



Brighton Marina to Newhaven Western Harbour Arm Plan

Summary of findings for the Local Community

January 2016

Lewes District Council and Brighton and Hove City Council

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Executive Summary

The Brighton Marina to Newhaven Coastal Management Implementation Plan, here after known as the Plan, was commissioned by Lewes District Council (LDC) and Brighton and Hove City Council (BHCC) to develop a plan for the sustainable management of the coastline over the next 100 years. The Plan has reviewed and updated the previous studies undertaken along the frontage including the Selsey Bill to Beachy Head Shoreline Management Plan (Halcrow, 2006), the Brighton Marina to Saltdean Coastal Defence Strategy (Posford Duvivier, 2001) and the Saltdean to Western Breakwater Strategy Plan (Mouchel, 2002) to develop this Plan in line with the current Government Flood and Coastal Risk Management Guidance (Environment Agency, 2010).

Under the current Government guidance, projects are assessed to determine the availability of national government funding. To be eligible for funding, a scheme has to be shown to be justifiable at the national level, determined by comparing the economic value of the property and infrastructure protected from erosion against the cost of implementing the coastal defences. It should also be noted that under the current government funding guidance, although schemes may be eligible for funding, it is unlikely that the scheme will be fully funded by the government. Therefore external local contributions will be required to top-up the government funding. It is important that this strict Government guidance is followed, to ensure that viable and sustainable schemes are developed (where possible), to ensure that a robust business case can be clearly presented to the Government when applying for funding.

To develop the Plan, an assessment of the potential future behaviour of the cliff was undertaken, based on a review of how the cliff has retreated historically. Using the historic retreat rates, the residual life of the defences and future sea level rise, the estimated extent of future cliff retreat was calculated. The estimated future retreat rates along the frontage (based on no defences being present) varied from 31.4m to 90.82m over the 100 year period depending on the different geologies along the frontage.

Using this assessment, a series of coastal management options to sustainably manage the frontage over the next 100 years have been developed. Following a workshop with the project team and the Environment Agency, the options were cut

down to a short list for each of the Strategy Units (SUs) along the frontage. The short list of options for each of the SUs is outlined below:

Table 0.1: Short list of Options for the SU's. It should be noted that these shortlist options are designed to protect the toe of the cliff from coastal erosion. However due to weathering and the natural behaviour of the cliff the cliff top is likely to continue to retreat. Therefore the options will not completely eliminate the threat to the cliff top assets, but will significantly reduce them. N.B these outline options have developed to provide erosion protection to the toe of the cliff for 100 years i.e. until year 2115. However this may not necessarily maintain the amenity value of the promenade. It should also be noted that options developed are only outline; so it is recommended that further more detailed studies are undertaken to develop the options further to ensure they are suitable.

SU	Option	Description
SU01- Brighton Marina to Rottingdean High-Street	Do Minimum/Maintenance	High level maintenance of the seawall, rock revetment and eastern end rock groyne/beach. Concrete cladding of the seawall in Year 13 to extend the life of the seawall.
	Rock revetment in front of seawall	High level maintenance of the seawall, rock revetment and eastern end rock groyne/beach. Concrete cladding of the seawall and placement of rock revetment in Year 13.
	Replace seawall	Medium level maintenance of the seawall, rock revetment and eastern end rock groyne/beach. Phased implementation of the new seawall in Year 28, and 58 based on the residual life of the defences.
	Coastal adaptation	High level maintenance of the seawall, rock revetment and eastern end rock groyne/beach until Year 40, followed by a medium level of maintenance from Year 40. Re-route of the A259 inland and construction of rock revetment at the western extent of Rottingdean in Year 40 to allow the A259 to re-join current alignment through the town. Relocation of some houses will also be required from Year 60. Further detailed study is required to consider the wider environmental and social impacts.
SU02 - Rottingdean High-Street to East Saltdean	Do Minimum/Maintenance	High level maintenance of the seawall, rock revetment and eastern end rock groyne/beach. Phased concrete cladding of the seawall in Year 10, 15 and 30 to extend the life of the seawall.
	Rock revetment in front of seawall	High level maintenance of the seawall, rock revetment and eastern end rock groyne/beach. Phased concrete cladding of the seawall and placement of rock revetment in Year 10 and 28.
	Replace seawall	Medium level maintenance of the seawall, rock revetment and eastern end rock groyne/beach. Phased implementation of the new seawall in Year 18, 28, and 43 based on the residual life of the defences.
	Coastal adaptation	High level maintenance of the seawall, rock revetment and eastern end rock groyne/beach until Year 40. Re-route of the A259 inland and setback of houses from Year 40. Further detailed study is required to consider the wider environmental and social impacts.
SU03 – Saltdean Undefined	Rock revetment in front of cliff	Construction of rock revetment at toe of cliff in Year 30. Medium level of maintenance works every 10 years after construction.
	Re-route of road (A259)	Continue to leave undefended and then re-route the road inland in Year 50 and setback of houses from Year 70. Further detailed study is required to consider the wider environmental and social impacts.
SU04 - Telscombe Cliffs	Rock revetment in front of cliff	Construction of rock revetment at toe of cliff in Year 50. Medium level of maintenance works every 10 years after construction.
	Coastal adaptation	Continue to leave undefended and then re-route the road inland and setback of houses in Year 60. Further detailed study is required to consider the wider environmental and social impacts.
SU05 –	Construction of new	Construct a new concrete seawall and rock groyne in Year 4. After construction

SU	Option	Description
Portobello (Southern Water Pumping Station)	seawall and rock groyne	medium level of maintenance.
SU06 – Telscombe	Rock revetment in front of cliff along whole section	Construction of rock revetment at toe of cliff in year 3. Medium level of maintenance works every 10 years after construction.
	Rock revetment in front of cliff along the eastern end of the section	Construction of rock revetment at toe of cliff in year 3. Medium level of maintenance works every 10 years after construction.
	Coastal adaptation	Remain undefended and then set back of houses inland from Year 20. Further detailed study is required to consider the wider environmental and social impacts.
SU07 – Peacehaven Defended	Do Minimum/Maintenance	High level maintenance of the seawall and groynes. Concrete cladding of the seawall in Year 20 to extend the life of the seawall.
	Rock revetment in front of seawall	High level maintenance of the seawall and groynes. Concrete cladding of the seawall and placement of rock revetment in Year 20.
	Rock revetment in front of seawall (without cladding)	High level maintenance of the seawall, and groynes. Construction of rock revetment in Year 20.
	Replace seawall	Construction of new seawall in Year 20. High level maintenance of the seawall every 10 years after construction.
	Rock groynes and beach recharge	High level maintenance of the seawall and groynes. Construction of rock groynes and beach recharge from Year 18.
	Coastal adaptation	High level maintenance of the seawall, rock revetment and eastern end rock groyne/beach until Year 50. Set back of houses inland from Year 0. Further detailed study is required to consider the wider environmental and social impacts.
SU07b – Peacehaven Defended (Groynes 18 and 19)	Rock revetment in front of seawall (whole section)	Removal of concrete groyne and construction of rock revetment in front of seawall in year 3. Medium level of maintenance every 10 years.
	Replace groyne 18 with rock groyne and seawall works (shorten promenade)	Replacement of groyne 18 with rock groyne, removal of groyne 19 and shorten promenade in year 3. Protect the wall with a rock revetment. Medium level of maintenance every 10 years.
	Rock revetment in front of seawall (short length)	Removal of concrete groyne, shorten promenade and construction of rock revetment in front of seawall in year 3. Medium level of maintenance every 10 years.
	Removal of concrete groynes and construction of 2 rock groynes and beach recharge	Removal of concrete groynes, construction of 2 rock groyne in year 3. Medium level of maintenance every 10 years.
SU08 – Peacehaven to Newhaven	Managed Realignment – geomorphological surveys	No viable options developed as economic benefits are very low and therefore no schemes would be justifiable for FDGiA funding. Furthermore the SU has a Managed Realignment policy over the next 100 years, and therefore the SMP does not recommend any works. It is recommended that a more detailed geomorphological study of this area is undertaken to determine a more thorough understanding of the complex retreat of the cliff in this section.

This short list of options has been appraised by the project team to determine the potentially viable options based on the value of the assets being protected (benefits), compared against the cost to implement the management schemes (costs), to develop a benefit cost ratio. For a scheme to be considered for Government funding the benefit cost ratio has to be above one, so the value of the benefits are greater than the costs of the scheme. The value of the costs and benefits has also been used to estimate the amount of Government funding the schemes may be eligible for (Section 3 of this report). It is important to note that the main road (A259) provides a significant amount of the benefits, especially in Rottingdean and Saltdean. However, east of Saltdean, and through Peacehaven the route of the road is more inland and therefore not at risk of erosion. Hence the value of the benefits is significantly reduced, and as a result the benefit cost ratios are lower. Therefore the schemes in these areas will attract less government funding.

