Brighton Marina to River Adur Flood and Coastal Risk Management Scheme


Brighton Seafront, February 2017

Outline Business Case

Version No: 0.3
Date: February 2019

BUSINESS CASE APPROVAL SHEET

1 Review & Technical Approval

Project title	Brighton Marina to River Adur Flood and Coastal Risk Management Scheme		
Authority project reference	B&H12	EA reference	
Lead authority	Brighton and Hove City Council	Date of OBC	
Consultant	Jacobs		
Job title	**Name**	**Signature**	**Date**
'I have reviewed this document and confirm that this project meets our quality assurance requirements, all of the required environmental obligations and Defra investment appraisal conditions. I confirm that all internal approvals, including member approval, have been completed for this project and recommend we apply to the Environment Agency for a capital grant of £ '.			
Authority Project Executive	Yann Vochelle		
'I have reviewed this document and confirm that it meets the current business case guidelines for local authority and Internal Drainage Board applications.'			
OBC reviewer	Becky George		
'I confirm that I have consulted with the Director of Business Finance and that we are ready to send the project for assurance.'			
Area Flood Risk Manager	Gordon Wilson		
NPAS Assurance ☐ Projects £100k - £10m (Tick the appropriate box)		Large project review group (LPRG) ☒ Projects >£10m	
Recommended for approval			Date
NPAS or LPRG Chair			
Capital grant of £		Version number	

2 Project Financial approval

Financial Scheme of Delegation (FSoD approval):

Approval	Project £	Name	Signature	Date
Chief Executive	>£20m			
Executive Director of Operations	>£10m			
Director of Operations	£1-£10m			
Area Manager	£100k- £1m			
Director of Business Finance	>£100k			
Area FCRM Manager (GiA & Levy <£100k and Project<£1m)	<£100k			

3 Defra approval

Date sent to Defra (or N/A)		Version number (if different)	
Date approved by Defra (or N/A)			
Comments			

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1. Executive Summary

(The Executive summary should not repeat detail contained in the main body of the business case but consist of a concise summary of the key matters. Do not repeat tables shown in the main body of the business case.)
(The Executive summary should be no more than 3 pages long.)

1.1. Introduction

(A brief statement of what the project is and the approval the business case is seeking What are we trying to do? (£ required and the benefits or outcomes being delivered.)

1.1.1. This is a supported Outline Business Case for the Brighton Marina to River Adur Flood and Coastal Risk Management (FCRM) Scheme. The recommended 0.5% Annual Exceedance Probability (AEP) Improve option will protect 13 residential and 105 commercial properties (including Shoreham Sewage Pumping Station and Shoreham Power Station) predicted to be lost to erosion within the first 20 years under a No Active Intervention scenario and will reduce the present day flood risk to a further 6 residential and 8 commercial properties at a Present Value (PV) cost of £23,793k (including a combined 33% adjusted optimism bias and 50%ile risk contingency (28% of the total project costs) for a 15 year benefit period.

1.1.2. Significant partnership funding contributions of £5,981k (cash cost) from Adur District Council (ADC), £6,357k from Brighton and Hove City Council, £10,937k from Shoreham Port Authority and £90k from Western Esplanade Management Company are to be provided. These costs include a combined 33% adjusted optimism bias and 95%ile risk contingency (42% of the total project costs and inflation.

1.1.3. The requested approval for this Outline Business Case is in the sum of £36,082k (cash cost), which includes a combined 33% adjusted optimism bias and 95%ile risk contingency (42% of the total project costs and inflation and a contribution of £23,364k (cash cost) from Adur District Council, Brighton and Hove City Council, Shoreham Port Authority and Western Esplanade Management Company. Therefore, FCRM Grant in Aid (GiA) funding of £12,718k (cash cost) is sought.

1.1.4. This Outline Business Case builds on the Brighton Marina to River Adur Flood and Coastal Erosion Risk Management Strategy Review which was approved by the Environment Agency Large Project Review Group (LPRG) in 2014.

1.1.5. The proposed scheme is located on the south coast, Sussex along the open coast of Shoreham and Brighton. This is covered by Unit 2 – Open Coast from the 2014 Strategy, see Figure 1. The scheme frontage stretches for approximately 11km from the River Adur in the West to Brighton Marina in the East. Works within the first phase (15 year benefit period) are located in six key areas, these are shown in Figure 1.

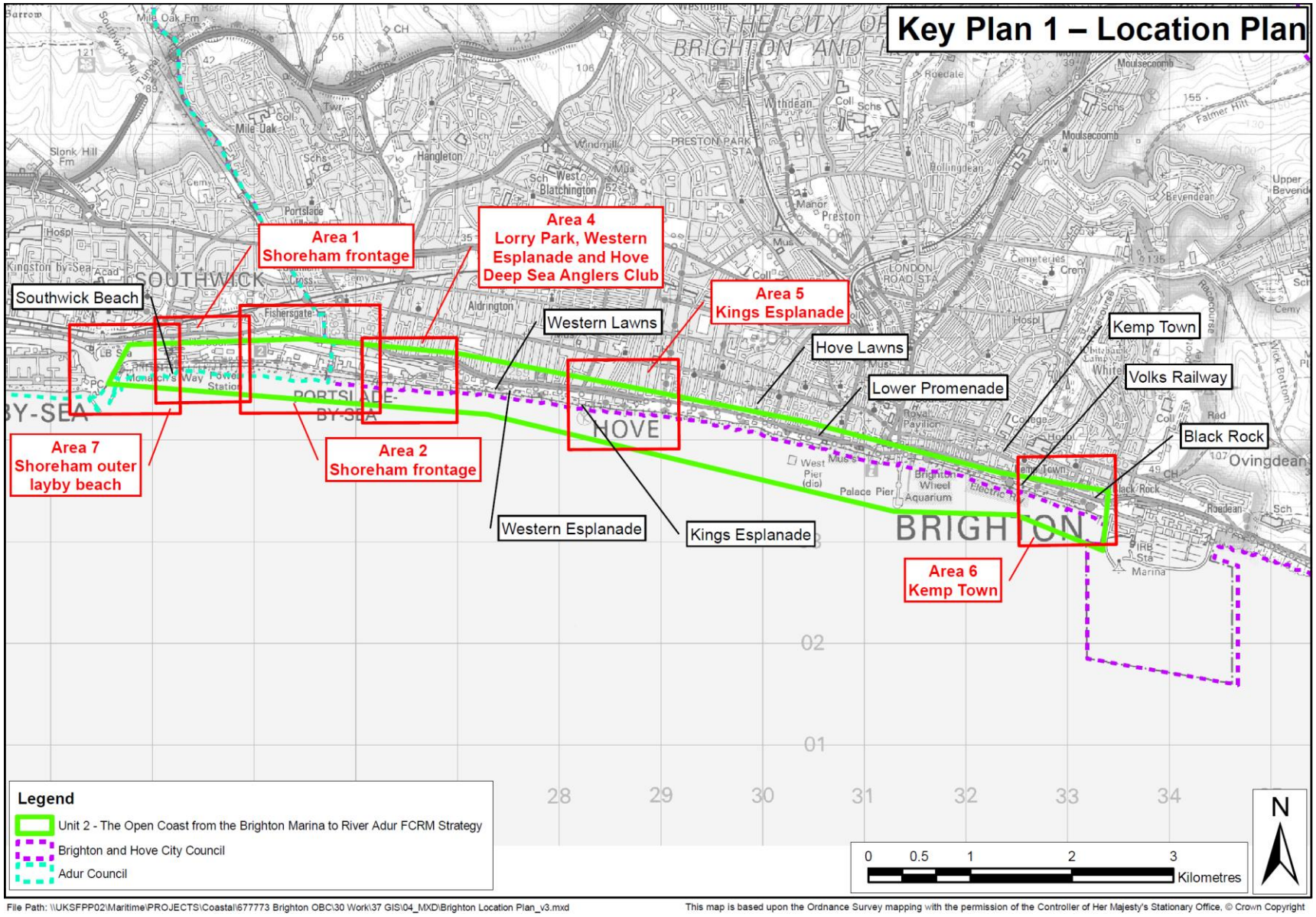


Figure 1 Location plan

1.2. Strategic case

Strategic context

(Summarise the strategic case, this should not repeat detail from the main body of the business case but highlight summarised key points. Do not copy sections from the main body of the business case, summarise key points Summarise strategic drivers for investment, with reference to supporting strategies, programmes and corporate plans.)

1.2.1. Brighton and Hove City Council (BHCC) and Adur District Council (ADC) exercise their flood risk and coastal erosion risk management functions as risk management authorities (RMAs) in accordance with the Coast Protection Act (1949) and the Flood and Water Management Act (2010) (FWMA2010). Delivery of FCRM measures, proposed by this project, will contribute towards the Environment Agency's (EA) objectives for their National Flood and Coastal Erosion Risk Management Strategy (NFCERMS).

1.2.2. The Beachy Head to Selsey Bill Shoreline Management Plan 2006 (SMP2) recommended a Hold the Line (HTL) policy for the three epochs 0-20, 20-50 and 50-100 years for Brighton Marina to Portslade by Sea policy unit (4d12) and Shoreham Harbour (Southwick) policy unit (4d13).

1.2.3. This Outline Business Case is supported by the Brighton Marina to River Adur Flood and Coastal Erosion Risk Management Strategy Review ("the 2014 Strategy"), which was approved and adopted in 2014. The Strategy is consistent with the Beachy Head to Selsey Bill Shoreline Management Plan (SMP2), which was adopted by the relevant Operating Authorities in 2006. The 2014 Strategy recommended that a capital improvement scheme should be undertaken for Units 1 – Shoreham Locked Section and Unit 2 – Open Coast to improve the coastal defences to a 0.5% AEP to reduce long term (100 year) flood and erosion risk taking account of long term climate change predictions to sea level rise.

1.2.4. After approval of the 2014 Strategy, Brighton and Hove City Council entered into negotiations to secure a partnership contribution to the scheme from Brighton and Hove City Council itself and Adur District Council. A Memorandum of Understanding to facilitate this contribution has been agreed and signed by Brighton and Hove City Council, Adur District Council and Shoreham Port Authority. The release of the contribution, as stipulated in the agreement, is subject to FBC Environment Agency approval. Shoreham Port Authority and Western Esplanade were also consulted but no additional partnership contributions over and above their ongoing maintenance contributions has been forthcoming to date.

The case for change

(Why make this investment now? The current situation and the problem to be solved; benefits to be delivered; and opportunity for improvement.)

1.2.5. The supply of natural beach material to the open coast frontage from the west is impeded by the mouth of the River Adur and the associated training walls. Limited sediment supply coupled with the natural attempt of the coast at Shoreham to orientate itself into a position normal to the prevalent south south-west wave direction, has resulted in significant erosive forces at the Shoreham end of the frontage. The residual life of the assets along the Shoreham Port frontage range from 15-30 years to <1 year. Shoreham Port Authority has a strategic programme of defence renewal, the speed of which is subject to the availability of funds, and manages immediate breach risk on an ad hoc basis by repairing seawalls, re-deploying rock armour from ineffective structures to form revetments on vulnerable sections and repairing existing timber and rock groynes. Under a No Active Intervention scenario, it is predicted that erosion will result in the failure of defences along Southwick Beach by Year 5 and breach through into the locked section by Year 15.

1.2.6. The open coast frontage is also at risk of flooding from wave overtopping. Significant variations in defence heights and beach widths along the frontage have resulted in a number of weak points susceptible to flooding. Deteriorated and aged assets along the Southwick to Hove frontage have resulted in a poorly controlled beach susceptible to significant storm draw down and breach risk. A low crest level at the Hove Deep Sea Anglers' building which is exposed to wave overtopping can result in flooding of Western Esplanade and Basin Road. The poor beach alignment at Kings Esplanade has resulted in a promontory at this section of the frontage with a narrow steep beach susceptible to wave overtopping. The SoP of the current defences ranges from >100% AEP to 0.5% AEP. However, some of those assets that provide a 0.5% AEP are in poor condition with residual life of <1 year.

1.2.7. The lack of a consistent and sustained beach management programme has exacerbated the imbalance of beach material along the open coast affecting both erosion and flood management.

Mechanical shingle bypassing at Shoreham by Shoreham Port Authority supplies has ranged from approximately 11,000m^3/yr to 33,700m^3/yr but the available volume from Shoreham is dependent on the rate of natural accretion on an annual basis. Whilst, accretion of material at the eastern end of Brighton beach at Kemp Town has continued. The lack of an agreed beach management framework has resulted in infrequent shingle recycling.

1.2.8. The net drift along the frontage averages about 16,000 m^3/year. To ensure that the 16,000 m^3 per year target is met, combined bypassing from Shoreham Beach and recycling from Kemp Town (Black Rock) is recommended. This ensures a flexible approach that can meet natural variations in material supply from both sources.

1.2.9. The storm events during Winter 2013/14 caused significant damage and disruption, including flooding to 30 commercial premises on Brighton seafront and factories and warehouses within Shoreham Port. Brighton and Hove City Council received financial contributions as part of the storm recovery fund and is currently restoring Open Coast (Unit 2) defences. Emergency repair works included the repair of breaches in seawalls and rebuilding some of the more critical groynes and revetments.

1.2.10. Erosion and flood mapping shows that under a No Active Intervention scenario it is predicted that 13 residential and 105 commercial properties would be lost to erosion within the first 20 years including Shoreham Sewage Pumping Station (serving 60,000 population equivalent from Shoreham and Portslade) and Shoreham Power Station (420 mW, sufficient to power 250,000 homes). This increases to 260 residential and 248 commercial properties by Year 100, including the loss of the majority of businesses and land forming Shoreham Port and sections of the A259.

1.2.11. In addition, under a No Active Intervention scenario a further 6 residential and 8 commercial properties would also be at flood risk under a 0.5 % AEP event today, rising to 10 residential and 2 commercial properties in 100 years. Many properties affected by both erosion and flooding are lost to erosion before they come under flood risk.

1.2.12. The development of a series of new sea defences along the Brighton Marina to River Adur frontage will reduce the risk of erosion and flooding to the areas of Brighton and Shoreham.

Objectives

(Main objectives of the project - which should be SMART (Specific, measurable, achievable, realistic and time bound) and any constraints or dependencies.)

