

# Strategy approval report



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Authority Strategy Reference

Defra CPW Number

Promoting Authority

Strategy Name



Date

Version

## 2.7 Choice of Preferred Option

### 2.7.1 Appraisal Summary

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

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

### 2.7.2 Health and Safety Considerations

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

### 2.7.3 Economic Assessment and Decision Rule

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

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

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

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

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

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

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

**Table 10a Economic summary for each management unit**

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

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

**Table 10b Factors affecting option choice for each management unit**

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

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

## 2.7.4 Sensitivity tests on option choice and economic appraisal

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

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

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

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

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

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

**Table 10c Economic summary for combined management units**

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

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

## 2.7.5 Environmental and Social Assessment

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

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

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

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

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

## 2.7.6 Key political and social concerns

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

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

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

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## 2.7.7 Preferred Option Selection

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

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

**Table 11 Summary of preferred strategy options**

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

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

## 2.7.8 Management of key residual risks

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

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**Table 12 Residual risk management**

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

## 2.7.9 Recommendation

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

## 2.8 Other Considerations

### 2.8.1 Public Safety

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

### 2.8.2 Non-construction Actions

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

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