Decisions will now need to be taken by the Councils as to which of the options are to be taken forward, following discussions with key stakeholders e.g. Southern Water, Town Councils, East Sussex County Council and the local community and residents groups. Once the preferred options have been decided, the coastal schemes will need to be developed in more detail, and a more detailed scheme specific business case presented to the Environment Agency to confirm the amount of potential government funding. Once this has all been completed the design can be developed for construction and construction can commence. Therefore it can be seen that it is quite a long process and is likely to take several years before a scheme will be in place.

It should be also noted that the development of the capital schemes will be subject to obtaining the relevant permissions, licences and permits from Natural England (Environmental Designations), South Downs National Park (Planning), Local Planning Authority and the Marine Management Organisation (works in the coastal area). It is vital these are obtained prior to construction.

Finally, in addition to the development of individual coastal management schemes, it is also essential that annual monitoring and surveys of the cliff are undertaken. Both Councils should work closely with colleagues involved in the

regional monitoring programme in analysing the annual cliff survey data and augmenting it with further data where necessary in order to establish whether the cliffs are behaving in line with the scenarios modelled in this study.

Glossary

Adaptation – the process for managing the impacts of coastal change on communities and individuals, in advance of erosion and or realignment, with the aim of reducing the risk and mitigating the adverse effects.

Appraisal – an appraisal is undertaken to assess all the options and develop preferred options to take forward for further investigation.

Asset – This refers to something of value and may be environmental, economic, social or recreational.

Benefits – include residential and non-residential buildings that will have a positive economic value. If these benefits are lost there will be an economic loss to the property owner.

Benefit Cost Analysis – a comparison of present value coastal defence scheme benefits and costs as part of an economic appraisal. The benefit-cost ratio is the total present benefits divided by the total present value costs.

Benefit Cost Ratio - The benefit-cost ratio is the total present benefits divided by the total present value costs.

Berm – ridges in material that are found on beaches, often related to the high water level.

Capital works – significant works or upgrades to defences or the construction of new defences.

Cash value – the current value of a cost of benefit.

Cliff Face – the front of the cliff which exposed to weathering and erosion.

Coastal Defence – a term used to encompass both coastal protection against erosion and sea defence against flooding.

Culver Chalk - a firm slightly yellowy white chalk.

Deposits – materials that were laid down in rivers (Dry Valleys) or when sea levels were much higher. The materials are very loosely compacted making them a weak material that can fail easily.

Discounting - a reduction to the value of the cost benefit to account for future changes in the cash price. See Present Value.

Do Nothing baseline – a zero cost option which involves no action on site. In the case of existing defences it assumes walk away: cease all maintenance, repairs and other activities immediately. The Do Nothing baseline is used to compare the costs of all Do Something options.

Down wearing – erosion of the shore platform leading to a reduction in the level of the platform.

Dry Valley – features formed by river flows in the last ice age which can be seen within the cliffs. These are now filled with weak loose materials which consist of sands, gravels and silts.

Economic Appraisal – an appraisal that takes into account a wide range of costs and benefits, generally those which can be valued in monetary terms.

Environment – the term encompasses all the facets of our surroundings: landscape/natural beauty, flora, fauna, geological or geomorphological features and buildings, sites and objects of archaeological, architectural or historic interest.

Erosion – the loss of land through a combination of wave attack and slope processes e.g. high groundwater erosion leading to failure of slope materials. This may include cliff instability, where coastal processes result in the periodic reactivation of landslide systems or promote rock falls.

FDGiA (Flood Defence Grant in Aid) - funding from the government to pay for flood and coastal erosion risk management works that reduce the risks or impacts of flooding or coastal erosion.

Geomorphological Survey – a survey of the cliffs is undertaken to recognise and map ancient and modern slope movements, surface groundwater and the geology to assess the potential hazards of the slope.

Groundwater – is water located beneath the Earth's surface in soil pore spaces and in the fractures of rock formations. The level of groundwater fluctuates depending on the amount of rain and surface water infiltration.

Groynes – structures in rock or concrete perpendicular to the shoreline used to control beach material movement.

High level maintenance – a proactive maintenance regime, with works being undertaken regularly to ensure that the performance of the asset is maintained at a good level.

Hold the Line – a Shoreline Management Policy which involves the building or maintenance of defences so that the position of the shoreline remains.

Local Nature Reserves – areas of land of local importance declared by the Local Authority in consultation with English Nature under the provisions of the 'National Parks and Access to the Countryside Act 1949', which are managed to enhance their value.

Longshore Sediment Transport – movement of sediment along the coastline by wave action.

Maintenance works – work undertaken on the current coastal defences to ensure they continue to help maintain the current standard of defence. It does not refer to improvements to such works to maintain the same level of protection against a new or increased risk.

Managed Realignment- a Shoreline Management Policy which allows the shore to move naturally, but still some management to help direct it in some areas.

Medium level maintenance - a proactive maintenance regime, with works being undertaken regularly to ensure that the performance of the asset is maintained at a fair level.

Newhaven Chalk – a firm white chalk (N.B. this is the geological term for the chalk and not the location).

Palaeocene Deposits – younger materials than the Newhaven and Culver Chalk. Consist of weak sands and silts, which are weaker than the chalk.

Present Value –calculated to account for variation to the cash value in the future. It is assumed the cash value will decrease in the future, so the Present value is a discounting of the cash value.

Property Roll-back – a managed realignment option which involved the relocation of a line of properties further inland.

Recession (of the coastline) – the position of the coastline retreats landwards due to coastal erosion.

Residual life- the expected amount of time left for a defence to continue being operational. A value is determined based on the current state of the defence.

Revetment – a cladding of rocks to stabilise and protect the base of the cliff or seawall against wave erosion.

Scour – the erosion that occurs at the base of a structure of cliff caused by wave attack.

Setback – a coastal adaptation process which involves the relocation of properties inland away from the cliff edge.

Shoreline Management Plan (SMP) – a high level policy document for coastal management published by the Environment Agency.

Shore Platform – a flat rocky surface at the base of a cliff formed by wave erosion.

Site of Special Scientific Interest (SSSI) – an area of land or water notified under the Wildlife and Countryside Act (1981), as being of special nature or geological conservation importance.

Undercutting – erosion at the base of the cliff caused by wave attack.

Weathering – the wearing away and breaking up of rocks caused by wind, water, changes in temperature, burrowing animals and plant roots.

Water Framework Directive (WFD) Assessment– an environmental assessment undertaken to ensure that any proposed schemes do not have a negative impact upon the management of waterbodies.

1 Introduction

1.1 Background

Lewes District Council (LDC) and Brighton and Hove City Council (BHCC) appointed Mott MacDonald to develop a Coastal Management Implementation Plan (henceforth known as the Plan) for the coastline between Brighton Marina and Newhaven. The Plan aims to build upon the Selsey Bill to Beachy Head Shoreline Management Plan (Halcrow, 2006), the Saltdean to Western Breakwater Strategy Plan (Mouchel, 2002) and the Brighton Marina to Saltdean Coastal Defence Strategy (Posford Duvivier, 2001) which were previously developed for this section of coastline. Where necessary, The Plan has examined and refined the current coastal management policies, providing a strategic overview of the suggested options for future sustainable management of the coastline. The outputs of this plan will then provide recommendations for individual studies and schemes to be taken forward and developed in more detail and help LDC and BHCC to make informed future planning decisions for effective coastal management.

1.1.1 Site Location

The frontage examined in this Plan extends from (but not including) Brighton Marina in the west to the western harbour arm at Newhaven Harbour in the east (Figure 1.1). The frontage falls within the administrative area of two coastal protection authorities: Brighton and Hove City Council (BHCC), whose responsibility extends from Brighton to East Saltdean and Lewes District Council (LDC) who are responsible for the rest of the frontage from East Saltdean to Newhaven.

Figure 1.1: Location of the Study Area. The Study area extends approximately 10km from the eastern extent of Brighton Marina through to the Newhaven Western Harbour Arm, covering areas of both defended and undefended chalk cliff.