1.2.13. The overall aim of the Outline Business Case is to review and update the preferred option identified in the Brighton Marina to River Adur Flood and Coastal Erosion Risk Management Strategy Review to promote a scheme to reduce flood risk to people and property (both residential and commercial). Brighton & Hove City Council and Adur District Council's overall objective is defined as "to defend the frontage from erosion and encroachment from the sea as outlined in the Coastal Protection Act 1949 in order to protect people, property, the environment and the local economy".

1.2.14. The objectives established for the 2014 Strategy were reviewed and updated. The objectives were set through consultation with the Steering Group and with representatives from key national and local organisations. These are:

- To develop coastal defence options that are sustainable, technically sound, environmentally acceptable and economically viable in accordance with current Environment Agency Flood and Coastal Erosion Risk Management – Appraisal Guidance (FCERM-AG);
- To establish a long term sustainable framework for the next 100 years for the management of the frontage;
- To develop a fully integrated 15-year detailed programme of work for individual frontages, in line with the overall management framework;
- To identify outcome measures in accordance with current FCERM Grant in Aid (GiA) criteria;
- To ensure that the Outline Business Case (OBC) is related to neighbouring strategies and other high level plans.

1.3. Economic case

Options considered

(Summarise the economic case, this should not repeat detail from the main body of the business case but highlight summarised key points. Do not copy sections from the main body of the business case, summarise key points Summarise initial long list of options identified, indicate those rejected, with reasons why, and those short listed for detailed appraisal in a table.)

1.3.1. The 2014 Strategy preferred option was reviewed and updated in light of information made available since 2014. New information included a review of coastal process information including beach profile data and recycling data (an addendum to the Strategy Coastal Processes Report is included in Appendix D), a review of defence condition was undertaken to update the programme of works (an updated Condition Defence Report is included in Appendix E) and a Geotechnical Desk Study including UXO search was produced to inform outline design (Appendix F). This updated information was used to review the Strategy No Active Intervention Report and an Addendum is included in Appendix G.

1.3.2. The 2014 Strategy preferred option was developed for outline design taking into account the newly available information and taking consideration of technical viability, buildability, sustainability, access restrictions and health and safety. The option was considered over an appraisal of 100 years. A detailed costing exercise was undertaken to develop costs for the option based on these outline designs using Early Supplier Engagement (ESE).

Key findings

(Once completed, summarise the economic appraisal findings on the short listed options. Include comments on any relevant technical, environmental and social issues for each option in a table.)

1.3.3. The Improve 0.5% AEP was confirmed as the leading option.

Preferred way forward

(Overall conclusions, recommendations and justification.)

1.3.4. The preferred option is identified based on the FCERM-AG decision process rules. The incremental benefit cost ratio for the 0.5% AEP option is >3 making this the leading option.

1.3.5. Table 1 shows a summary of the key economic parameters costs for the leading options assessed for SoP over the 100 year appraisal period. The preferred option is highlighted in green.

Table 1 Benefit Cost Ratio for each Option (100 year appraisal period)

Option		Present Value costs (£'000)	Present Value damages (£'000)	Present Value benefits (£'000)	Average benefit: cost ratio (BCR)	Incremental benefit: cost ratio (IBCR)	Option for incremental calculation
2	Do Minimum	2,667	117,759	114,522	42.9	-	
3	Maintain	32,685	25,857	206,424	6.3	3.1	Do Min
4	1.33% AEP	40,170	18,256	214,025	5.3	1.0	Maintain
5	1% AEP)	40,632	16,789	215,492	5.3	3.2	Improve 1.33% AEP
6	0.5% AEP	41,365	14,507	217,774	5.3	3.1	Improve 1% AEP

1.4. Commercial case

(Summarise the commercial case, this should not repeat detail from the main body of the business case but highlight summarised key points. Do not copy sections from the main body of the business case, summarise key points)

Procurement strategy

(Summarise the planned and adopted approach to procurement.)

1.4.1. Key procurement drivers have been identified for the scheme building on the project objectives, and scheme requirements. The scheme requires design services. These will be appointed via a suitable professional public service framework. Construction services which will be brought into the project team at an early stage through open tender (following OJEU procurement procedures).

Key contractual terms and risk allocation

(Summarise key terms in the contractual arrangements (e.g. contract lengths, matters to be managed, onerous or unusual clauses) and how risks are allocated between parties within the commercial or other agreements.)

1.4.2. The NEC suite of contracts will be used to deliver the scheme. NEC3 Professional Services Contract (PSC) will be put in place for the design services. The Engineering and Construction

Contract (ECC) will be used to deliver the Construction. A two stage open book contract approach will be taken to the construction contract.

Efficiencies and Commercial arrangements

(Identify any wider commercial issues or arrangements including a summary of efficiencies achieved with any necessary detail (e.g. project efficiency register if applicable) included in the appendices.)

1.4.3. There is a target for Risk Management Authorities to achieve efficiencies in all schemes funded by FCRM GiA. In accordance with current guidance, these efficiencies are managed using the Combined Efficiency and Recording Tool (CERT) and this process has been adopted at this early stage of the project

1.5. Financial case

Summary of financial appraisal

(Summarise the financial case, this should not repeat detail from the main body of the business case but highlight summarised key points. Do not copy sections from the main body of the business case, summarise key points) (Summarise projected or confirmed financial position for the project identifying how and when project funds will be spent and the initial upfront capital or revenue investment as well as the future costs.)

1.5.1. For development of the OBC financial business case for the preferred option a 15 year benefit period is adopted. A 15 year benefit period is adopted as this is the time period between delivery of the benefits (year 2) and the next major investment (year 18), in accordance with the Partnership Funding guidance (EA, 2014).

1.5.2. Table 2 presents the financial summary for the preferred option 0.5% AEP for the 15 year benefit period.

1.5.3. The PV Cost Grant in Aid (for Approval) is £10,253,555.

Table 2 Summary of project costs (15 year benefit period)

	Economic appraisal	Whole-life cash cost	Approval
Costs up to OBC (outline design)	Does not apply – sunk costs	146,200	
Costs after OBC			
Staff costs	175,375	192,400	192,400
Consultants', cost consultants and contractor fees	266,194	285,000	285,000
Site investigation and survey	108,606	115,000	115,000
Construction & site supervision costs	16,940,871	20,485,562	20,485,562
Environmental mitigation & enhancement	0	0	0
Consents & Licences	51,942	55,000	55,000
95%ile plus Adjusted OB (represents 42% of project FSoD approval)	Does not apply	Does not apply	10,713,230
50%ile plus Adjusted OB (represents 28% of project FSoD approval)	5,024,370	6,051,274	Does not apply
Inflation (at 2.5%)	Does not apply	Does not apply	4,236,343
Future costs (maintenance)	(PV)	(Cash)	Does not apply
	943,989	1,244,700	

	Economic appraisal	Whole-life cash cost	Approval
Future Optimism Bias (30%)	283,197	373,410	
Project Total Costs	**23,793,484**	**28,802,346**	**36,082,535**
Project Total Costs (excluding maintenance)	**22,566,298**	**27,184,236**	**36,082,535**
Contributions – ADC	3,433,602	4,153,943	5,981,179
Contributions – BHCC	3,611,510	4,375,236	6,356,725
Contributions – SPA	5,223,730	6,975,889	10,936,696
Contributions - Western Esplanade Management Company	43,901	57,885	89,936
Grant in Aid (for Approval)	**10,253,555**	**11,621,283**	**12,717,997**

Funding sources

(Summarise the source of funding planned or agreed. This should cover funds to deliver the project, initial investment and the whole life costs of the project. Please specify the source of external contributions and any conditions placed on funding, with letters of agreement or support included in the appendices. Show EA funding by function.)

1.5.4. The Partnership Funding calculator raw score is 45% and the adjusted partnership score is 100%.

1.5.5. Brighton and Hove City Council and Adur District Council have confirmed their continued commitment to sign the legal agreement (subject to members approval) to provide a contribution towards the scheme as it progresses. Table 3 outlines the annual commitments for each contributing partner. These contributions meet approximately 60% of the project total PV cost. The remainder of the funding for the scheme is sought from FCRM GiA. The Memorandum of Understanding from Brighton and Hove City Council and Adur District Council is included in Appendix Q.

Table 3 Funding Sources (Cash costs)

Annualised funding profile (£)	**Yr 0 2018/19**	**Yr 1 2019/20**	**Yr 2 2020/21**	**Yr 3 2021/22**	**Yr 4 2022/23**	**Yr 5-17**	**Total**
Grant in Aid (including inflation and optimism bias)	**0**	**222,475**	**456,074**	**2,781,204**	**9,258,244**	**0**	**12,717,997**
Contributions for capital works (ADC) (including inflation and optimism bias)	0	0	0	85,771	3,215,333	1,486,643	4,787,747
Contributions for capital works and capital beach management works (BHCC) (including inflation and optimism bias)	0	0	0	1,087,029	688,759	0	1,775,788
Contributions for asset and beach management (BHCC) (including inflation and optimism bias)	102,907	287,829	108,117	302,400	113,591	2,397,728	3,312,572
Contributions (SPA) for capital beach management works and asset management (including inflation and optimism bias)	102,907	688,996	108,117	723,877	113,591	7,016,996	8,754,484
Contributions (WE) for asset and beach management (including inflation and optimism bias)	3,217	3,296	3,379	3,463	3,549	55,087	71,991
Contributions subtotal	209,031	980,121	219,613	2,202,540	4,134,823	10,956,454	18,702,582

Annualised funding profile (£)	Yr 0 2018/19	Yr 1 2019/20	Yr 2 2020/21	Yr 3 2021/22	Yr 4 2022/23	Yr 5-17	Total
Project Total	**209,031**	**1,202,596**	**675,687**	**4,983,744**	**13,393,067**	**10,956,454**	**31,420,579**
Maintenance: BHCC (inc risk)	88,951	88,951	88,951	88,951	88,951	1,156,358	1,601,111

1.5.6. The MoU says that a Contributions Schedule should be developed within 3 months of the signing of the MoU which will contain the details for the heads of terms agreement that will bind us all in a legal agreement on contributions and repayments.

Table 4 Partnership Funding calculator

	%	Description	Total PV £
Raw partnership funding score	45		
Funding:			
Contributions		Brighton and Hove City Council; Adur District Council Shoreham Port Authority Western Esplanade Management Company	12,312,743
Other: (list)			
Local Levy			
Non GiA contributions			12,312,743
Adjusted Partnership funding score	100		
Grant in Aid			£10,253,555

1.5.7. The contributions referenced in the partnership calculators are the minimum required to ensure a 100% partnership funding score. The maintenance costs have been excluded from the partnership calculators. Maintenance costs have not been included as the Risk Management Authority (RMA) is a Local Authority. Future ongoing costs and any contributions towards these are a matter for local agreement by the RMA. This is stated in the PF calculator.

1.5.8. The partnership calculators are included in Appendix I to the OBC. Actual contributions are greater than this to meet the costs of the full scheme. Actual PV contributions are £12,312,743 (including risk) as shown in Table 2.

1.5.9. The PV Cost (for Approval) is £23,793,484.

1.5.10. Funding for maintenance costs for the 15 year benefit period are not being sought and these are excluded from Table 4. Maintenance costs are being met by Brighton and Hove City Council, Shoreham Port Authority and Western Esplanade Management Company.

Overall affordability

(Summarise the overall affordability of the project – both in terms of its capital and revenue – over the lifespan of the investment and any issues or risks or constraints in relation to current funding. Also comment on planned arrangements for sharing any cost overruns.)

1.5.11. Table 5 presents a summary of the project spend profile for the 15 year benefit period in cash costs including inflation.

Table 5 Summary of project spend profile (15 year benefit period)

Annualised spend profile (£)	Yr 0 2018/19	Yr 1 2019/20	Yr 2 2020/21	Yr 3 2021/22	Yr 4 2022/23	Yr 5 - 17	Total
Authority, Consultant fees & Cost consultant fees	0	112,067	224,133	33,242	107,958	0	477,400

Annualised spend profile (£)	Yr 0 2018/19	Yr 1 2019/20	Yr 2 2020/21	Yr 3 2021/22	Yr 4 2022/23	Yr 5 - 17	Total
Construction & site costs	162,500	800,027	275,833	3,564,478	9,324,564	6,528,161	20,655,563
50%ile plus Adjusted OB (represents 28% of project FSoD approval)	46,531	261,171	143,162	1,030,182	2,700,936	1,869,292	6,051,274
Inflation (at 2.5%)	0	29,332	32,558	355,842	1,259,609	2,559,001	4,236,343
Project total costs	**209,031**	**1,202,596**	**675,687**	**4,983,744**	**13,393,067**	**10,956,454**	**31,420,579**
Less: Contributions inc risk and inflation	209,031	980,121	219,613	2,202,540	4,134,823	10,956,454	18,702,582
Capital Grant	**0**	**222,475**	**456,074**	**2,781,204**	**9,258,244**	**0**	**12,717,997**
Maintenance costs (BHCC) inc risk	88,951	88,951	88,951	88,951	88,951	1,156,358	1,601,111

1.6. Management case

Project management

(Summarise the management case, this should not repeat detail from the main body of the business case but highlight summarised key points. Do not copy sections from the main body of the business case, summarise key points)
(Summarise project management arrangements for the scheme, including project governance, roles and responsibilities and the project plan, noting any linkage to higher programme management arrangements or portfolio management arrangements. Summarise the planned communications, stakeholder engagement and equality analysis screening.)

1.6.1. The scheme is being led by Brighton and Hove City Council in their capacity as Risk Management Authority.

1.6.2. The scheme will be managed in accordance with PRINCE2. Following PRINCE2 principles a project board and steering group has been running since the start of the scheme.

Benefits realisation

(Summarise benefits showing ownership, how they will be monitored and reported, and when they will be realised covering both financial (cash releasing or cost avoidance) and non financial benefits (productivity, data quality, environmental. legislative compliance etc).)

1.6.3. The scheme will reduce the risk of present day flooding to 6 households, all of which are at very significant risk. In addition the scheme reduces erosion risk to protect 13 residential and 105 commercial properties (including Shoreham Sewage Pumping Station and Shoreham Power Station) predicted to be lost to erosion within the first 20 years under a No Active Intervention scenario.

