



**Cumbria
Coastal
Strategy**

**Technical Appraisal
Report for Policy Area**

11d6 St. Bees

(Technical report by Jacobs)

Policy area: 11d6 St Bees

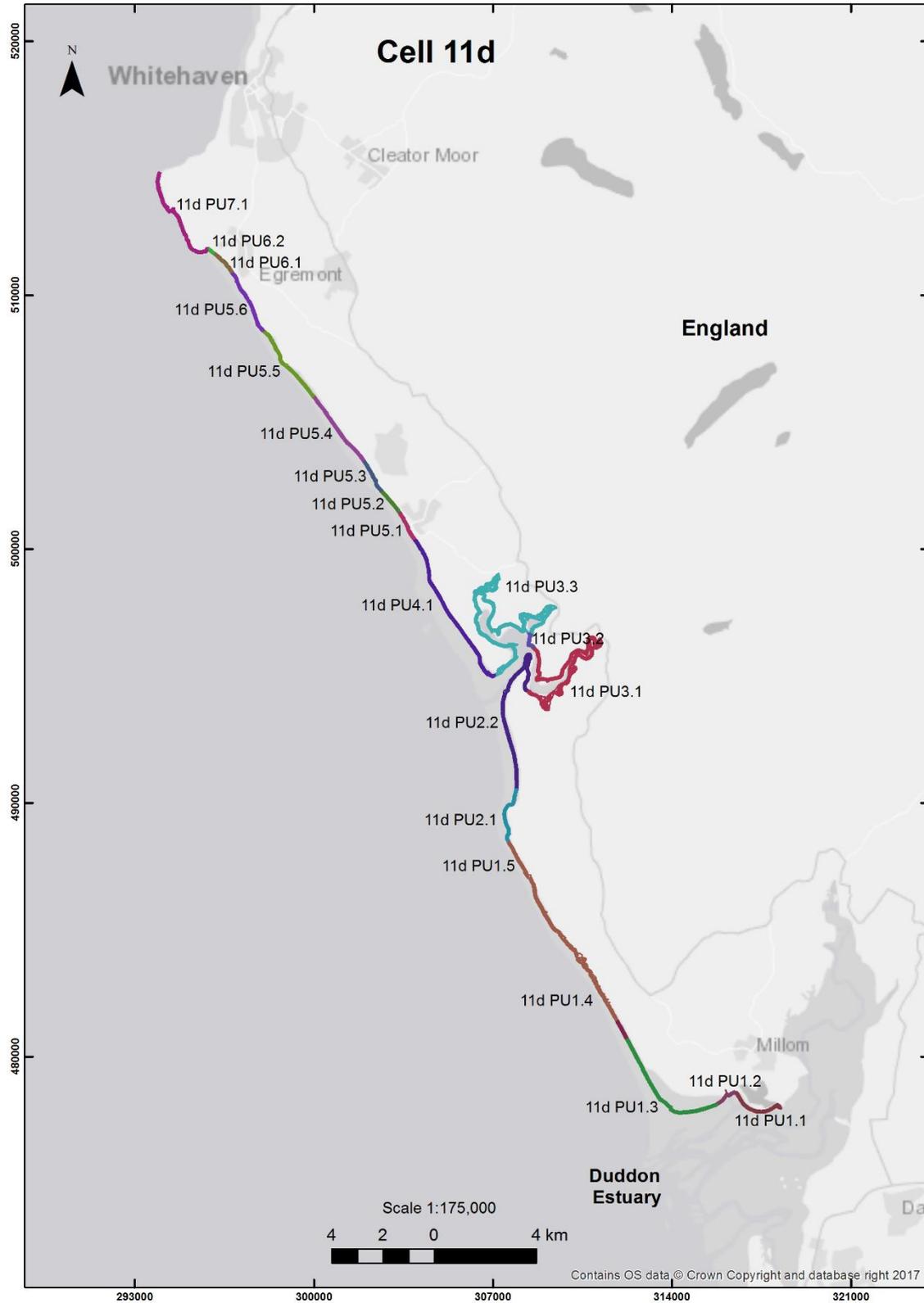


Figure 1 Sub Cell 11d Hodbarrow Point to St Bees Head Location Plan of Policy Units. Baseline mapping © Ordnance Survey; licence number 100026791

1 Introduction

1.1 Location and site description

Policy Units:	11d6.1: Pow Beck to St Bees promenade 11d6.2: St Bees – St Bees Promenade (priority unit)
Responsibility:	Copeland Borough Council Private defence owners
Location:	The policy area falls within Sub cell 11d: Hodbarrow Point to St Bees Head. The policy area extends from Pow Beck northwards to the defended frontage and promenade at St Bees, which extends north to the transition to the hard rock cliffs of St Bees Head.
Site overview:	<p>The key risk along this frontage is coastal erosion which could result in the loss of land and ultimately properties at St Bees. There is some localised flood risk due to the water course, Rottington Beck.</p> <p>The coastline encompasses a diverse range of habitats including mud and sand flats, shingle and pebble beaches, honeycomb worm reefs, soft cliffs and high sandstone cliffs of St Bees. St Bees Head is of national importance for both its geological exposures and the range of habitats supported. The sheer cliffs provide an important breeding site for a variety of colonial seabirds, including guillemots, fulmar, kittiwake, razorbill, cormorant, shag and herring gull. The cliffs are also the only breeding site on the entire coast of England for black guillemots. The cliffs and slopes south of the St Bees village are also SSSI designated.</p> <p>There is potential for material released from the cliffs to be gradually moved alongshore to feed adjacent frontages, once it becomes broken down by waves. Any fine sediments are, however, likely to be lost offshore due to the exposed nature of this shoreline.</p> <p>The nearshore zone, seaward of mean high water, was designated as a Marine Conservation Zone in 2013, covering the Cumbria Coast, to protect the diversity of habitats found along the headland and to retain its natural character.</p> <p>The headland of St Bees Head is defined as a Heritage Coast; heritage coasts were established to conserve, protect and enhance the natural beauty of the coastline, together with their supported habitats and heritage features.</p> <p>The defended frontage at St Bees consists of a promenade which protects recreational ground and properties of St Bees. The defences predominantly consist of a concrete seawall forming the promenade with a sloping revetment to the south which as of 2016 has added rock protection positioned to the top of the revetment to reduce ongoing cliff erosion above the defences. Timber groynes front this policy unit, some of which are in a dilapidated condition. A small stream, Rottington Beck, drains through the beach at the northern end of the St Bees frontage.</p>

1.2 Current SMP policy

The policy details for the whole policy area are shown in the table below, taken directly from the SMP2 (Halcrow, 2011); non priority units have been greyed out.