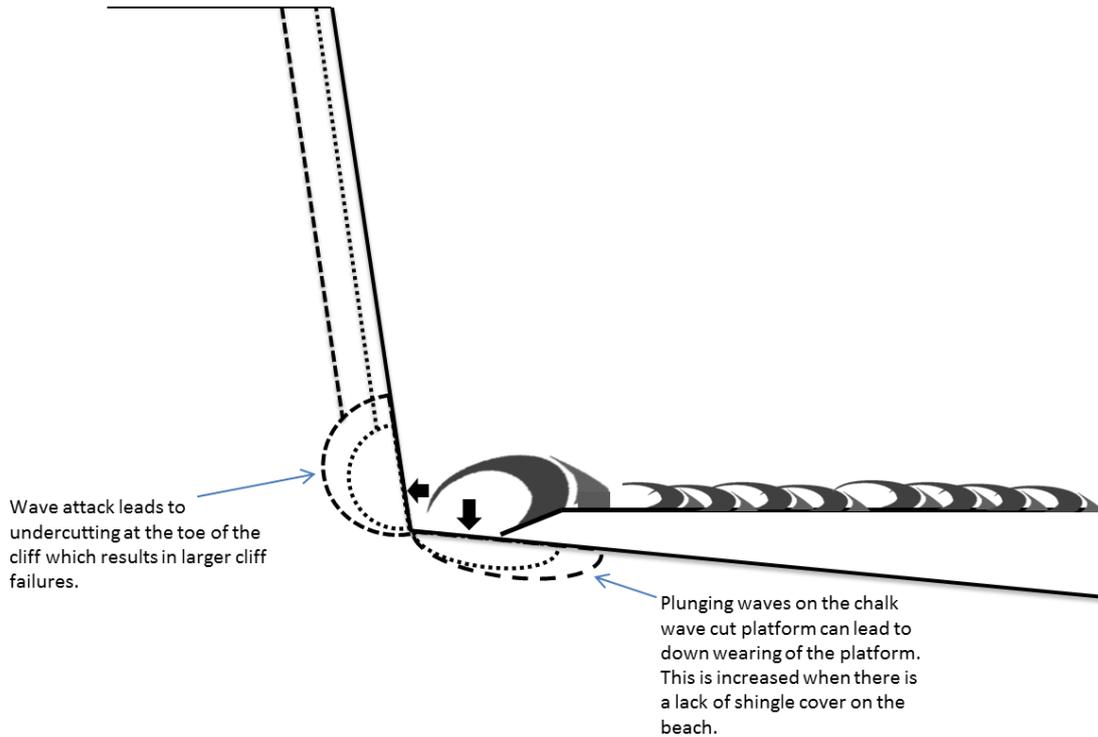


Source: Contains Ordnance Survey data © Crown Copyright and database right 2014

The existing coastal defences along the frontage consist of concrete seawalls, concrete and rock groynes, rock revetments and natural shingle beaches. These protect the toe of the cliff from coastal erosion and undercutting, helping to reduce the rate of cliff retreat along the defended sections of frontage. Along the undefended sections of the frontage the cliffs are currently experiencing an average rate of erosion between 0.28m - 0.48m per year depending on the geology of the cliffs which changes along the frontage. The average annual rate of historic retreat has been developed to allow comparison between the different geologies within the cliff along the study area and project future retreat rates. However, in reality, failures of the cliff occur as large episodic events rather than as a small annual retreat.

In addition to the erosion of the cliffs, the shore platform at the base of the cliff is subjected to erosion and down-wearing, which can lead to the undermining of structures (Figure 1.2). The down wearing of the platform is reduced when there is extensive shingle cover. However, during winter months and large storm events it has been noted that the amount of shingle cover can be significantly reduced which may lead to increased erosion and undermining of the defences.

Figure 1.2: The sketch below highlights the process of how the chalk cliff and shore platform can be subjected to wave erosion.



1.1.2 Nature Reserves and Environmentally Protected Areas

The frontage is heavily designated under environmental legislation. This means that the natural environment along the frontage is protected due to the presence of the white chalk geology as well as the presence of rare flora and fauna e.g. beetles, breeding sea birds and chalk grassland. As such development within the area is limited to ensure the geology of the cliffs is not damaged and natural habitats are maintained. The protected areas are explained in Table 1.1 and Figure 1.3. Consideration of the environmental sensitivities has been included throughout the option development. Figure 1.2 summarises the environmental designations within or close to the frontage.

The South Downs National Park also forms part of the study area and encompasses parts of the cliff between the Marina and Rottingdean and at Telscombe Tye. The foreshore along the whole frontage is also a protected area.

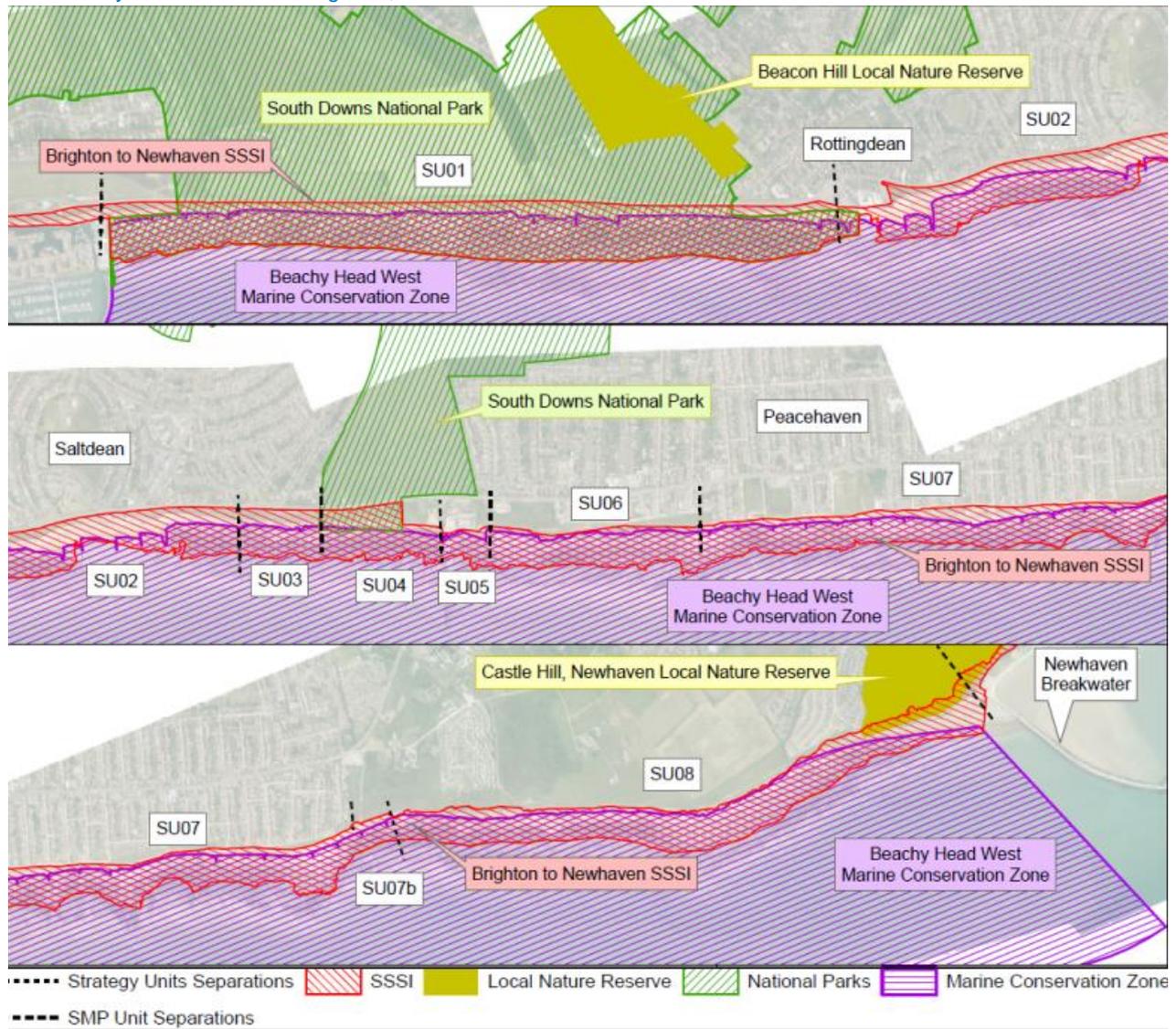
Table 1.1: The extent and description of the environmentally designated areas within the Plan area.