Table 6 Summary of FCRM Outcome Measures

Benefit realisation	
OM2	6
OM2b	6
OM3	8
OM3b	8
OM3c	8

Risk management

(Summarise key risks of the project, the risk owner and how these are being managed and mitigated. A copy of your Risk Potential Assessment and/or risk register should be included in the appendices.)

1.6.4. A risk register has been developed to identify and manage risks. The key risks with high priority associated with the delivery of the scheme are documented in Table 7 below. The risk register has been used to inform the risk contingency for the scheme. The project risk register and Adjusted Optimism Bias register are in Appendix J to the OBC.

1.6.5. As the project progresses the risk register will be developed to assign risks to the party best placed to manage it, and risks will be monitored and updated with regular risk workshops.

1.6.6. The management of risk will be undertaken by the Delivery Team with the strategic level of risk being managed by the project board.

Table 7 High Priority Risks

Key Risks	Proposed Mitigation
Funding availability - OBC does not receive FCRM GiA.	Ongoing review of MTP submissions and close working with the EA Area Team to profile funding.
Beach material no longer available from Shoreham bypassing. Alternative source required for recycling/beach widening	Confirmation of source and grading at detailed design. Liaison with Shoreham Port Authority and Environment Agency.
Variation in inflation (Client)	Monitor inflation and allow risk budget
Unacceptable quality/grading of rock	Certificates of quality to be approved by client. Known source of rock.
More frequent defence failure leads to more reactive maintenance than planned	Regular defence surveys to identify key areas for potential failure and areas which have already failed. React quickly if failure occurs.
Changes to wall design	Detailed planning permission application. Detailed samples and 3D images of final works to be consulted on at detailed design.
Early defence failure leads to works being more significant than planned	Continue monitoring programme, in particular pre and post storms. React quickly if defence condition rapidly deteriorates.
Increased volume of shingle required for beach widening	Volume designed against conservative case beach profiles.
Unforeseen ground conditions (eg contaminated material, voids, steel, etc) that affect the detailed design or construction costs.	Undertake further detailed site / ground investigations as part of the detailed design phase. SI at site of existing defences. Redesign of proposed defences as necessary.
Site security on site becomes issue due to unforeseen event	Consultation with public and local authorities to determine any issues before reaching site.

Assurance, approval & post project evaluation

(Summarise assurance and approval arrangements, including any gateway review requirements. These can be internal (for example project board meetings, peer reviews etc) or independent (NPAS, LPRG). Ensure project milestones accommodate the timing of these steps as well as FSoD approval. Include details of any post project reviews or post project benefits management and reporting arrangements.)

1.6.7. The Project Board has assurance roles in place, supported by a Memorandum of Understanding. Further finance, legal and procurement assurance can be sought from within the lead Local Authority of Brighton and Hove City Council where required.

1.6.8. The EA Large Project Review Group (LPRG) will review the scheme as it moves from outline design towards detailed design and construction.

1.6.9. On completion of the scheme post project evaluation will review and report on the project outcome against original business case (costs, plan and objectives), lessons learnt to inform systems and future projects, and delivery of benefits.

1.7. Recommendation

(Formal recommendation of the proposed outcome and the approval sought for the scheme.)

1.7.1. It is recommended that approval is given to the OBC for the Brighton Marina to River Adur Flood and Coastal Erosion Risk Management Scheme. This OBC sets out the justification for construction of improved defences to reduce flood and erosion risk to the residential and business communities of Brighton and Shoreham. The new defences will reduce the risk of coastal erosion and coastal flooding to a 0.5% AEP standard of tidal flood protection over the next 15 years

(including climate change). Further phases of capital works will be required to maintain the SoP, as existing assets reach the end of their residual life.

1.7.2. The total estimated sum for approval at OBC stage is £36,082k (cash cost) which includes a combined 33% adjusted optimism bias and 95%ile risk contingency (42% of the total project costs risk contingency of £10,713k and £4,236k inflation.

1.7.3. It is recommended that the project proceeds to the detailed design, licencing and consents stage culminating in the implementation of coastal defence improvement works commencing in April 2021.

2. The Strategic case

2.1. Introduction

(Summarise the problem, the need for an intervention (including the consequences of doing nothing), any previous works and the basis of the strategic approach.)

2.1.1. The proposed scheme is located along the open coast from the River Adur in the west to Brighton Marina in the east. The scheme lies within the boundaries of Unit 2 – Open Coast of the approved Brighton Marina to River Adur Flood and Coastal Erosion Risk Management Strategy (Halcrow, 2014).

2.1.2. The length of the coastal frontage is approximately 10km. This consists of:

- 2.15km of Adur District Council frontage;
- 7.85km of Brighton and Hove City Council open coastal frontage.

2.1.3. The open coast is orientated southerly on the section east of the river mouth and re-orientates south south-westerly towards the eastern section. See Figure 1.

2.1.4. The hinterland behind the shingle beach coastline between the River Adur and Brighton Marina is heavily developed, with Shoreham Port at the western end and the urban areas of Hove and Brighton to the east. Shoreham Port is a thriving and successful commercial port. Typical activities by the Port and its tenants include the bulk handling of timber and aggregates and the export of grain and recycled materials. The Port is also the fourth largest fishing port in England and Wales (www.marinemanagement.org.uk/fisheries/statistics/annual.htm).

2.1.5. There are no internationally designated sites within the scheme area, however, there are a number of national and local designations (Section 3.3).

2.1.6. The coastline between Brighton Marina and the River Adur in Sussex features one of the country's most well-known tourist beaches. The beach and other coastal defences along the frontage also provide erosion protection to the hinterland. Under a No Active Intervention scenario it is predicted that 13 residential and 105 commercial properties would be lost to erosion within the first 20 years including Shoreham Sewage Pumping Station (serving 60,000 population equivalent from Shoreham and Portslade) and Shoreham Power Station (420 mW, sufficient to power 250,000 homes). This increases to 260 residential and 248 commercial properties by Year 100, including the loss of the majority of businesses and land forming Shoreham Port and sections of the A259.

2.1.7. In addition, under a No Active Intervention scenario a further 6 residential and 8 commercial properties would also be at flood risk under a 0.5 % AEP event today, rising to 10 residential and 2 commercial properties in 100 years. Many properties affected by both erosion and flooding are lost to erosion before they come under flood risk.

2.1.8. During the development of this business case an assessment of the residual life of the current defences was undertaken, it concluded that a number of defences along the Portslade By Sea and Basin Road frontages are in poor or very poor condition and offer a low standard of protection (See Section 2.6). These defences are at significant risk of failure with residual lives of less than 1 year in some locations. The ongoing coastal erosion along this western section of the frontage has resulted with a narrowing of beach leaving the defences exposed to wave action.

2.1.9. The supply of natural beach material to the open coast frontage from the west is impeded by the mouth of the River Adur and its associated training walls. The limited supply of sediment coupled with the tendency of the coast at Shoreham to orientate itself to a position normal to the prevalent south south-west wave direction, has resulted in significant erosion at the Shoreham end of the frontage. Under a No Active Intervention scenario, it is predicted that erosion will result in the failure of defences along Southwick Beach by Year 5 and breach through into the locked section by Year 15.

2.1.10. In addition, the open coast frontage is at risk of flooding from wave overtopping. Significant variations in defence heights and beach widths along the frontage have resulted in a number of weak points susceptible to flooding and risk of breach. The lack of a consistent and sustained beach management programme has exacerbated the imbalance of beach material along the open coast affecting both erosion and flood management.

2.1.11. The storm events during Winter 2013/14 caused significant damage and disruption, including flooding to commercial premises on Brighton seafront and factories and warehouses within Shoreham Port. Properties on Basin Road South also flooded and shingle and debris from

collapsed coast protection structures were deposited along Basin Road and along large areas of the promenade through Portslade and Hove, resulting in the temporary closure of access to the sewage works, power station, café and other port tenants. Brighton and Hove City Council received financial contributions as part of the storm recovery fund to restore open coast defences. Emergency repair works included the repair of breaches in seawalls and rebuilding some of the more critical groynes and revetments. Adur District Council also received funds to replace failed groynes and emergency works to protect the sea wall from collapse. Many other coastal structures including seawalls, groynes and revetments have been left in a collapsed or partially collapsed condition, leaving parts of the study area at greater risk from any future storm events of a similar magnitude.

2.1.12. With climate changing, sea levels rising and the increasing frequency and intensity of storms, the existing coastal defences are under increasing threat from the elements. The beaches and defences, together with Brighton and Hove's residential and commercial assets along the frontage, need to be managed to guard against the risk of flooding and erosion to ensure that the coastline remains a vibrant and vital focus for the area's economy into the future.

2.2. Business strategies

(Reference how the project aligns with the business strategy for the organisation and any related national or functional strategies, noting any changes since previous presentations of the project. Include consideration of national policy documents, relevant local plans such as River Basin Management Plans, SMPs and CFMPs and portfolio strategies (e.g. IT, property) and any other relevant initiatives.)

Existing strategies and studies

2.2.1. The Brighton Marina to River Adur frontage lies within the administrative areas of Brighton and Hove City Council (BHCC) and Adur District Council (ADC) who are both Risk Management Authorities (RMAs) and have duties in accordance with the Coastal Protection Act (1949) and the Flood and Water Management Act, 2010 (FWMA2010).

2.2.2. The Beachy Head to Selsey Bill Shoreline Management Plan 2006 (SMP2) sets the high level policy for the management of this frontage. The scheme frontage lies within Sub Cell 4d of the SMP2, and extends across two policy areas: Brighton Marina to Portslade by Sea (PU 4d12) and Shoreham Harbour (Southwick) (PU 4d13). The SMP2 policy for both policy areas is Hold the Line for the next 100 years.

2.2.3. The Brighton Marina to River Adur Flood and Coastal Erosion Risk Management Strategy Review was approved by Defra in 2014. The 2014 Strategy covers approximately 11km length of coastline and splits the strategy frontage into 3 flood and erosion units. See Figure 2.

2.2.4. The 2014 Strategy recommends Improve (0.5 % AEP, 1 in 200-year standard) for Unit 1 – Shoreham Locked Section and Unit 2 – Open Coast and Sustain for Unit 3 – Brighton Marina, all of which are in agreement with the preferred Hold the Line policy outlined in SMP2.

2.2.5. The 2014 Strategy review is consistent with recommendations in the River Adur Catchment Flood Management Plan (CFMP), published September 2009.

2.2.6. The Strategy recommended short term capital schemes along the coast at Southwick Beach to Portslade, Western Esplanade, Hove Deep Sea Anglers' Buildings, Kings Esplanade and Lower Promenade to reduce the risk of erosion and flooding due to wave overtopping. Improvement works to the lock gates at Shoreham Locked Section were also included to address flood risk.

2.2.7. This OBC relates to the works required along Unit 2 – Open Coast of the Strategy from the River Adur to Brighton Marina. Works within the first phase (15 year benefit period) are located in six key areas, these are shown in Figure 1.

2.2.8. Unit 1 – Shoreham Locked Section is not included in the OBC as Shoreham Port Authority who own and maintain the lock gates are exploring development of these structures to deliver operational improvements to the port. As part of the development of the design for new structures, consideration of flood protection to the locked section will be undertaken. These works will be privately funded and will not be seeking FCRM_GiA funding.

2.2.9. Unit 3 – Brighton Marina is owned and maintained by Brighton Marina Company, a private organisation who wholly fund maintenance and refurbishment of the defences. Money from FCRM-GIA is not being sort for this Unit.

2.2.10. Unit 3 – Brighton Marina has no interdependency and no shared benefits with the other 2014 Strategy units.

2.2.11. However, flooding from Unit 1 – Shoreham Locked Section affects some assets also affected by erosion and wave overtopping risk along Unit 2 – Open Coast. Therefore, the damages assessment assesses flood damages from both Shoreham Locked Section and the open coast frontage to ensure double-counting is avoided. Under Do Something options it is assumed that the current situation at Shoreham Port is maintained.

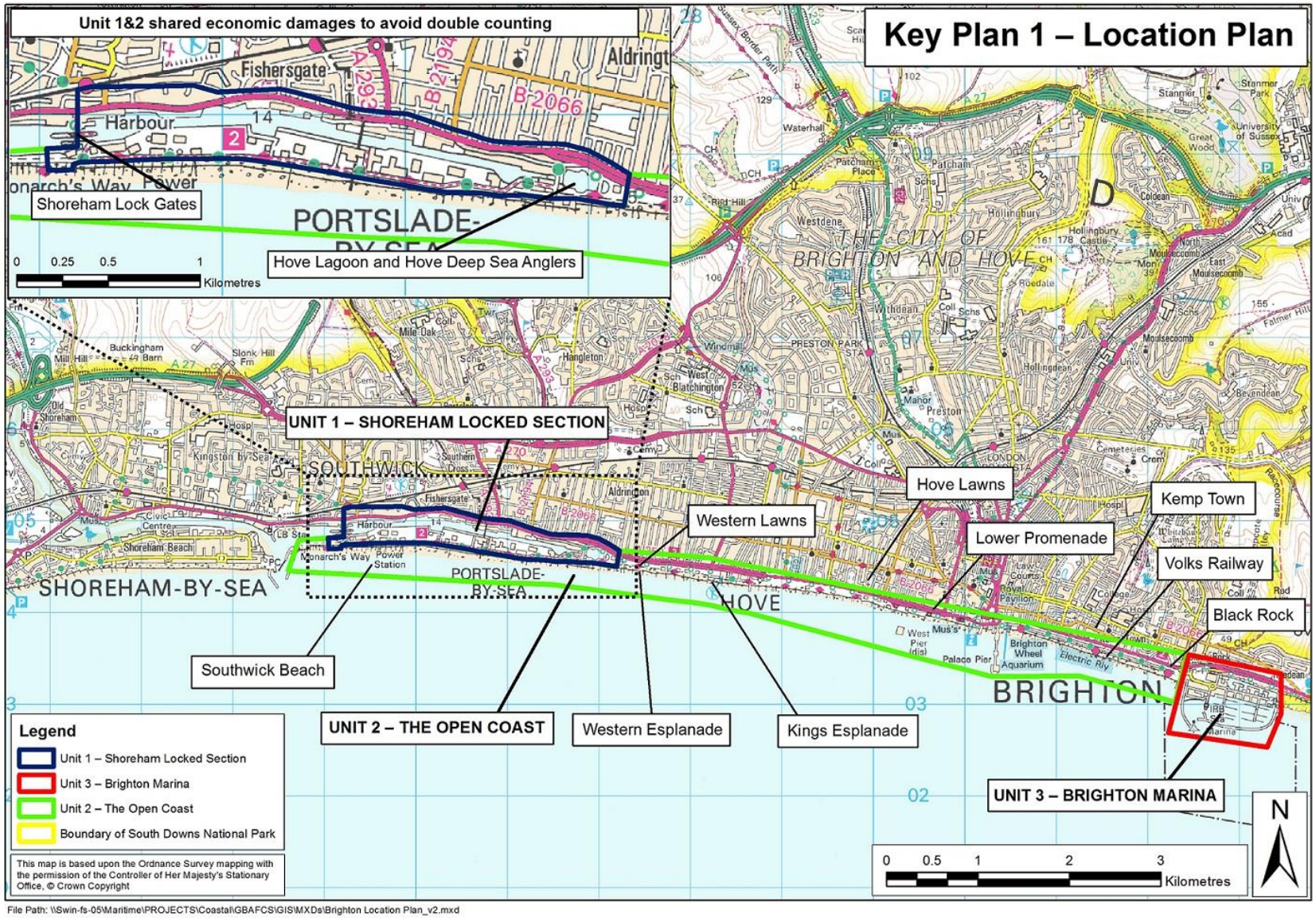


Figure 2 Strategy location plan

Flood risk from other sources

2.2.12. The SMP2 and 2014 Strategy focus on coastal flooding and erosion but it is important that all forms of flooding are considered during the development of the scheme. As Risk Management Authorities and BHCC also as Lead Local Flood Authority (LLFA), BHCC and ADC have an overall aim to reduce the risks to people and property from all forms of flooding and as such have carried out several assessments to understand these risks.

