4.11 It is anticipated that funding of the preferred option will be through FCRM GiA supported by contributions. At the project funding group meeting (held on 6th March 2014) a declaration by the Runswick Bay Coastal Protection Trust indicated that a significant contribution of £100,000 is currently held in Trust towards a capital scheme.
- 1.4.12 Yorkshire Water installed and now maintain the foul water pumping station located on the seawall. In addition they have pipework within the foreshore to which they would lose some access if the preferred scheme option was taken forward. Consequently Yorkshire Water have proposed re-locating their inflow pipework out of the foreshore to within the existing seawall footprint, although the existing storm water overflow pipe would remain. Yorkshire Water would pay for the re-location work as a contribution in kind. Whilst no firm estimate has been developed, based upon preliminary discussions a budget cost of £200,000 (excluding 30% optimism bias) to undertake the works has been included.

Key delivery risks

- 1.4.13 The table below sets out what are considered to be the high level project risks.

Table 1.3 Risks and mitigation

Key delivery risk	Mitigation
Defence failure before implementation of the works	Ongoing monitoring and maintenance, including prompt inspection and repairs following storms.
Lack of approval by EA to this PAR	Ensure that business case is prepared in line with EA appraisal guidance. Undertake early liaison with EA.
Lack of agreement from Natural England	Letter of comfort received. Ongoing dialogue with Natural England to ensure that environmental reporting meets the necessary mitigations.
Cost estimates prove to be low	Confirm key rates with contractor. Optimism bias of 30% applied to all major costs following discussions with a contractor/rock supplier. Undertake appropriate sensitivity checks to key rate items.
Yorkshire Water fail to secure internal approval to funding service diversion	YW previously advised via email that the investment needed for the sewer relocation has been prioritised into their programme. Following design (of the diversion) the scheme would be submitted for authorisation of expenditure. Further to a meeting on the 9th October 2015, YW confirmed their continued commitment to deliver an investment partnership opportunity at Runswick Bay, that benefits all contributing parties and provides the necessary sea defences to the village (YW letter dated 21st October 2015). Residual risk is now considered to be low.

1.5 Recommendation

- 1.5.1 It is recommended that approval be given for the Runswick Bay Coast Protection Scheme preferred option of a rock armour fillet (Option 6), rock armour placement at a cost of £1,040,000 (incl. £14,700 inflation, £390,000 contingency (95%ile) & £300,000 external private funding contribution).

1.6 Briefing paper

Risk management authority	Scarborough Borough Council		Project Executive	Stewart Rowe	
Project title	Runswick Bay Coastal Protection Scheme		Code	SBC8	
Consultant	CH2M	Contractor	n/a	Cost consultant	n/a
The problem	The coastal defences protecting the village are at an increasing risk of seawall deterioration and toe erosion. Failure or loss of even part of the existing defence structures at Runswick Bay could have serious and relatively rapid implications for the properties and infrastructure founded on the protected coastal slopes.				
Assets at risk from flooding or erosion	The whole village of Runswick Bay, including a total of 96 residential and 17 non-residential properties access road to village, car parks and popular amenity beach.				
Existing standard of flood protection	n/a		Proposed standard of flood protection	n/a	
Description of proposed scheme	Construction of a rock armour fillet to the existing seawall, extending from the existing concrete groyne to the cliffs beyond the northern seawall.				
Costs (PVC) £ (100-year life including maintenance)	£ 1,200,000 (incl. contribution)	Benefits (PVb) £	£ 21,100,000	Average benefit:cost ratio (PVb/PVc)	18 to 1
NPV £	£ 19,900,000	Incremental benefit:cost ratio	11 to 1	Whole-life cost £ (cash value)	£ 2,770,000
Choice of preferred option	Option 6 - Rock Armour Fillet				
Total eligible cost of the capital grant applied for	£ (including £ 14,700 inflation, £ 390,000 contingency (95%) & £ 300,000 ext. contribution)				1,040,000
Delivery programme	Planning approval		May 2016		
	Award construction contract		August 2016		
	Start date of construction		September-October 2016		
	End date of construction		March 2017		
	End of project		December 2017		
Are funds available for the delivery of this project?		Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>			
External approvals	Planning permission MMO marine licence Crown Estate consent Yorkshire Water agreement				
Partnership Funding and Outcome Measures	Contributions to Outcome Measures 1-4		OM1 - PV Benefits (£21,100k), PV Costs (£1,550k), B/C ratio 14/1 (excl. contributions) or 18/1 (incl. contributions) OM3 - 96 Number properties		
	Raw Partnership Funding score		206		
	Adjusted score		235		

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1.7 Key plans

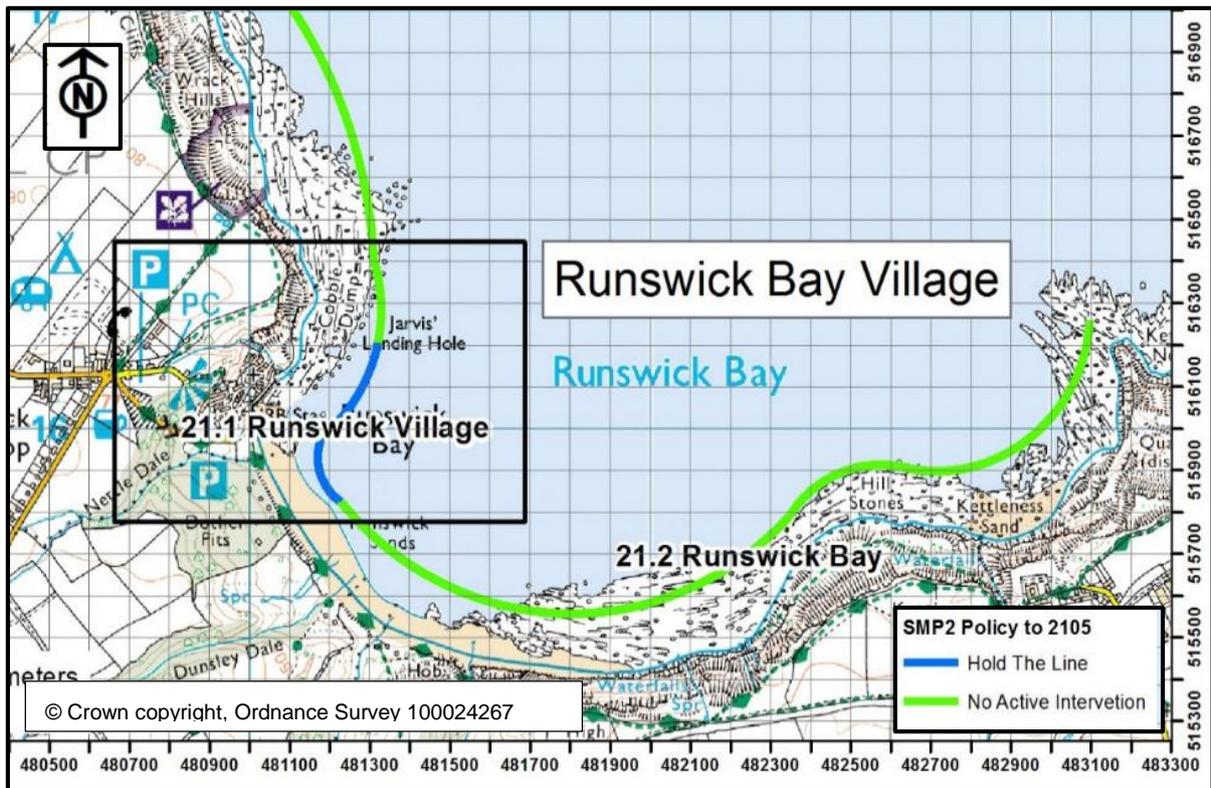


Figure 1.1: Runswick Bay location and SMP Policy Units

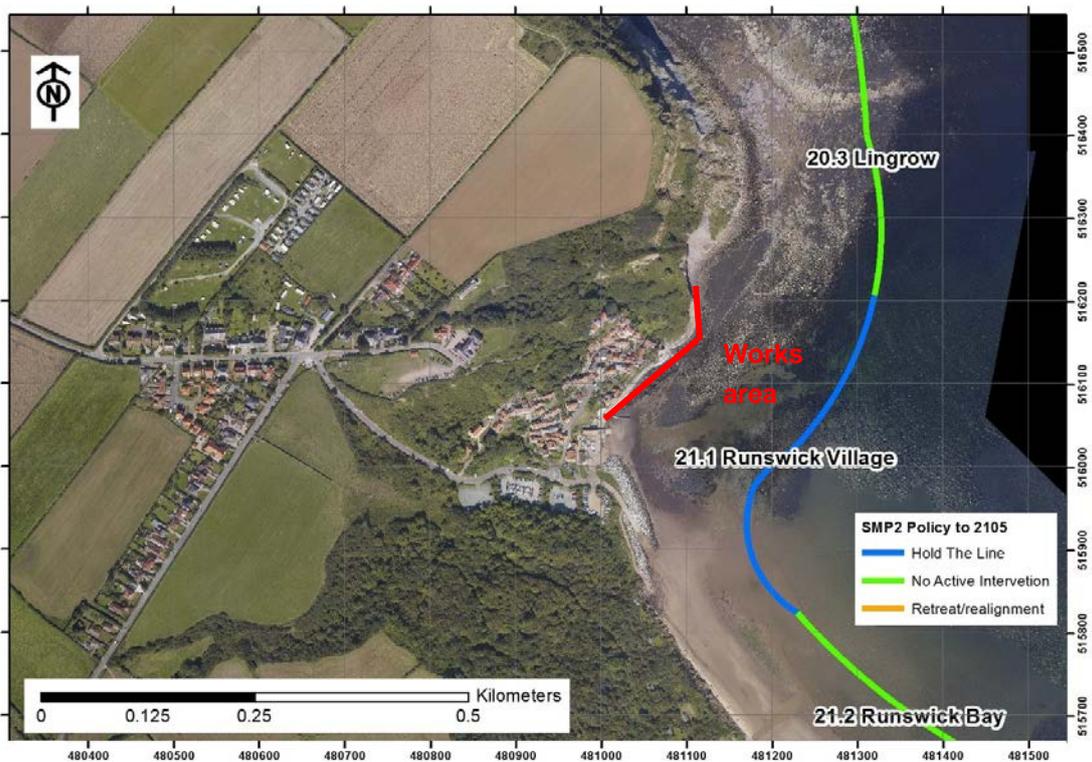


Figure 1.2: Runswick Bay works area

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2 Introduction and background

2.1 Purpose of this report

- 2.1.1 The purpose of this report is to support an application for Flood and Coastal Erosion Risk Management Grant in Aid (FCRM GiA) funding for the Runswick Bay Coastal Protection Scheme, and to seek approval to undertake the works.
- 2.1.2 This report presents the business case for implementation of the approved Strategy for this frontage. The appraisal has been carried out in accordance with Flood and Coastal Erosion Risk Management Appraisal Guidance (FCRM-AG) and associated Environment Agency policies and procedures.

2.2 Background

Strategic and legislative framework

- 2.2.1 The Runswick Bay Coastal Strategy (the Strategy) was developed during 2013/14, and was approved in May 2015, to identify the preferred strategic approach for managing flood and coastal erosion risk to the coastal frontage extending from Thorndale Shaft (to the north) and Sandsend Ness, North Yorkshire, a length of approximately 7 kilometres. It includes the communities of Runswick Bay Village and the smaller settlements of Port Mulgrave and Kettleness. The length of coastline covered by the Strategy is included within the River Tyne to Flamborough Head Shoreline Management Plan (SMP2).
- 2.2.2 The Strategy was developed through the involvement of a Project Steering Group led by SBC and including the Environment Agency, North Yorkshire County Council, North York Moors National Park Authority, North Yorkshire & Cleveland Coastal Forum, Natural England, Runswick Bay Home Owners Association, The Mulgrave Estate, Local Councillors and Local Parish Representatives.
- 2.2.3 At an early stage the Strategy confirmed that the primary area of concern is Runswick Bay Village, north of the lifeboat station. The main problem at this location is the ongoing risk of seawall deterioration, toe erosion and the implications for the stability of the slopes behind. Failure or loss of even part of the existing defence structures at Runswick Bay could have serious and relatively rapid implications. Around 96 residential and 17 non-residential properties are considered to be at risk from coastal erosion, along with local roads and other infrastructure.
- 2.2.4 Elsewhere, at the settlements of Port Mulgrave and Kettleness the current risk to properties and infrastructure was assessed to be low.
- 2.2.5 The Strategy encompasses five SMP2 Policy Units, from Port Mulgrave to Kettleness. For Runswick Bay Village the recommended policy options are 'Hold the Line' through all three epochs. The policy options at Port Mulgrave are 'Retreat or Realign' in the first two epochs, no active intervention (NAI) thereafter. For Lingrow, Runswick Bay and Kettleness the policy options are all NAI.
- 2.2.6 In line with the SMP2 the Strategy focussed on additional coastal protection measures at Runswick Bay Village. For the remainder of the study area frontage between Thorndale Shaft and Sandsend Ness it was concluded that ongoing monitoring would be adequate at this stage. It may be necessary for occasional intervention to make safe, for example at Port Mulgrave following storm damage.