Designation	Extent	Description
Brighton to Newhaven Cliffs Site of Special Scientific Interest (SSSI)	The length of the Plan shoreline from Brighton Marina to Newhaven Harbour	The cliffs have been designated for their geology as well as for rare flora and fauna that live on the cliff face and the narrow strip of cliff top chalk grassland
Beachy Head West Marine Coastal Zone	The length of the Plan shoreline from Brighton	The area is protected as it contains some of the best examples of chalk habitats in the south east including chalk reefs and

Designation	Extent	Description
(MCZ)	Marina to Newhaven Harbour	gullies supporting specialised communities of animals and seaweeds. Additionally, the sites are known to support the rare short-snouted seahorse
The South Downs National Park	Encompasses parts of the cliff between the Marina and Rottingdean and at Telscombe Tye	The South Downs National Park is designated to protect a rich variety of wildlife and habitats including rare and internationally important species and help maintain the distinctive environment of the South Downs.
Beacon Hill Nature Reserve	An area just to the north of the Plan area, to the west of Rottingdean.	Beacon Hill Local Nature Reserve is designated for its chalk grassland which supports a range of plants and butterflies
Castle Hill Nature Reserve	At the eastern extent of the Plan area on the Newhaven cliffs.	Castle Hill overlaps the SSSI, and is designated for its geological importance but also the presence of seabirds and WWII gun emplacements

Source: Natural England 2015; South Downs National Park, 2015

Figure 1.3: Environmental designations along the frontage. It can be seen that the Marine Conservation Zone and SSSI extend across the whole Plan area. The South Downs National Park meets the coastline between the Marina and Rottingdean and at Telscombe. The Local Nature Reserves are just set back from the coast at Beacon Hill, immediately to the west of Rottingdean; and at Castle Hill on the eastern most extent of the Newhaven Cliffs.



Source: Aerial Photography from CCO, 2013, Shapfiles of Environmental Designations from EA (accessed 2015)

1.2 Shoreline Management Plan

A shoreline management plan (SMP) is a high level assessment of coastal management strategies. The strategies can be divided into short term (0-20 years), medium term (20-50 years) and long term (50-100 years) plans. The current coastal management policies for the coastal frontage are detailed in the Beachy Head to Selsey Bill SMP (Halcrow, 2006). The coastal policies consist of:

- Hold the Line (HTL): Maintain/improve the current defences to defend the coastline from erosion or flooding.
- Monitor, Manage and Review (MMR): Account for the long term uncertainty in cliff retreat. This monitoring has been occurring since the SMP was produced in 2006.
- No Active Intervention (NAI): Any current defences are left to fail and the cliff erodes naturally.

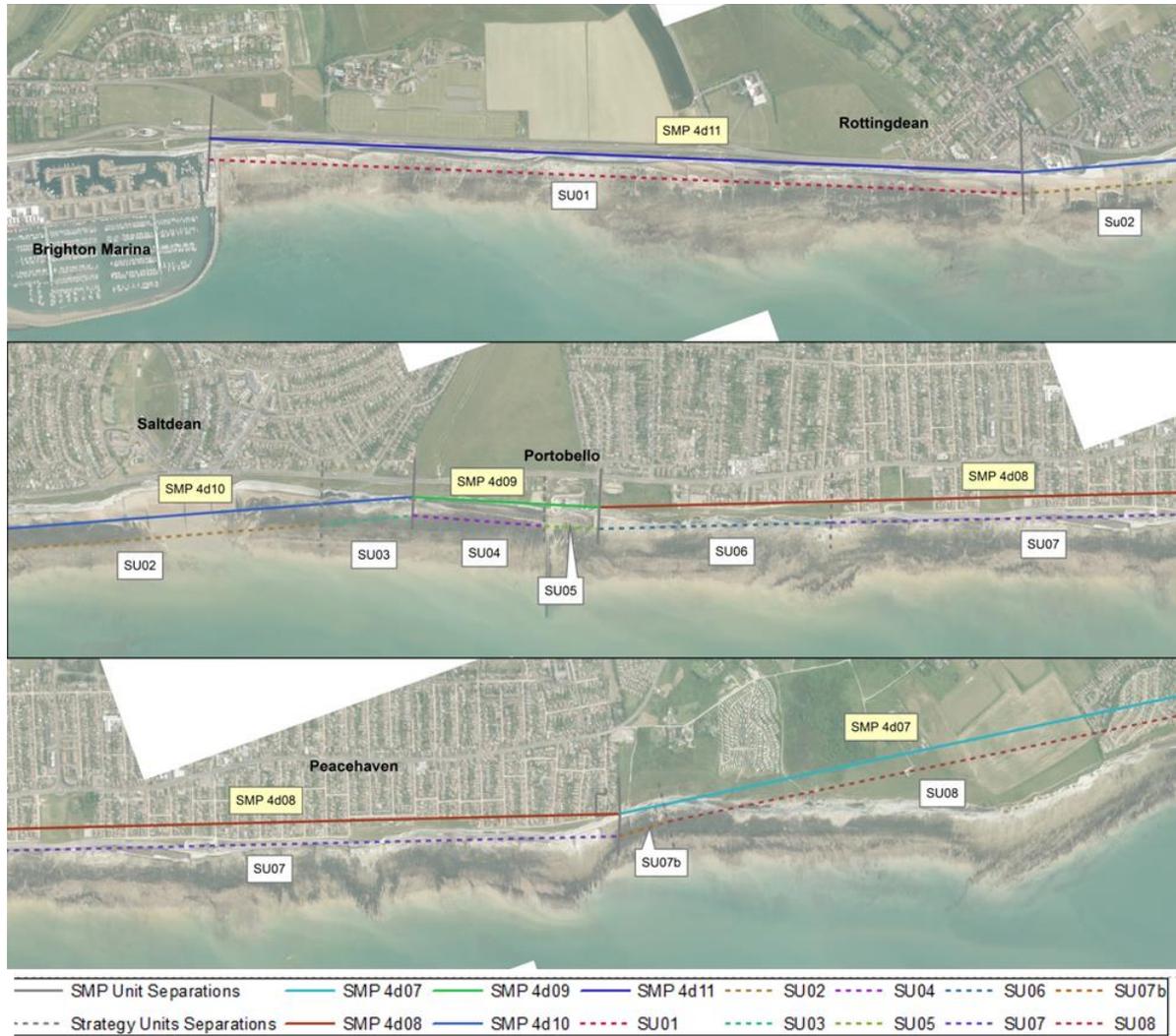
- Managed Realignment (MR): Defences not maintained and coastline left to erode/flood. However, there is some maintenance of the defences to manage where the erosion occurs. In addition, relocation of assets at risk occurs.

This Plan has assessed the SMP to determine how well it matches current conditions. For the basis of this assessment, the frontage has been broken down into Strategy Units (SU). The SUs are based loosely on those set out in the SMP, but are broken down further to separate between where the coast is currently defended or undefended. These SUs current conditions and recommendations from the SMP (Halcrow, 2006) are highlighted in Table 1.2. The locations of the SUs are also visualised in Figure 1.4.

Table 1.2: The division of the frontage into SUs and the coastal management policies recommended by the SMP (Halcrow, 2006)

SU Unit	Current Status	Short term	Medium Term	Long Term
SU01	Defended	HTL	HTL	MMR
SU02	Defended	HTL	HTL	MMR
SU03	Undefended	HTL	HTL	MMR
SU04	Undefended	NAI	NAI	NAI
SU05	Defended	NAI	NAI	NAI
SU06	Undefended	HTL	HTL	HTL
SU07	Defended	HTL	HTL	HTL
SU07b	Defended	MR	MR	MR
SU08	Undefended	MR	MR	MR

Figure 1.4: The extent of the study area and division of the frontage into SMP units (solid line) and Strategy Units (dotted line) that have been developed for this study. It can be seen that to produce the Strategy Units some of the SMP units have been broken down into smaller Strategy Units based on where the coast is currently defended or undefended.



Source: Aerial Photography from Channel Coastal Observatory, 2013

2 Aims of the Study

2.1 Aims

The development of a new Plan has been commissioned by the two Councils, in partnership, to develop the existing coastal strategies. The new Plan will take account of the changes in coastal management guidance and appraisal strategies, particularly economic assessment guidance, following the 2010 updates to the governments' guidance on applying for funding for coastal defences.

The aim of the Plan is to provide a greater understanding to the Councils of:

- Future estimates of coastal erosion;
- The costs and benefits of potential options, taking full account of environmental considerations, together with economic impacts;
- Gaps in funding for coastal defences;
- Inform future coastal management policy and feed into any future reviews;
- Potential action plans and budgets required to obtain the best return from existing defence assets.

These aims were met in the Plan through the completion of the studies and appraisals outlined below:

- Development of a cliff recession model;
- An economic assessment
- A review and update of the environmental baseline to ensure that any proposed options will not have a detrimental effect upon the environment;
- A Water Framework Directive Assessment; and
- Development of a programme of works to assist future budget setting.

2.2 Coastal Management Guidance

Since the passing of the 1949 Coast Protection Act Local Coastal Protection Authorities (in this study this includes LDC and BHCC) and the Environment Agency have been given permissive powers to carry out works, under general supervision by central government (DEFRA), to protect any land in their area at risk of erosion or encroachment by the sea, subject to environmental designations. However, complete protection of the coasts is rarely possible as resources of both the local area and the nation as a whole are limited.