2.2.13. The Environment Agency's surface water flood mapping for the study area indicates generally low risk in the study area. Changing the existing defences and introducing new defences will have no impact on these existing issues.

The Brighton and Hove City Plan

2.2.14. The Brighton and Hove City Plan Part One was adopted in March 2016. The areas of Shoreham Harbour (DA8) and The Seafront (SA1) are highlighted as Development and Special Area Policies.

2.2.15. Shoreham Port and the open coast frontage fall within the Shoreham Harbour regeneration area and the area has been highlighted as a key opportunity area for regeneration, new employment, new housing and increased recreational activities. In order to maximise the opportunities offered by this diverse waterfront location a Joint Area Action Plan (JAAP) has been developed that will contain detailed policies for the harbour area to address a range of issues, including the provision of infrastructure.

2.2.16. With regard to 'The Seafront (SA1)', the City Plan outlines that the council will work in partnership to ensure the on-going regeneration and maintenance of the seafront in an integrated and coordinated manner. A key priority is to Work in partnership with Defra, the Environment Agency, Natural England and Southern Water to continue to maintain coastal defences and to ensure appropriate waste water treatment infrastructure.

2.3. Environmental and other considerations

(Summarise any relevant environmental issues, any regulatory requirements or legal obligations or any other dependencies around the project.)

Location and designations

2.3.1. There are no statutory designated sites for nature conservation located within the scheme areas, however, there are a number of non-statutory designated sites for nature conservation located within the scheme area. These sites are illustrated on the Environmental Constraints Plan in Appendix F of the Preliminary Environmental Information Report (PEIR) (Appendix H). The designations include:

- Basin Road South Local Wildlife Site (LWS);
- Black Rock Beach LWS.

2.3.1. Brighton to Newhaven Site of Special Scientific Interest (SSSI) and Beachy Head Marine Conservation Zone are located adjacent to the eastern end of the scheme and the South Downs National Park lies to the immediate east of Brighton Marina.

2.3.2. Vegetated shingle, an 'Annex 1' and UK Priority Habitat is present along extensive lengths of the frontage, and many of the ecological habitats both within and outside the designated marine sites comprise Local BAP habitats supporting Local BAP species.

2.3.3. There are a number of Scheduled Monuments, Conservation Areas, Historic Parks and Gardens and Listed Buildings located within the scheme areas. The eastern area of Shoreham Port and the seafront to Hove Lawns is an Archaeological Notification Area.

Strategic Environmental Assessment

2.3.4. A Strategic Environmental Assessment (SEA) was undertaken to inform the selection of the preferred options in the 2014 Strategy and is available on request.

2.3.5. The Strategy's Water Framework Directive Compliance Statement concluded that implementation of the Strategy preferred options is not expected to cause deterioration in the potential or status of any of the water bodies within or adjacent to the Strategy area, or prevent water bodies from achieving their objectives including future Good potential or status. Therefore, further assessment

of the strategy against the conditions listed in Article 4.7 is not required in respect of these conditions.

2.3.6. A number of sites with the Strategy area have been identified as having potential for contamination, including old industrial sites such as those adjacent to the estuary or canal of Shoreham Port or to the south of the former gas works along Southwick beach, as well as present industries such as fuel storage depots, a scrap metal wharf, Shoreham sewage treatment works and the gas fired power station.

Preliminary Environmental Information Report

2.3.7. A Preliminary Environmental Information Report (PEIR) has been prepared for the proposed scheme and is included in Appendix H. Letters of Support from key stakeholders are provided in Appendix R. The PEIR has considered current and future baseline conditions against the following topic areas:

- Biodiversity;
- Cultural heritage and archaeology
- Townscape, seascape and visual amenity;
- Ground conditions;
- Transport and navigation;
- Population, health and economy (including noise);
- Water and hydromorphology;

2.3.8. For each topic area the PEIR identifies the key issues of potential concern, outlines mitigation and enhancement options that may be considered, and proposes what further assessment will be undertaken to progress the scheme through the detailed design and planning process.

Preliminary Water Framework Directive Assessment

2.3.9. Due to its location within two designated waterbodies (River Adur water body and Sussex Coastal water body), a preliminary Water Framework Directive (WFD) Assessment has also been prepared in accordance with The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003 and is included as Appendix E of the PEIR (Appendix H). An assessment of the impacts of the scheme options on the Adur transitional and Sussex coastal water bodies noted that there are no significant impacts. The specific pressures considered included hydromorphology, biology (including habitats and fish) water quality, protected areas and non-native invasive species. Given the already modified shoreline, overall, the scheme provides overall benefits and therefore supports the WFD requirements for no deterioration to a water body.

2.3.10. During the next stage, the WFD did recommend that the higher sensitivity habitats are mapped during the detailed design stage to inform the works and delivery of materials. And that further assessment is carried out to identify how works can be designed, timed and delivered to avoid impact to fish, including any migratory species associated with the Adur.

Archaeology and Historic Environment

2.3.11. This scheme will impact the historic environment due primarily to the proximity of works to the Conservation Areas and non-designated assets around Kings Esplanade (Area 5) and Kemp Town (Area 6). These impacts will be temporary and unlikely to be significant as no direct physical impacts will occur to the heritage assets themselves. In addition, there are considered to be potential impacts in relation to the marine deliveries of shingle from Area 6 to Areas 7 and 5 to impact upon protected wreck sites in the area. The route of such deliveries will be considered further at detailed design stage to avoid damage as far as possible. There is also potential for the proposed works to impact upon below ground archaeology located within the Archaeological Notification Area. However, the ground disturbance associated with previous developments, reduces the possibility of archaeological remains being uncovered in most of this area.

2.3.12. Due to the potential for such impacts we will work to minimise the heritage impact to the greatest possible extent. We will work with the County Archaeologist during the detailed design process to determine the extent of any mitigation or watching brief required for these works. A full appraisal of archaeological and cultural heritage assets is included in Section 5.4 of the PEIR (Appendix H).

Landscape and Visual Environment

2.3.13. A full Landscape and Visual Impact Assessment is recommended to be undertaken at detailed design, expanding the work completed within the Preliminary Environmental Information Report. This assessment should follow current Landscape Institute and Institute of Environmental Management and Assessment Guidelines for Landscape and Visual Impact Assessment (3rd Edition). The LVIA should inform the development of a landscape master plan, developed from the Indicative Landscape Plan (ILP), which will identify landscape and wider environmental mitigation and enhancement measures associated with the scheme.

Other Consents

2.3.14. Other environmental consents that are likely to be required as the scheme progresses include a Marine Licence. The need for further consents and licenses may be identified as the scheme progresses.

2.4. Objectives

(State the investment objectives for the project, which should be SMART (Specific, measurable, achievable, realistic and time bound).)

2.4.1. The overall aim of the Outline Business Case is to review and update the preferred option identified in the Brighton Marina to River Adur Flood and Coastal Erosion Risk Management Strategy Review to promote a scheme to reduce flood risk to people and property (both residential and commercial). Brighton & Hove City Council and Adur District Council's overall objective is defined as "to defend the frontage from erosion and encroachment from the sea as outlined in the Coast Protection Act 1949 in order to protect people, property, the environment and the local economy".

2.4.2. The objectives established for the 2014 Strategy were reviewed and updated. The objectives were set through consultation with the Steering Group and with representatives from key national and local organisations. These are:

- To develop tidal and coastal defence options that are sustainable, technically sound, environmentally acceptable and economically viable in accordance with current Environment Agency Flood and Coastal Erosion Risk Management – Appraisal Guidance (FCERM-AG);
- To establish a long term sustainable framework for the next 100 years for the management of the frontage;
- To develop a fully integrated 15-year detailed programme of work for individual frontages, in line with the overall management framework;
- To identify outcome measures in accordance with current FCERM Grant in Aid (GiA) criteria;
- To ensure that the Outline Business Case (OBC) is related to neighbouring strategies and other high level plans.

2.5. Current arrangements

(Describe the existing situation, organisational approach, activities and the associated investment or revenue costs.)

2.5.1. The current approach to coastal erosion and flood risk management along this frontage is outlined in the Strategy/SOC and is summarised here (include as Appendix C to the OBC).

Summary

2.5.2. The open coast frontage between the River Adur and Brighton Marina is heavily developed and constrained by a range of seawalls and revetments. The shingle beach, which provides the main form of coastal defence, is controlled by a series of timber, rock, masonry and concrete groynes. The current SoP ranges from a 100% AEP to a 0.5% AEP SoP. Although some of those assets that provide a 0.5% AEP are in poor condition with residual life of <1 year.

2.5.3. Under a No Active Intervention scenario it is predicted that 13 residential and 105 commercial properties would be lost to erosion within the first 20 years including Shoreham Sewage Pumping Station (serving 60,000 population equivalent from Shoreham and Portslade) and Shoreham Power Station (420 mW, sufficient to power 250,000 homes). This increases to 260 residential and 248 commercial properties by Year 100, including the loss of the majority of businesses and land forming Shoreham Port and sections of the A259.

2.5.4. In addition, under a No Active Intervention scenario a further 6 residential and 8 commercial properties would also be at flood risk under a 0.5 % AEP event today, rising to 10 residential and 2 commercial properties in 100 years. Many properties affected by both erosion and flooding are lost to erosion before they come under flood risk.

2.5.5. Annual shingle bypassing across the mouth of the River Adur from Shoreham 'West Beach' to Southwick Beach has been undertaken by Shoreham Port Authority to feed beaches starved of sediment supply by the River Adur breakwaters. During the 1992 to 2017 period, approximately 17,600 m^3 has been moved each year. Shoreham Port Authority has also occasionally coordinated the movement of shingle from Black Rock to Southwick on behalf of Brighton and Hove City Council. Approximately 7,500 m^3 was moved in 2010, 9,000 m^3 was moved in 2013 and 6,650m^3 was moved in 2017.

2.5.6. Shoreham Port Authority manage the coastal frontage between the River Adur and Western Esplanade, Western Esplanade Management Company (WemCo) manage the Western Esplanade and Brighton and Hove City Council manage between Western Esplanade and Brighton Marina.

2.5.7. Shoreham Port Authority currently spend approximately £300,000 per annum on asset and beach maintenance, including the shingle bypass operation. The Western Esplanade Management Company (WemCo) allocate approximately £2,500 per year to the repair of the timber groynes. Brighton and Hove City Council has an annual budget of approximately £200,000 per year for their coastal frontage. It is estimated that approximately £164,000 is allocated to the River Adur to Brighton Marina frontage each year for the repair of concrete structures and for beach re-profiling.

2.5.8. The coastal frontage is monitored by the Adur and Worthing Coastal Survey Team as part of the Strategic Regional Coastal Monitoring Programme, coordinated by the Channel Coastal Observatory (CCO). The data produced by Adur and Worthing councils is freely available via the www.channelcoast.org website and includes: ATV-mounted laser scan surveys of the entire frontage undertaken on a six monthly basis in the spring and autumn and beach level surveys undertaken every 3 months. Post storm surveys are also undertaken by the Brighton and Hove City Council Engineer and Shoreham Port Authority. Post storm event inspections are undertaken by an in-house maintenance team, surveyors and engineering staff.

2.6. Defence condition summary

2.6.1. A walkover defence condition assessment was undertaken of the frontages where works were scheduled for the first 15 years to inform the OBC and provide an update to the 2014 Strategy Defence Condition Report. An updated Defence Condition Report is included in Appendix E. Table 8 provides a summary of the defences which are classed as poor or very poor condition (hot spot areas) highlighting issues with the current arrangements in these locations.

Table 8 Defence 'hot spot' areas

CPSE / Groyne ID	Photo	Notes	Condition	Residual life	Standard of protection
574 / 3815		Portslade By Sea wall	Very Poor	<1 year	<0.2% (>1 in 500)
574 / 3817		Portslade By Sea wall	Poor	<5 years	<0.2% (>1 in 500)

CPSE / Groyne ID	Photo	Notes	Condition	Residual life	Standard of protection
574 / 3701		Basin Road wall	Very poor	<1 year	<0.2% (>1 in 500)
574 / 3702		Basin Road beach and piled wall	Very Poor	<1 year	<0.2% (>1 in 500)
574 / 3703		Basin Road wall	Very Poor	<1 year	<0.33% (>1 in 300)
VG1 – VG5		Aldrington Villas (Western Esplanade) Timber Groyne Field – 5 No.	Poor	<5 years	
PG2		Portslade by Sea – Rock Groyne East (west of Western Esplanade)	Fair	5 – 10 years	
S22		Portslade by Sea Groynes	Very poor	< 1 year	
S19		Timber groyne in front of Parkers Factory	Very Poor	<1 year	

Asset management

2.6.2. The current asset management approach is in line with the SMP policy and seeks to ‘maintain and repair’ the FCRM assets. Annual inspections of the condition of all FCRM assets are undertaken following the EA guidance. Due to the poor condition of many of the assets they are required to undergo a biannual inspection. Additionally, following any storm event a ‘post storm survey’ is undertaken to inspect the assets. This records any damage or changes to their condition and remedies any defects.