Previous studies

- 2.2.7 A number of studies have been undertaken over past years, looking at slope stability, seawall deterioration and overtopping, and options to manage these problems. Three key studies which informed the Strategy and this scheme are:
- Runswick Bay Coastal Strategy Rapid Risk Assessment, High-Point Rendel (1998);
 - Runswick Bay Coastal Defence Strategy Study, HR Wallingford (2001);
 - Runswick Bay Coastal Defence Strategy Study Cauldron Cliff to Kettleness Point, High-Point Rendel (2002).

Social and political background

- 2.2.8 As noted in the Strategy, Runswick Bay Village is extremely popular with tourists and artists due to its very picturesque setting on the hillside and within the bay. Ongoing protection would preserve not only the existing village community but also one of the most popular holiday destinations along the Yorkshire coast.

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Location and designations

- 2.2.9 Runswick Bay is formed between the bedrock headlands of Caldron Cliff to the north and Kettle Ness to the south and comprises a deeply indented sandy bay approximately 2 km in length that is cut in softer glacial sediments. The margins of the bay are backed by steep cliffs of Jurassic shale and sandstone while its centre is backed by less-steep slopes of superficial glacial sediments that are deeply incised by streams. Both the glacial sediments and the bedrock are prone to instability and thick sequences of landslide debris have been commonly encountered.
- 2.2.10 The village of Runswick Bay is developed between the valleys of the Runswick and Nettledale Becks in the north-western part of the bay. Most of the eastern part of the village is founded on weathered shale and associated landslide debris. Properties further west and the access road (Runswick Bank) and car parks are founded on glacial sediments that have been affected by landsliding to a depth of many metres. The village is fronted by four separate sea defences, of varying age and construction, which stretch from Runswick Beck north of Caldron Cliff south to Nettledale Beck.
- 2.2.11 There are no Ramsar Sites, Special Protection Areas (SPA), Special Areas of Conservation (SAC), Scheduled Monuments or Protected Wreck Sites within the Runswick Bay area. The Runswick Bay Site of Special Scientific Interest (SSSI) is some distance north of the proposed works.
- 2.2.12 The whole of the strategy study area, including Runswick Bay Village, is within the North York Moors National Park. This area was designated as a National Park in 1952, due to its diverse landscape of moorland, dales, woodland and coast. Also, the area of Runswick Bay, in addition to other coastal regions along this stretch of coast, has been defined as a Heritage Coast for its landforms and abundance of minerals and fossils and is known as a coastline of tall cliffs and secluded bays. The village and surrounding coastline at Runswick are some of the most scenically outstanding areas of the National Park and Heritage Coast attracting thousands of visitors each year.

History of coastal erosion and slope instability

- 2.2.13 This area of coast consists of unstable cliffs susceptible to landslides, which are made up of soft Jurassic bed rock and weak glacial sediments. Ongoing erosion of these different rocks has formed the indented coastline seen today, with embayments at Runswick Bay and Port Mulgrave and intervening headlands.
- 2.2.14 Runswick Bay has a long history of slope instability, the first recorded slope failures occurred in 1682 when the whole village, located further north than at present, collapsed towards the shore. Successive landslips of varying severity occurred in 1873, 1953 and, in 1958 when the old road was closed twice in one week due to landslides. This road was abandoned in 1961 with the construction in 1961 and 1963 of a new access road on its present alignment further to the west. Around the same time a sea wall extension and new car park were constructed at the base of this road. Landslips and rock falls were experienced immediately north of the village during the 1970's, including a landslip at Rose Cottage in 1975, resulting in the loss of various assets.
- 2.2.15 A mass concrete sea-wall constructed in 1970 provided coastal protection to the southern edge of the village, access road and car park areas. Following its construction, the seawall was subjected to a combination of marine and land based erosional mechanisms causing the wall to move in a seaward direction with backwards rotational tilting. Seawall deterioration and failure was caused by earth pressure loading from slope failures behind the wall, beach erosion exposing the toe of the wall and wall toe failure of the fractured and folded shale bedrock (Mouchel 2012). This sea wall was replaced by rock armour by the Emergency Works scheme in 1999-2000.

2.3 Current approach to slope instability and coastal erosion risk management

Measures to manage slope instability and coastal erosion

- 2.3.1 Two monitoring programmes have been implemented. Scarborough Borough Council (SBC) conduct a ground movement monitoring programme for a number of sites along the North Yorkshire coastline, which includes the collection and analysis of all groundwater and ground movement data every 6 months. At Runswick Bay this involves monitoring inclinometers and taking groundwater readings in the area of the southern defences.
- 2.3.2 In addition the Cell 1 Regional Coastal Monitoring Programme (Cell 1 RCMP), which includes strategic monitoring of the whole of the Cell 1 coast, comprises topographic survey of the beach at Runswick

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Bay every 6 months, 2-yearly walkover inspection of asset condition and cliff activity and 2-yearly collection and analysis of aerial photography and LiDAR data.

2.3.3 Whilst slope stability and coastal protection are the dominant issues at Runswick Village, wave overtopping discharges were also assessed to be in excess of suggested tolerable discharges.

Measures to manage the consequences of slope instability and coastal erosion

2.3.4 At this time there are no specific measures in place to manage the consequences of erosion or slope failure.

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3 Problem definition and objectives

3.1 Outline of the problem

- 3.1.1 The main problem at Runswick Bay Village is the ongoing risk of seawall deterioration, toe erosion and the implications for the stability of the slopes behind. In recent years, erosion has been more common, which suggests a loss of beach material from the bay and increased exposure of the seawalls and cliffs. Inspections undertaken in 2012 identified for example significant cracking in the wall running below the village properties, and undercutting of the toe in several locations. In addition the northern seawall is cracked and damaged, and there is erosion of the rocky foreshore and undercutting of the seawall.
- 3.1.2 On 5th December 2013 a significant storm surge, driven by strong northerly winds, coincided with one of the highest astronomical tides of the year. Significant elements of the patchwork defences north of the RNLI building were damaged and removed by the sea. The Runswick Bay Rescue Boat (RBRB) timber slipway was also damaged.
- 3.1.3 Wave overtopping is also a problem, causing occasional damage to properties and slopes behind the existing seawalls. Calculations indicate that in the do nothing scenario overtopping discharges at the Runswick Village seawall would reach around 3.5 litres per second per metre (l/s/m) during a storm event having a 2% annual probability (1 in 50 year return period), increasing to 22 l/s/m for a 0.05% annual probability event. These figures are much higher than the mean discharge limit of 0.1 l/s/m for an “aware pedestrian with a clear view of the sea, not easily upset or frightened and able to tolerate getting wet” (reference EurOtop, Wave Overtopping of Sea Defences and Related Structures: Assessment Manual).
- 3.1.4 Currently patch and repair works are undertaken on an as-required basis by SBC. This approach is reasonably effective but over time the overall integrity of the seawall is likely to reduce, and there is always the risk of storm conditions leading to failure before remedial works can be undertaken. Consequently it is not considered to be a sustainable approach much beyond the short-term.
- 3.1.5 The issues at Runswick Bay Village will be exacerbated over time with climate change. As sea levels rise increased water depths will allow larger waves to propagate further up the beach and cause greater damage to the existing defences. In areas where overtopping is an issue this will also be significantly amplified.
- 3.1.6 The UKCP09 projections have been reviewed to assess the most recent sea level rise projections. The data for the medium emissions scenario for Runswick Bay was extracted from the UK Climate Projections website. The predictions are based on a spread of probabilities for reactions of sea level to climate change. The central estimate which predicts an increase of 0.42m in sea level, is considered to be the most likely and has been used in the assessment of risk.
- 3.1.7 Failure or loss of even part of the existing defence structures at Runswick Bay Village could have serious and relatively rapid implications. With reference to the Cliff Instability and Erosion Risk Mapping (2015 StAR), along the village frontage the defences protect an extensive area of soft glacial settlements. Loss of part or all of the existing seawall would probably lead to rapid toe erosion, with the potential to cause landslides and accelerated material loss. Equally failure of the northern seawall could trigger re-activation of the “old village slip” (the landslide that caused the village to largely disappear in the 17th century).
- 3.1.8 Given the ongoing deterioration of the existing defences, the potential impacts of storms on the defences such as the one that occurred in December 2013, and the significance of the consequences should the defences fail, it is considered necessary to intervene as soon as possible.
- 3.1.9 There is also an issue relating to bathing water quality. Close to the end of the access ramp to the beach, to the South of the Lifeboat Station, there is a tendency for seaweed to collect between the two lines of rock armour. This is also the area where the Nettledale Beck emerges through the rock armour onto the beach. Odorous ponds can develop in certain conditions, and this also inhibits access to the beach.

3.2 Consequences of doing nothing

- 3.2.1 Under the do nothing scenario, no measures would be undertaken to prevent deterioration of the seawalls, toe erosion and ongoing erosion of exposed cliffs. (Appendix K risk map and technical note

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refer). Seawall damage and failures would not be addressed, leading to an acceleration of structural damage, cliff exposure and subsequent erosion, all compounded by sea level rise. The actual rate of deterioration and time to significant failure is difficult to predict, however there is potential for the defences to unravel quite quickly leading to significant erosion and the initiation of landslides. In the medium to long term the village would need to be abandoned.

- 3.2.2 A range of assets would be at risk including residential and non-residential properties, and various infrastructure and recreational assets. Most of the properties in the village are second homes or holiday lets – SBC advise that 12 properties are first homes occupied on a permanent basis. There are also a number of Grade II listed buildings. With regard to the natural environment, there is a potential to revert to a more natural coast in the long term, but it is anticipated that there would be short term impacts such as pollution due to erosion damage to sewerage infrastructure and smothering of seabed habitats with debris from erosion.
- 3.2.3 Once the seawall has failed the access road and paths to the majority of the properties in the lower village (post code area TS13 5HU) would be lost - this is estimated to occur within 3 to 10 years. The other post code area in the lower village, TS13 5HT, has some properties with an access lane coming off the main road down the cliff just above the car parks and so these properties are assumed to be lost over a longer period of time. There is also a risk that cliff failures and recession of the top cliff line would result in loss of properties in the upper village.
- 3.2.4 The lower car parks, sailing club boat park and access road down the cliff are protected by the rock armour defences and cliff stabilisation works that were completed in 2001. Whilst these works would continue to provide protection, say for up to 75 years, there is a significant risk that beyond 20 years outflanking of the defence from a failure in the village to the north, or from the active unprotected cliff to the south, could initiate loss of these assets.

Table 3.1 Runswick Bay Assumed Do Nothing Property Losses

Location	Properties at Risk	Timing of Loss
Lower village - post code area TS13 5HU	47 residential 11 non-residential	3 to 10 years
Lower village - post code area TS13 5HT	49 residential 6 non-residential	90% chance of loss between years 10 and 50
Upper village – post code area TS13 5HS	27 residential 4 non-residential	4% chance of loss within 100 years.
Upper village – post code area TS13 5JQ	5 residential	0.2% chance of loss within 100 years
Lower car park area	Access road and car parks	10% chance of loss by year 50 50% chance of loss by year 99

- 3.2.5 The numbers of properties at risk in the table above are the same as those used in the approved strategy. Subsequently more recent data has been provided by SBC (Council Tax department) which suggests there are different residential property counts in some of the post code areas. These property numbers, which are overall lower than assumed for the strategy, have been included as a sensitivity test (see Section 6.2 below).

3.3 Strategic issues

- 3.3.1 The approved strategy option was Option 6 Rock armour fillet. This comprised a rock fillet approximately 2 metres high (i.e. at a crest level of +4.7m AOD) and 7-8 metres wide placed at the toe of the seawalls. The rock fillet extends from the lifeboat station northwards to approximately 40m north of the seawall at Upgarth Hill. A plan and sections of the proposed works are at Appendix D.
- 3.3.2 This option would provide protection to the toe of the seawall to limit outflanking, undermining and scour. The performance of the rock fillet would be similar but less effective than the larger scale rock apron considered for Option 3, due to the reduced quantity of rock. Nonetheless the lower face of the seawall would be protected from direct impact, the risk of scour would be reduced and overtopping would also be reduced. There would remain an ongoing need to maintain the upper parts of the existing walls, to a greater extent than expected for Option 3 to compensate for the reduced rock quantity.

- 3.3.3 There are several aspects of the proposed scheme that, at Strategy stage, were expected to need further consideration and development.
- The linear extent of the rock armour is likely to be adjusted to accommodate the existing sewers in the beach in front of the Yorkshire Water (YW) pumping station.
 - A set of access steps will be required approximately halfway between the concrete groyne and Runswick Beck.
 - The rock profile and linear extent in front of the cliffs to the north of the northern seawall will need to be refined.
 - The extent of further consultation and environmental reporting will need to be confirmed.
 - Natural England’s assent for the purposes of section 28H of the Wildlife and Countryside Act 1981 will need to be secured.
 - The position with regard to the recommended Marine Conservation Zone at Runswick Bay will need to be updated, and the impacts and any mitigation measures, such as the relocation of boulders on the rock platform, will need to be assessed in more detail as necessary.
 - The timetable for the works, including YW enabling works (sewer diversion), will need to be confirmed.
 - The scale of external contributions will need to be confirmed.