Funding is now assessed through Flood and Coastal Resilience Partnership Funding. Partnership Funding awards coastal defence schemes a percentage of funding based on the degree to which they achieve specific outcomes. The outcomes are based on:

- A reduction of flood and erosion risk;
- A reduction of flood and erosion risk, specifically to residential properties;
- A reduction of flood and erosion risk to habitats;
- The creation of new habitats.

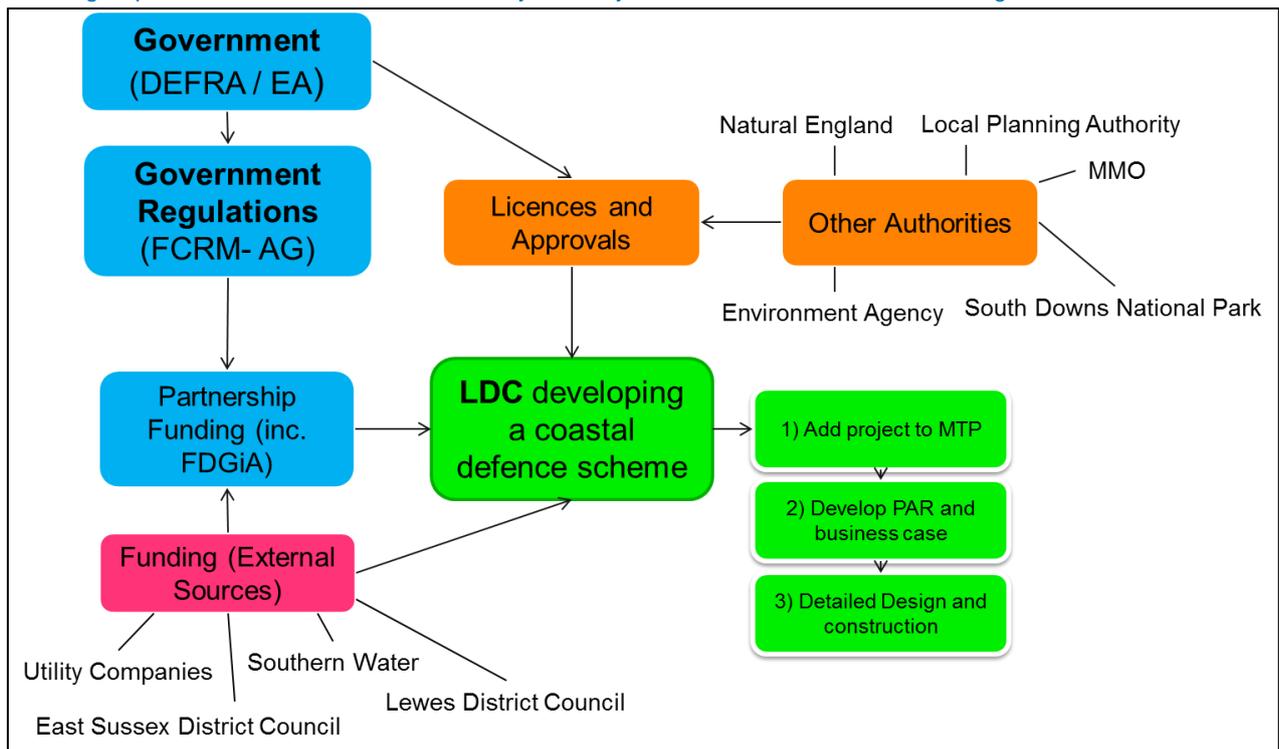
In order to help fund coastal protection on a national level, DEFRA provides a Flood Defence Grant in Aid (FDGiA), the guidance for which is provided in the FCERM guidelines (2010) (Figure 2.1). In this document it is stated that grants are accessible to schemes that are:

- Technically Sound
- Environmentally Acceptable
- Economically Justifiable
- Cost Effective

If these four categories are not achieved then it is unlikely that government funding will be provided for coastal schemes. However, even if these categories are achieved, the FDGiA grant is available for not just coastal flooding and erosion, but also inland flooding. This means that the grant must be justifiable at a national level over other potential projects. Therefore, even in cases with FDGiA funding, further local contributions are often required to achieve the full amount of funding to allow the implementation of the coastal defence scheme. This can be from outside sources including Utility Services, Highways Authority and Councils, private companies and local initiatives (Figure 2.1)

Therefore it is important that the government guidance for funding is considered when delivering the aims of the Plan to ensure that potentially viable solutions are developed. This will ensure that the schemes are suitable to be taken forward in the future and are more likely to gain potential government funding.

Figure 2.1: Chart of processes requiring fulfilment leading up to and including the final construction phase. The government affects the feasibility of schemes through both funding and licensing requirements. However, funding and licencing requirements will also be determined by a variety of other authorities and external agents.



3 Results of the Study

3.1 Shortlisted Options

The coastal management options considered in the Plan include:

- **Concrete cladding** - Concrete cladding of the current seawall to increase the residual life by reducing scour of the face of the wall.
- **Seawall** – Once the current seawall has reached the end of its residual life it will be replaced with a new one of similar design.
- **Rock revetment in front of seawall** – construction of a rock revetment at the base of the seawall to continue to protect the toe of the wall from scour and undermining. The current seawall will be clad in concrete and then a rock revetment will be constructed at the toe.
- **Rock revetment in front of cliff** – a rock revetment will be placed at the toe of the cliff to prevent undercutting and destabilising of the cliff.
- **Rock groyne** – rock groynes are proposed to be installed to help maintain beach material (and in some places in conjunction with beach recharge) to protect the toe of the current seawall from scour and undercutting.
- **Adaptation** – relocation inland of assets at risk. Coastal adaptation can be described as the “process of managing the impacts of coastal change on communities and individuals, in advance of erosion and/or realignment, with the aim of reducing the risk and mitigating the adverse effects” (RPA, 2008). Adaptation can take a variety of forms and is a community based approach; however the approach is a relatively new concept, with previous examples mainly based on the Norfolk Coast. In this Plan, adaptation refers to mainly the re-routing of the A259 away from the cliff top and/or the setback of the houses further inland when they are at risk from cliff erosion (property roll-back). Should this option be taken forward it would require further refinement and a more detailed study to look at the different adaptation options which could be appropriate.
- **Beach Recharge** – it is assumed beach recharge will be installed in conjunction with rock groynes. Raising the beach levels will provide protection to the toe of the current seawall and reduce scour of the wave cut platform.

Figure 3.1: Examples of the sea wall (left) and rock groynes (right) already present on the frontage.



3.2 Methodology

3.2.1 Cliff Retreat

Cliff retreat was estimated over the next 100 years based on a scenario that all management of the defences along the coastline stopped and the cliffs were free to erode (Do Nothing scenario). Values of projected future retreat were calculated from a combination of geology, an annual average of historic retreat rates based on maps, aerial photography and laser scan cliff surveys, future sea level rise and the residual life of the current defences. The projected future retreat rates were then used to determine which assets were at risk over the 100 year period. It is important to note that these averages do not mean the cliff retreats at a steady rate; instead larger events tend to occur less regularly.

Table 3.1 below shows the projected future cliff retreat rates based on the different geologies along the coast. The lengths and locations of different geologies are shown in Figure 3.2.

Table 3.1: Average future projected annual cliff retreat for different geologies along the coast.

Geology	Undefended average projected future retreat rate (m/year)*	Once defended average projected future retreat rate (m/year)*
Newhaven Chalk	0.53	0.04
Culver Chalk	0.61	Not present in defended sections
Dry Valley Deposits	0.81	0.07
Palaeocene Deposits	0.52	Not present in defended sections

* The average annual projected future retreat rates are calculated by taking the average of the annual projected future rates of retreat over the 100 year period. Therefore at the beginning of the 100 year period the projected future retreat rates are less than those shown in the table above, but by the end of the 100 year period the annual projected future retreat rates are greater than those shown in the table above. It should also be noted that these averages do not mean that the cliffs retreat at a steady rate; instead larger events tend to occur less regularly.

Based on these different factors the projected total future retreat varied from 31.4m to 90.82m over the 100 year period under a Do Nothing scenario, and from 3.69m to 33.68m under a defended scenario based on the options outlined in Section 3.3 below. This is applicable only for SU01-07b, SU08 has been excluded as there are no options to install defences along this section of the frontage. Therefore even though the options protect the toe of the cliff from erosion, there is still likely to be retreat of the top of the cliff due to weathering and the natural behaviour of the cliff. As a result the installation of coastal defence options will not completely eliminate the threat of erosion to cliff top assets, but it will significantly reduce it.

Figure 3.1: The location and extent of the different geologies along the frontage.