Table 1 Current SMP policy for policy area 11d6

Overview: *The long term plan will be to allow the coast to realign to a more natural position to sustain a beach in this location, but ensure the management of coastal risks to St Bees for amenity, recreational, and tourism benefit. Continued erosion of the maritime cliffs and slopes south of St Bees village will maintain their designated SSSI status and supply the neighbouring frontages with sediment to support natural defences and help reduce the effects of sea level rise in defended areas. However, this will also result in continued erosion risk to a golf course and coastal footpaths. Assets at St Bees beach and promenade will be maintained at least until the long term at which time their sustainability will be reassessed.*

Location		Policy and Approach (from 2010)		
		0-20 years	20-50 years	50-100 years
11d6.1	Pow Beck to St Bees promenade	No active intervention – continued natural erosion of designated cliffs.	No active intervention – Continued natural erosion of designated cliffs.	No active intervention – Continued natural erosion of designated cliffs.
11d6.2	St Bees promenade	Hold the line – Maintain defences to maintain the beach amenity, do not extend defences into SSSI to the south. Conduct further studies into long term solutions for future flood and erosion risk management of the beach amenity.	Hold the line – Depending on outcomes of studies, maintain defences to maintain the beach amenity, and realign when defence residual life expires, do not extend defences into SSSI to the south.	Managed realignment – Depending on outcomes of studies, construct set back defences to a more sustainable alignment where the natural shore alignment would be. Realigning defences along the promenade to a more sustainable alignment would provide additional space for beach rollback with sea level rise while still maintaining an amenity beach.

2 Appraisal of priority units

There are two policy units within the Policy Area 11d6 St Bees, one of which has been identified as a priority unit:

- 11d6.2: St Bees – St Bees Promenade

2.1 Existing approach to flood and coastal erosion risk management

2.1.1 Justification of current SMP policy

Section 0 sets out the SMP policies for this priority unit. The primary justifications for the policies at the SMP level were:

- Social: Importance of the beach as an amenity attracts tourists to the area and is important for the local economy.
- Environmental: Realigning defences along the promenade to a more sustainable alignment could provide additional space for beach rollback with sea level rise and help to maintain an amenity beach.

2.1.2 Current defences

This policy area includes both undeveloped till cliffs between Pow Beck and the start of the promenade at St Bees, and the defended priority frontage of St Bees promenade, extending north to the transition to the hard rock cliffs of St Bees Head, see Figure 2 and Figure 3. A small stream, Rottington Beck, drains through the beach at the northern end of the St Bees frontage, the position of its discharge is held by the northern retaining wall of the promenade (Halcrow, 2011).

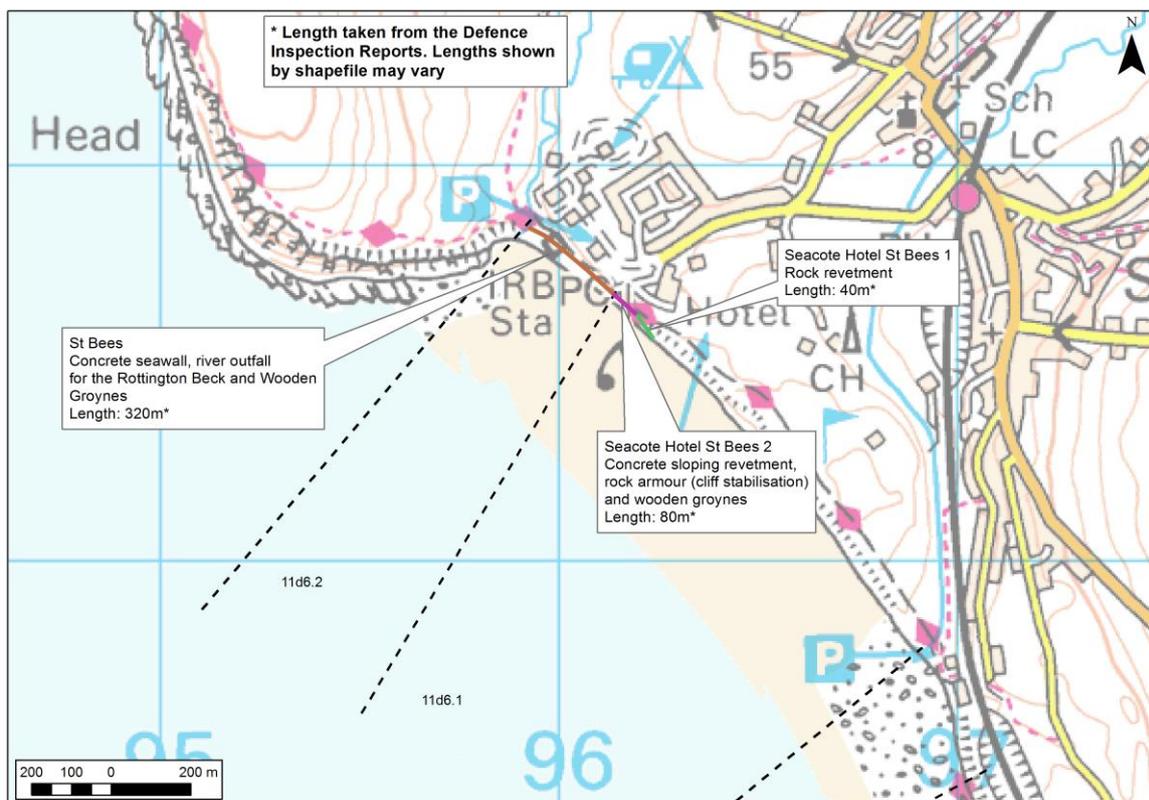


Figure 2 Policy unit location plan and defence overview. Baseline mapping © Ordnance Survey: licence number 100026791.



Figure 3 St Bees Frontage © North West Regional Monitoring Programme, 2015

The shoreline from Rottington Beck, in the north, along St Bees to the Seacote Hotel, in the south, is protected by a concrete seawall fronted by timber groynes. At the far southern end of policy unit 11d6.1 the frontage transitions into low till cliffs; which are defended by a rock structure.

The seawall, the promenade and the timber groynes were constructed in the late 1950s. Along St Bees promenade there are nine timber groynes, the upper gravel beach is present throughout the section with the foreshore being comprised of boulders and gravel (scar features) predominantly in the south, with sand increasingly prevalent towards St Bees Head. The timber groynes are in a poor condition, with several missing groyne planks, Figure 4.