3.4 Key constraints

- 3.4.1 Key constraints include the need to:
- avoid adverse impacts on the North York Moors National Park, North Yorkshire and Cleveland Heritage Coast, the Cleveland Way National Trail, North Yorkshire Moors Important Bird Area and the Runswick Bay SSSI;
 - ensure there are no detrimental impacts or loss of extent of the proposed MCZ;
 - ensure that the strategy does not cause deterioration in the current status of the waterbodies in the area and that it supports their achievement of WFD objectives;
 - take account of the Yorkshire Water pumping station located north of the lifeboat station and slipway, and the sewers located in the foreshore;
 - timetable the scheme works to follow the enabling works to be undertaken by YW, and to be undertaken outside the main holiday season.
- 3.4.2 A Scoping Report, prepared to follow the format of the Environment Agency’s Preliminary Environmental Information (PEI) report, has been produced to support this appraisal report (Appendix N). The purpose of the Scoping Report is to:
- Consult with statutory bodies and interested parties for their views;
 - Identify issues that have been ‘scoped in’ and ‘scoped out’ of the future environmental assessment;
 - Outline the methodology for undertaking the Environmental Impact Assessment (EIA);
 - Report on partnership working opportunities; and
 - Provide a formal record of the scoping stage and the options appraisal.

3.5 Objectives

- 3.5.1 The Strategy (Section 3.3) sets out a series of high level objectives relating to the appraisal of options, development of a long-term programme of measures and funding.
- 3.5.2 At the scheme level the objectives reflect the need to take account of local constraints, including environmental issues, reflecting the key constraints listed above, for example:
- deliver environmental mitigation measures as agreed with Natural England;
 - ensure appropriate liaison with the public and other stakeholders;

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- modify the rock footprint to provide protection for and allow access to Yorkshire Water sewers;
- review methods for improving habitat colonisation of the rock armour (reference to the University of Hull research);
- incorporate access steps within the works.

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4 Options for managing the risk of coastal erosion

4.1 Potential FCERM measures

4.1.1 For Runswick Bay Village a range of potential measures was considered at strategy stage, including 'do nothing' (NAI), ongoing maintenance, minimal works, more substantial works and inspection and monitoring.

4.2 Long list of options

4.2.1 In addition to Option 1 – 'Do nothing' and Option 2 – 'Do minimum', the long list of coastal management options for more substantial works included technical solutions covering:

- Option 3 - Rock armour apron to seawall toe;
- Option 4 - Seawall buttressing;
- Option 5 - Stepped concrete revetment to the seawall;
- Option 6 - Rock armour fillet (reduced section rock armour apron);
- Option 7 - Rock groyne at Cobble Dump;
- Option 8 - Reduced rock armour fillet to seawalls (in combination with a rock groyne);
- Option 9 (A/B) - Shingle recharge (with and without rock groynes);
- Option 10 - Rock armour berm to protect exposed cliff;
- Option 11 - A fishtail rock armour groyne; and
- Option 12 - offshore breakwaters (using rock armour).

4.3 Options rejected at preliminary stage

4.3.1 All options were subject to an initial, high-level screening and the long list was presented for evaluation at a Steering Group meeting on 7 November 2013. Essentially options were rejected for reasons of safety, effectiveness of protection given, future maintenance commitment and environmental impact (aesthetic, landscape and visual amenity). These rejected options included seawall buttressing, stepped concrete revetment to the seawall, the rock groyne at Cobble Dump (as an option on its own), shingle recharge, the fishtail rock armour groyne and the offshore breakwaters. A summary of the high level screening is presented below.

Table 4.1 Summary of the long list options rejected at preliminary appraisal

Option No	Appraisal
4	Seawall buttressing - Discounted on the basis of adverse impacts on visual amenity.
5	Stepped concrete revetment to seawall - Discounted for the following reasons: likely to perform poorly due to the prevailing wave climate; it would attract algae/bio-fouling and would be slippery; and it would form a dominant, stark and severe visual feature within the bay.
9A	Shingle recharge - Discounted as the material would be unlikely to stay in place and would therefore require frequent maintenance and topping up operations.
9B	Shingle recharge with rock groynes - Discounted on that basis that this option would require a lot of maintenance and groynes are not a preferred option at amenity beaches.
10	Rock berm to protect exposed cliff - Discounted on the basis that this option was considered to provide insufficient protection to the Village.
11/12	Fishtail groyne and offshore breakwaters (Option 11 and Option 12 combined) - Discounted on the basis of high cost, health and safety implications, environmental and aesthetic/landscape/visual amenity impacts.

4.4 Options short-listed for appraisal

4.4.1 Subsequently five options, including 'do nothing' as the economic baseline, were taken forward for detailed appraisal for Runswick Bay Village. In line with the strategy objectives these were assessed

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against technical, environmental and socio-economic criteria by applying standard appraisal techniques.

- Option 1 - Do nothing (economic baseline);
- Option 2 - Do minimum;
- Option 3 - Rock apron to seawall toe;
- Option 6 - Rock armour fillet (reduced section rock apron);
- Options 7 & 8 - Rock groyne at Cobble Dump plus reduced length rock armour fillet to seawalls.

4.4.2 These options are summarised below. Indicative drawings are included in Appendix D.

Option 1 - Do nothing

4.4.3 This option is the economic baseline. It is a zero cost option; no repair, maintenance or other works would be carried out other than necessary actions to deal with immediate health and safety risks. The consequences of this option are discussed in Section 3.2 above.

Option 2 - Do minimum

4.4.4 This option is a low cost maintenance option providing limited risk reduction and consequently limited benefits. It would consist of patch and repair works to the seawalls, and monitoring to provide early warning of any significant problems. However, it would not include for large scale repair works and consequently may have a limited design life.

4.4.5 This option effectively adopts a reactive maintenance approach. Monitoring of the seawalls would identify the occurrence of problems at an early stage so that repair works could be undertaken before problems escalated. It would include for example patch repairs to areas of concrete spalling or cracking, repair or replacement of loose or missing blockwork, repairs to access steps.

4.4.6 If repairs are undertaken effectively and carried out in a timely manner this type of do minimum approach can be effective. It follows that this option is highly dependent upon regular monitoring, including post-storm surveys, and prompt repairs. There also remains the risk that storm events would cause significant damage before any remedial works could be carried out. It is considered that this option would only be viable for a limited period of time, say around 20 years, after which it would revert to 'do nothing'. Overall it is not considered to meet objectives to reduced flood and erosion risks in the long term.

Option 3 - Rock armour apron

4.4.7 The option comprises the protection of the seawalls by the placement of rock armour aprons at the toe. The rock aprons, which would be similar to the existing rock revetment south of the village, would extend from the lifeboat station to the outlet of Runswick Beck, and then around the convex seawall at Upgarth Hill tapering out along the cliff toe.

4.4.8 A 3 metre berm (at crest level of +6.0m AOD) and slope of 1 in 2, giving overall apron widths of 12 or 13 metres has been assumed, using rock provisionally sized at 3 to 6 tonnes.

4.4.9 The primary reason for protecting the toe of the seawalls is to reduce the amount of wave energy reaching the walls. Rock is very effective for a number of reasons. It is very good at dissipating wave energy, and would significantly reduce the energy reaching the walls themselves and reduce overtopping. This energy dissipation would also encourage any available sediments to settle. The rock also provides additional weight at the toe of the structure which improves overall seawall stability. Further, if limited erosion of the beach was to occur the rock could settle without losing the overall integrity of the apron.

4.4.10 Ongoing maintenance of the exposed upper part of the seawalls would still be required but this would be significantly less due to the protection provided by the rock apron. In addition, no special measures would need to be undertaken to ensure that drainage through the seawall remained uninterrupted.

4.4.11 A rock structure of this type would be expected to last with minimal maintenance for 100 years plus. The most likely maintenance work would be the reinstatement of any displaced rocks.

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Option 6 - Rock armour fillet

- 4.4.12 A rock armour fillet approximately 2 metres high (i.e. at a crest level of +4.7m AOD) and 7 to 8 metres wide would be placed at the toe of the seawalls and extend some 30 or 40m north of the seawall at Upgarth Hill.
- 4.4.13 This option would provide protection to the toe of the seawall to limit outflanking, undermining and scour. The performance of the rock armour fillet would be similar but less effective than Option 3, due to the reduced quantity of rock. Nonetheless the lower face of the seawall would be protected from direct impact, the risk of scour would be reduced and overtopping would also be reduced. There would remain an ongoing need to maintain the upper parts of the existing walls, to a greater extent than expected for Option 3 to compensate for the reduced rock quantity.

Options 7&8 - Rock groyne with reduced length rock armour fillet

- 4.4.14 This option comprises a rock groyne at Cobble Dump (Option 7), with the addition of a rock armour fillet approximately 2 metres high which would be placed at the toe of the seawalls. The fillet would be to the same profile as Option 6, but would not extend as far along the seawall. North of the Upgarth Hill (northern) seawall, shelter from the predominant northerly waves would be provided by the rock groyne.
- 4.4.15 The rock groyne would consist of 3 to 6 tonne rock with a core of locally-sourced rock. Crest level would be at 4.5m ODN 2 metres wide. The rock fillet would use similar size rock armour with a 2m wide berm and apron slope at 1 in 2 approximately 5.5m wide.
- 4.4.16 The rock armour fillet would provide protection to the toe of the seawall to limit undermining and scour. The performance would be limited compared to a more substantial rock apron (as in Option 3), but the lower face of the seawall would be protected from direct impact and the risk of scour would be reduced. The rock groyne would provide protection to the undefended area to the north of the seawall, reducing the risk of outflanking.

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5 Options appraisal and comparison

5.1 Technical issues

- 5.1.1 The primary objective of the do something options is to protect the frontage from erosion through maintenance or enhancement of the existing defences. **Option 2** - do minimum relies on effective and timely repairs being undertaken to the existing defences themselves. Unlike the other three do something options this approach is very dependent upon frequent inspection, particularly after storm events, to identify any deterioration of the existing seawalls. In addition it is not always easy to undertake repairs to a standard equivalent to the original wall construction.
- 5.1.2 **Option 3** involves the placement of a rock armour apron in front of the existing seawalls. It is assumed that rock delivery would be by sea, a well-established approach for this type of work. At this stage rock type, sourcing and detailed delivery techniques have not been established. Good performance of the apron would depend upon correct sizing of the main armour and underlayer, as well as controlled placement, to minimise the risk of rock displacement. The existing rock armour at the slipway is a good indicator of what would be required. One access to the beach through the rock would be required linking in with the existing steps in the wall.
- 5.1.3 A rock apron of this type would be effective in reducing wave energy before it reaches the existing seawalls, reducing the risk of further seawall damage and undercutting, reducing overtopping and encouraging sediment deposition.
- 5.1.4 The footprint of Option 3 would cover portions of the Yorkshire Water sewers that run down from the village and extend onto the beach, and then along the beach to the pumping station. It is very unlikely that the apron could be configured to avoid covering the sewers and still maintain its full integrity as a defence, and a sewer diversion would be required. It should be noted that Yorkshire Water have agreed to co-operate with SBC in promoting a rock revetment scheme by undertaking any sewer diversion works deemed necessary (refer to Appendix R).
- 5.1.5 **Option 6**, the rock armour fillet, is a cut-down version of Option 3, having the same attributes but to a lower level. The reduced volume of rock would provide reduced energy dissipation, and the smaller profile (lower berm level, narrower overall profile) would allow more waves to reach the existing seawalls. However, crucially the toe of the existing seawall would be protected so that the risk of undermining and seawall instability would still be reduced. Given the reduced profile the rock size would need to be optimised for the layer thickness.
- 5.1.6 As Option 3 there would be an issue with covering Yorkshire Water sewers, and again diversion works would be required. Again one access to the beach through the rock would be required.
- 5.1.7 The final option, **Options 7&8**, is a combined (reduced length) rock armour fillet and rock groyne option. The rock fillet would be the same as Option 6, but would not extend as far northwards. Instead a rock groyne or bund would be constructed running perpendicular to the coast, to intercept waves coming from the north, the predominant wave direction. The intention would be for large northerly waves to be forced to break, limiting the size of waves (and amount of wave energy) reaching the area north of the Upgarth seawall, and to an extent the northern seawall itself.
- 5.1.8 The performance of this combined option would be expected to be the same as Option 6. The key uncertainty is the effectiveness of the rock groyne, and further work would be required to confirm the groyne length, crest level and location to ensure that it is optimised. In addition possible impacts on sediment supply would need to be considered.
- 5.1.9 The issues relating to the Yorkshire Water sewers are the same as for Option 6.
- 5.1.10 The impacts of future sea level rise on the three major options would vary. For Option 3 it would lead to larger waves impinging on the rock, but the rock apron would retain its integrity and any reduction in effectiveness would be relatively limited. Sea level rise would potentially be more of an issue with Option 6, simply because the volume of rock is smaller than Option 3. Consequently increases in water level and wave height have more potential to impact upon the existing seawall. However, as long as the rock was not displaced the toe of the seawall would remain protected.

For the rock armour fillet in Options 7&8 the comments on the impacts of sea level rise for Option 6 are relevant. With regard to the groyne, the design would need to assess the appropriate crest level to ensure that sufficient wave energy was being dissipated even with increases in water level over time.