Source: Aerial photography from CCO (2013)

3.2.2 Economic Assessment

For the Councils to apply for funding for any coastal protection works they have to abide by the Governments strict regulations. These cannot be changed, and the ability to meet the criteria for funding will ultimately determine the viability of any coastal protection works that will be undertaken. For a scheme to be eligible for government funding it has to have a Benefit Cost Ratio greater than at least 1. A Benefit Cost Ratio is a calculation that divides the value of the benefits (the assets protected e.g. houses) by the cost of implementing works. The value of the benefits and costs decrease over time due to discounting, which accounts for future changes in the cash price. Schemes with higher Benefit Cost Ratios are more likely to achieve Government funding than those with lower ratios.

3.2.2.1 Benefits

The benefits of a scheme are based on the value of property and infrastructure that are protected by a scheme, which would otherwise have been lost if defences were not present along the frontage and the cliffs were free to erode. The guidance assumes that the value of the property is based on the current property value and this remains the same value throughout the 100 year assessment period but will be subject to discounting. The economic value of these benefits will determine the value of a scheme.

To undertake the assessment of the benefits in this Plan the following assumptions have been made:

- A buffer has been applied to the properties that are at risk of erosion:
 - A 10m buffer has been included when the cliff is **undefended** to account for a 5m retreat resulting from a failure event; and then a further 5m buffer to ensure that the properties are a safe distance from the edge of the cliff.
 - A 5m buffer has been included where the cliff is **defended** to ensure that the property is a safe distance from the edge of the cliff. It has been assumed that there will not be a large failure event as the toe of the cliff is protected from erosion.
- A house is at risk as soon as part of the property area, including the garden and driveway, is within the projected erosion lines
- A house is at risk as soon as the access to the house is within the projected erosion lines.

Failure events are calculated based on the amount of cliff retreat based on previous failure events.

Once the benefits were calculated, they are compared to the predicted project costs to determine a benefit cost ratio.

3.3 Defence options

Defence options have been developed for each Strategy Unit and have been compared in terms of what the key issues are in terms of the technical, economic and environmental feasibility of the options. With the exception of the coastal adaptation option all the schemes outlined below have a lifespan of 100 years, provided they receive the correct level and type of maintenance over the 100 year period. However the maintenance of the defences is not Central Government funded. So the Councils will have to undertake the maintenance works out of their own maintenance budgets. A summary of each Strategy Unit follows and a chart outlining the proposed implementation stages for each of the options is in Appendix A.

SU01 Brighton Marina to Rottingdean High Street

Length: 2.2km



Current SMP policy: Year 0-20: HTL Year 20-50: HTL Year 50-100: MMR

Key Issues

- Risk of loss of the main road (A259) from Year 25 based on no further maintenance of the defences
- Properties at risk over the next 100 years based on no further maintenance of the defences
- Residual life of defences range from 20-60 years based on no further maintenance of the defences
- Majority of economic justification for a scheme is in relation to protection of the main road (A259)
- Options are economically justifiable but will require further external funding contributions
- Potential risk to the main Southern Water trunk sewer that runs through the cliff and other utility services.

Options

Scheme	Do Minimum/ Maintenance	Rock Revetment in Front of Seawall	Replace Seawall	Coastal Adaptation
Description	High level maintenance of the seawall, rock revetment and eastern end rock groyne/beach. Concrete cladding of the seawall in Year 13 to extend the life of the seawall. Ongoing monitoring and maintenance will be required to ensure that the cliffs are retreating as expected.	High level maintenance of the seawall, rock revetment and eastern end rock groyne/beach. Concrete cladding of the seawall and placement of rock revetment in Year 13. Ongoing monitoring and maintenance will be required to ensure that cliffs are retreating as expected.	Medium level maintenance of the seawall, rock revetment and eastern end rock groyne/beach. Phased implementation of the new seawall in Year 28, and 58 based on the residual life of the defences. Ongoing monitoring and maintenance will be required to ensure that cliffs are retreating as expected.	High level maintenance of the seawall, rock revetment and eastern end rock groyne/beach until Year 40, followed by a medium level of maintenance from Year 40. Re-route of the A259 inland and construction of rock revetment at the western extent of Rottingdean in Year 40 to allow the A259 to re-join current alignment through the town. Relocation of some houses will also be required from Year 60. Further detailed study is required to consider the wider environmental and social impacts. Ongoing monitoring and maintenance will be required to ensure that cliffs are retreating as expected.
Cost	£7.4 million	£14.8 million	£17.6 million	£8.5 million (costs for the road diversion could vary significantly depending on the level of consultation required. Further more detailed study will be required if this option is taken forward,
Benefit Cost Ratio	10.0	5.0	4.2	8.7
Potential Funding Availability	Economically justifiable, the benefits from protection outweigh the costs of the scheme. However, the scheme would need a further £1.8 million in external funding contributions for the option to be fully funded.	Economically justifiable, the benefits from protection outweigh the costs of the scheme. However, the scheme would need a further £9 million in external funding contributions for the option to be fully funded.	Economically justifiable, the benefits from protection outweigh the costs of the scheme. However, the scheme would need a further £9 million in external funding contributions for the option to be fully funded.	Economically justifiable, the benefits from protection outweigh the costs of the scheme. However, the scheme would need a further £2.2 million in external funding contributions for the option to be fully funded.

SU02 Rottingdean High Street to Saltdean

Length: 1.7km



Current SMP policy:	Year 0-20:HTL	Year 20-50: HTL	Year 50-100: MMR
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Key Issues

- Risk of loss of the main road (A259) from Year 15 based on no maintenance of the defences
- Properties at risk over the next 100 years based on no maintenance of the defences
- Potential risk to the main Southern Water trunk sewer that runs through the cliff and other utility services.
- Residual life of defences range from 15-55 years based on no maintenance of the defences
- Majority of economic justification for a scheme is in relation to protection of the main road (A259)
- Options are economically justifiable but most will require further external funding contributions

Options

Scheme	Do Minimum/ Maintenance	Rock Revetment in Front of Seawall	Replace Seawall	Coastal Adaptation
Description	High level maintenance of the seawall, rock revetment and eastern end rock groyne/beach. Phased concrete cladding of the seawall in Year 10, 15 and 30 to extend the life of the seawall. Ongoing monitoring and maintenance will be required to ensure that cliffs are retreating as expected.	High level maintenance of the seawall, rock revetment and eastern end rock groyne/beach. Phased concrete cladding of the seawall and placement of rock revetment in Year 10 and 28. Ongoing monitoring and maintenance will be required to ensure that cliffs are retreating as expected.	Medium level maintenance of the seawall, rock revetment and eastern end rock groyne/beach. Phased implementation of the new seawall in Year 18, 28, and 43 based on the residual life of the defences. Ongoing monitoring and maintenance will be required to ensure that cliffs are retreating as expected.	High level maintenance of the seawall, rock revetment and rock groyne/beach until Year 40. Re-route of the A259 inland and setback of houses from Year 40. Further detailed study is required to consider the wider environmental and social impacts. Ongoing monitoring and maintenance will be required to ensure that cliffs are retreating as expected.
Cost	£7.4 million	£11.9 million	£18.2 million	£19 million (costs for the road diversion could vary significantly depending on the level of consultation required. Further more detailed study will be required if this option is taken forward.)
Benefit Cost Ratio	21.0	13.1	8.5	8.2
Potential Funding Availability	The Benefit Cost Ratio is high enough that based on the calculations the capital works of the scheme may be fully funded.	Economically justifiable, the benefits from protection outweigh the costs of the scheme. However, the scheme would need a further £2.5 million in external funding contributions for the option to be fully funded.	Economically justifiable, the benefits from protection outweigh the costs of the scheme. However, the scheme would need a further £6.1 million in external funding contributions for the option to be fully funded.	Economically justifiable, the benefits from protection outweigh the costs of the scheme. However, the scheme would need a further £6.2 million in external funding contributions for the option to be fully funded.

SU03 Saltdean Undefended

Length: 0.3km



Current SMP policy

Year 0-20: HTL

Year 20-50: HTL

Year 50-100: MMR

Key Issues

- The area is currently undefended
- Risk of loss of the main road (A259) from Year 55 based on no defences
- Properties at risk over the next 100 years based on no defences
- Majority of economic justification for a scheme is in relation to protection of the main road (A259)
- Options are economically justifiable but some will require further external funding contributions
- Potential risk to the main Southern Water trunk sewer that runs through the cliff and other utility services.

Options

Scheme	Rock Revetment in Front of Cliff	Re-Route of Road
Description	Construction of rock revetment at toe of cliff in Year 30. Medium level of maintenance works every 10 years after construction. Ongoing monitoring and maintenance will be required to ensure that cliffs are retreating as expected.	Continue to leave undefended and then re-route the road inland in Year 50 and setback of houses from Year 70. Further detailed study is required to consider the wider environmental and social impacts. Ongoing monitoring and maintenance will be required to ensure that cliffs are retreating as expected.
Cost	£795,000	£2 million (costs for the road diversion could vary significantly depending on the level of consultation required. Further more detailed study will be required if this option is taken forward.)
Benefit Cost Ratio	39.3	15.4
Potential Funding Availability	The Benefit Cost Ratio is high enough that based on the calculations the capital works of the scheme may be fully funded.	Economically justifiable, the benefits from protection outweigh the costs of the scheme. However, the scheme would need a further £292,000 in external funding contributions for the option to be fully funded.