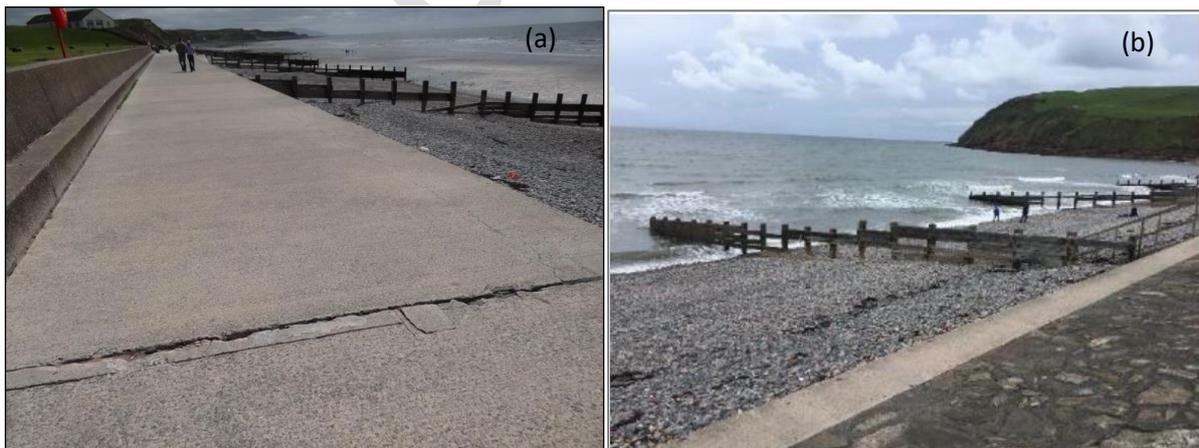


Figure 4 (a) St Bees Concrete seawall and wooden Groynes (b) South end of promenade

The sea wall structure is in a fair condition and reasonably well protected by the shingle beach. The foreshore is mobile across the whole of this frontage and vulnerable to movement and draw down during storms. Beach movement is controlled to a degree by the timber groyne field although there is little evidence of longshore drift. The beach is prone to cross shore movement and material tends to be drawn down during storms, leaving the backshore structures exposed to waves leading to increased overtopping and shingle being thrown onto the promenade.

Channel works at Rottington Beck were completed in 2014, the scheme provided a concrete face to the existing piles and building a concrete channel wall to provide a new channel for the beck. In 2016 armour stone was placed in front of the wall and at the edge of the concrete channel to prevent the beck from outflanking the concrete channel. At St Bees (11d6.2) the seawall is periodically overtopped by wave action but in a generally good condition (CH2M, 2017b), Figure 5.



Figure 5 (a) River outfall for the Rottington Beck and (b) North end of promenade

Table 2 provides the defence structural details 11d6.2 St Bees Promenade:

Table 2 Existing Defence Details

Location	Copeland Borough Council – Annual Coastal Defence Inspection (August 2017)					
	Structure Type	Length (m)	Crest Level (mOD)	Foreshore Toe Level (mOD)	Residual Life (years)	Responsibility
St Bees (11d6.2)	Concrete Sea Wall, river outfall for Rottington Beck and wooden groynes.	320	+6.6	+6.64	20-50	Copeland Borough Council
Seacote Hotel St Bees 2 (11d6.2)	Concrete sloping revetment, rock armour (cliff stabilisation) & wooden groynes	80	+6.6	+7.62 to +7.69	20-50	Front wall & Groynes: Copeland Borough Council Revetment & Cliff: Private (Seacote Hotel)

In 2016, remedial works to the toe of the cliff below the café were carried out with randomly placed sandstone. It was noted in the July 2016 defence inspection notes (CH2M, 2017a) that no geotextile was observed between the rock and the cliff and therefore although the placed rocks will slow the cliff erosion, waves and tidal water could still penetrate through and continue to destabilise the cliff. In August 2017, it was observed that the rock armour placed in front of café was in good condition, but where there is no rock there was bank erosion and undercutting (CH2M, 2017a).

2.1.3 Shoreline Change

The orientation of this shoreline, and the shelter afforded by St Bees Head means it is only exposed to waves from the southwest to south, southeast and therefore there is only a narrow window of waves that can drive southwards drift. Sediment drift potential is bi-directional but net northwards with the magnitude decreasing from south to north (Coastal Engineering UK, 2016), but actual transport rates are low as the shoreline lies almost shore normal to the predominant waves (Halcrow, 2011, 2018).

This coast is not believed to receive significant amounts of sediment from the offshore or rivers (Halcrow, 2011). Erosion of the beach and cliff deposits is therefore the key contemporary source of sediment and contributes a wide range of sediments to the beach systems, from muds to boulders.

Although the coarse shingle beach is only likely to be mobilised by high energy events, previously there have been concerns relating to the drawdown of beach material during storms, resulting in an increased risk of wave overtopping.

The lower sandy beach is more mobile, and the sand forms a veneer over the underlying till platform, therefore variations in beach level occur on a cyclical basis (Halcrow, 2011; Coastal Engineering UK, 2016), but generally change is of low magnitude (Coastal Engineering UK, 2016). An exception to this is to the north of Rottington Beck, where beach levels are more volatile and the most recent data indicates a general downward trend (Coastal Engineering UK, 2016; CH2M, 2017b).

The longer term data shows that there has been very little change in the cliff top position between Pow Beck and the Seacote Hotel. However, there have been substantial changes over the longer term in the position of the cliff face and cliff toe. Based on site observations, this is likely due to mudsliding and partial failures of the cliff, which will variably change the elevation of the cliff face at a given point along the profile and appear to advance the toe of the cliff through the deposition of 'talus' (debris from cliff face failures) onto the beach. These talus deposits are subsequently eroded, giving the impression of advance and retreat of the cliff toe in the profile data. The large changes in elevation on the gravel beach (± 1.5 m) are due to changes in the position of storm ridges across the beach (CH2M, 2017b).

The defended frontage shows a significant amount of variability over the longer term. The relatively high nature of the upper gravel beach relative to earlier surveys likely indicates a landward movement of material, which then becomes at least temporarily trapped by the groynes present. The groynes do not cross the lower sandy foreshore, and the sediment here is therefore freer to move. This has likely resulted in the net export of material from this frontage over the monitoring period, leaving the foreshore relatively low. However, the change in elevation of the foreshore is cyclical and not a cause for concern currently, other than the erosion behind the rock armour at the Seacote Hotel frontage, which indicates overtopping and erosion of the toe of the till cliff (CH2M, 2017b).

Rottington Beck drains through the beach but does not appear to be having an influence on the coastal process, the position of the discharge is held by the northern retaining wall. In the past the Rottington Beck has been subject to build up of shingle blocking flows and then erosion on the northern side, by discharge from the outflow (CH2M, 2017b).

The long term change analysis shows the influence of groynes with accumulation of sediment being more common on the southeast side of the groynes and lowering more common on their north west side. This would indicate a predominantly northwards drift of material in the intervening period. The area of highest magnitude elevation change is located at the end of a groyne, most likely resulting from scour due to the effects of that groyne, (CH2M, 2017b).

Immediately north of the policy area, St Bees Head is a sediment divergence zone and potential sediment movement from the southern part of the rocky headland is southwards towards St Bees beach although actual rates of supply are low or negligible due to the rocky nature of the coast. Mean historic recession rates for the headland have been estimated at 0.01 m per year with a maximum erosion of 0.12 m per year (Capita Symonds, 2011).