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5.2 Environmental assessment

5.2.1 A Strategic Environmental Assessment (SEA) was undertaken to appraise the potential effects arising from strategy options, and to ensure that environmental considerations were taken into account during the strategy level decision-making process. The scoping process was initially undertaken for the SEA at the Environmental Scoping Consultation Stage. Consultation was undertaken with Natural England, the Environment Agency, English Heritage, Yorkshire Water, National Trust, North York Moors National Park Authority, North Yorkshire and Cleveland Heritage Coast, North Yorkshire Council, Crown Estate, the Marine Management Organisation and the North Eastern Inshore Fisheries and Conservation Authority. There was a further review of the scope in April 2014, when key stakeholders and the public were consulted on the Draft SEA ER.

5.2.2 The potential environmental effects which could result from the scheme have also been assessed in outline and documented in the Scoping Report. The Scoping Report supports the business case, refer to Appendix N, and will inform future detailed design phases of the project, ensuring that environmental opportunities and constraints are considered throughout. The following table summarises the key environmental impacts for the short-listed options and also flags any mitigation or enhancement opportunities. A detailed table of environmental effects is included in Appendix A of the Scoping Report.

Table 5.1 Key environmental effects, mitigation and opportunities

Key positive effects	Key negative effects	Mitigation or enhancement opportunity				
Option 1 - Do nothing						
<ul style="list-style-type: none"> in the medium term, this option would allow for a naturally functioning coastline to develop, which would have minor positive effects in the medium to long term and would achieve Strategy objectives linked to 'naturalness and natural evolution of the coast' 	<ul style="list-style-type: none"> would not maintain the current standard of protection loss of the majority of properties in the lower village in the short term, and access to the lower village and properties in the upper village in the longer term, with complete failure of the defences leading to significant erosion, landslides and abandonment of the Village in the medium to long term major adverse impact on cultural and architectural heritage major adverse impact on local infrastructure 	Not applicable				
Option 2 - Do minimum						
<ul style="list-style-type: none"> this option would maintain (but not improve) the existing standard of defence in the short term in the longer term, this option would allow for a naturally functioning coastline to develop, which would have minor positive effects in the long term and would achieve Strategy objectives linked to 'naturalness and natural evolution of the coast' 	<ul style="list-style-type: none"> increase in the frequency and level of intervention required to maintain the defences. The seawall would deteriorate and fail in the medium term loss of the majority of properties in the lower village in the medium term, and access to the lower village and properties in the upper village in the longer term, with complete failure of the defences leading to significant erosion, landslides and abandonment of the Village in the long term major adverse impact in the long term on cultural and architectural heritage major loss of local infrastructure in the long term 	Any patch repairs should have surface texture added to the concrete walls to increase colonisation potential				
Option 3 - Rock apron to seawall toe						
<ul style="list-style-type: none"> major beneficial impacts in terms of flood protection for residents, the local economy and community structure, and the protection of the Runswick Bay 	<ul style="list-style-type: none"> major adverse impacts on ecology in the medium and long term due to a loss of inter-tidal habitat from coastal squeeze associated with sea level rise within area of recommended MCZ, although 	<ul style="list-style-type: none"> provision of additional access from the promenade area to the beach 				
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Key positive effects	Key negative effects	Mitigation or enhancement opportunity
<p>village from erosion and dereliction</p> <ul style="list-style-type: none"> beneficial in terms of the visual appearance of the built townscape which would otherwise be lost to erosion (balancing the adverse impact on the natural landscape) major beneficial impact on the cultural heritage interest of the village and its contribution to the interest of the North Yorkshire Moors National Park and the Yorkshire and Cleveland National Trail major beneficial impact on local infrastructure 	<p>this is currently an area of relatively low ecological value</p> <ul style="list-style-type: none"> major adverse impact associated on the natural landscape and seascape as the defences would not allow the landscape to respond to the existing environmental conditions (balancing the adverse impact on the built townscape) short-term disruption during construction works 	<ul style="list-style-type: none"> Measures (including warning signs) would be required to reduce the risk of harm from clambering over rock boulders During construction undertake good construction practices
Option 6 - Rock armour fillet (reduced section rock apron)		
As Option 3	<ul style="list-style-type: none"> minor adverse impacts on ecology in the medium and long term due to a loss of inter-tidal habitat from coastal squeeze associated with sea level rise. However, the reduced footprint would result in less impact on the ecology of the inter-tidal area compared to the rock apron (Option 3) adverse impact associated on the natural landscape and seascape as the defences would not allow the landscape to respond to the existing environmental conditions, albeit a lower level of visual impact as a result of the smaller scale and footprint of the rock armour fillet compared to the rock armour apron (Option 3) short-term disruption during construction works 	As Option 3
Options 7&8 - Rock groyne at Cobble Dump plus reduced length rock armour fillet to seawalls		
As Options 3 and 6 but to lower level than Option 6 due to greater visual impact on setting	<ul style="list-style-type: none"> higher levels of adverse impact compared to those associated with Option 3 and Option 6 (with a similar adverse impact of the natural landscape as the defences would not allow the landscape to respond to the existing environmental conditions) higher level of adverse visual impact on the built landscape and cultural heritage compared to rock fillet (Option 6) as a result of the construction of the groyne within the bay, which would represent a new element on the landscape in addition to the rock apron or fillet in front of the built landscape of the Village increased footprint compared to rock armour fillet (Option 6) as a result of the new rock groyne would result in a greater impact on the ecology of the inter-tidal area within the recommended MCZ short-term disruption during construction works 	As Options 3 and 6

5.3 Social and community effects

- 5.3.1 For Runswick Bay Village the key concern for home-owners and businesses is the long term protection of property and assets from erosion and potentially cliff instability. Tied into this is the need to maintain the village as a very popular tourist destination. In the absence of a programme of measures to provide protection there would be both actual losses and the stress of dealing with those losses.
- 5.3.2 Clearly do nothing would not provide protection. Do minimum would defer the problem by providing short-term protection, but formal adoption of this approach would almost certainly have present-day consequences with regard to, for example, property prices and health implications with increased stress.
- 5.3.3 From an economic perspective all three major do something options would provide virtually equivalent longer term protection to the Village. However the public consultation suggested that these three options were not perceived in exactly the same way. Clearly the implementation of any of these options would provide reassurance and reduce stress for home-owners, businesses and other asset owners. However Option 3 was considered to provide the greatest level of reassurance as it was less dependent upon downstream works.

5.4 Option costs

- 5.4.1 The derivation of capital, maintenance and other costs for each of the village protection options is briefly summarised below. All options include a 30% Optimism Bias added to the present value (PV) cost estimate for all works. Whilst full investigations and design have not yet been carried out it is considered to be a reasonable percentage contingency given the nature of the work and inquiries made with a framework contractor. No adjustment between options has been made.
- 5.4.2 Cost rates within the strategy were drawn from several sources including the Environment Agency's "Flood Risk management Estimating Guide – Update 2010", other recent PARs, and SPONs Civil Engineering and Highway Works Price Book (2009).
- 5.4.3 The key cost component in the three main do-something options is the primary rock armour. Since the strategy discussions have been held with a national contractor undertaking rock armour works in the region. The contractor's quoted primary rock armour rate was slightly under the rate used in the strategy, but was a competitive rate that might not be realised for this scheme. The advice was to add 5% to this rate, and consequently the strategy rate of £110.66 per cubic metre has been retained. Likewise a 5% increase has been added to the contractor's underlayer rate, giving a rate for estimating purposes of £97 per cubic metre.
- 5.4.4 Given the dependence of the overall scheme cost upon these rates they have been the subject of an onerous sensitivity test (armour rock +50%, underlayer +30%).
- 5.4.5 All costs (and benefits) have been adjusted to a base date of March 2015. Based upon indices published by the Office for National Statistics a reasonable estimate of cost uplift between the date of the original estimates, August 2013 and March 2015 is 4%. This uplift has been applied to all costs except rock armour and rock underlayer, for which contractor supplied rates have been used.
- 5.4.6 **Option 1 – Do nothing** - this has zero costs.
- 5.4.7 **Option 2 - Do minimum** - it is assumed that for the duration of this option, two post-storm site visits will be conducted to inspect the structure and provide early warning of defects. It has been assumed that patch repair of the concrete structure will on average occur at 10 year intervals. In addition, costs include annual monitoring survey costs for the seawall and also the southern defences. It is very difficult to predict when total failure may occur but it has been assumed that all expenditure will cease after 20 years. The whole life (20 yr) PV costs for this option are therefore assessed to be around £0.2m.
- 5.4.8 **Option 3 - Rock apron** - the development of the costs for the construction of a rock armour apron along the study area, with a small gap at Runswick Beck, assumes construction in 2016/17. The capital works include one set of access steps through the rock from the seawall to the beach. Maintenance works (patch repairs to existing seawall, rock armour re-profiling) are assumed to be every 20 years until year 50, and thereafter every 10 years between year 50 and year 100 due to the projected effects of climate change. The whole life (100 year) PV costs for this option are circa £2 million excluding contributions.

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- 5.4.9 **Option 6 - Rock armour fillet** - the cost build-up and maintenance frequency is similar to Option 3. Capital costs are lower but maintenance costs are higher. The cost rate for patch repairs to the existing seawall has been tripled to take account of the increased exposure of the seawall. The whole life (100 year) PV costs for this option are circa £1.3 million excluding contributions.
- 5.4.10 **Options 7&8 - Rock groyne and reduced length rock armour fillet** - again this is similar to Option 3. Capital costs are slightly lower. Although the seawall is only protected by the rock fillet as Option 6, it has been assumed that the sheltering effect of the groyne will reduce exposure of the existing seawall to wave action and consequently the cost rate for patch repairs is as Option 3. Nonetheless overall the maintenance works, which include re-profiling of both the rock armour fillet and the rock armour groyne, are estimated to cost significantly more than Option 3 and approximately twice as much as Option 6. The whole life (100 year) PV costs for this option are very similar to Option 3, circa £2 million excluding contributions.
- 5.4.11 Table 5.2 presents the PV costs of the four do something options, in order of total PV cost. Cost estimates include all inspection and monitoring costs beyond the RCMP Cell 1, which is funded separately.
- 5.4.12 In addition to the works to protect the village directly, an assessment of costs to maintain and repair the southern defences (rock armour, seawall and cliff stabilisation works) completed in 2001 has been made. These works protect the south side of the village and the beach access, and future maintenance and repair works are expected to include rock armour re-profiling, drainage works, shear key piling and concrete patch repairs every 20 years. In addition costs have been allowed for the Yorkshire Water sewer diversion and an annual survey. For the do minimum option these costs have been applied only for the duration of the option i.e. 20 years.

Table 5.2 Summary of options - present-value costs - no contributions (£ rounded)

Option number	Option 2	Option 6	Options 7 & 8	Option 3
Option name	Do Minimum (20 years)	Rock armour fillet	Rock groyne and reduced rock fillet	Rock armour apron
Capital Scheme Implementation Costs				
Construction costs	0	486,000	930,000	1,024,000
Site investigation and survey (10%)	0	48,600	93,000	102,400
Environmental mitigation (7.5%)	0	36,400	69,700	76,800
Environmental enhancement (incl.)	0	0	0	0
Site supervision (7.5%)	0	36,400	69,700	76,800
SBC staff costs	0	49,200	49,200	49,200
Consultant fees	0	54,300	54,300	54,300
Yorkshire Water service diversion	0	193,000	193,000	193,000
Optimism Bias (30%)	0	271,000	438,000	473,000
Sub Total	0	1,175,000	1,897,000	2,049,000
Maintenance (Year 0-4)				
New works maintenance	3,900	3,900	3,900	3,900
Existing southern defences maintenance	3,900	3,900	3,900	3,900
PV Other (env. etc 5%)	400	400	400	400
PV fees etc (12%)	900	900	900	900
Optimism Bias (30%)	2,700	2,700	2,700	2,700
Sub Total	11,800	11,800	11,800	11,800
Total Costs Year 0-4	11,800	1,187,000	1,909,000	2,061,000

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Future Costs (Year 5-100)				
Capital	0	0	0	0
Maintenance (new defences)	30,300	54,700	105,000	45,600
Existing southern defences maintenance	94,300	183,000	183,000	183,000
PV Other (env. etc 5%)	6,200	11,900	14,400	11,400
PV fees etc (12%)	14,900	28,600	34,600	27,500
Optimism Bias (30%)	43,700	83,500	101,000	80,400
Sub Total	189,000	362,000	439,000	348,000
Total PV Cost	201,000	1,550,000	2,350,000	2,410,000

5.4.13 Option 2 - do minimum has a significantly lower cost than the other options due to its limited scope and duration. Option 6 is the next lowest PV cost option, at around 60% of the cost of Option 3, which reflects the reduced scale of rock included in this option compared to Option 3. The PV cost of the combined Options 7&8 is similar to Option 3.

5.4.14 A financial contribution towards a capital scheme has been offered to SBC by the local residents. This is in the form of a charitable trust and based upon current information this has been estimated at £100k (PV £96,600), refer to the RBCPT letter in Appendix R, and this sum has been deducted from the first 5 year costs of Options 3, 6 and 7&8 in the table below. In addition the anticipated cost of diverting Yorkshire Water's pipelines is expected to be met by Yorkshire Water themselves as a contribution in kind (refer to YW letters in Appendix R). Currently this work is valued at £260k (PV £251,160). Consequently a total contribution of PV £347,760 has been included in Table 5.3.