SU04 Telscombe Cliffs

Length: 0.4km



Current SMP policy

Year 0-20: NAI

Year 20-50: NAI

Year 50-100: NAI

Key Issues

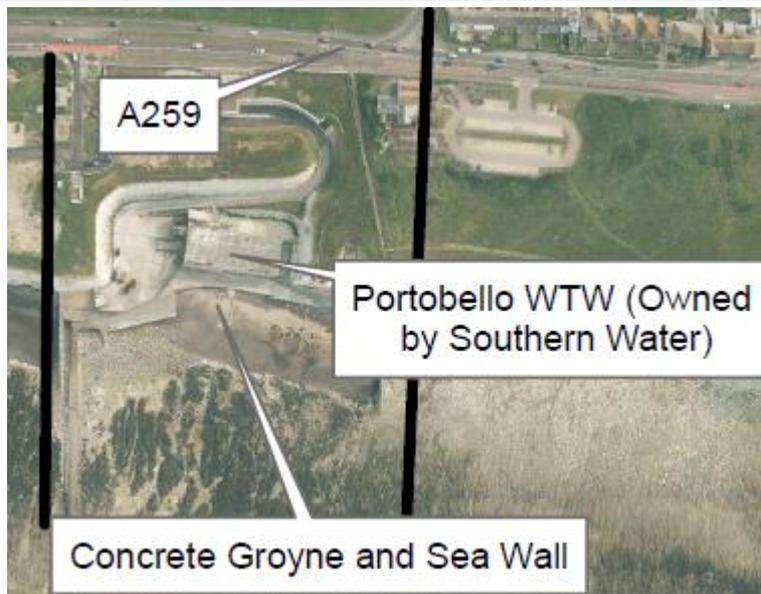
- The area is currently undefended
- Risk of loss of the main road (A259) from Year 65 based on no defences
- Properties at risk over the next 100 years based on no defences
- Majority of economic justification for a scheme is in relation to protection of the main road (A259)
- Potential risk to the main Southern Water trunk sewer that runs through the cliff and other utility services.

Options

Scheme	Rock Revetment in Front of Cliff	Coastal Adaptation
Description	Construction of rock revetment at toe of cliff in Year 50. Medium level of maintenance works every 10 years after construction. Ongoing monitoring and maintenance will be required to ensure that cliffs are retreating as expected.	Continue to leave undefended and then re-route the road inland and setback of houses in Year 60. Further detailed study is required to consider the wider environmental and social impacts. Ongoing monitoring and maintenance will be required to ensure that cliffs are retreating as expected.
Cost	£593,000	£568,000 (costs for the road diversion could vary significantly depending on the level of consultation required. Further more detailed study will be required if this option is taken forward.)
Benefit Cost Ratio	37.6	39.3
Potential Funding Availability	The Benefit Cost Ratio is high enough that based on the calculations the capital works of the scheme may be fully funded.	The Benefit Cost Ratio is high enough that based on the calculations the capital works of the scheme may be fully funded.

SU05 Portobello

Length: 0.2km



Current SMP policy

Year 0-20: NAI

Year 20-50: NAI

Year 50-100: NAI

Key Issues

- Southern Water Pumping Station and Southern Water assets on the cliff top at risk of erosion
- 5 year residual life for defences based on no maintenance of the defences
- No economic benefits for Government funding as the only assets at risk are Southern Water assets
- Defence options are not economically justifiable for government funding as the only assets at risk are Southern Water assets.

Options

Scheme Construction of new seawall and rock groyne

Description Construct a new concrete seawall and rock groyne in Year 4. After construction medium level of maintenance. Ongoing monitoring and maintenance will be required to ensure that cliffs are retreating as expected.

Cost £988,000

Benefit Cost Ratio -

Potential Funding Availability Not economically justifiable for Government funding, the cost is more than any benefits that would be provided.

SU06 Telscombe

Length: 0.8km



Current SMP policy	Year 0-20: HTL	Year 20-50: HTL	Year 50-100: HTL
Key Issues			
<ul style="list-style-type: none"> The area is currently undefended Properties at risk over the next 100 years based on no defences Majority of economic justification for a scheme is in relation to protection of the property 		<ul style="list-style-type: none"> Options are not economically justifiable because the benefit cost ratios are less than 1 The main road (A259) is not at risk over 100 years (road more than 10m from the 100 year projected cliff line) 	
Options			
Scheme	Rock Revetment in front of cliff along whole section	Rock Revetment in front of cliff along the eastern end of the section	Coastal Adaptation
Description	Construction of rock revetment at toe of cliff in year 3. Medium level of maintenance works every 10 years after construction. Ongoing monitoring and maintenance will be required to ensure that cliffs are retreating as expected.	Construction of rock revetment at toe of cliff in year 3. Medium level of maintenance works every 10 years after construction. Ongoing monitoring and maintenance will be required to ensure that cliffs are retreating as expected.	Remain undefended and then set back of houses inland from Year 20. Further detailed study is required to consider the wider environmental and social impacts. Ongoing monitoring and maintenance will be required to ensure that cliffs are retreating as expected..
Cost	£4.6 million	£3.4 million	£14 million
Benefit Cost Ratio	0.6	0.8	0.2
Potential Funding Availability	Not economically justifiable because the benefit cost ratio is less than 1, so the costs of the scheme are greater than the value of the assets being protected.	Not economically justifiable because the benefit cost ratio is less than 1, so the costs of the scheme are greater than the value of the assets being protected.	Not economically justifiable because the benefit cost ratio is less than 1, so the costs of the scheme are greater than the value of the assets being protected.

SU07 Peacehaven Defended

Length: 2.4km



Current SMP policy Year 0-20: HTL Year 20-50: HTL Year 50-100: HTL

Key Issues

- Properties at risk over the next 100 years based on no maintenance of the defences
- Some property at risk even though defended due to proximity to cliff
- Residual life of defences range from 15-20 years based on no maintenance of the defences
- Majority of economic justification for a scheme is in relation to protection of property
- Some options are economically justifiable but will require further external funding contributions

Options

Scheme	Do Minimum/ Maintenance	Rock Revetment in Front of Seawall	Rock Revetment in Front of Seawall (without cladding)	Replace Seawall	Rock Groynes and Beach Recharge	Coastal Adaptation
Description	High level maintenance of the seawall and groynes. Concrete cladding of the seawall in Year 20 to extend the life of the seawall. Ongoing monitoring and maintenance will be required to ensure that cliffs are retreating as expected.	High level maintenance of the seawall and groynes. Concrete cladding of the seawall and placement of rock revetment in Year 20. Ongoing monitoring and maintenance will be required to ensure that cliffs are retreating as expected.	High level maintenance of the seawall, and groynes. Construction of rock revetment in Year 20. Ongoing monitoring and maintenance will be required to ensure that cliffs are retreating as expected.	Construction of new seawall in Year 20. High level maintenance of the seawall every 10 years after construction. Ongoing monitoring and maintenance will be required to ensure that cliffs are retreating as expected.	High level maintenance of the seawall and groynes. Construction of rock groynes and beach recharge from Year 18. Ongoing monitoring and maintenance will be required to ensure that cliffs are retreating as expected.	High level maintenance of the seawall and groynes. until Year 50. Set back of houses inland from Year 0. Further detailed study is required to consider the wider environmental and social impacts. Ongoing monitoring and maintenance will be required to ensure that cliffs are retreating as expected.
Cost	£9 million	£15.9 million	£9.3 million	£24.2 million	£26 million	£18.5 million
Benefit Cost Ratio	1.5	0.9	1.5	0.6	0.5	1.1
Potential Funding Availability	Economically justifiable, the benefits from protection outweigh the costs of the scheme. However, the scheme would need a further £4.7 million in external funding contributions for the option to be fully funded.	Not economically justifiable because the benefit cost ratio is less than 1, so the costs of the scheme are greater than the value of the assets being protected.	Economically justifiable, the benefits from protection outweigh the costs of the scheme. However, the scheme would need a further £6.3 million in external funding contributions for the option to be fully funded.	Not economically justifiable because the benefit cost ratio is less than 1, so the costs of the scheme are greater than the value of the assets being protected.	Not economically justifiable because the benefit cost ratio is less than 1, so the costs of the scheme are greater than the value of the assets being protected.	Economically justifiable, the benefits from protection outweigh the costs of the scheme. However, the scheme would need a further £5.8 million in external funding contributions for the option to be fully funded.