Defence of this shoreline means it is difficult to accurately define future rates of potential change; the following predictions have been made by previous studies:

Table 3 Predictions of future erosion

	By year 20	By year 50	By year 100
Futurecoast (Halcrow, 2002)	-	-	50 to 100 m
NCERM (Do nothing) (EA)	0 to 39 m	10 to 130 m	20 to 260 m
SMP2 (Halcrow, 2011)	2 to 4 m	5 to 10 m	10 to 20 m

Continued coastal monitoring is necessary to appraise erosion rates and assess changes in risk levels as the groynes continue to deteriorate and no longer have an influence on the beach movement.

2.2 Outline of the problem

2.2.1 Background

St Bees Bay extends from St Bees Head to Sea Mill Lane. Seacote beach lies at the north of the bay; main visitor facilities include large car parks, children's play area (opened in 2014), hotel with bars and restaurant and caravan parks and a beach cafe and shop. There is a RNLI lifeboat station with a slipway providing access onto the beach. The beach amenity and lifeboat access are at risk of coastal erosion and some localised flood risk due to the water course, Rottington Beck. There is also concern regarding residual life of the promenade and issues of outflanking to the south.

In 2016 rock armour was added to the top of the revetment in front of the café. Where rock armour is absent there has been bank erosion and undercutting resulting in an unstable steep cliff section. It is also understood that RNLI have commissioned a study to look at remedial work to the life boat ramp. The timber groynes are in a dilapidated condition. A recent study (Capita Symonds, 2011) recommended that deterioration should be allowed to continue while only carrying out maintenance work required to ensure public safety. This will allow time to determine whether the groynes are necessary and full refurbishment can be delayed until that, time if required (Capita Symonds, 2011).

The current SMP2 policy is "Hold the line" in the first two epochs. The policy changes to Managed realignment in the 50 to 100 year epoch when the existing coastal defence assets are due for replacement. This would allow the currently defended frontage to realign to a more sustainable alignment with the natural cliff to the south.

2.2.2 Issues, constraints and opportunities

Investigations and continuing monitoring of beach profiles suggests sediment transport is relatively low. A previous recommendation was the maintenance and replacement of timber groynes to be deferred for 10 years whilst further beach monitoring is undertaken to determine if the groynes are necessary to stabilise the beach (Capita Symonds, 2011).

The route of the new England Coast Path follows along the St Bees promenade (the route is now open, but not yet available for public use; anticipated summer or autumn 2018). The proposals allow for the trail to 'roll back' in response to coastal change.

Although the beach in front of the promenade is not specifically included within the St Bees Head SSSI, it partly lies within the impact risk zones of units to both the north and south, Works have been already been carried out to reduce the risk of erosion of the cliff directly below the café. Extension of these works to the currently unprotected section immediately to the south would infringe on the St Bees Head SSSI and there would also be potential for impacts on the Marine Conservation Zone, therefore consent from Natural England as well as Copeland Borough Council would be required.

There is a proposal by West Cumbria Mining for a new underground or undersea mine, together with an above ground enclosed processing and storage area on the former Marchon Industrial site, located inland from the coast. The proposed mining areas lie offshore of this frontage. The Environmental Impact Assessment (EIA) prepared in support of the proposals did not identify any direct impacts on this frontage but did recognise that the direct impacts on the marine and intertidal environment relate to subsidence of the seabed following mining works; the impact of which has not been fully assessed (West Cumbria Mining, 2017). The EIA includes recommendations for further study and monitoring.

Other issues to consider include the economic importance of St Bees as a tourist destination and the economic viability of “Hold the line” policy in 11d6.2 with the need to consider alternative funding availability.

2.2.3 Strategy considerations and general approach

2.2.3.1 Key considerations

Since the SMP2 was produced further monitoring data has been collated. The strategy has considered this more recent data to appraise:

- current defence conditions and risks
- recent shoreline change
- St Bees Groyne Appraisal Report, 2011 – the groyne appraisal report was prepared to consider the long term effectiveness of the existing timber groynes along the St Bees shoreline. Copeland Borough Council is responsible for maintenance of the defences, which is proving to be expensive, Capita Symonds 2011 report was prepared to investigate future maintenance or replacement or abandonment of the groynes so that money is being spent in a sustainable manner. Options appraised were focused on the groynes, and considered:
 - Do nothing
 - Do minimum – leaving the groynes to deteriorate as in the Do nothing options while only carrying out maintenance to ensure public safety
 - Refurbishment of groynes followed by ongoing maintenance
 - Delayed refurbishment of groynes followed by ongoing maintenance
 - Removal of groynes
 - Replace existing timber groynes with rock armour groynes

The appraisal concluded the preferred solution was the delayed refurbishment of the timber groynes and ongoing maintenance, with continued monitoring. The options presented in the report have been incorporated in to the strategy options development and appraisal.

2.2.3.2 Strategy approach

The following situations arise along this frontage, and will be addressed as follows:

- SMP appropriate - the SMP2 policy does not need review so the aim of the strategy is to develop measures to implement the policy. Future works to manage flood and erosion risk may be eligible for a proportion of FDGiA funding and the economic appraisal will consider costs and benefits, following FCERM-AG guidance. In particular the strategy needs to consider the viability of the SMP policy to realign the defences when they are due for replacement in the 50 to 100 year epoch.

2.3 Options development and appraisal

The main options report defined the long list options, each of these has been screened at a high level against technical, economic and environmental criteria to develop a list for final detailed appraisal.

The options presented in the St Bees Groyne Appraisal Report (Capita Symonds, 2011) have also been reviewed and incorporated.

The following long listed options have been considered for 11d6.2:

- Do nothing
- Do minimum
- Hold the line: maintain through proactive maintenance
- Hold the line: maintain through proactive maintenance (delayed scenario)
- Hold the line: maintain through reinforcing existing defences
- Hold the line: improve existing defences
- Hold the line: improve through constructing new shore control structures
- Hold the line: improve through constructing new revetments or seawalls
- Hold the line: improve through beach recharge
- Hold the line: improve through cliff or slope stabilisation
- Managed realignment: construct defences once set back
- Other considerations: adaptive management of assets

The second stage has been to appraise the short listed options. Section 2.4 outline the identification of long listed options and the assessment of shortlisted options and approaches (measures) that could be adopted to achieve the SMP policy.

Do nothing has been appraised as a baseline in all frontages. This option assumes that no further works would be undertaken and the existing defences would deteriorate over time, resulting in failure.

Additional information on environmental impacts is provided in a **Strategic Environmental Assessment: Environmental Report** which systematically appraises the potential environmental consequences of the proposed strategy and recommend any actions needed to mitigate and monitor identified adverse effects.

The economic feasibility of implementing an option has been appraised through considering the packages of measures required for its implementation have been costed and the benefits of the strategic options were identified and evaluated. The Do nothing option provides the baseline for the economic appraisal. This is reported in the **Economic assessment** report.

2.4 11d6.2 St Bees promenade

2.4.1 11d6.2 - Initial screening of options

Table 4 below summarises the rationale for taking long options forward to the short list stage.