Table 5.3 Summary of option PV costs - including contributions (£ rounded)

Option number	PV Costs £			
	Option 2	Option 6	Options 7 & 8	Option 3
Option name	Do minimum (20 years)	Rock armour fillet	Rock groyne and reduced length rock fillet	Rock armour apron
<i>Implementation (Year 0-5)</i>				
PV costs no contributions	11,800	1,187,000	1,909,000	2,061,000
PV value of contributions	0	348,000	348,000	348,000
PV Costs incl. contributions	11,800	839,000	1,561,000	1,713,000
<i>Future Costs (Year 6-100)</i>				
PV costs (no further contributions anticipated)	189,000	362,000	439,000	348,000
Total PV costs with no contributions	201,000	1,549,000	2,347,000	2,409,000
Total PV Cost (including contributions)	201,000	1,200,000	2,000,000	2,060,000

5.4.15 Given the scale of contributions, and that they apply equally to the three major do something options, they have no impact on option choice as the relative differences in cost remain very similar. Full details of the cost estimates are included in Appendix H.

5.5 Benefits of options (damages avoided)

5.5.1 Potential economic damages to assets at risk have been assessed as summarised below. The base date for damages is March 2015 (as costs). As for the strategy an uplift of 4% has been used for all damages compared to the base date of August 2013. The timing of property losses under the do nothing scenario are set out in Section 3.2 above.

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Residential Properties

- 5.5.2 Reference has been made to the Valuation Office website council tax valuation list (www.voa.gov.uk). In accordance with the MCM valuation of properties has used risk free market values, i.e. not taking into account reductions in value due to perceived or real erosion risks.
- 5.5.3 Within the strategy house prices were obtained from sale data provided by the Land Registry (<http://houseprices.landregistry.gov.uk/price-calculator>) and from other internet sources (www.zoopla.co.uk) for the post code area. The average prices for the post code area and property types were then assigned to the individual identified properties on the basis of council tax banding.
- 5.5.4 Due to the desirable location the property values were expected to be relatively high compared to regional averages. The average property value in the village based on sales between 1995 and 2013, using the Land Registry house price calculator, was estimated to be £271,000.

Non- Residential Properties

- 5.5.5 As above, reference has been made to the Valuation Office website. Non-residential properties include properties such as shops, self-catering holiday units, public conveniences, car parks, village reading room, sailing club building and life boat house and rescue boat station. Market values were estimated from the rateable value published by the VOA and a yield factor as described in the MCM.

Infrastructure

- 5.5.6 The Yorkshire Water Pumping Station is built into the coastal defences and has been included as a non-residential property based on its rateable value. No allowance for infrastructure such as electricity, gas, telecommunications or potable water supply has been included as it is assumed that the whole lower village would be lost at the same time. Likewise the access road into the village has not been counted as it is assumed that it would be lost at the same time as the village properties and the use of the beach.

Recreational assets

- 5.5.7 An assessment of recreational loss has been made based on annual visitor numbers, using the Value of Enjoyment methodology as detailed in Chapter 8 of the MCM (2010). Based upon available data (e.g. people count data for the Cleveland Way) it has been estimated that there are 110,000 day visitors to Runswick Bay each year. The actual loss per adult has been estimated at £2.00. Assigning failure probabilities over 100 years gives total recreational and amenity damages of £2.3m for do nothing, and £1.7m for do minimum at March 2015 values. The remaining options are considered to have no recreational and amenity damages.

Table 5.4 Summary of present-value damages (PVd) and benefits (PVb) (£ thousands rounded)

Option	Asset Damage (PVd)	Recreational Damage (PVd)	Damage (PVd)	Damage avoided	Benefits (PVb)
Option 1 - Do-nothing	19,500	2,320	21,800		
Option 2 - Do minimum (20 years)	9,770	1,650	11,400	10,400	10,400
Option 6 - Rock armour fillet	720	0	720	21,100	21,100
Options 7&8 - Rock groyne and reduced length rock fillet	720	0	720	21,100	21,100
Option 3 - Rock armour apron	720	0	720	21,100	21,100

Environmental assets

- 5.5.8 No losses or gains to environmental assets have been included in the economics.

Risk to Life

- 5.5.9 The economic damages associated with "risk to life" have not been included in the assessment. It has been assumed that any significant slope stability/landslide problem would not occur suddenly but would be a relatively slow event which would allow time for evacuation (eg. Holbeck Hall).

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5.5.10 Full details of the economic assessment are provided at Appendix G.

5.5.11 The do nothing PV damages over the 100 year appraisal period are estimated at £22m; the do minimum PV damages are about half of this figure. The remaining three options, i.e. the major do something options, are all assessed to provide the same standard of protection and consequently the same residual damages. At well under £1m these are significantly less than the 'do minimum' PV damages.

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6 Selection and details of the preferred option

6.1 Selecting the preferred option

6.1.1 The following table summarises the benefit cost assessment for the five options considered for Runswick Bay. Costs take account of anticipated contributions.

Table 6.1 Benefit - cost assessment - including contributions (rounded)

Option	PV costs (£ thousands)	PV benefits (£ thousands)	Average benefit/cost ratio (BCR)	Incremental benefit/cost ratio (BCR)	Option for incremental calculation
Option 1 - Do-nothing	0				
Option 2 - Do minimum (20 years) *	201	10,400	51.6		
Option 6 - Rock armour fillet **	1,200	21,100	17.6	10.7	Option 2
Options 7&8 - Rock groyne and reduced length rock fillet	2,000	21,100	10.5	N/A	
Option 3 - Rock armour apron	2,060	21,100	10.2	N/A	

* Highest BCR ** Economically preferred option.

6.1.2 Option 2 - do minimum has the highest average BCR but does not meet the majority of the project objectives, given that it is anticipated to be sustainable for only around 20 years before reverting to 'do nothing'. Under the FCERM guidance a move to Option 6 is economically justified as it has a very robust BCR of 18 to 1 and iBCR of 11 to 1. It should be noted that if contributions are excluded the BCR of 14 to 1 and the iBCR of 8 to 1 are still economically justifiable scores.

6.1.3 Options 3 and 7&8 are assessed to provide the same level of protection as Option 6, consequently choosing between these three options is simply a matter of least cost. Any other decision would be on the basis of other non-economic influences or requirements.

6.1.4 Overall the economically preferred option is Option 6, comprising:

- capital scheme works - rock armour fillet construction;
- ongoing scheme maintenance - patch repairs to the seawall, rock armour re-profiling and associated annual monitoring survey;
- maintenance of the existing southern defences including rock armour re-profiling, drainage works, shear key piling and concrete patch repairs, plus annual monitoring survey;

6.1.5 Note that funding approval is being sought for the capital scheme works only.

6.2 Sensitivity testing

6.2.1 It is important to consider whether any foreseeable changes to costs and benefits for any of the options would be likely to change the preferred option, or even affect the economic justification for proceeding with any works. The following table presents the outcomes of the checks undertaken.

Table 6.2 Sensitivity Checks

No.	Sensitivity Check	Op. 6 BCR	Op. 6 iBCR	Impact
-	Baseline case (including contributions)	18	11	Note that for the baseline case excluding contributions, the BCR is 14 and the iBCR is 8.
1	Overall reduction in no. residential properties at risk from 96 to 79	13	8	Option benefits and average BCRs reduce. For Option 6 the BCR and iBCR reduce but remain robust. No change in economic option choice.

No.	Sensitivity Check	Op. 6 BCR	Op. 6 iBCR	Impact
2	Options 3, 6, 7&8 - increase in cost of armour rock + 50%, underlayer + 30%	16	9	This has a similar impact upon all three rock armour options. The iBCR for Option 6 relative to Option 2 decreases but is still very robust. No change in economic option choice.
3	Option 6 - increase in scale of rock required (25% overall option cost increase)	14	8	The average BCR and the iBCR both drop but remain robust. Overall PV cost is still significantly lower than Options 3 and 7&8. No change in economic option choice.
4	Option 6 - maintenance cost increase 200% to cover higher than anticipated repair works to the existing seawall and rock armour re-profiling	16	10	Increases PV costs by limited amount. This only has a small impact upon the average BCR which remains robust. No change in economic option choice.
5	Option 6 - increased damages resulting from reduced delay for property loss (75 years)	17	10	Limited impact on overall benefits. Small reductions in average BCR and iBCR. Both remain robust. No change in economic option choice.
6	No contributions (currently estimated at PV £348K)	14	8	Reductions in the BCRs for Options 3, 6 and 7&8. Also decrease in the iBCR for Option 6 but still robust. No change in economic option choice.
7	No contributions & monetised benefits only	12	7	As above, reductions in the BCRs for Options 3, 6 and 7&8. Also decrease in the iBCR for Option 6 but still robust. No change in economic option choice.

6.2.2 Based upon current estimates it is clear that the choice of Option 6 is economically robust. Average benefit cost ratios remain relatively high and none of the checks undertaken suggest a change of option.

6.3 Details of the preferred option

Technical aspects

- 6.3.1 The new rock armour element of the preferred option, Option 6, is intended to achieve a balance between on the one hand environmental impacts and cost, and on the other performance. Rock armour fillets of this type have an established track record in reducing wave impacts, erosion and overtopping. Optimisation of the rock profile will ensure that wave energy is sufficiently reduced to limit impacts on the existing seawall and provide the proposed 100 year design life. Further, rock sizing will take into account the need for rock stability, the proposed cross-section and the founding beach material.
- 6.3.2 Some lengths of the rock fillet will be more vulnerable to wave attack than others due to their alignment in relation to the dominant wave direction, for example the northerly half of the northern seawall. In these areas it will be beneficial to ensure that larger rocks from the proposed 3t to 6t weight range are used, certainly on all outer faces. Directly in front of the village the smaller rock will be adequate.
- 6.3.3 At strategy stage it was agreed that Yorkshire Water would need to divert their existing sewer from the foreshore to avoid it being covered by the rock fillet. One further development has been made following the latest consultation with Yorkshire Water in October 2015. YW are promoting the construction of a new shore parallel sewer closer to the seawall which will also be protected by the proposed rock armour. At the southern end the rock armour will now be curtailed at the northern face of the pumping station, thus affording protection to the structure whilst not directly covering the existing outflow pumping main.

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- 6.3.4 One set of concrete steps will be constructed through the rock armour to maintain access between the seawall and the beach.
- 6.3.5 In order to retain the integrity of the existing seawalls ongoing patch and repair works will be required throughout the 100 year design life. Aside from responding to any damage identified through regular monitoring it will also be prudent to inspect the defences following any significant storm incidents.
- 6.3.6 In addition to the new construction works ongoing maintenance to the southern defences will also be required, as described above.
- 6.3.7 There is a risk in relation to the impact upon Yorkshire Water's storm overflow sewers in the foreshore. This pipe will remain outside the footprint of the rock armour fillet. This risk is being dealt with through discussion with Yorkshire Water and there will need to be careful planning of the work to avoid damaging these pipes in the foreshore.
- 6.3.8 It is not anticipated that there will be any issues relating to delivery and placement of the rock armour, especially given the earlier construction of the Southern Defence works. However the rock delivery will need to avoid damage to the existing rocky habitat.

Environmental aspects

- 6.3.9 A formal screening and scoping opinion request for the preferred option (Option 6) was submitted by letter on 3rd August 2015 (refer to Appendix M). The requirement for formal EIA under the Town and Country Planning (EIA) Regulations, the Marine Works (EIA) Regulations and the EIA (Land Drainage Improvement Works) Regulations (1999) was subsequently determined in consultation with the local planning authority, the Marine Management Organisation and the Environment Agency. This will be carried out during the detailed design stage. Note that SBC is not the local planning authority; this is the North York Moors National Park Authority.
- 6.3.10 There are no Ramsar Sites, Special Protection Areas (SPAs) or Special Areas of Conservation (SACs), within the Runswick Bay Strategy Study Area. Natural England has confirmed (in their letter of comfort of 17 February 2015 and during subsequent consultation in August 2015) that consequently there is no requirement for appropriate assessment under the Habitats Regulations. Natural England have also confirmed that they consider that the preferred option is likely to lead to an environmentally acceptable solution.
- 6.3.11 With regards to the achievement of Water Framework Directive objectives, the strategy includes an objective to ensure that the strategy does not cause deterioration in the current status of the waterbodies in the area and that it supports their achievement of WFD objectives. For the preferred option, Option 6, no significant impact on compliance with WFD objectives is envisaged. Implementation would prevent the potential release of sediments and pollutants into coastal waters through erosion in the medium term, which would have minor beneficial effects on coastal water quality. No significant impact on surface or ground water is envisaged except in the immediate vicinity of the bay. Section 9.2 of the SEA Environmental Report and Appendix B of the Scoping Report refers (see Appendix N).
- 6.3.12 The preferred option would reduce the risk of seawall failure in the short, medium and long term (the life of the strategy), and reduce wave overtopping for residents in Runswick Bay Village. Consequently the risks to residential and commercial properties and other infrastructure would be significantly reduced. Further, this would alleviate much of the stress and anxiety felt by residents and property owners, particularly as the rock apron would provide visual reassurance.
- 6.3.13 With regard to the natural environment, this option would not allow the landscape to respond to the existing environmental conditions, and would not result in a natural coastal landscape. However, the protection of the Runswick Bay from erosion and the Village from dereliction would represent a major beneficial impact on the townscape and built environment, which would contribute to the landscape of the North Yorkshire Moors National Park (meeting the aims of the NYMNP Core Strategy to protect and enhance the special qualities of the National Park) and the North Yorkshire and Cleveland Heritage Coast.
- 6.3.14 Although Natural England have confirmed that they consider that the preferred option is likely to lead to an environmentally acceptable solution, further assessment of potential impacts on the recommended Marine Conservation Zone (rMCZ) as a result of coastal squeeze and consideration of mitigation

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measures will be required during the EIA. Currently, mitigation measures being considered include the need for sensitive ecological features to be protected from disturbance or damage and opportunities to be sought to establish new habitats where possible. In addition measures such as warning signs would be required to reduce the risk of harm from clambering over rock boulders. Access through the rocks would also be provided.