Flood incident and emergency response management

2.6.3. The Environment Agency do not currently provide a flood warning service for the Brighton coastal frontage. However, this is currently being reviewed by the Environment Agency following the localised flooding of the Lower Promenade during the 2013/2014 winter storms. The Environment Agency do however currently provide a flood warning service and flood alerts for the Shoreham / Portslade area. This area reflects the potential flood extent due to tidal flooding within the Shoreham Locked Section.

2.6.4. Shoreham / Portslade is served by the EA's Tidal Flood Forecasting and Met Office Weather Warning services. Operational alerts are raised by the EA to ADC and BHCC when sea levels exceed the trigger thresholds. Residents and businesses at risk from flooding are actively encouraged to sign up to the EA Flood Line Warnings Direct service to help them prepare for potential flood events.

Main benefits

(Identify the high level strategic and operational benefits that will accrue as a result of the investment.)

2.6.5. The high level strategic benefits from this scheme are wider than those identified by the number of properties at reduced risk from flooding and erosion. The scheme will benefit a number of partner organisations by helping to meet their organisational objectives and requirements including Shoreham Port Authority which will benefit the area through rejuvenation of local commercial businesses encouraging employment and further investment in the area. The scheme will also benefit in terms of reduced health and stress impacts within the floodplain and will enhance amenity and tourism.

2.6.6. As a result of investment there are many benefits to partner organisations, as identified in their corporate plans. These benefits are summarised in Table 9 below.

Table 9 Strategic benefits

Benefits to partners	**Measures**
increase the resilience of people, property and business to the risk of flooding and coastal erosion (Environment Agency corporate plan)	OM1: £181,973,988 (based on 15 year benefit period) OM2a: 6 households OM2b: 6 households OM2c: 0 OM3A: 8 households OM3B: 8 households OM3A: 8 households
protect and improve water, land and biodiversity (Environment Agency corporate plan)	People are able to engage in coastal leisure activities
creating a better place (Environment Agency corporate plan)	Communities are better prepared and resilient to erosion and flooding incidents. Better local environment that enhances people's lives and supports a sustainable economy
Brighton and Hove Council's City Plan 2016	Improvements to the standard of protection of the defences in conjunction with the beach management works will greatly improve the visual appearance of the seafront and contribute towards key aspects of the City Plan
a conserved and enhanced landscape (Natural England's corporate plan 2014-19)	The scheme enhances and conserves the landscape.
access to open spaces and encourage open air recreation (Natural England's corporate plan 2014-19)	Access to the shoreline is maintained, the existing open spaces adjacent to the seafront are protected from coastal erosion and flood risk.
Southern Water	Reduced problems from sediment accretion and blockage at Southern Water asset in Kemp Town (Area 6)
Southern Water / Scottish Power	Reduced erosion and flood risk to key infrastructure including Sewage pumping station

	and power station
Shoreham Port Authority	Reduced erosion and flood risk to Shoreham Port (existing and to be developed facilities) Unlocking of development potential benefits the local economy and creates jobs

Main risks

(Describe the main risks associated with the delivery of the project and the approach to be taken to mitigate or manage these. Reference should be made to lessons learnt from previous projects, to any early Risk Potential Assessment and to the detailed risk register.)

2.6.7. The key risks with high priority associated with the delivery of the scheme are outlined in Table 10 and forms part of the schemes risk register which is available in Appendix J.

2.6.8. The mitigation strategy has been built upon the lessons learned from the past projects undertaken by the project team. The risk register has also been used to inform the risk contingencyapplied to the project.

Table 10 Main Risks

Key Risks	Proposed Mitigation
Funding availability - OBC does not receive FCRM GiA.	Ongoing review of MTP submissions and close working with the EA Area Team to profile funding.
Beach material no longer available from Shoreham bypassing. Alternative source required for recycling/beach widening	Confirmation of source and grading at detailed design. Liaison with Shoreham Port Authority and Environment Agency.
Variation in inflation (Client)	Monitor inflation and allow risk budget
Unacceptable quality/grading of rock	Certificates of quality to be approved by client. Known source of rock.
More frequent defence failure leads to more reactive maintenance than planned	Regular defence surveys to identify key areas for potential failure and areas which have already failed. React quickly if failure occurs.
Changes to wall design	Detailed planning permission application. Detailed samples and 3D images of final works to be consulted on at detailed design.
Early defence failure leads to works being more significant than planned	Continue monitoring programme, in particular pre and post storms. React quickly if defence condition rapidly deteriorates.
Increased volume of shingle required for beach widening	Volume designed against conservative case beach profiles.
Unforeseen ground conditions (eg contaminated material, voids, steel, etc) that affect the detailed design or construction costs.	Undertake further detailed site / ground investigations as part of the detailed design phase. SI at site of existing defences. Redesign of proposed defences as necessary.
Site security on site becomes issue due to unforeseen event	Consultation with public and local authorities to determine any issues before reaching site.

Constraints

(Any constraints on the approach planned to deliver the project objectives, whether internal or externally driven. For example, whether the project must be delivered by a particular time; whether a particular technical solution affects the one or more of the options; or whether the availability of funding in relation to all or some of the options is affected or restricted. Note any changes from previous business case iterations.)

2.6.9. The heritage and environmental landscape of the open coastline will influence the final scheme. In particular:

- Basin Road South SNCI is located on the shoreline where works are proposed. This area is also an area of vegetated shingle. Vegetated shingle habitat may need to be mitigated for or compensated by replacement elsewhere.

- The presence of protected wreck sites in proximity to Area 6 (Kemp Town) will require further consideration to avoid adverse impacts during the marine shipment of beach material.
- There is potential for archaeological remains to be found during proposed works in the Archaeological Notification Area. Further investigation is required at the next stage to inform detailed design.

2.6.10. Other key constraints which may impact the timing of works and access, as well as potentially restricting working areas and the location of site compounds include:

- Access to privately owned land, for example, at Western Esplanade
- Minimising disruption to commercial fishing interests, Shoreham Harbour and the local business community, all of which are major contributors to the local economy.
- Minimising disruption to tourism and the amenity value of the coast including access to the water front. Site working along the Brighton frontage will need to be restricted to avoid peak tourist times.

2.6.11. Some sources of potential contamination have been identified, particularly associated with industrial land use in the vicinity of Shoreham Port, and the need to maintain the quality of ground and coastal waters will be important.

Dependencies

(Identify where the project objectives or delivery is reliant on other projects, business as usual activities, things to be in place or relies on decisions being taken outside the organisation (eg planning or support of partner organisations). Note any changes since the previous business case iteration.)

2.6.12. The business case for the scheme is dependent on provision of a contribution to be provided by Brighton and Hove City Council and Adur District Council. Once the legal agreement is signed and subject to OBC approval, funds can be drawn down to progress detailed design and construction. See Appendix Q for the Memorandum of Understanding.

2.6.13. The coastal processes assessment (refer to Appendix D) has indicated that in order to hold the line an annual average requirement of 16,000 m^3 per year for combined bypassing and beach recycling is required for all active intervention options. This requirement will need to be reviewed in the future in line with any changes to advice on climate change and sea level rise. Currently approximately 17,600 m^3 per year is bypassed from Shoreham Beach. The available volume from Shoreham is dependent on the rate of natural accretion on an annual basis. To ensure that the 16,000 m^3 per year target is met, combined bypassing from Shoreham Beach and recycling from Kemp Town (Black Rock) is recommended. This ensures a flexible approach that can meet natural variations in material supply from both sources. Recycling from Kemp Town alone is not sufficient to sustain ongoing beach maintenance and protection against increasing climate change. In the longer term, an addition of material into the open coast system is required to meet the beach widening requirements and ongoing beach maintenance. It is proposed this is met by continuing the current bypassing operation from Shoreham Beach.

3. The Economic Case

3.1. Introduction

(Summarise the approach being taken and methodology being followed to arrive at the best value for money option which is deliverable, and meets objectives.)

3.1.1. The development of options and the economic case for the OBC builds on and is supported by the information in the Brighton Marina to River Adur Flood and Coastal Erosion Risk Management Strategy Review (SOC), which reviewed and refined potential options for the open coast frontage between the River Adur and Brighton Marina.

3.1.2. The economic case for the scheme builds on and is supported by the information in the 2014 Strategy, which was approved in 2015. The 2014 Strategy recommended that a capital improvement scheme should be undertaken for Unit 2- Open Coast defences to improve the coastal defences to a 0.5% AEP SoP to reduce long term (100 year) erosion and flood risk taking account of long term climate change predictions to sea level rise.

3.1.3. The options appraisal has been carried out in accordance with the requirements of the Flood and Coastal Erosion Risk Management Appraisal Guidance (FCERM-AG) and associated EA policies, procedures and advice. Options have been assessed on the basis of benefit cost ratio and assessment against technical, environmental and economic factors.

3.2. Long list options

(Describe the long list of options originally considered in relation to delivery of the project objectives. This could include different technological solutions, different timings etc. This may also include different ways of delivering the solution (such as in house, through third parties or through partnership arrangements) and if there are different funding sources for different options. Include a 'do nothing', a 'do minimum' and a range of 'do something' options sufficient to demonstrate a wide and considered approach.)

3.2.1. Reflecting the Hold the Line policy in the SMP, a long list of generic options considered technically suitable for providing continued and improved flood and erosion risk management for the study area were identified in the 2014 Strategy.

3.2.2. The Strategy assessed long list options for each of the three Units in respect to high level economic, technical, social and environmental factors. Table 11 summarises the long list options appraised for Unit 2 – Open Coast and identifies those taken forward to the short list.

Table 11 Unit 2 – Open Coast long list options considered in the 2014 Strategy

Option	Description	Benefits delivered /Issues involved	Reason for short list or rejection
1. No Active Intervention	No further works or repairs would be undertaken and beach recycling and bypassing operations would stop.	The defences would be left to deteriorate and fail over time. Ongoing erosion would breach the frontage at Southwick Beach eventually resulting in open water conditions within the locked section, resulting in wall failure when water drains out of the basin.	Short-listed Baseline for economic assessment
2. Do Minimum	Reactive repair of seawalls and some movement of shingle to protect vulnerable seawall sections.	The groynes will continue to deteriorate and will eventually fail. Reactive repair would only delay onset of breach. Ongoing erosion would breach the frontage at Southwick Beach eventually resulting in open water conditions within the locked section, resulting in wall failure when water drains out of the basin.	Short-listed

Option	Description	Benefits delivered /Issues involved	Reason for short list or rejection
3. Maintain 1	The existing groynes, seawalls and other defences will be refurbished and repaired as required. The movement of shingle from west to east across the river mouth will continue to feed the beach at Southwick Beach.	Option 3 would result in accretion at Kemp Town with material that could potentially be used to feed neighbouring frontages. This option does not make best use of beach material within the coastal process unit. Option 5 – Maintain 3 provides the best flexibility to beach management. No difference in cost between transportation from each source.	Not short-listed. This option does not make best use of beach material within the coastal process unit.
4. Maintain 2	As Option 3, except beach material will not be moved across the Adur river mouth. Shingle will be taken from the beaches at Kemp Town to recharge the beaches at the west end of Shoreham Port.	Option 4 would result in the reduction of Kemp Town beaches increasing flood risk along this frontage. Option 5 – Maintain 3 provides the best flexibility to beach management. No difference in cost between transportation from each source.	Not short-listed. This option does not make best use of beach material within the coastal process unit.
5. Maintain 3	As Option 3, except shingle to feed the Shoreham Port frontage will be sourced from both Kemp Town and also moved across the Adur river mouth, as current operations.		Short-listed Provides the best flexibility to beach management. No difference in cost between transportation from each source.
6. Sustain 1	Upgrade existing groynes with higher and/or longer groynes to increase the size of the beaches to sustain the current standard of protection. Groynes, seawalls and other defences will be refurbished and repaired as required. Continue with beach bypassing from Shoreham Beach and recycling from Kemp Town.		Not short-listed. The current SoP along the coast varies from 100 % AEP at some locations to greater than 0.2 % AEP at others. Sustaining such extreme standards of protection would not ensure the most economical and appropriate option for the frontage.
7. Sustain 2	Seawalls and other defences will be raised where appropriate to sustain the current standard of protection. Groynes and other defences will be refurbished and repaired as required. Continue with beach bypassing from Shoreham Beach and recycling from Kemp Town.		Not short-listed. As for Option 6
8. Improve 1	The existing groynes will be upgraded with higher and/or longer groynes to increase the size of the beaches to improve the current standard of protection. Groynes, seawalls and		Short-listed

Option	Description	Benefits delivered /Issues involved	Reason for short list or rejection
	other defences will be refurbished and repaired as required. Continue with beach bypassing from Shoreham Beach and recycling from Kemp Town.		
9. Improve 2	Seawalls and other defences will be raised where appropriate to improve the current standard of protection. Groynes and other defences will be refurbished and repaired as required. Continue with beach bypassing from Shoreham Beach and recycling from Kemp Town.	Significant wall raising would have impacts on some more sensitive areas, for example, the tourist areas of Brighton beach.	Short-listed (combined with beach Improve 1) These options are carried through to short list but have been developed so that combinations of wall raising and beach widening have been considered within each option.
10. Improve 3	The existing groynes will be removed at the end of their residual life. Offshore breakwaters will be constructed to control sediment transport and maintain the beach. Seawalls and other defences will be refurbished and repaired as required. Continue with beach bypassing from Shoreham Beach and recycling from Kemp Town.	Offshore breakwaters afford protection by helping to build the beach leeward of the breakwaters. Will have considerable impacts on the local environment and amenity.	Not short-listed. Option relies on a constant source of beach material feeding the system. This frontage is a closed system. The only material being moved into the system is from bypassing and this volume is not sufficient to beach build behind offshore breakwaters. This option would also be considerably more expensive than other improve options and have considerable impacts on the local environment and amenity.
11. Improve 4	The existing groynes will be removed at the end of their residual life. Revetments will be constructed in front of the seawall to improve the standard of protection.	The beach would not be maintained. Reduction of the beach at the Southwick end and ceasing of any bypassing would result in a loss of beach and increasing maintenance requirements to prevent revetments undermining. This option would not be sustainable in the long term and would have significant impact on amenity and tourism interests.	Short-listed (combined with beach Improve 1) Option is not taken through to short list, but revetments to improve the standard of protection or as coastal erosion defences have been considered within the more detailed short list options along short lengths in combination with beach management.
12. Improve 5	The existing groynes would be removed at the end of their residual life. Raised seawalls will be constructed to improve the standard of protection.	The beach would not be maintained.	Short-listed (combined with beach Improve 1) As for Option 11

3.3. Short list options

Overview

(Summarise the options from the long list carried forward for further appraisal and evaluation and why the other options have been discounted. Set out the full descriptions of options for further appraisal which should include, a 'do nothing' or 'status quo', 'do minimum' and at least 2 alternatives.)