Table 4 Screening of long list options

Long list options	Description	Short listed?	Rationale
Do nothing	No further works undertaken,	Baseline only	Defences would deteriorate, leading to eventual failure, under this option and the beach would be

Long list options	Description	Short listed?	Rationale
	defences left to deteriorate and fail		unconstrained and allowed to form a more natural alignment. It has been assessed for comparative purposes only in order to demonstrate the benefits on other options.
Do minimum	Reactive patch and repair of promenade defences only	Baseline only	This option would only carry out patch and repair works to the existing promenade structures it may become a default option if funding not available. This option leaves the existing timber groynes to deteriorate, only carrying work to ensure public safety.
Hold the line: maintain through proactive maintenance	Refurbishment of defences followed by ongoing maintenance to maintain the existing defences. Timber groynes not included, assumed not required.	Yes	Patch repairs if carried out well and are timely could be effective in maintaining the existing structures in the short term, until the structures meet the end of their residual life. This option is similar to 'Hold the line: maintain through proactive maintenance (delayed scenario)'. Although it assumes that the groynes are not necessary and therefore these would not be maintained. Timber groynes would be left to deteriorate, only carrying work to ensure public safety.
Hold the line: maintain through proactive maintenance (delayed scenario)	Delayed refurbishment of groynes followed by ongoing maintenance to maintain the existing defences.	Yes	Patch repairs if carried out well and are timely could be effective in maintaining the existing structures in the short term, until the structures meet the end of their residual life. Refurbishment work would be required for the groynes to improve their overall condition; this assumes the groynes are required to maintain the beach.
Hold the line: maintain through reinforcing existing defences	For this frontage, the measures involved are likely to be the same as those considered above, so this has not been considered further as a separate option.		
Hold the line: improve existing defences	Measures to strengthen existing structures. Incorporating additional toe works to mitigate storm erosion and removal of groynes.	Yes	Strengthen existing promenade structures, concrete seawall and revetment and the rock works at the southern end of the frontage, to improve resilience against storm erosion, this option would include incorporating a toe structure to the existing defences, consistent along the frontage. This option would involve the removal of the existing timber groynes.
Hold the line: improve through constructing new shore control structures	Construction of new shore control structures, such as groynes, reefs, breakwaters to manage the ongoing erosion.	No	This option would replace the timber groynes with rock groynes. However, current evidence suggests that it is questionable whether the groynes have any significant effect on sediment drift and consequently whether they provide any protection to the main promenade structure. Therefore it is not considered that major capital expenditure on rock groynes would be justified.
Hold the line: improve through constructing new revetments or seawalls	Removal of the existing defences and construction of new	No	The defences (excluding the groynes) are in a fair to good condition with only minor defects reported and therefore do not presently require replacement. Rock revetments have recently been added to prevent further storm erosion.

Long list options	Description	Short listed?	Rationale
	revetments or seawalls.		This option would require a large capital investment and the economic justification for the Hold the line policy is questionable. The long term SMP2 policy is to allow the beach to roll back and form a more sustainable functioning shoreline. Therefore, this option is not considered further.
Hold the line: improve through beach recharge	Recharge beach through either nourishment or recycling, which could include a range of different sediments.	No	Sediment transport rates are relatively low in this unit and so there is no obvious source for recycling. This would also impact the adjacent SSSI and influence the natural sediment transport along the frontage. This option would require high ongoing costs to maintain a recharge beach profile and does not offer a resilient solution to erosion.
Hold the line: improve through cliff or slope stabilisation	Introduce cliff or slope stabilisation measures, such as rock toe works, netting, rock bolting, drainage schemes.	No	Undefended cliffs to the south of the policy unit pose an outflanking risk. To continue to defend and extend cliff protection would require a large capital investment and consent from Natural England as cliff sections to the south are a designated site (SSSI). Therefore, this option is not considered further.
Managed realignment: construct defences once set back	Allow existing defences to eventually fail and construct set back defences	Yes	Set back of defences could result in loss of some recreational space and tourism (campsite, café etc.) but potentially help sustain a beach in the longer term with sea level rise and reduce maintenance costs to defences as defended frontage could follow a more natural shoreline.
Other considerations: adaptive management of assets	Allow existing defences to eventually fail and allow beach to realign naturally.	No	Removing existing defences and allowing the shoreline to re-orientate naturally would take many years. The beach is an important amenity asset which would be inaccessible while the realignment (erosion) took place before a new amenity beach could be formed. Also does not provide protection to assets and properties further inland should erosion be allowed to continue.

2.4.2 11d6.2 - Development and appraisal of short listed options

The appraisals below incorporates information from the St Bees Groyne Appraisal Report (Capita Symonds, 2011).

Do nothing (Option 1)

This is considered as a baseline against which other options can be appraised. Under this option all maintenance and management of the defences would cease and defences would be allowed to fail.

Technical Under a Do nothing scenario, the groynes would continue to deteriorate and eventually any effect on longshore drift would be lost: although recent studies were unable to conclude the effectiveness of groynes along this frontage there is a possibility that the beaches could become more mobile and volatile following failure of the groynes.

The backing seawall and promenade will remain vulnerable to wave attack, particularly during storm conditions when there is potential for beach drawdown. The timing of failure will therefore depend upon the frequency and severity of storm events, but it is possible that failure could occur from the medium term. This will be a result of either crest failure or undermining and breach. The life boat ramp would become unusable due to abrasion of the concrete exposing the reinforcement, which is hazardous to the public and can damage the launch vehicles.

Erosion of the low cliffs behind the promenade could be fairly rapid as the shoreline attempts to reach a more equilibrium position. The most extreme erosion estimate of 260 m by year 100 would put approximately 124 properties, the caravan parks, car park, play park and amenity land at risk.

Environmental	<p>In the short term, as the groynes deteriorate planks will become loose and piles may collapse; leading to safety concerns to the beach users.</p> <p>Do nothing would lead to eventual failure of defences which leaves a large area of St Bees at risk of flooding and coastal erosion. Several assets including the promenade, the caravan sites, car parks, and potentially residential properties would be at risk of loss or damage from erosion as well as repeated inundation. The loss of the promenade would reduce the area's amenity value and prevent access to the area by lifeboat.</p> <p>However, Do nothing potentially allows the intertidal habitats which are part of the MCZ designations to naturally expand landward with the natural realignment of the coastline. The St Bees Head SSSI is a partially geological designation which would be enhanced by the reinstatement of more natural erosion rates and coastal processes Do nothing may allow. This may impact on the RSPB Reserve also present on St Bees Head. The potential impacts of Do nothing on WFDs of relevant waterbodies must be considered, for example impacts on the Bathing Water designation and the higher sensitivity habitats present.</p>
Cost	There are no direct costs associated with the Do nothing option.
Damages	Potential loss of the Promenade would lead to loss of amenity and loss of access by the lifeboat. Increased exposure to the caravan parks, beach café and shop and the play park. The discounted present value damages are estimated to be £5,160 k, including £3,270 k amenity and recreational visitor losses.