- 6.3.15 It is also noted that SBC had commissioned the University of Hull to investigate approaches to encourage habitat colonisation of rock armour, particularly anything that speeds up the colonisation process. The outcomes will be monitored, and there would be an opportunity for any successful methods to be considered for use at Runswick Bay.
- 6.3.16 The major part of the work would be rock delivery by sea and rock placement. During construction close liaison with local residents and businesses would be undertaken. Careful consideration to programming and timing to minimise adverse impacts on bathing waters, local residents, visitor amenities, local businesses, the tourist economy and ecology would be needed. Particular issues to be addressed include the provision of suitable access arrangements, management of traffic and considerate site practices, suitable siting of construction and storage areas and avoiding the release of fines or contaminants.
- 6.3.17 On completion of the works it is anticipated that minimal maintenance would be required to the rock armour, and a reduced level of repair works required to the seawall.
- 6.3.18 The consultation with the public indicated that Option 3, the larger rock apron, was perceived as providing greater certainty of protection. As part of the liaison process it would be important to explain how the preferred option would also provide effective protection. The Strategy noted that the development of a preferred option for Runswick Bay was likely to have a number of impacts and effects associated with it. These were likely to require further and more detailed environmental impact assessment at scheme level, including technical and social assessment, at which stage an Environmental Impact Assessment (EIA) will need to be undertaken.
- 6.3.19 The environmental topics, as presented in Schedule 4 of the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulation 2011, are outlined in Table 4 of the Scoping Report along with a recommendation and rationale as to whether these topics will be scoped in or out of the future EIA. These topics are listed below (with those scoped out identified by *):
- Population (including tourism and recreation),
 - Landscape (including townscape, seascape and visual amenity),
 - Flora and fauna (including terrestrial/marine ecology and overwintering birds),
 - Cultural, architectural and archaeological heritage,
 - Climate factors (including air quality*, noise/vibration and climate),
 - Water resources (including Water framework Directive, bathing water quality and groundwater),
 - Soil (including designated geological sites*),
 - Traffic and transport (including roads, vehicular/pedestrian access and parking),
 - Material assets (including use of natural resources and generation of waste)*.
- 6.3.20 At this stage of the development of the scheme there are several uncertainties relating to the proposals and potential effects. The main uncertainties that will need to be resolved during the next phases of the project include the location of site compounds, haul routes across the site, sequence of construction, extent of vegetation clearance and construction methods. This detail will allow the full scale of potential effects to be assessed and appropriate mitigation to be designed. These uncertainties will be removed during design development and contractor involvement in order for the full EIA to be completed with confidence.
- 6.3.21 Key issues identified by Natural England are landscape effect and visual effect. Natural England have confirmed that the Scheme will likely lead to adverse impacts on the natural landscape but positive effects on the built landscape (Runswick Bay village), and therefore their conclusion is that the overall effect will be neutral. During construction there will be potential temporary visual effects for local residents and footpath users of the Cleveland Way National Trail within and around the site from construction equipment. Natural England have re-affirmed that their letter of comfort (dated 17 February 2015, refer to Appendix O) provided for the coastal strategy is still valid at PAR stage.

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- 6.3.22 A Water Framework Directive (WFD) preliminary assessment (included within the Scoping Report) has concluded that the proposed scheme will not conflict with the WFD objectives and a detailed compliance assessment is not required.

Local political considerations

- 6.3.23 The Strategy and this appraisal were developed through the involvement of a Project Steering Group led by SBC and including the Environment Agency, North Yorkshire County Council, North York Moors National Park Authority, North Yorkshire & Cleveland Coastal Forum, Natural England, Runswick Bay Home Owners, The Mulgrave Estate, Local Councillors and Local Parish Representatives.
- 6.3.24 Any approved works to provide improved protection against erosion at Runswick Bay would be carried out by SBC through their powers under the Coast Protection Act 1949.
- 6.3.25 The works require planning consent by North York Moors National Park Authority.
- 6.3.26 The works require a MMO Marine Licence.

Costs for the preferred option

- 6.3.27 The following table summarises the whole life cash cost, the project cost for which this PAR is seeking approval and the PV cost used in the economic appraisal.

Table 6.3 Project costs for option 6 (£ thousands rounded)

Costs	Cost for economic appraisal (PV)	Whole-life cash cost	Capital grant approval project cost
Costs up to PAR: (not including costs of approved study)			
SBC staff costs	Sunk costs	2,000	
Site investigation and survey	Sunk costs	0	
Consultants' fees	Sunk costs	20,000	
Subtotal	Sunk costs	22,000	
PAR to construction: (Year 0)			
SBC staff costs	25,000	25,000	25,000
Site investigation and survey	48,600	50,300	50,300
Consultants' fees	35,000	35,000	35,000
Other costs	0	0	0
Subtotal	109,000	110,000	110,000
Construction: (Year 1)			
Construction costs	486,000	503,000	503,000
Inflation allowance for 60 months (@ 2%)			14,700
Environmental enhancement	36,400	37,700	37,700
Environmental mitigation	Incl.	Incl.	Incl.
SBC staff costs	24,200	25,000	25,000
Consultants' fees	19,300	20,000	20,000
Site supervision	36,400	37,700	37,700
Compensation	0	0	0
Yorkshire Water service diversion	193,000	200,000	200,000
Subtotal	795,000	823,000	838,000
Future costs:			
Maintenance	288,000	1,180,000	
Future construction	0	0	
Risk contingency:			
Monte Carlo 95% or similar			390,000

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Costs	Cost for economic appraisal (PV)	Whole-life cash cost	Capital grant approval project cost
Monte Carlo 50% or similar (£41K)	Use Opt. Bias	Use Opt. Bias	
Optimism Bias 30%	357,000	635,000	
Contributions (excl. OB)			-300,000
Total	1,550,000	2,770,000	1,040,000

6.3.28 The following table compares the approved strategy cash cost with the current estimated strategy cost using the current PAR estimates. The current PAR preferred option is the dominant capital cost within the strategy, and the reduction in capital cost is primarily due to the reduction in Optimism Bias from 60% to 30%. Likewise the reduction in maintenance costs is also due to the reduction in Optimism Bias.

6.3.29 Note that the PAR estimates have been prepared with Year 0 as 2015/16 as in the table below, compared to the strategy Year 0 of 2014/15. This makes no significant difference to the overall totals.

Table 6.4 Updated cost of strategy for whole cell/frontage (£k)

Cash Costs	To Year 0	Year 1	Year 2	Year 3	Year 4	Five Year Totals	Future Years	Overall Total
	2015/16	2016/17	2017/18	2018/19	2018/19			
Latest Approved Strategy Implementation Cost								
Cash Capital	150	800	50*	0	0	1,000	0	1,000
Cash Non capital	6	3	3	3	3	18	1,873	1,891
Cash Total	156	803	53	3	3	1,018	1,873	2,891
Current PAR Forecast of Strategy Implementation Cost								
Cash Capital	165	710	0*	0	0	875	0	875
Cash Non capital	3	3	3	3	3	13	1,524	1,536
Cash Total	168	712	3	3	3	888	1,524	2,412

* Refers to bathing water quality budget allowed for in the StAR but not included in this PAR.

Contributions and funding

6.3.30 It is anticipated that funding of the preferred option will be through FCRM GiA supported by contributions. At the project funding group meeting (held on 6th March 2014) a declaration by the Runswick Bay Residents Association indicated that a significant contribution could be made available towards a capital scheme option. It is understood that the amount being proposed is currently £100,000., and that a Charity Trust has already been set up to manage the local contribution. Consequently there appears a very high likelihood of this amount being provided.

6.3.31 As a scheme is anticipated to be undertaken in Year 1 (2016/17), this sum equates to a £96,600 PV contribution (£100,000 x 0.966 at 3.50%).

6.3.32 Yorkshire Water installed and now maintain the foul water pumping station located on the seawall. In addition they have pipework within the foreshore to which they would lose some access if the preferred scheme option was taken forward. Consequently Yorkshire Water have proposed re-locating their pumping station inflow pipework on the foreshore to within the proposed rock armour footprint, although the existing storm water overflow pipe seawards of the toe would remain. The new pipework would be designed in tandem with the scheme and will be afforded the protection of the rock armour. Yorkshire Water would pay for the re-location work as a contribution in kind. Following a meeting with YW in October 2015, YW has confirmed that they are progressing design of the sewer relocation and that they plan to start the relocation by September 2016.

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- 6.3.33 Whilst no firm estimate has been developed, based upon preliminary discussion a budget cost of £200,000 to undertake the works has been included in the strategy. Optimism Bias at 30% has been added to this figure to give a cash cost of £260,000. As Yorkshire Water are proposing to cover this cost by not charging for the works, an equivalent amount, £260,000, has been included as a contribution as well.
- 6.3.34 No other contributions have been sourced at this stage. However, SBC are confident that both the financial contribution from the residents and the contribution in kind will materialise. Consequently these have been accounted for in the project summary sheet presented above. Relevant correspondence is enclosed at Appendix R.

Outcome Measures and Partnership Funding Score

- 6.3.35 The contributions to Outcome Measures (OMs) relate to the economic benefits, and the protection of properties from erosion. Given that the scheme is scheduled to be completed in 2016/17 the benefits are assessed to accrue in that year.
- 6.3.36 It estimated that 92 residential properties will be lost from the lower village in the medium term and a further 4 properties in the long term in a 'do nothing' scenario. These properties are all in the 21–40% most deprived areas band. Additional residential properties in the upper village are at a much lower risk of loss, and consequently have not been included in the OM assessment.

Table 6.5 Outcome Measure contributions and prioritisation score

Outcome Measure (OM)	2015/16	2016/17	2017/18	2018/19	2019/20	Future years	Total	
OM2 Households at reduced risk (number – nr)	-	n/a	-	-	-	-	n/a	
OM2b – Households moved from very significant or significant risk to moderate or low (nr)	-	n/a	-	-	-	-	n/a	
OM2c – Proportion of households in 2b that are in the 20% most-deprived areas (nr)	-	n/a	-	-	-	-	n/a	
OM3 – Households with reduced risk of erosion (nr)	-	96	-	-	-	-	96	
OM3b – Proportion of those in 3 protected from loss within 20 years (nr)	-	92	-	-	-	-	92	
OM3c – Proportion of households in 3b that are in the 20% most-deprived areas (nr)	-	0	-	-	-	-	0	
OM4a – Hectares of water-dependent habitat created or improved (ha)	-	0	-	-	-	-	0	
OM4b – Hectares of intertidal habitat created (ha)	-	0	-	-	-	-	0	
OM4c – Kilometres of river protected (km)	-	0	-	-	-	-	0	
OM1 – Economics								
Whole-life present value benefits (£ thousands)						-	21,100	
Whole-life present value costs (£ thousands)						-	720	
Benefit:cost ratio						-	17.6	
Raw Partnership-Funding score (%)							-	206

Outcome Measure (OM)	2015/16	2016/17	2017/18	2018/19	2019/20	Future years	Total
Non-FCERM grant in aid contributions towards the scheme whole-life costs (£ thousands)						-	360
Adjusted Partnership-Funding score (%)						-	235

6.3.37 The FCRM GiA Partnership Funding (PF) Calculator has been completed (Appendix A) to gauge the scale of Grant in Aid that may be provided for the scheme works, taking into account the PV costs and benefits, contributions and properties better protected against erosion. This shows that the scheme has a partnership funding score of 206% with an adjusted score of 235%.

6.3.38 The sensitivity checks presented in Table 6.2 above have also been used within the PF calculator to show how these checks impact upon the scores, refer to the PF sheets in the economics update in Appendix G.

- Sensitivity check 1 allows for a reduction in the number of properties better protected against erosion. This also reduces the economic benefits. For this check the PF raw score is 163% and the adjusted score is 192%.
- Sensitivity check 2 allows for an increase in cost of armour rock (+ 50%) and underlayer (+ 30%). This increases the economic costs. For this check the PF raw score is 189% and an adjusted score is 214%.
- Similar scores are obtained for sensitivity check 3 (overall costs increased by 25%), 173% raw score and 196% adjusted score.
- Sensitivity check 4 (increase maintenance costs by 200%) and check 5 (reduce duration of benefits by 25%) give almost identical raw and adjusted scores of 197-198% and 226-227% respectively.
- Sensitivity check 6 (no contributions) gives a raw and adjusted score of 206%. Using only monetised benefits with no contributions (sensitivity check 7) drops both scores to 198%.