3.3.1. The 2014 Strategy developed the short-listed options in greater detail following consideration of technical viability, sustainability, economics and environmental issues. The short-listed options that were taken forward for Unit 2 – Open Coast included:

- Option 1 – No Active Intervention;
- Option 2 – Do Minimum;
- Option 3 – Maintain;
- Option 4A – Improve 1.33% (1 in 75 years) standard of protection – wall raising and beach widening
- Option 4B – Improve 1.33% (1 in 75 years) standard of protection – beach widening
- Option 5A – Improve 1% (1 in 100 years) standard of protection – wall raising and beach widening
- Option 5B – Improve 1% (1 in 100 years) standard of protection – beach widening
- Option 6A – Improve 0.5% (1 in 200 years) standard of protection – wall raising and beach widening
- Option 6B – Improve 0.5% (1 in 200 years) standard of protection – beach widening

3.3.2. Three different standards of protection were considered for each Improve option (1.33% AEP; 1% AEP and 0.5% AEP). Further technical details on each short-listed solution are provided in the 2014 Strategy Options Appraisal Report (Appendix C).

Technical assessment

(Provide a brief technical description of each solution, how any technical risks are to be addressed and any technical opportunities or innovations offered.)

3.3.3. Table 12 presents the short-list of options taken forward for further appraisal with a brief technical description.

Table 12 Short-listed options considered in the Strategy with technical descriptions

Option Number	Option	Technical Description
Unit 2 – Open Coast		
Option 1	No Active Intervention	No further works or repairs would be undertaken and beach recycling and bypassing operations would be stopped. The defences would be left to deteriorate and fail over time. Ongoing erosion would breach the frontage at Southwick beach eventually resulting in open water conditions within the locked section, resulting in quay wall failure when water drains out of the basin.
Option 2	Do Minimum	Reactive repair of seawalls and some movement of shingle to protect vulnerable seawall sections. The groynes will continue to deteriorate and will eventually fail. Reactive repair would only delay onset of breach. Ongoing erosion would breach the frontage at Southwick beach eventually resulting in open water conditions within the locked section, resulting in quay wall failure when water drains out of the basin.
Option 3	Maintain	Maintain and replace groynes and defences as required. Annual bypassing and recycling of 16,000 m^3/year of shingle to feed Shoreham Port frontage and Brighton beaches sourced from west of the River Adur mouth and Kemp Town beaches. With predicted sea level rise, flood risk will increase over time. In addition to assets required to address flood risk, along the Shoreham Port frontage new assets are also required to

Option Number	Option	Technical Description
		address erosion risk problems with potential release of contaminated material, for example, at the lorry park to the west of Western Villas. New works required: • New access ramp for access to beach for recycling works between 574/3912 and 574/3913 in Year 2; • New groyne field – VG1-VG5 in Year 2; • New rock revetment at 574/3814 and 574/3702 in Year 2; • New rock groynes 1 & 2 between PG4 and S22 in Year 2; • New flood gate and ramp for access to beach for recycling works between 574/3702 and 574/3701 in Year 2.
Option 4A	Improve 1.33 % (1 in 75 years) standard of protection – Wall Raising and Beach Widening	Maintain and replace groynes and defences as required. Annual bypassing and recycling of 16,000 m^3/year of shingle to feed Shoreham Port frontage and Brighton beaches sourced from west of the Adur river mouth and Kemp Town beaches. Movements of beach material taken from Kemp Town would be required to feed the widened beaches. New works required: • New access ramp for access to beach for recycling works between 574/3912 and 574/3913 in Year 2; • Groynes B8 and B9 – Raise groynes to widen beach in Year 6; • Groyne B5 & B6 – Raise groynes to widen beach in Year 42 and Year 94 respectively; • Groynes H1 to H9 inclusive – Extend and raise groynes to widen beach in Year 97; • Groynes H10 to H16 inclusive – Extend and raise groynes to widen beach in Year 2 and again in Year 92; • Groyne H30 – Extend and raise groyne to widen beach Year 2 and again in Year 92; • Hove Lagoon Outfall – Extend in Year 2 and again in Year 92; • Groyne H31 – Extend and raise groyne to widen beach in Year 2 and again in Year 92; • New groyne field – VG1-VG5 in Year 2. Extend in Year 82; • New rock revetment at 574/3814 and 574/3702 in Year 2; • New rock groynes 1 & 2 between PG4 and S22 in Year 2. Extend in Year 65; • New flood gate and ramp for access to beach for recycling works between 574/3702 and 574/3701 in Year 2; • Groyne PG 1 –Extend groyne to widen beach in Year 2 and again in Year 85; • Groyne S20 – Build up at inner end and extend to widen beach Year 2; • Wall 574/3703 – Raise wall in Year 30 and again in Year 95.
Option 4B	Improve 1.33 % (1 in 75 years) standard of protection – Beach Widening	Maintain and replace groynes and defences as required. Annual bypassing and recycling of 16,000 m^3/year of shingle to feed Shoreham Port frontage and Brighton beaches sourced from west of the Adur river mouth and Kemp Town beaches. Movements of beach material taken from Kemp Town would be required to feed the widened beaches. New works required: • Works as described above for Option 4A, except replacement of “Wall 574/3703 – Raise wall in Year 30 and again in Year 95” with the following: • Groynes T1, S4, S6, S8, S10, S11, S12, S13, S14, S15 – Extend groynes to widen beach in Year 30 and again in Year

Option Number	Option	Technical Description
		94; • Southern Water Outfall S16 – Extend in Year 94.
Option 5A	Improve 1 % (1 in 100 years) standard of protection – Wall Raising and Beach Widening	Maintain and replace groynes and defences as required. Annual bypassing and recycling of 16,000 m^3/year of shingle to feed Shoreham Port frontage and Brighton beaches sourced from west of the Adur river mouth and Kemp Town beaches. Movements of beach material taken from Kemp Town would be required to feed the widened beaches. New works required: • New access ramp for access to beach for recycling works at between 574/3912 and 574/3913 in Year 2; • Groynes B8 and B9 – Raise groynes to widen beach in Year 2 and again in Year 95; • Groyne B5 & B6 – Raise groyne to widen beach in Year 40 and Year 90 respectively; • Groynes H1 to H9 inclusive – Extend and raise groynes to widen beach in Year 94; • Groynes H10 to H16 inclusive – Extend and raise groynes to widen beach in Year 2 and again in Year 90; • Groyne H30 – Extend and raise groyne to widen beach in Year 2 and again in Year 90; • Hove Lagoon Outfall – Extend in Year 2 and again in Year 90; • Groyne H31 – Extend and raise groyne to widen beach in Year 2 and again in Year 90; • New groyne field – VG1-VG5 in Year 2. Extend in Year 65; • New rock revetment at 574/3814 and 574/3702 in Year 2; • New rock groynes 1 & 2 between PG4 and S22 in Year 2. Extend in Year 50; • New flood gate and ramp for access to beach for recycling works between 574/3702 and 574/3701 in Year 2; • Groyne PG 1 – Extend groyne to widen beach in Year 2 and again in Year 75; • Groyne S20 – Build up at inner end and extend to widen beach in Year 2; • Wall 574/3703 – Raise in Year 20 and again in Year 90.
Option 5B	Improve 1 % (1 in 100 years) standard of protection – Beach Widening	Maintain and replace groynes and defences as required. Annual bypassing and recycling of 16,000 m^3/year of shingle to feed Shoreham Port frontage and Brighton beaches sourced from west of the Adur river mouth and Kemp Town beaches. Movements of beach material taken from Kemp Town would be required to feed the widened beaches. New works required: • Works as described above for Option 5A, except replacement of "Wall 574/3703 – Raise wall in Year 20 and again in Year 90" with the following: • Groynes T1, S4, S6, S8, S10, S11, S12, S13, S14, S15 – Extend groynes to widen beach in Year 20 and again in Year 90; • Southern Water Outfall S16 – Extend in Year 90.
Option 6A	Improve 0.5 % (1 in 200 years) standard of protection – Wall Raising and Beach Widening	Maintain and replace groynes and defences as required. Annual bypassing and recycling of 16,000 m^3/year of shingle to feed Shoreham Port frontage and Brighton beaches sourced from west of the Adur river mouth and Kemp Town beaches. Movements of beach material taken from Kemp Town would be required to feed the widened beaches. New works required:

Option Number	Option	Technical Description
		• New access ramp for access to beach for recycling works between 574/3912 and 574/3913 in Year 2; • New rock revetment at 574/3814 and 574/3702 in Year 2; • New rock groynes 1 & 2 between PG4 and S22 in Year 2; • New flood gate and ramp for access to beach for recycling works between 574/3702 and 574/3701 in Year 2; • Groynes B8 and B9 – Extend and raise to widen beach in Years 2 and 85; • Groyne B5 – Extend and raise to widen beach in Year 30; • Groyne B6 – Extend and raise to widen beach in Year 80; • Groynes H1 to H9 inclusive – Extend and raise to widen beach in Year 83; • Groynes H10 to H16 inclusive – Extend and raise to widen beach in Years 2 and 80; • Groynes H30, H31 and Hove Lagoon Outfall – Extend and raise groyne to widen beach in Year 2 and again in Year 80; • Groynes VG1 to VG5 inclusive – Replace groyne field in Year 2; • Groyne PG1 – Replace groyne in Year 2
Option 6B	Improve 0.5 % (1 in 200 years) standard of protection – Beach Widening	Maintain and replace groynes and defences as required. Annual bypassing and recycling of 16,000 m^3/year of shingle to feed Shoreham Port frontage and Brighton beaches sourced from west of the Adur river mouth and Kemp Town beaches. Movements of beach material taken from Kemp Town would be required to feed the widened beaches. New works required: • Works as described above for Option 6A, except replacement of "Wall 574/3703 – Raise wall in Year 10 and again in Year 70" with the following: • Groynes T1, S4, S6, S8, S10, S11, S12, S13, S14, S15 – Extend groynes to widen beach in Year 10 and again in Year 80; • Southern Water Outfall S16 – Extend in Year 80.

3.3.4. As the beach widening options in all cases were economically less favourable than the wall raising and beach widening options, only the latter options were reviewed by the OBC. Therefore, the short list options taken forward to OBC were:

- Option 1 – No Active Intervention;
- Option 2 – Do Minimum;
- Option 3 – Maintain;
- Option 4A – Improve 1.33% (1 in 75 years) standard of protection – wall raising and beach widening
- Option 5A – Improve 1% (1 in 100 years) standard of protection – wall raising and beach widening
- Option 6A – Improve 0.5% (1 in 200 years) standard of protection – wall raising and beach widening

3.3.5. The programme of works for each option was reviewed in relation to updated information since the strategy.

3.3.6. Since the 2012 strategy, some refurbishment works have been undertaken along the Shoreham Port frontage. These included some limited encasement in concrete of sections of the sheet pile wall at 574/3703, the addition of a single layer of 4 to 6 tonne rock to add some additional stability in front of 574/3702 and the reconstruction of groynes T1 to S18 inclusive. Along many sections of 574/3702 and along exposed sections of 574/3703, rubble sacks have been placed in front of the

wall by Shoreham Port Authority to provide some resistance to ongoing erosion and exposure of the wall.

3.3.7. In 2014/2015, SPA also undertook improvement works to groynes PG2 and PG4 which are located on the eastern stretch of Shoreham Ports frontage bounding the private beach owned by Western Esplanade residents. These improvement works included the raising of the landward end of the groynes in order to build up the beach crest within the groyne bays to manage coastal erosion and flood risk. As a consequence, alongshore drift of beach material further east to Western Esplanade and Brighton beaches has been interrupted. It is expected that this is a short term interruption and that material will start to bypass the groynes again within 5 to 15 years once the bays have infilled fed by material from alongshore drift.

3.3.8. Shoreham Port Authority have continued to recycle beach material from Shoreham Beach (west of the western Shoreham breakwater) in magnitudes similar to or greater than in previous years (see Table 1 of the Coastal Processes Report –Technical Addendum (Halcrow, 2018)). Beach profiles along the frontage have generally stayed stable since 2012, except along the Outer Layby beach (beach which runs along the reclaimed area to the west of the Lock Gates) where notable beach loss has occurred.

3.3.9. In addition, to these changes, updated costs from the Early Supplier Engagement has indicated price increases since 2014 which has meant that more cost appropriate solutions have had to be found. These includes:

- The review of the proposed new timber groyne field and beach recharge scheme at Western Esplanade. This scheme has been postponed. To ensure the 0.5% AEP SoP for the first 15 years, a new flood wall west of Hove Deep Sea Anglers Hut buildings is now included in the proposed scheme coupled with beach recharge along the beach fronting Western Esplanade villas.
- At the lorry park a new rock revetment has been postponed. The scheme now includes for the use of rock armour won from the western Shoreham Port frontage (Area 2) to be used to construct a temporary rock armour to provide erosion protection for the first 15 years.

3.3.10. Proposed capitals works within the first phase of works (15 year benefit period) are located in six key areas shown in Figure 1.