Do minimum (Option 2)

<p>This is also considered as a baseline against which other options can be appraised. Under this option only reactive patch and repair maintenance would be undertaken, with no works to address any increase in risk due to sea level rise. This option would involve leaving the groynes to deteriorate as in the Do nothing option, only carrying out works to maintain public safety.</p>	
Technical	<p>The works under this option are low cost and reactive. As the beach is a popular amenity area, safety works could include removal of loose planks, bolts screws and removal of piles when they are near collapse. The promenade structure consists of concrete seawalls and concrete sloping revetments, with a short section of rock at the southern limit of the policy unit, the works to maintain public safety could be significant as the structures fail.</p> <p>The backing seawall and promenade will remain vulnerable to wave attack, particularly during storm conditions when there is potential for beach drawdown. It is uncertain whether without groynes the beaches will become more mobile and volatile, which would increase the vulnerability of the structures. There could also be an impact on Rottington Beck retaining structure, with potential for increased scour.</p> <p>This option would not provide a long term solution and would only be likely to increase the lifespan of the defences by approximately 5 to 10 years. Once defences start to fail, the consequence of risk being the same as the Do nothing only delayed.</p>
Environmental	Once the defences fail, the impacts will be as in Option 1 – see above for details.
Costs	<p>The Present Value Total Cost with Optimism Bias (PV(OB)c) is estimated to be £154 k.</p> <p><i>Assumes design life of option 30 years</i></p>
Benefits	This option would maintain the amenity value of the beach and access for lifeboat by delaying the loss of the Promenade until approximately years 25 to 55. The loss of the promenade would lead to loss of amenity and access by the lifeboat. Increased exposure to the caravan parks, beach café and shop and the play park. The benefits are £2,100 k compared to Do nothing option.

Hold the line: maintain through proactive maintenance (Option 3)

<p>Measures to maintain the existing defences. This option assumes that the timber groynes are not required and applies only to works to the groynes to ensure public safety. The existing promenade structures would see a continuation of current activities involving annual inspection and periodic maintenance with rock armour toe protection added to extend the life allowed in years 25 and 75 years.</p>	
Technical	<p>The study by Capita Symonds (2011) was unable to conclude the effectiveness of the groynes and consequently whether they are providing any protection to the Promenade. This option assumes the timber groynes are not required and would only maintain the existing promenade structures.</p> <p>Patch repairs if carried out well and are timely could be effective in maintaining the existing structures in the short term, until the structures meet the end of their residual life. The backing seawall and</p>

	<p>promenade will remain vulnerable to wave attack, particularly during storm conditions when there is potential for beach drawdown. It is uncertain whether without groynes the beaches will become more mobile and volatile, which would increase the vulnerability of the structures. There could also be an impact on Rottington Beck retaining structure, with potential for increased scour.</p> <p>There is a high risk of undermining of the promenade due to lower beach levels, which would be addressed by this option through allowance for rock armour in years 25 and 75. This section of shoreline already stands proud of the adjacent stretch, and it is expected that it will become increasingly exposed in the future due to sea level rise, resulting in increased risk of overtopping and beach lowering.</p>
Environmental	<p>This option would maintain the current defences, which would protect the promenade and the caravan sites, car parks, and properties from flooding and erosion for some time. However, this will not mitigate against any changes to sea level and so risk of overtopping will increase in the future as a result of climatic factors. Should the defences ultimately fail, the potential impacts would be as Option 1.</p> <p>Hold the line options lead to risk of impacts of coastal squeeze on intertidal habitats as the hard alignment prevents the expansion of intertidal habitats as the foreshore lowers. As the intertidal area is designated as an MCZ, this may impact on the value of this designation. Impacts of this option on the WFD objectives of the relevant waterbodies must be considered.</p>
Costs	<p>The Present Value Total Cost with Optimism Bias (PV(OB)c) is estimated to be £560 k.</p> <p>Assumes design life of option 50 years</p>
Benefits	<p>This option would maintain the amenity value of the beach and access for lifeboat for some time, by delaying the loss of the Promenade until approximately years 30 to 60. The loss of the Promenade would lead to loss of amenity and access by the lifeboat. Increased exposure to the caravan parks, beach café and shop and the play park. The benefits are £3,330 k compared to Do nothing option.</p>

Hold the line: maintain through proactive maintenance (Option 4)

	<p>Measures to maintain the existing defences. This would be a continuation of current activities involving periodic maintenance to the timber groynes and promenade defences. This option would need to be preceded by refurbishment works to improve the overall condition of the existing groynes (Capita Symonds, 2011). The refurbishment of the groynes is delayed until year 10.</p>
Technical	<p>This option involves periodic maintenance to the groynes to replace planks and piles to maintain the function of the groynes. Further refurbishment works would also need to be planned for 20 year intervals.</p> <p>Within 25 to 60 years the promenade structures will meet the end of their residual life, with the inclusion of a delay of 5 to 10 years due to proactive maintenance. The consequence of risk being the same as the Do nothing only delayed.</p> <p>Delaying the refurbishment works may lead to further work to maintain public safety and the refurbishment works are likely to be more extensive due to the deteriorating condition. This option does allow for further beach monitoring to be carried out in the interim to determine whether the groynes provide protection to the St Bees Promenade, in which case a more suitable option would be considered and the potential removal of the groynes.</p>
Environmental	<p>Impacts will be as in Option 3.</p>
Costs	<p>The Present Value Capital Cost is estimated to be £860 k and the Present Value Total Cost with Optimism Bias (PV(OB)c) is estimated to be £700 k.</p> <p>Assumes design life of option 50 years</p>
Benefits	<p>Provide protection in the short to medium term to the assets (camp sites, café, recreational areas) at risk along the frontage. The benefits are £3,330 k compared to Do nothing option.</p>

Hold the line: improve existing defences (Option 5)

	<p>This would involve measures to improve the existing defence resilience to potential increased erosion risk. Modification to the existing structures by incorporation of additional toe works. The works are to mitigate storm erosion and potential implications of the removal of the timber groynes.</p>
Technical	<p>The removal of the existing timber groynes would negate the need for their ongoing maintenance necessary to ensure public safety. As there is uncertainty regarding the groynes role in providing additional protection to the promenade toe protection would be constructed along the frontage,</p>