SU07b Peacehaven Defended (Groynes 18 and 19)

Length: 0.15 km



	Current SMP policy	Year 0-20: MR	Year 20-50: MR	Year 50-100: MR
Key Issues				
	<ul style="list-style-type: none"> Properties at risk over the next 100 years based on no maintenance of the defences 5 year residual life of defences under a based on no maintenance of the defences 			<ul style="list-style-type: none"> A scheme may be justified by assessing the negative impact upon the rest of the Peacehaven defences if this end section is allowed to fail.
Options				
Scheme	Rock Revetment in Front of Seawall (whole section)	Replace Groyne 18 with Rock Groyne and Seawall Works (shorten prom)	Rock Revetment in Front of Seawall (short length)	Removal of Concrete Groynes and Construction of 2 Rock Groynes and Beach Recharge
Description	Removal of concrete groyne and construction of rock revetment in front of seawall in year 3. Medium level of maintenance every 10 years. Ongoing monitoring and maintenance will be required to ensure that cliffs are retreating as expected.	Replacement of groyne 18 with rock groyne, removal of groyne 19 and shorten promenade in year 3. Protect the wall with a rock revetment. Medium level of maintenance every 10 years. Ongoing monitoring and maintenance will be required to ensure that cliffs are retreating as expected.	Removal of concrete groyne, shorten promenade and construction of rock revetment in front of seawall in year 3. Medium level of maintenance every 10 years. Ongoing monitoring and maintenance will be required to ensure that cliffs are retreating as expected.	Removal of concrete groynes, construction of 2 rock groyne in year 3. Medium level of maintenance every 10 years. Ongoing monitoring and maintenance will be required to ensure that cliffs are retreating as expected.
Cost	£1.2 million	£1.5 million	£976,000	£3 million
Benefit Cost Ratio	0.3	0.3	0.4	0.1
Potential Funding Availability	Although the Benefit Cost Ratio is less than 1, the scheme is potentially justifiable to ensure a sustained level of protection along the whole Peacehaven frontage.	Although the Benefit Cost Ratio is less than 1, the scheme is potentially justifiable to ensure a sustained level of protection along the whole Peacehaven frontage.	Although the Benefit Cost Ratio is less than 1, the scheme is potentially justifiable to ensure a sustained level of protection along the whole Peacehaven frontage.	Although the Benefit Cost Ratio is less than 1, the scheme is potentially justifiable to ensure a sustained level of protection along the whole Peacehaven frontage.

SU08 Peacehaven to Newhaven

Length: 2.4km



Current SMP policy

Year 0-20: MR

Year 20-50: MR

Year 50-100: MR

Key Issues

- No properties at risk
- Currently undefended
- A small amount of benefits can be calculated from the loss of agricultural land and relocation of mobile homes at Newhaven Heights. However, this is not enough to justify implementing coastal defence works.

Options

Scheme	No viable options developed as economic benefits are very low and therefore no schemes would be justifiable for FDGiA funding. Furthermore the SU has a Managed Realignment policy over the next 100 years, and therefore the SMP does not recommend any works. It is recommended that a more detailed geomorphological study of this area is undertaken to determine a more thorough understanding of the complex retreat of the cliff in this section. Further discussions regarding the management of the frontage should be had with the owners of Newhaven Heights, Newhaven Port Authority, Newhaven Town Council, Lewes district Council and East Sussex County Council.
Description	
Cost (£k)	
Benefit Cost Ratio	

4 What happens next?

The plan is a high level study which builds upon the Shoreline Management Plan and previous Strategies in line with the most recent government guidance. The aim of the Plan has been to produce a series of recommendations which can be taken forward as individual business cases and developed in more detail.

Moving forward, the next necessary steps are to decide whether the adoption of the recommendations of this report will be taken forward. Figure 4.1 and Table 4.1 outline the stages required to allow a scheme to be constructed. It can be seen that this plan is the second step in the six step process. Therefore there is a lot more work required prior to construction. The first step will be to add the schemes to the Environment Agency’s Medium Term Plan. Once this has been completed, business cases for each scheme, in the form of Project Appraisal Reports, will need to be developed to gain approval and funds for the works from DEFRA. During the PAR stage, opportunities for third party contributions to the proposed scheme will be identified. Following the approval of the funding application, detailed design of the defences can be undertaken. This would lead to the appointment of a contractor and construction of the defences.

Figure 4.1: The stages of development from SMP to construction.

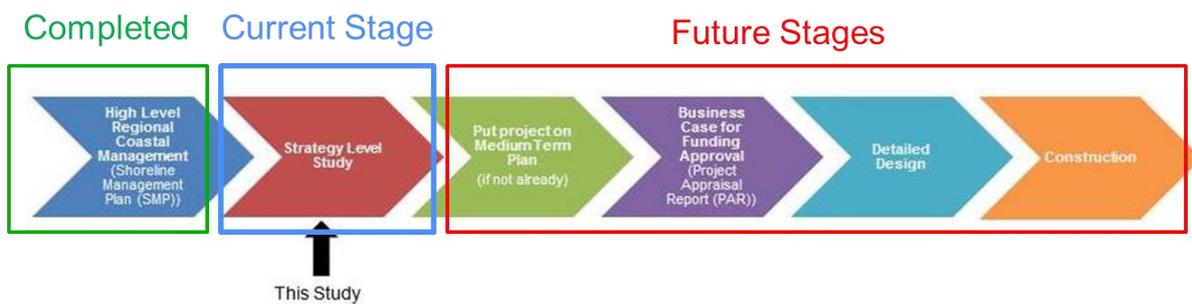


Figure 4.1: The next stages of project development to allow a coastal defence scheme to get to construction

Stage	Description
Medium Term Plan	The Councils will need to add the selected projects to the Medium Term Plan (reviewed annually) to make the Environment Agency aware that there is likely to be a bid for funding for a scheme in the future. Normally projects are put on the Medium Term Plan following their identification in a Strategy (the equivalent of this Plan).
Project Appraisal Report (PAR)	A PAR is developed following the identification of projects for capital schemes and once they have been entered onto the Medium Term Plan. During the PAR the options will be developed further and more detailed economic assessments and design undertaken. The output of the PAR is the presentation of the business case to the Environment Agency for approval of Government funding.
Detailed Design	If the project gains approval for Government funding, the next phase is to undertake detailed design. During this stage of the project the designs for the options will be refined and greater detail added. The outputs will be used to procure the contractor for the works and ultimately used in the construction of the scheme. At this stage a number of licences and permits will also need to be applied for.
Procurement of Contractor	Following the completion of the detailed designs a contractor will be procured to undertake the construction works. However, it is sometimes possible for the detailed design stage to be let as a design and build contract, where a contractor will undertake the design phase of the works and the construction.
Construction	Once the project has been approved for Government funding, licences and permits have been obtained and the design has been completed, construction can commence, subject to any restrictions in the licences and permits.

4.1 Conclusion

Therefore it can be seen that it is a long process to implement coastal defence, and along this section the Councils are at the start of the process.

The Councils are keen to ensure that a plan for sustainable management along the frontage is developed to allow the effective management of the coastline. However, as it can be seen from the results of this assessment, the government guidance that has to be followed to allow a scheme to apply for government funding is very strict. These funding requirements have to be met and therefore there are some limitations to the options which can be proposed along the frontage.

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Appendices

Appendix A. Implementation Plan	29
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Appendix A. Implementation Plan

The chart below outlines the proposed implementation stages for each of the options.

Unit	Option																																																								
		51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100						
SU01	Do Minimum/Maintenance																																																								
	Rock Revetment in Front of Seawall																																																								
	Replace Seawall																																																								
	Coastal Adaptation																																																								
SU02	Do Minimum/Maintenance																																																								
	Rock Revetment in Front of Seawall																																																								
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	Rock Revetment in front of cliff along the eastern end of the section																																																								
	Coastal Adaptation																																																								
SU07	Do Minimum/ Maintenance																																																								
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	Rock Groynes and Beach Recharge																																																								
	Coastal Adaptation																																																								
SU07b	Rock Revetment in Front of Seawall (whole section)																																																								
	Replace Groyne 18 with Rock Groyne and Seawall Works (shorten prom)																																																								
	Rock Revetment in Front of Seawall (short length)																																																								
	Removal of Concrete Groynes and Construction of 2 Rock Groynes and Beach Recharge																																																								
SU08	Adaptation Study																																																								

High Level Maintenance
Medium Level Maintenance
Low Level Maintenance
Cladding of the Seawall
Put Project on MTP
Develop PAR
Undertake Detailed Design
Construction
Relocation of Houses
Re-Route of Road
Social Adaptation Study
Geomorphological Study