3.3.11. The proposed maintenance regime has been updated to account for recent defence configuration changes along the frontage. The OBC proposed that beach material won from Shoreham Beach by Shoreham Port Authority will be placed at Shoreham Outer Layby (Area 7) and in front of wall 574/3703 (Area 1), as is usually undertaken during the maintenance bypassing operations. Whilst the beach material obtained from Kemp Town (Area 6) will be placed at Western Esplanade (Area 4). Material is currently being blocked from passing onto the Brighton frontage from the Shoreham Port frontage because of recent works undertaken to groynes PG2 and PG4. It is expected that once these bays fill up that sediment will continue to bypass along the frontage from the Shoreham Port frontage to Brighton freely again and a biennial recycling of 32,000m^3 made up of material from both Shoreham beach and Kemp Town can be assumed. This is in addition to the annual 5,000m^3/year sourced from Kemp Town. It is estimated based on current beach profiles that the bays will fill up by year 10.

3.3.12. The available volume from Shoreham Beach and Kemp Town beach are, however, dependent on the rate of natural accretion on an annual basis. To ensure that the 16,000 m^3 per year target is met, combined bypassing from Shoreham Beach and recycling from Kemp Town (Black Rock) is recommended. This ensures a flexible approach that can meet natural variations in material supply from both sources. Recycling from Kemp Town alone is not sufficient to sustain ongoing beach maintenance and protection against increasing climate change. In the longer term, an addition of material into the open coast system is required to meet the beach widening requirements and ongoing beach maintenance. It is proposed this is met by continuing the current bypassing operation from Shoreham Beach.

Table 13 Short-listed options considered in the OBC with technical descriptions

Option Number	Option	Technical Description
Unit 2 – Open Coast		
Option 1	No Active	No further works or repairs would be undertaken and beach

Option Number	Option	Technical Description
	Intervention	recycling and bypassing operations would be stopped. The defences would be left to deteriorate and fail over time. Ongoing erosion would breach the frontage at Southwick beach eventually resulting in open water conditions within the locked section, resulting in quay wall failure when water drains out of the basin.
Option 2	Do Minimum	Reactive repair of seawalls and some movement of shingle to protect vulnerable seawall sections. The groynes will continue to deteriorate and will eventually fail. Reactive repair would only delay onset of breach. Ongoing erosion would breach the frontage at Southwick beach eventually resulting in open water conditions within the locked section, resulting in quay wall failure when water drains out of the basin.
Option 3	Maintain	Maintain and replace groynes and defences as required. Beach monitoring and maintenance including allowance for recycling of 5,000 m^3/year of shingle to feed the Shoreham Port frontage and Brighton beaches sourced from Kemp Town beaches. With predicted sea level rise, flood risk will increase over time. Biennial bypassing and recycling of 32,000 m^3 and 10,000 m^3, respectively under year 10 reducing to 32,000 m^3 in total thereafter for the 100 year appraisal period, of shingle to feed Shoreham Port and Brighton beaches sourced from west of the Adur river mouth and Kemp Town beaches. In addition to assets required to address flood risk, along the Shoreham Port frontage. New assets are also required to address erosion risk problems with potential release of contaminated material, for example, at the lorry park to the west of Western Villas. New works required: • Movement of beach material from Kemp Town to Shoreham Outer Layby to widen beach in Year 2; • New rock revetment at 574/3702 in Year 3; • New temporary rock revetment at 574/3814 in Year 3; • New flood gate and ramp for access to beach for recycling works between 574/3702 and 574/3701 in Year 22. • New rock revetment at 574/3814 in Year 22; • New rock groynes 1 & 2 between PG4 and S22 in Year 22; • New groyne field – VG1-VG5 in Year 20; • New access ramp for access to beach for recycling works between 574/3912 and 574/3913 in Year 22.
Option 4A	Improve 1.33 % (1 in 75 years) standard of protection – Wall Raising and Beach Widening	Maintain and replace groynes and defences as required. Beach monitoring and maintenance including allowance for recycling of 5,000 m^3/year of shingle to feed the Shoreham Port frontage and Brighton beaches sourced from Kemp Town beaches. With predicted sea level rise, flood risk will increase over time. Biennial bypassing and recycling of 32,000 m^3 and 10,000 m^3, respectively under year 10 reducing to 32,000 m^3 in total thereafter, of shingle to feed the Shoreham Port frontage and Brighton beaches sourced from west of the Adur river mouth and Kemp Town beaches. In addition to assets required to address flood risk, along the Shoreham Port frontage new assets are also required to address erosion risk problems with potential release of contaminated material, for example, at the lorry park to the west of Western Villas. New works required:

Option Number	Option	Technical Description
		• Movement of beach material from Kemp Town to Shoreham Outer Layby to widen beach in Year 2; • Wall 574/3703 – Raise wall in Year 25 and again in Year 85. • New rock revetment at 574/3702 in Year 3; • New temporary rock revetment at 574/3814 in Year 3; • New flood gate and ramp for access to beach for recycling works between 574/3702 and 574/3701 in Year 22. • New rock revetment at 574/3814 in Year 22; • New rock groynes 1 & 2 between PG4 and S22 in Year 22; • New groyne field – PG1, VG1-VG5 in Year 20. Extend in Year 75; • Wall 574/3811 – Raise wall in Year 2 and again in Year 34. • Groynes H11 to H17 inclusive – Extend and raise groynes to widen beach in Year 2 and again in Year 52; • Wall 574/3806 and 574/3805 – Raise wall in Year 30. • Groynes H1 to H9 inclusive – Extend and raise groynes to widen beach in Year 97; • Groyne B5 & B6 – Raise groynes to widen beach in Year 42 and Year 94 respectively; • Groynes B8 and B9 – Raise groynes to widen beach in Year 26; • New access ramp for access to beach for recycling works between 574/3912 and 574/3913 in Year 22.
Option 5A	Improve 1 % (1 in 100 years) standard of protection – Wall Raising and Beach Widening	Maintain and replace groynes and defences as required. Beach monitoring and maintenance including allowance for recycling of 5,000 m^3/year of shingle to feed the Shoreham Port frontage and Brighton beaches sourced from Kemp Town beaches. With predicted sea level rise, flood risk will increase over time. Biennial bypassing and recycling of 32,000 m^3 and 10,000 m^3, respectively under year 10 reducing to 32,000 m^3 in total thereafter, of shingle to feed the Shoreham Port frontage and Brighton beaches sourced from west of the Adur river mouth and Kemp Town beaches. In addition to assets required to address flood risk, along the Shoreham Port frontage new assets are also required to address erosion risk problems with potential release of contaminated material, for example, at the lorry park to the west of Western Villas. New works required: • Movement of beach material from Kemp Town to Shoreham Outer Layby to widen beach in Year 2; • Wall 574/3703 – Raise wall in Year 15 and again in Year 80. • New rock revetment at 574/3702 in Year 3; • New temporary rock revetment at 574/3814 in Year 3; • New flood gate and ramp for access to beach for recycling works between 574/3702 and 574/3701 in Year 22. • New rock revetment at 574/3814 in Year 22; • New rock groynes 1 & 2 between PG4 and S22 in Year 22; • New groyne field – PG1, VG1-VG5 in Year 20. Extend in Year 70; • Wall 574/3811 – Raise wall in Year 2 and again in Year 30. • Groynes H11 to H17 inclusive – Extend and raise groynes to widen beach in Year 2 and again in Year 52; • Wall 574/3806 and 574/3805 – Raise wall in Year 26. Extend

Option Number	Option	Technical Description
		in Year 88. • Groynes H1 to H9 inclusive – Extend and raise groynes to widen beach in Year 94; • Groyne B5 & B6 – Raise groynes to widen beach in Year 40 and Year 90 respectively; • Groynes B8 and B9 – Raise groynes to widen beach in Year 24; • New access ramp for access to beach for recycling works between 574/3912 and 574/3913 in Year 22.
Option 6A	Improve 0.5 % (1 in 200 years) standard of protection – Wall Raising and Beach Widening	Maintain and replace groynes and defences as required. Beach monitoring and maintenance including allowance for recycling of 5,000 m^3/year of shingle to feed the Shoreham Port frontage and Brighton beaches sourced from Kemp Town beaches. With predicted sea level rise, flood risk will increase over time. Biennial bypassing and recycling of 32,000 m^3 and 10,000 m^3, respectively under year 10 reducing to 32,000 m^3 in total thereafter, of shingle to feed the Shoreham Port frontage and Brighton beaches sourced from west of the Adur river mouth and Kemp Town beaches. In addition to assets required to address flood risk, along the Shoreham Port frontage new assets are also required to address erosion risk problems with potential release of contaminated material, for example, at the lorry park to the west of Western Villas. New works required: • Movement of beach material from Kemp Town to Shoreham Outer Layby to widen beach in Year 2; • Wall 574/3703 – Raise wall in Year 10 and again in Year 70. • New rock revetment at 574/3702 in Year 3; • New temporary rock revetment at 574/3814 in Year 3; • New flood gate and ramp for access to beach for recycling works between 574/3702 and 574/3701 in Year 22. • New rock revetment at 574/3814 in Year 22; • New rock groynes 1 & 2 between PG4 and S22 in Year 22; • New groyne field – PG1, VG1-VG5 in Year 20. Extend in Year 60; • Wall 574/3811 – Raise wall in Year 2 and again in Year 20. • Groynes H11 to H17 inclusive – Extend and raise groynes to widen beach in Year 2 and again in Year 52; • Wall 574/3806 and 574/3805 – Raise wall in Year 18. Extend in Year 80. • Groynes H1 to H9 inclusive – Extend and raise groynes to widen beach in Year 83; • Groyne B5 & B6 – Raise groynes to widen beach in Year 30 and Year 80 respectively; • Groynes B8 and B9 – Raise groynes to widen beach in Year 22; • New access ramp for access to beach for recycling works between 574/3912 and 574/3913 in Year 22.

Environmental assessment

(Details of the environmental impact or benefit of each of the options to enable these to be ranked for option selection. This could include routine environmental assessments but also any effects on the local community or other stakeholders.)

3.3.13. The Preliminary Environmental Information Report (PEIR) (Appendix H) assesses the environmental implications of the preferred option (the proposed scheme). This report identifies

and describes all the key the environmental issues, constraints and opportunities relating to the proposed scheme and recommends the actions required to further assess or manage these during subsequent phases of the scheme implementation.

3.4. Economic appraisal

Benefits

(Summarise the benefits identifying and valuing quantifiable measures and monetary benefits (cash releasing and non cash releasing) and explain the source of information and assumptions underlying their valuation. Show the main types, values and beneficiaries. Make reference to any benefits maps or benefits profiles produced.)

3.4.1. The 2014 Strategy No Active Intervention (NAI) Report (Appendix J in Appendix C) provides predicted erosion rates based on a NAI scenario where no further bypassing from Shoreham beach or recycling from Kemp Town would take place and assuming all defence maintenance is ceased. This would rapidly result in the denuding of Southwick to Portslade beaches, resulting in the failure of defences along Southwick Beach by Year 5 and breach through into the locked section by Year 15.

3.4.2. The appendices to the NAI report (Appendix J) provide detailed erosion trendline mapping and flood extent mapping for different return periods (for no defences and for wave overtopping). For Unit 2 – Open Coast only the flooding due to wave overtopping is also considered.

3.4.3. The 2014 damage assessment which has a 100-year appraisal period has been updated using GDP Deflator so that the base date is revised to Q4 2018. The 2014 Strategy economic assessment is documented in the Options Appraisal Report Appendix G (included in Appendix C).

3.4.4. For the comparison and appraisal of the short-listed options a 100 year appraisal period has been used in accordance with FCERM-AG to ensure an appropriate period over which a robust comparison of shortlisted options can be made.

3.4.5. The OBC economic assessment is documented in the Economics Report in Appendix I.

Table 14 No Active Intervention Damages Summary (100 year appraisal period)

	Assets	PV Damages (£k) (100yr appraisal period)	PV Damages (£k) (15yr appraisal period)
Flood	Residential property (damages)	649	169
	Non-residential property (damages)	4,250	902
	Residential property (write off)	193	0
	Non-residential property (write off)	6,339	4,594
	Residential Evacuation/Accommodation	5,550	1,371
	Emergency Response and Recovery	2,939	721
Total PV Flood Damages		**19,920**	**7,757**
Erosion	Residential property (write off)	11,661	175,644
	Non-residential property (write off)	199,539	1,449
	Traffic Disruption	1,161	0
Total PV Erosion Damages		**212,361**	**177,093**
Total PV Damages		**232,281**	**184,850**

3.4.6. For comparison of the short-listed options, the present values damages (PVd) and benefits (PVb) have been calculated against the do-nothing baseline for the 100 year appraisal period. Following the implementation of a Do Something option, there remains the possibility of damage occurring during extreme events. The damages for a Do Something option shown in Table 15 are the

residual damages that remain once the Do Something option is in place. The benefit cost ratios for all options are shown in Table 17.

Table 15 Do Something Benefits (100 year appraisal period)

Do Something Benefits (100 year appraisal period)				
Option		Damage (PVd) (£k)	Benefits (PVb) (£k)	Key qualitative benefits
1	No Active Intervention	232,281		
2	Do Minimum	117,759	114,522	
3	Maintain	25,857	206,424	
4	1.33% AEP	18,256	214,025	
5	1% AEP	16,789	215,492	
6	0.5% AEP	14,507	217,774	Partnership contributions support option of 0.5%AEP

Non-financial benefits appraisal

3.4.7. The shortlisted options were appraised based on economic, technical, environmental and social factors and considering the feedback from key stakeholders and public consultation in the 2014 Strategy. To assist in the appraisal of options and assess the impacts on a number of key objectives, a series of Appraisal Summary Tables (AST) was produced. This is included in Appendix L of the 2014 Strategy (included as OBC Appendix C).

Costs

(Summarise the costs, including those related to mitigating and managing the risks identified in section 2.6. In the early stages this could include an Optimum Bias which should be updated in subsequent stages following a more detailed risk analysis of costs and benefits under each option. The basis of the subsequent risk calculation should be noted, for example Monte Carlo or alternative approaches taken and the outcome.)

3.4.8. A full cost breakdown of constructing each of the short-listed options, has been appraised. In accordance with the FCERM-AG, costs are estimated over the usual 100 year appraisal period to derive a Present Value (PV) cost for each option. The full cost breakdown for each option is provided in the Economics Report in Appendix I.

3.4.9. The costs have been produced through a detailed assessment of unit cost data, previous client and consultant scheme experience and budget cost estimates provided by the project's ESE contractor, Mackleys.

3.4.10. An allowance for consents and licences and detailed design costs are also included.

3.4.11. For project comparison over the 100 year appraisal period, an optimism bias figure of 30% has been included within the construction cost (see Appendix J).