	<p>assumed to be in the form of rock armour. Continued coastal monitoring is necessary to appraise erosion rates and assess changes in risk levels once the groynes are removed.</p> <p>The seawall and promenade will remain vulnerable to wave attack, particularly during storm conditions when there is potential for beach drawdown. It is uncertain whether without groynes the beaches will become more mobile and volatile, which would increase the vulnerability of the structures. Under this option it is therefore suggested the rock toe works are undertaken immediately after the timber groynes are removed to provide a buffer and aid in reducing the risk of significant storm undermining potential, this could be undertaken as early as 5 to 10 years – as the timber groynes continue to deteriorate and are no longer having an impact. It is envisaged that the shingle beach could be excavated, rock toe protection placed and shingle replaced to partially cover the rock.</p> <p>This section of shoreline already stands proud of the adjacent stretch, and it is expected that it will become increasingly exposed in the future due to sea level rise, resulting in increased risk of overtopping and beach lowering. Therefore, it is not anticipated that this would provide a long term solution and may only delay failure of defences to the medium, with the consequence of risk being the same as the Do nothing only delayed</p>
Environmental	<p>This option would improve the current defences, which would protect the promenade and the caravan sites, carparks, and properties from flooding and erosion. However, this will not mitigate against any changes to sea level and so risk of overtopping will increase in the future as a result of climatic factors unless the sea wall is increased. The rock armour if or when exposed may detract from the amenity value of the beach and in the longer term could cause safety concerns for amenity beach users.</p> <p>The removal of the groynes structures would allow the intertidal habitats to be enhanced through the reinstatement of coastal processes. The MCZ designation may be enhanced as a result of this. However, works to excavate shingle beach and the installation of the rock armour may be detrimental to these habitats. However, similar impacts of Hold the line options may result in the long term due to the remaining seawall. Potential impacts on the WFD objectives of relevant waterbodies must be considered.</p>
Costs	<p>The Present Value Capital Cost is estimated to be £710 k and the Present Value Total Cost with Optimism Bias (PV(OB)c) is estimated to be £1,130 k</p> <p>Assumes design life of option 50 years</p>
Benefits	<p>Provide protection in the short to medium term to the assets (camp sites, café, recreational areas) at risk along the frontage. The benefits are £3,330 k compared to Do nothing option.</p>

Managed realignment: construct defences once set back (Option 6)

	<p>This would require the set back of defences which could result in loss of some recreational space and tourism (campsite, café etc.) but potentially reduce maintenance costs to defences. This will involve the removal of the existing structures and options to determine the set back defence line and options.</p>
Technical	<p>There is concern that the alignment of the defences may not be sustainable in the long term, due to economic justification and sea level rise. Therefore there is a need to consider alternative alignment for the long term epochs (50 to 100 years).</p> <p>Prior to any scheme, detailed understanding of the potential implications on the realignment needs to be fully investigated and ensure the most rational, sustainable alignment be adopted, with the consideration of any future consequences.</p> <p>The range of possible realignments needs to be investigated, potential options could involve:</p> <ol style="list-style-type: none"> (a) Retreat to natural high land – removal of the existing defences and allowing the shoreline to adjust to a natural alignment. (b) Identify a new set back location and ensure a suitable standard of protection to the assets at risks. <p>For both options a more sustainable shoreline could be created through natural erosion of the shoreline (cliffs and beach), a potential realignment zone has been identified to give an indication of the area that may be affected by an alternative alignment.</p> <p>The amenity facilities, parts of the caravan park and property in and adjacent to the erosion risk zone could potentially be relocated or adapted through roll back but this would need to be considered through the land use planning process implemented under a Coastal Change Management Area.</p>



Figure 6 Option 6 – Potential realignment zone

There would be a need to undertake technical studies to assess the feasibility, costs and benefits of new set back alignments. This would depend upon the extent of sea level rise to be catered for as it may be possible to link together areas of slightly higher natural topography.

Environmental	<p>This option would result in the adaptation of the amenity beach to long term erosion risk and would require the realignment or adaptation of the recreational sites, tourist amenity and car parking space that would need to be set back and adapted to the realigned beach. The construction of new defences and adaptation of the seafront amenities would have impact on the visual amenity of the area. It would be important to consider the potential amenity benefits alongside landscape impacts and the footprint of the new defences, potentially constructed on designated areas.</p> <p>Allowing for the natural erosion of the coastline may benefit the MCZ and the SSSI by allowing more natural processes to develop the habitats within these designations with minimal constraint. Potential impacts on WFD objectives of relevant waterbodies must be considered.</p>
Costs	<p>Removal and disposal of existing structures and construction of a replacement set back structure, likely to be rock revetment.</p> <p>The Present Value Total Cost with Optimism Bias (PV(OB)c) is estimated to be £4,130 k.</p> <p>Assumes design life of option 100 years, with realignment in year 60.</p>
Benefits	<p>Provide protection to assets at erosion risk along the frontage from outflanking due to erosion of the cliffs in the south. The benefits are approximately £5,200 k compared to Do nothing option.</p>

2.4.3 11d6.2 - Discussion of Options

Table 5 summaries the cost and benefits for the options considered above.

The 2011 St Bees Groyne Appraisal (Capita Symonds, 2011) concluded that the delayed refurbishment of the timber groynes and ongoing maintenance as the preferred solution (Option 4). Delaying refurbishment allows for further data collection to determine whether the groynes are necessary and whether to continue implementation of this option (Capita Symonds, 2011).

The history of the defended frontage means gaining an understanding of the potential future predictions of shoreline evolution is difficult. The short term plan is continue to maintain the frontage for amenity, recreational and tourism value, but in the long term realign to a more natural and affordable position to enable the beach to remain in the future. A Do nothing (Option 1) would lead to safety concerns to the beach users as the existing structures deteriorate. Under a do

minimum (Option 2), once the timber groynes have deteriorated and are no longer having an effect on the shoreline, storm beach response could see significant draw down fronting the defences which could lead to a potentially dramatic and unpredictable failure, the works to maintain public safety could be significant.

Hold the line through proactive maintenance (Option 3) would not help to address the public safety concerns and costs, but would prolong the structure for an additional 5 to 10 years; this option assumes the timber groynes are not required therefore the promenade structures could become more exposed due to increased volatility of the fronting beach. Option 4 is the same as Option 3, except the timber groynes are maintained. This will provide some protection to the existing promenade structure in the short term, but investment in the timber groynes would be required due to their current poor condition.

Improving the existing defences (Option 5) involves modification to the existing structures by incorporation of additional toe works. The works are to mitigate storm erosion and potential implication of the removal of the timber groynes. This would provide a buffer to the erosion of the promenade structure to help prolong their life, but is unlikely to provide a long term solution.

In the short term Option 4 and Option 5 are the most suitable options in ensuring the amenity, recreational and tourism value is maintained for some time. The removal of the timber groynes (Option 5) would allow material to be released and give an indication of the future shoreline response, however there will be costs involved in the removal of the timber groynes and construction of a new rock toe. Maintaining the timber groynes in the short term (Option 4) would also maintain the amenity, recreational and tourism value, but would require ongoing investment to ensure they maintain the beach fronting the promenade.

In the long term as the adjacent shoreline to the south erodes the current promenade will become increasingly exposed, such that in their current location the defences would need strengthening with rock armour at the toe, as with Option 5 and further strengthening and raising in the long term to cope with lowering foreshore and sea level rise. This would result in a significantly smaller beach with difficult access, potentially detracting from the amenity value of the village. The long term SMP policy (50 – 100 years) therefore proposes to realign the defences at a set back a more sustainable shore alignment, while still maintaining an amenity beach. Option 6 involves the realignment of the frontage: the range of possible alignments would need further investigation and detailed understanding of the potential implications on the realignment needs to be fully investigated and ensure the most rational, sustainable alignment be adopted, with the consideration of any future consequences for the future development of the visitor facilities. This option would also manage the potential outflanking risk posed by the policy of “No active intervention” in the adjacent frontage to the south (policy unit 11d6.1).