7 Putting the project in place

7.1 Project planning

Phasing and approach

- 7.1.1 The rock armour works will be undertaken in a single phase, as it is expected that rock delivery and placing could all be undertaken in a matter of weeks. It is anticipated that rock delivery will be by barge, possibly being shipped from Norway. Associated works include the construction of one set of concrete access steps through the rock, which will be undertaken at the same time. This will lead from the existing access point on the wall.
- 7.1.2 Enabling works are required. It will be necessary for Yorkshire Water to have undertaken the diversion of their pipelines prior to rock placement, and it would be preferable for the diversion to have been completed and commissioned before the main works start on site.
- 7.1.3 At this stage the only constraint on the timing of the works is to avoid the peak summer tourist season (June to August).
- 7.1.4 Engagement with key stakeholders and communities will need to continue in order, for example, to:
- address habitat and other environmental issues. This may include compliance with the proposed Marine Conservation Zone, depending upon the timing of the designation.
 - communicate scheme proposals and the potential impacts.
 - enter into legal agreements with Yorkshire Water and the local residents (Runswick Bay Coastal Protection Trust).

Programme and spend profile

- 7.1.5 The anticipated high-level programme for the rock armour construction works is outlined in the table below. All construction works will take place in 2016/17. The exact timing of the sewer diversion works have not yet been advised by Yorkshire Water, but the current expectation is for completion by June 2016.

Table 7.1 Key dates

Activity	Date
Approval and consents	August 2015 - January 2016
Detailed design	February 2016
Works information finalised by	April 2016
To tender	June 2016
Yorkshire Water service diversion completed	October 2016
Target price agreed by	September 2016
Construction start	October 2016
Construction completion	March 2017

- 7.1.6 The following table sets out the estimated year-on-year expenditure for the proposed scheme.

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Table 7.2 Annualised spend profile (£ rounded)

Cash Cost	To Year 0	Year 1	Year 2	Year 3	Year 4	Five Year	Future Years	Overall Total
	2015/16	2016/17	2017/18	2018/19	2019/20	Totals		
	(£)	(£)	(£)	(£)	(£)	(£)	(£)	(£)
Pre-Construction								
SBC staff costs	2,000					2,000		2,000
Consultants fees	20,000					20,000		20,000
Costs to PAR Totals	22,000	0	0	0	0	22,000	0	22,000
Capital								
Rock Armour								
Construction		503,000				503,000		503,000
Site investigation (10%)	50,300					50,300		50,300
Env. mitigation (7.5%)		37,700				37,700		37,700
Env. enhancement (incl.)		0				0		0
Site supervision (7.5%)		37,700				37,700		37,700
SBC staff costs	25,000	25,000				50,000		50,000
Consultants fees	35,000	20,000				55,000		55,000
YW Service Diversion		200,000				200,000		200,000
Optimism Bias (30%)	33,100	247,000				280,000		280,000
Capital Totals	143,000	1,070,000	0	0	0	1,210,000	0	1,213,000
Contributions		-360,000				-360,000		-360,000
Capital Totals less contributions	143,000	710,000	0	0	0	853,000	0	853,000
Non-Capital								
Rock Armour & Southern Defences								
Maintenance	1,664	1,664	1,664	1,664	1,664	8,320	1,002,000	1,010,000
Other (env. etc 5%)	84	84	84	84	84	416	50,100	50,500
Fees etc (12%)	200	200	200	200	200	998	120,300	121,300
Optimism Bias (30%)	584	584	584	584	584	2,920	351,500	355,000
Non capital Totals	2,530	2,530	2,530	2,530	2,530	12,700	1,524,000	1,536,000
Overall Totals	168,000	712,000	2,530	2,530	2,530	888,000	1,524,000	2,412,000

Notes: The figures above do not include the bathing water quality budget allowed for in the StAR and excludes inflation. Inflation is estimated at £14,700 over the first five years based upon a 2% inflation rate.

Procurement Strategy

7.1.7 The procurement of the works will be under the control of SBC. It is envisaged that the works will be design and build, and that delivery will be by invitation to tender from within the Council's contractor framework or through the YorCivils/YorConsult Framework, which covers the Yorkshire and Humber region.

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7.1.8 SBC's 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. More information is contained in Appendix R. A sustainability register has been included in Appendix S and an initial carbon calculation is included in Appendix Q.

7.2 Delivery risks

High-level risk register

7.2.1 The table below sets out what are considered to be the high level project risks. A detailed risk register is included at Appendix L.

Table 7.3 High-level risk schedule and mitigation

Key project risk	Adopted mitigation measure
Defence failure before implementation of the works	<ul style="list-style-type: none"> Ongoing monitoring and maintenance, including prompt inspection and repairs following storms.
Lack of approval by EA to this PAR	<ul style="list-style-type: none"> Ensure that business case is prepared in line with EA appraisal guidance. Undertake early liaison with EA to get comments.
Lack of agreement from Natural England	<ul style="list-style-type: none"> Letter of comfort received. Ongoing dialogue with Natural England to ensure that environmental reporting meets their requirements, and that the works include any necessary mitigation measures.
Cost estimates prove to be low	<ul style="list-style-type: none"> Confirm key rates with contractor Optimism bias of 30% applied to all major costs. Undertake appropriate sensitivity checks to confirm that increases to key rates will not undermine the economic case.
Yorkshire Water fail to secure internal approval to funding service diversion	<ul style="list-style-type: none"> YW previously advised (email from YW dated 27th January 2015) that the investment needed for the sewer relocation has been prioritised into the programme. Following design (of the diversion) the scheme would be submitted for authorisation of expenditure. Further to a meeting on the 9th October 2015, YW confirmed their continued commitment to deliver an investment partnership opportunity at Runswick Bay, that benefits all contributing parties and provides the necessary sea defences to the village (YW letter dated 21st October 2015). Residual risk is now considered to be low.
Delay to construction of service diversion.	<ul style="list-style-type: none"> Maintain regular liaison with YW and ensure notification of any delay is received as early as possible. Provide assistance (data etc.) with progressing design works.
Objection from local residents or businesses regarding temporary or permanent works	<ul style="list-style-type: none"> Ongoing engagement. Clarity over what is planned and why it is necessary.
Technical or programme issues relating to procurement and delivery of suitable rock.	<ul style="list-style-type: none"> Early contractor involvement would mitigate against rock delivery constraints due to potential high demand for rock and limited options for transport.

Safety plan

7.2.2 The new CDM 2015 regulations came into force on April 6th 2015. The role of CDM co-ordinator in the previous CDM Regulations 2007 has been removed and replaced with a new role of principal designer. The principal designer's role is to plan, manage and monitor and co-ordinate the pre-construction phase and to ensure, as far as is reasonably practical, that the project is carried out without risks to health and safety.

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7.2.3 The decisions made at this project appraisal stage consider the potential options for minimising health and safety risks whilst still achieving the required coastal erosion risk management outcomes. This involves liaison with the local community as to the best timing for the works. The initial assessment of high level risks associated with the short-listed options include:

- construction and buildability
- operation and maintenance
- foreseeable emergency requirements
- alterations to the existing situation

7.2.4 On the basis of the initial risk assessment the development of this PAR will include:

- use of early contractor involvement (ECI)
- health and safety input into detailed design, buildability and planning
- designers to identify specific risks/mitigation as part of the Design Risk Register
- identify specific residual risks to the contractor
- include safety, health and environment (SHE) boxes on design drawings
- provide the contractor with accurate and comprehensive pre-construction Information
- Public Safety Risk Assessment

7.2.5 During the construction phase, site health and safety will be the responsibility of the principal contractor supported by the principal designer, supervisor, designers and client. The site will be subject to regular checks and audit by the principal contractor, supervisor and the client

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Appendix A Project report information sheet

A.1 General Details

Authority project ref (as in medium term plan)	SBC8		
Project name (60 characters max.)	Runswick Bay Coastal Protection Scheme		
Name of authority	Scarborough Borough Council		
Defra reference (if known)	YOS351C/001A/011A		
Name	Title: Mr	First name: Robin	Last Name: Siddle
Is the project to carry out emergency work?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
Strategy plan reference	YOS351C/001A/011A		
River basin management plan	n/a		
System asset management plan	n/a		
Shoreline management plan	River Tyne to Flamborough Head		
Project type (list below)	Project within Strategy - Coast Protection/sea defence		
Shoreline management study/ preliminary study/ strategy plan/prelim. works to strategy/ project within strategy/stand-alone project/ Strategy implementation/sustain sos. coast protection/sea defence/tidal flood defence/non-tidal flood defence/flood warning Tidal/flood warning - fluvial/special			

A.2 Contract details

Estimated start date of works or study (DDMMYY)	01/09/16	
Estimated time work or study will take to complete*	6	*In months
Contract type*	SBC Framework	(*Direct labour, framework, non framework, design/construct)

A.3 Costs

	Application (£000's)
PAR preparation	22
Capital grant for Environment Agency approval	1,040
Total whole-life costs (cash)	2,770

For breakdown of costs see Table 6.3 in Section 6

A.4 Contributions

Own resources	0
Windfall contributions	0
Deductible contributions (excl. OB)	300
Loans	0
European regional development fund (ERDF) Grant	0
Other items not included	0

A.5 Location (to be completed for all projects)

EA region or area of project site (all projects)	North East
Name of watercourse (fluvial projects only)	n/a

Project appraisal report

District council Area of project (all projects)

Scarborough Borough Council

Grid Reference (all projects)

NZ 810161

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

A.6 Description

Specific town/district to benefit from the project

Runswick Bay Village, North Yorkshire

Brief project description, including essential elements of the project or study (240 characters maximum)

Construction of a rock armour fillet to the existing seawall, extending from the existing concrete groyne adjacent to the lifeboat station to the cliffs beyond the northern seawall (approx. 220m). Works will incorporate access steps to the beach.

A.7 Details

Design standard (chance per year)	n/a	years
Existing standard of protection (chance per year)	n/a	years
Design life of project	100	years
Fluvial design flow (fluvial projects only)	n/a	m ³ /s
Tidal design level (coastal and tidal projects only)	n/a	m
Length of river bank or shoreline improved	220	m
Number of groynes (coastal projects only)	0	
Total length of groynes* (coastal projects only)	0	m
Is it a beach management project?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
Is it a water level management project?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
Defence type (embankment, walls, storage etc)	Walls, rock armour	

*Note this should be the total length of all groynes added together (ignore any river training groynes)

A.8 Further agreements

Maintenance agreements	<input checked="" type="checkbox"/> Does not apply	<input type="checkbox"/> Received	<input type="checkbox"/> Awaiting
EA region permission	<input type="checkbox"/> Does not apply	<input checked="" type="checkbox"/> Received	<input type="checkbox"/> Awaiting
Non-statutory objectors	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	(For coastal schemes fill in form CPA1 and CPA2)	
Date objections cleared (DDMMYY)	n/a		
Other agreements	n/a		
	<input type="checkbox"/> Does not apply	<input type="checkbox"/> Received	<input type="checkbox"/> Awaiting

A.9 Environmental considerations

Natural England letter (or equivalent)	144019_Runswick Bay coastal strategy		
	<input type="checkbox"/> Does not apply	<input checked="" type="checkbox"/> Received	<input type="checkbox"/> Awaiting
Date received (DDMMYY)	17/02/15		

A.10 Sites of international importance

Answer 'Yes' if the project is within, next to or could affect the designated site

Special protection area (SPA)	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
Special area of conservation (SAC)	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
Ramsar site	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
World Heritage Site	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
Other (for example, biosphere reserve)	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No

A.11 Sites of national importance

Answer 'Yes' if the project is within, next to or could affect the designated site

Project appraisal report

Environmentally sensitive areas (ESA)	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
Site of special scientific interest (SSSI)	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
National or regional landscape designation	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
National park or the broads	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
National nature reserve	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
Areas of Outstanding Natural Beauty (AONB), Restoring Sustainable Abstraction (RSA), Regional Screening Coordinator (RSC)	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
Scheduled ancient monument	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Other designated heritage sites	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No

A.12 Other environmental considerations

Listed structure consent	<input checked="" type="checkbox"/> Does not apply	<input type="checkbox"/> Received	<input type="checkbox"/> Awaiting
Has a water level management plan been prepared?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	
Does the project need a Food and Environmental Protection Act (FEPA) licence?	<input type="checkbox"/> Does not apply	<input type="checkbox"/> Received	<input type="checkbox"/> Awaiting

A.13 Compatibility with other plans

Shoreline management plan	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Does not apply
River basin management plan	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input checked="" type="checkbox"/> Does not apply
Catchment flood management plan	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input checked="" type="checkbox"/> Does not apply
Water level management plan	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input checked="" type="checkbox"/> Does not apply

A.14 SEA or environmental impact assessment

Strategic environmental assessment (SEA)	<input type="checkbox"/> Statutory required	<input checked="" type="checkbox"/> Voluntary	<input type="checkbox"/> Does not apply
Environmental impact assessment (EIA)	<input type="checkbox"/> Yes (schedule 1)	<input checked="" type="checkbox"/> Yes (schedule 2)	<input type="checkbox"/> Does not apply
SEA or EIA status	<input type="checkbox"/> Scoping report prepared	<input type="checkbox"/> Draft	<input type="checkbox"/> Draft advertised <input checked="" type="checkbox"/> Final

Other agreements

Scoping Report (PEI format) prepared	<input type="checkbox"/> Does not apply	<input checked="" type="checkbox"/> Received	<input type="checkbox"/> Awaiting
MMO Marine Licence	<input type="checkbox"/> Does not apply	<input type="checkbox"/> Received	<input checked="" type="checkbox"/> Awaiting
Planning permission	<input type="checkbox"/> Does not apply	<input type="checkbox"/> Received	<input checked="" type="checkbox"/> Awaiting
Crown Estate consent	<input type="checkbox"/> Does not apply	<input type="checkbox"/> Received	<input checked="" type="checkbox"/> Awaiting
Yorkshire Water agreement	<input type="checkbox"/> Does not apply	<input checked="" type="checkbox"/> Received	<input type="checkbox"/> Awaiting
	<input type="checkbox"/> Does not apply	<input type="checkbox"/> Received	<input type="checkbox"/> Awaiting
	<input type="checkbox"/> Does not apply	<input type="checkbox"/> Received	<input type="checkbox"/> Awaiting
	<input type="checkbox"/> Does not apply	<input type="checkbox"/> Received	<input type="checkbox"/> Awaiting

A.15 Benefit Type

Local Authorities only;

For projects done under the Coast Protection Act 1949 please separately identify:

FRM = Benefits from reduction of asset flooding risk, or

CERM = Benefits from reduction of asset erosion risk.

Benefit type (list below)

CERM - DEF

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

A.16 Land area

Total land area to benefit	6 approx. (village area) Ha		
Present use of land	FRM	CERM	
Agricultural	0	0	Ha
Developed	0	3	Ha
Environmental or amenity	0	3	Ha
Scheduled for development	0	0	Ha

A.17 Property and infrastructure protected

Residential	FRM	CERM	
Number of properties	n/a	96	
Value	n/a	21,100	£ thousands

Commercial or industrial	n/a	17	
Value	n/a	Incl.	£ thousands

Critical infrastructure	n/a	1	
Value	n/a	Incl.	£ thousands

Key civic sites	n/a	-	
Value	n/a	-	£ thousands

Other (description below)	n/a	-	
Value	n/a	-	£ thousands

Description

This is the total number of properties considered to have some probability of loss.

A.18 Costs and benefits

Present value of total project whole life costs (see note)	1,550 (excl.contributions) 1,200 (with contributions)	£ thousands
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(include all costs, including those not eligible for a grant)

Will the project meet the statutory requirement? Yes No

	FRM	CERM	
Present value of residential benefits	n/a	21,100	£ thousands
Present value of commercial and industrial benefits	n/a	Incl.	£ thousands
Present value of public infrastructure benefits	n/a	Not incl.	£ thousands
Present value of agricultural benefits	n/a	Not incl.	£ thousands
Present value of environmental and amenity benefits	n/a	Incl.	£ thousands
Present value of total benefits (FRM and CERM)	n/a	21,100	£ thousands
Net present value	n/a	19,900	£ thousands
Benefit : cost ratio	n/a	17.6	
Base date for estimate (DDMMYY)	30/03/15		

Partnership Funding Calculator

Notes:

1. Only consider Option 6 – Rock fillet to seawall.
2. Calculation Version 8 January 2014.
3. PV costs include appraisal and design / construction costs.
4. PV whole-life benefits currently include residential, commercial and agricultural benefits only, i.e. excludes amenity benefits (to be confirmed).
5. PV Private Contributions secured to date (Runswick Bay residents £100,000 PV in 2 years, Yorkshire Water £260,000 PV in 2 years, pending confirmation). Total PV contributions £347,760.
6. FCRM Partnership Funding Calculator for Flood and Coastal Erosion Risk Management Grant in Aid (FCRM GiA) – Calculation sheet for the base case is shown overleaf.
7. The following sensitivity checks were also carried out and are included in Appendix G.

	Sensitivity Checks
1	Overall reduction in no. residential properties at risk (all damages reduce)
2	Options 3, 6, 7&8 - increase in cost of armour rock + 50%, underlayer + 30%
3	Option 6 - increase in scale of rock required (25% overall option cost increase)
4	Option 6 - maint. cost increase 200% to cover higher than anticipated repair works costs
5	Option 6 - increased damages resulting from reduced delay for property loss (75 years) – included as Base Case Test 5.
6	No contributions (currently estimated at PV £338K)
7	No contributions & monetised benefits only

Project appraisal report

FCRM Partnership Funding Calculator for Flood and Coastal Erosion Risk Management Grant in Aid (FCRM GiA)

Version 8 January 2014

Project Name Runswick Bay Strategy
Unique Project Number PAR Option 6 Rock Armour Fillet - Baseline Case

Key

All figures are in £'s
 Figures in Blue to be entered onto Medium Term Plan

SUMMARY: prospect of FCRM GiA funding

Raw Partnership Funding Score	206%	(1)	Scheme Benefit to Cost Ratio:	13.43	to 1
External Contribution or saving required to achieve an Adjusted Score of 100%	0	(2)	Effective return to taxpayer:	24.50	to 1
Adjusted Partnership Funding Score (PF)	235%	(3)	Effective return on contributions:	60.65	to 1
PV FCRM GiA towards the up-front costs of this scheme (PV Cost for Approval)	860,825	(4)	Cell (2) shows the minimum amount of contributions and/or reductions in scheme cost that are required to raise the Adjusted PF Score to at least 100%. Further increases on this will improve this scheme's chances of an FCRM GiA allocation in the desired year. Planned savings and contributions should be entered into cells (9,10,12) and cells (14-17). See NOTE below.		

1. Scheme details

Risk Management Authority type of asset maintainer	LA	(5)	<input type="text" value="Yes"/> (6)	Is evidence available that a Strategic Approach has been taken, and that double counting of benefits has been avoided?
Duration of Benefits (years)	100	(7)	<p>All costs and benefits must be on a Present Value (PV) Whole-Life basis over the Duration of Benefits period. Where Contributions are identified these should also be on a Present Value basis.</p> <p>The total value of any necessary contributions will depend on whether maintenance (ongoing costs) is funded through revenue FCRM GiA, or by other means.</p> <p>NOTE: This scheme is to be maintained by an RMA other than the EA (ref cell 5). Capital FCRM GiA will fund the appropriate share of the up-front costs (cell 11) with any shortfall needing to be paid for via contributions identified in cells (14-17). Future ongoing costs (cell 12) and any contributions towards them are a matter for local agreement by the RMA and should NOT be included in cells (14-17). It is recommended that the RMA takes the opportunities created during scheme development to separately secure contributions towards future ongoing costs (cell 12).</p>	
PV Whole-Life Benefits:	21,092,000	(8)		
PV Costs				
PV Appraisal Costs	22,000	(9)		
PV Design & Construction Costs	1,188,585	(10)		
Sub Total - PV Cost for Approval (appraisal, design, construction)	1,208,585	(11)		
PV Post-Construction Costs	382,004	(12)		
PV Whole-Life Costs:	1,570,589	(13)		
PV Contributions secured to date				
PV Local Levy secured to date	0	(14)		
PV Public Contributions secured to date	0	(15)		
PV Private Contributions secured to date	347,760	(16)		
PV Funding from other Environment Agency functions/sources secured to date				
PV Total Contributions secured to date	347,760	(18)		

2. Qualifying benefits under Outcome Measure 2: households better protected against flood risk

Number of households in:	Before			After			Change due to scheme		
20% most deprived areas							0	0	0
21-40% most deprived areas							0	0	0
60% least deprived areas							0	0	0
At:	Moderate risk	Significant risk	Very significant risk	Moderate risk	Significant risk	Very significant risk	Moderate risk	Significant risk	Very significant risk
Annual damages avoided (£), compared with a household at low risk							150	600	1,350
Change in household damages, in:	Per year			Over lifetime of scheme			Qual. benefits (discounted)		
20% most deprived areas	£	-	-	£	-	-	OM2 (20%)	£	-
21-40% most deprived areas	£	-	-	£	-	-	OM2 (21-40%)	£	-
60% least deprived areas	£	-	-	£	-	-	OM2 (60%)	£	-

3. Qualifying benefits under Outcome Measure 3: households better protected against coastal erosion

Number of households in:	Before		Damages per household avoided:		£		
20% most deprived areas			Annual damages avoided	£	6,000	£	6,000
21-40% most deprived areas	4	92	Loss expected in	£	50	£	20
60% least deprived areas			Present value of Year 1 loss (i.e. first year damages, discounted based on when loss is expected)	£	1,184	£	3,015
	Long-term loss	Medium-term loss		Long-term loss	Medium-term loss		
Change in household damages, in:	Year 1 loss avoided:		Over lifetime of scheme:		Qual. benefits (discounted):		
20% most deprived areas	£	-	£	-	OM3 (20%)	£	-
21-40% most deprived areas	£	282,151	£	28,215,067	OM3 (21-40%)	£	8,425,968
60% least deprived areas	£	-	£	-	OM3 (60%)	£	-

4. Qualifying benefits under Outcome Measure 4: statutory environmental obligations met

Payments under:		Assumed benefits per unit:	Qual. benefits (discounted):			
OM4a	Hectares of net water-dependent habitat created	£	15,000	OM4a	£	-
OM4b	Hectares of net intertidal habitat created	£	50,000	OM4b	£	-
OM4c	Kilometres of protected river improved	£	80,000	OM4c	£	-
				OM4	£	-

5. Qualifying benefits arising from the overall scheme for entry into the Medium-Term Plan

OM deprivation:	Qual. benefits:	Payment rate:	FCRM GiA contribution:	
OM1	£	12,666,032	£	703,668
OM2	£	-	£	-
OM2	£	-	£	-
OM2	£	-	£	-
OM2	£	-	£	-
OM2	£	-	£	-
OM3	£	-	£	-
OM3	£	8,425,968	£	2,527,790
OM3	£	-	£	-
OM3	£	-	£	-
OM4	£	-	£	-
OM4	£	100.0	£	-
Total	£	21,092,000	£	3,231,459

Maximum for Outcomes delivered. The actual value any scheme is eligible for may be less.

Sensitivity Testing. It is important that users of this calculator appreciate the implications on funding from changes to input data which may become necessary as the project develops and better information is available. Five typical tests are provided below. Users should consider how appropriate these are to their project, what other tests may be appropriate and how best to use the information with all those that may be involved in the project.

Raw Score	Contribution for 100% Score (£k)
206%	0
74%	391,742
206%	-
167%	-
#N/A	#N/A
198%	-

As scenario above
 Sensitivity 1 - Change in PV Whole Life Cost (25% increase)
 Sensitivity 2 - Change in OM2 - 50% of households in Very Significant (Before) risk may already be in Significant Risk band
 Sensitivity 3 - Change in OM3 - 50% of households in Medium Term loss (Before) may already be in Long Term loss
 Sensitivity 4 - Increase Duration of Benefits by 25%
 Sensitivity 5 - Reduce Duration of Benefits by 25%

END OF WORK SHEET

Appendix B List of reports produced

Title	Date	Author
Technical Memorandum - Runswick Bay Strategy Economics Update	02/07/2014	CH2M Hill
Technical Memorandum - Runswick Bay Water Quality	17/09/2013	CH2M Hill
Runswick Bay Coastal Strategy: Strategic Environmental Assessment - Environmental Report	Jul-14	CH2M Hill
Technical Memorandum - Runswick Bay Strategy Option Screening Technical Assessment	24/03/2014	CH2M Hill
Technical Note - Runswick Bay Slope Stability - Review of Previous Work	31/05/2013	Halcrow
Runswick Bay SEA - Environmental Report - Results of Public Consultation following Public Exhibition and Online Survey	09/07/2014	CH2M Hill
Option Screening Technical Assessment (for Steering Group Meeting)	Nov-13	CH2M Hill
Storm Surge Damage, 5th December 2013 (for Steering Group Meeting)	Feb-14	CH2M Hill
Option Appraisal Summary Tables	Nov-13	CH2M Hill
Walk-over Visual Inspections of Assets following UK East Coast Storm Surge of 5th December 2013	Dec-13	CH2M Hill
Runswick Bay Coastal Protection Scheme: Rapid Marine Ecology Overview	25/08/2014	University of Hull
Water Quality Issues at Runswick Bay: Nettledale Beck Diffuse Pollution Assessment	11/11/2015	University of Hull
Runswick Bay Coastal Strategy Final Draft Public Consultation Analysis	18/03/2015	Scarborough Borough Council
Runswick Bay Coastal Strategy Scoping Report	Nov -15	Ch2M

Appendix C Photographs

Appendix D Figures

Appendix E Details of the proposed works

Appendix F Indicative landscape plan

Appendix G Economic appraisal

Appendix H Cost breakdown

Appendix I Expenditure profile

Appendix J Project programme

Appendix K Technical reports

Appendix L Risk register

Appendix M Consultee screening letter

Appendix N Environmental reports

Appendix O Natural England letter of comfort

Appendix P Site waste management plan

Appendix Q Carbon Calculator

Appendix R Procurement strategy and contributions

Appendix S Sustainability register and risk assessment