Based on available data, the current SMP2 policy of Hold the line in the short to medium term (0 to 50 years) by maintaining the existing defences and allowing further monitoring and studies remains viable. There is however a need to better understand the role the existing timber groynes have in providing protection to the Promenade. An approach of continued coastal monitoring is necessary to appraise erosion rate changes in the frontage and the undefended area to the south. After monitoring risk levels over the next ten years an adaptive approach should be developed to address anticipated changes in the medium and long term. Further investigation of the potential set back alignments needs to be considered through the future local development planning process.

Table 5 Policy unit 11d6.2 Summary of economics

Option	Present Value Total cost** (PVC)* £m	PV Benefit (Damage Avoided)** £m	Average Benefit Cost Ratio**
Option 1 Do nothing	0	0.00	-
Option 2 Do minimum	0.9	2.20	2.4

Option 3 Hold the line: maintain through proactive maintenance	0.6	5.16	8.6
Option 4 Hold the line: maintain through proactive maintenance	0.7	5.16	7.4
Option 5 Hold the line: improve existing defences	1.2	5.16	4.3
Option 6 Managed realignment: construct defences once set back	6.5	-	
<i>*Present Value cost (PVC) inclusive of 60% optimisation bias</i>			

For comment

3 Appraisal of non priority units

There is one additional unit within this area, which has been defined as a non priority unit:

- 11d6.1 Pow Beck to St Bees promenade

A light touch review has been undertaken of current SMP recommendations, taking into account conclusions from option appraisals for the adjacent frontage, where appropriate.

3.1 11d6.1 Pow Beck to St Bees promenade

3.1.1 Existing approach to flood and coastal erosion risk management

The existing SMP2 policy along this frontage is No active intervention from the short term, to “allow continued natural erosion of the designated cliffs”. The primary justification for the policy was that it allows a continuation of natural processes along the eroding designated cliff section, supportive to the geological SSSI (St Bees Head) between Pow Beck and St Bees Promenade (Figure 7).



Figure 7 Pow Beck to St Bees promenade. Aerial photograph © North West Regional Monitoring Programme, 2015.

Defences are present, in the form a rock revetment, along the Seacote Hotel. These have a residual life of around 20 to 50 years and are privately maintained (Seacote Hotel) (see Table 6 and Figure 8). The remainder of the frontage, along St Bees Golf Course is undefended. Here the cliffs are active and showing signs of rock falls and mudslides. There is limited debris at the base of the cliffs, suggesting it is fairly rapidly incorporated into the beach. Futurecoast provides an erosion estimate of 50 to 100 m over 100 years. The recession potential is in the order of 0.5 m per year to 1.0 m per year, but a single landslide event could cause up to 10 to 50 m of erosion (Halcrow, 2011).

Table 6 Existing Defence Details

Location	Copeland Borough Council – Annual Coastal Defence Inspection (August 2017)					
	Structure Type	Length (m)	Crest Level (mOD)	Foreshore Toe Level (mOD)	Residual Life (years)	Responsibility
Seacote Hotel St Bees (11d6.1)	Rock Revetment	40	+6.1	+7.62 to +7.69	20-50	Private (Seacote Hotel)
St Bees Golf Course	Natural cliff	970	+6.7	+6.49 to +7.11	20-50	Private (St Bees golf club)



Figure 8 (a) Seacote Hotel St Bees 2 boundary wall with rock protection, (b) Seacote Hotel St Bees 1 Rock protection (11d6.1), (c) Part way along golf club cliff and (d) South end of golf club cliffs

3.1.2 Strategy considerations

Since the SMP2 was adopted, the intertidal and nearshore zone of the Cumbria coast has been designated as a Marine Conservation Zone (MCZ) (designated in 2013) to protect a wide range of habitats found within the site, including honeycomb worm reefs and rock habitats.

The status of the SSSI sites are favourable and the SMP policy is in accordance with the management principles for this designation, which is to allow “coastal processes to proceed freely”, which is considered essential for the “constant renewal of geological exposures and for maintaining the range of habitats and associated species” (Natural England Views About Management (VAM) statement, 2005¹).

¹ The VAM is available online: <https://designatedsites.naturalengland.org.uk>

The cliff top is home to St Bees Golf Club, a 9 hole course situated on the West Coast of Cumbria beside the Irish Sea.

There is a public right of way that runs along the cliff edge; the route of the new England Coast Path follows this along most of the frontage (the route is now open, but not yet available for public use; anticipated summer or autumn 2018).

There is a proposal by West Cumbria Mining for a new underground or undersea mine, together with an above ground enclosed processing and storage area on the former Marchon Industrial site, located inland from the coast. The proposed mining areas lie offshore of this frontage. The EIA prepared in support of the proposals did not identify any direct impacts on this frontage but did recognise that the direct impacts on the marine and intertidal environment relate to subsidence of the seabed following mining works; the impact of which has not been fully assessed (West Cumbria Mining, 2017). The EIA includes recommendations for further study and monitoring.

The coastal monitoring data show that the cliffs in policy unit 11d6.1 are active, but there has been little change in cliff top position. Partial failure of the cliff face has been observed, with deposition of talus onto the beach. There has also been some erosion of the cliff behind the sea wall along Seacote Hotel frontage, most likely due to wave overtopping.

3.1.3 Discussion

There is no justification for any change in policy, which supports the SSSI designation for this frontage. The periodically unstable cliff face at multiple locations.

The proposed SMP2 policy is “No active intervention” in all three epochs.

If this policy is implemented there will, in time, need to be actions taken to avoid outflanking of the defences to the north for which the policy is “Hold the line” in short to medium term followed by long term Managed realignment (policy unit 11d6.2). This is discussed in the priority unit 11d6.2, Section 2.3. There are currently private defences along this frontage; these are not specifically considered by the SMP2. Any extension or modification of these would require consent by Natural England and would be likely to require a scheme level HRA and AA.

Future actions are:

- Continued monitoring of the cliff and beaches, as part of the North West Regional Monitoring Programme. This will also inform prediction rates for assessing benefits along the adjacent policy unit 11d6.2.
- Safe siting of the England Coast Path, the route of which runs along the cliff top. Although anticipated erosion rates along this stretch are extremely low, there remains some potential for cliff falls that could cause a few metres of erosion along isolated stretches; the proposals do recognise the potential need to roll back the route to follow the cliff line (see <https://www.gov.uk/government/publications/england-coast-path-in-the-north-west-of-england>). The route should therefore be monitored.

4 References

Capital Symonds (2011). St Bees Groyne Appraisal. Copeland Borough Council. Version: 31 January 2011.

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For comment