Present Values

(The detailed economic (present) values of costs and benefits for each option should be set out in tabular form appropriate to the appraisal carried out along with a commentary on any issues, source of figures and key assumptions (including discount rates applied to future costs).)

3.4.12. The combined costs for the leading options for the different SoP options are presented in Table 16.

Table 16 Option PV Cost Breakdown (100 year appraisal period)

	Option 2 Do Minimum	Option 3 Maintain	Option 4 Improve 1.33% AEP	Option 5 Improve 1.0% AEP	Option 6 Improve 0.5% AEP
Staff costs – Detailed design and construction	0	175,375	175,375	175,375	175,375
Consultants' fees – Detailed design and construction	0	253,015	253,015	253,015	253,015

	Option 2 Do Minimum	Option 3 Maintain	Option 4 Improve 1.33% AEP	Option 5 Improve 1.0% AEP	Option 6 Improve 0.5% AEP
Contractors' fees – Detailed design	0	0	0	0	0
Cost consultants' fees - Construction	0	13,179	13,179	13,179	13,179
Site investigation and survey	0	108,606	108,606	108,606	108,606
Construction (first phase of works - 15 years)	714,175	12,575,021	15,938,010	16,539,984	16,704,205
Maintenance (first phase of works - 15 years)	657,540	943,989	943,989	943,989	943,989
Consents & Licences	0	51,942	51,942	51,942	51,942
Environmental mitigation & enhancement	0	0	0	0	0
Site supervision		236,666	236,666	236,666	236,666
Optimism Bias (30%)	411,515	4,307,338	5,316,235	5,496,827	5,546,093
Subtotal	**1,783,230**	**18,665,132**	**23,037,017**	**23,819,584**	**24,033,070**
Future costs (construction)	337,371	9,667,133	12,061,574	11,815,202	12,214,413
Future costs (maintenance)	342,409	1,117,549	1,117,548	1,117,549	1,117,549
Future costs (construction and maintenance)	679,780	10,784,682	13,179,122	12,932,751	13,331,962
Optimism Bias (30%)	203,935	3,235,405	3,953,737	3,879,825	3,999,588
Total present-value cost	**2,666,945**	**32,685,218**	**40,169,876**	**40,632,160**	**41,364,621**

Option ranking & Economic appraisal conclusion

(Provide a clear analysis in tabular form as to how the options are ranked across the economic appraisal criteria noted above. This should also reference the critical success factors and investment objectives and the basis of arriving at the conclusion.)

3.4.13. The present value costs, damages, benefits and benefit cost ratios for the leading options for the different SoP options are presented in Table 17.

Table 17 Benefit Cost Ratio for each Option

Option	PV costs (£'000)	PV benefits (£'000)	Average benefit:cost ratio (BCR)	Incremental benefit:cost ratio (iBCR)*	Option for incremental calculation
Option 2 Do Minimum	2,667	114,522	42.9	-	
Option 3 Maintain	32,685	206,424	6.3	3.1	Do Minimum
Option 4 Improve 1.33% AEP	40,170	214,025	5.3	1.0	Maintain
Option 5 Improve 1% AEP	40,632	215,492	5.3	3.2	Improve 1.33% AEP
Option 6 Improve 0.5% AEP	41,365	217,774	5.3	3.1	Improve 1% AEP

**iBCR calculated by comparison of difference in benefits and costs of current option with that of option with next lowest standard of protection. The option against which the comparison is made is detailed in the final column titled "Option for incremental calculation".*

3.4.14. The preferred option is identified based on the FCERM-AG decision process rules. The preferred option is identified based on the FCERM-AG decision process rules. The Do Minimum has the highest BCR and is identified as the initial leading option. The incremental benefit cost ratio (iBCR) for the Maintain and 2% AEP (1 in 75) is >1 hence we can move up past this option. The incremental benefit cost ratios for the 1% AEP (1 in 100) options is >3 so we can continue to move up. The incremental benefit cost ratio for the 0.5% AEP (1 in 200) option is >3 so this then becomes the leading option.

3.4.15. This supports the 2014 Strategy preferred option for a 0.5% AEP SoP.

3.5. Preferred option

(Summarise results of the investment appraisal for each option in a table showing the overall score or ranking, covering critical success factors, and results from the economic and non financial benefits appraisals. Confirm the conclusion and the reasons for preferred option.)

3.5.1. The preferred options for the scheme will reduce erosion and wave overtopping providing a 0.5% AEP SoP. This option is consistent with the SMP2 and the 2014 Strategy preferred option.

3.5.2. The breakdown of the preferred option costs are shown in Table 18.

Table 18 Refined cost breakdown (first phase of works (15 years) and 100 year appraisal period)

Frontage	Design and development PV (£)	Construction PV (£)	Maintenance PV (£)	Risk Optimism Bias PV (£)	Total - Not including maintenance PV (£)	Total PV (£)
First Phase of Works (15 years)	478,056	16,704,205	943,989	5,437,875	22,336,940	23,564,125
100 year appraisal period	838,783	28,918,618	2,061,538	9,545,682	38,684,623	41,364,621

3.6. Sensitivity analysis

(Set out how the options have been tested for changes in assumptions. Include the switching values (the point at which a different option may be selected), scenario planning and effects of varying key assumptions on the overall ranking and option choice.)

3.6.1. There are many variables used in the calculation of both costs and benefits associated with the Do Something options. A series of sensitivity tests have been undertaken to determine the relative impact that changes to the costs and damages would have on the status of the preferred option to ensure it is robust under a variety of possible scenarios. Further details on the Sensitivity Tests are provided in Appendix I – Economics Report.

3.6.2. **Sensitivity Test 1 – Delay erosion by 10 years.** Open coast damages are predominately due to erosion of coastal assets. Central to this assessment are the residual lives of defences along the port frontage. The analysis presented is based upon defence surveys and field observations, and thus are considered realistic. However, it is possible that these are overestimates and erosion may be delayed further. This would reduce the No Active Intervention damages. As a sensitivity test all defence residual lives have been increased by 10 years, effectively delaying the onset of erosion to year 17 of the OBC. This reduces the No Active Intervention damages to £169 million.

3.6.3. **Sensitivity Test 2 – 25% increase in construction costs.** The total option costs include significant amounts for the maintenance and replacement of existing control structures and construction of new groynes. There is a wide variety of unit rates involved in the development of the overall costs, all of which are best estimates of likely costs. Therefore, it is not considered beneficial to vary any single item, but rather to consider a blanket increase in the cost of this aspect of the option. A 25% increase in the costs of construction works (e.g. groynes, walls, revetments, etc) has been assumed.

3.6.4. **Sensitivity Test 3 – No recycling from Shoreham Beach.** The large majority of costs for the open coast options are from the recharge and recycling of shingle. For all options it is assumed that the current practice of recycling from Shoreham Beach to the west of the Port entrance onto Southwick beach will continue, supplemented by additional material from the beach at Kemp Town, at the eastern end of the open coast frontage. In addition to this, periodic movements of shingle from the beach at Kemp Town, have been included to bolster the standard of protection along the frontage. This material is assumed to be moved at a unit cost of £13.83/m^3.

3.6.5. If it were not acceptable for material to be removed from Shoreham Beach, then material from Kemp Town would have to be relied on in the short term to re-feed the western beaches and widen beaches to improve the standard of protection where required. However, there is a limited volume that can be taken from Kemp Town before the standard of protection is compromised along this frontage. The need to widen beaches with sea level rise will result in the need to subsidise the shingle volume within this closed system with material from elsewhere.

3.6.6. For the purposes of this sensitivity test, it has been assumed that the shortfall in material required within the 100 year horizon will be obtained from an offshore source. The unit rate for sourcing material from an offshore location is £30/m^3.

3.6.7. **Sensitivity Test 4 – Excluding Shoreham Power Station**. Shoreham Power Station is the largest single asset exposed to erosion risk and flood damage (valued at £194 million). To test the robustness of the damage analysis without this major commercial asset, the power station was excluded from the Erosion NAI damage calculation. It has been assumed that the plot would not be empty in the absence of the power station and thus a value of £24.9 million has been derived from the risk free market value for Parker Steel. Parker Steel has recently expanded and the value per unit area was calculated and then applied to the power station's plot.

Table 19 Sensitivity Test Summary

Sensitivity Test	Preferred option	NPV (thousands)	Benefit Cost Ratio
Baseline option - 0.5% AEP (1 in 200)	Improve 0.5% AEP (1 in 200)	176,409	5.3
Delay erosion by 10 years	No change to preferred option: Improve 0.5% AEP (1 in 200)	113,276	3.7
25% increase in construction costs	Changes preferred option: Maintain	166,510	5.2
No recycling from Shoreham Beach	No change to preferred option: Improve 0.5% AEP (1 in 200)	166,532	4.2
Excluding Shoreham Power Station	No change to preferred option: Improve 0.5% AEP (1 in 200)	51,905	2.3

4. The Commercial case

4.1. Introduction and Procurement Strategy

(Set out what is to be procured and the procurement strategy to be followed to deliver the specific arrangements.)

4.1.1. The commercial case details the procurement strategy for the project, together with details of risk allocation and project efficiencies. It demonstrates that the preferred option for coastal defence improvements has a viable route for procurement and that a structured plan is in place for delivery.

4.1.2. This case sets out the approach for planning and managing the procurement of services. It also demonstrates the lead financial authorities proposed route for competitive procurement, in accordance with European Union (EU) and World Trade Organisation (WTO) rules and the current regulations in place for public sector procurements.

4.1.3. The project will involve the design and construction of rock revetments, brick/concrete walls and a timber groyne field with beach recycling within a coastal location, utilising materials and techniques established in the coastal environment.

4.1.4. This project has common characteristics and design similarities to a number of FCRM projects commissioned within the local area, both in its coastal environment and proposed defence structures. Embedding lessons learnt from these schemes will support this project in attaining the best quality and value design and construction.

4.1.5. Building on the project objectives, key drivers for the procurement of the scheme have been identified as follows. The procurement options will be considered against how well they meet the drivers set out for the scheme:

Table 20 Key Drivers for Procurement

Key Driver	Description
Quality	Defences sensitive to setting and resilient to provide 50 year design life. Experienced suppliers with proven ability on similar schemes and ability to demonstrate added value through experience to date.
Buildability	Buildability is important due to tidally restricted working areas and heavy tourism and recreational traffic along most of the frontage and site security.
Cost certainty	To support working within fixed budget from contribution and Grant in Aid
Value for money	To achieve best value for public spend. Identify and focus on efficient delivery supporting DEFRA's target for efficiency savings.
Optimum Programme	Programme of work that optimises construction and prioritises the improvement works to areas of greatest need. Considers working restrictions of tourism on annual working window. Experienced practitioners informing the licencing and consenting process for the works will support the delivery of an optimum programme.

4.1.6. Contracting Approach: Following determining the key procurement drivers, the preferred contracting approach to deliver the scheme is considered to be individual design and construction commissions. The decision builds on previous experience and consultation with the supply chain. This contracting approach involves the commission of a design supplier to undertake design independently and in advance of the commission of a construction supplier.

4.1.7. Direct appointment of the designer ensures that the most suitable supplier is appointed, providing (as will be set out for evaluation) a best value, high quality product. By formally bringing the construction supplier on board early in the design stage detailed construction experience will be fed into the design to inform quality, buildability, and the optimum programme of work from an early

stage. The construction supplier will be appointed via a first stage tender against the outline design, giving them exclusivity during the second stage (pre-construction stage).

4.2. Procurement route and timescales

(Detail the approach taken and method of procuring the necessary services, and any implementation milestones agreed. Also include details of the tender assessment process, the choice of preferred supplier and timescales.)

4.2.1. The preferred contracting approach for procuring the scheme can be delivered through the following routes to market:

- Existing frameworks
- Open or restricted tender

Design services

4.2.2. BHCC will procure the works via a suitable professional public services framework.

Construction services

4.2.3. Experience on recent schemes and lessons learnt through delivery and utilising different routes to market has demonstrated a strong and experienced range of regional construction suppliers. Access through open tender has demonstrated a clear and competitive route to market. Utilising this regional experience, it is felt the route to market for construction services that represents best value for this scheme will be through open tender under OJEU, ensuring the quality based supplier status questionnaire prevents unsuitable candidates from pricing.

4.3. Key contractual terms & risk allocation

(Provide a summary of the key terms in contracts with external parties. In particular explain the basis of apportioning risk between parties, covering those that arise in planning, design, implementation or construction and any residual risks. Noting the general principle that risk is passed to 'the party best able to manage them', subject to value for money.)

4.3.1. The lead contracting and financial authority for the scheme is Brighton and Hove City Council.

4.3.2. As a basic principle risks will be contractually allocated to the party best placed to manage each risk. Risk allocation will be assessed at the point each contract is prepared between Brighton and Hove City Council and each supplier to ensure the most appropriate allocation of risk.

4.3.3. Bringing the Contractor on board at an earlier stage and collaborative working, will support a focus on risk reduction and management through the pre-construction stage to construction.

4.3.4. Form of contract - Design supplier:

The design services will be undertaken under an NEC3 Professional services Contract as amended under the framework.

4.3.5. Form of Contract - Construction supplier:

The construction services will be delivered under the terms of the NEC4 Engineering and Construction Contract.

4.3.6. The preferred option for the construction services is to use an ECC Option C (Target contract with activity schedule). Under this contract payment will be made on the basis of the defined cost (actual cost calculated in accordance with NEC4:ECC) incurred by the Contractor in providing the works, plus their fee. At completion a pain/gain share will be applied to the final contract sum dependant on the difference between the target cost and the final defined cost plus fee.

4.3.7. The two stage approach provides high cost certainty and robust risk reduction prior to the signing of the contract. High confidence levels are provided to the suppliers through having adequate time to ensure the buildability of the final design and to undertake market testing of construction costs.

4.4. Efficiencies and commercial issues

(Summarise the strategy, framework and plan for driving value for money, setting out what has been done to date and the opportunities going forward. Include detail in the appendix (e.g. the project efficiency register - CERT). Also comment on any matters in relation to commercial aspects.)

4.4.1. The project will seek to generate efficiencies at each stage to ensure best value is achieved for the public purse. Projects arising from this OBC will develop a project efficiency register to record efficiency made and value added to the projects.

4.4.2. An efficiency Combined Efficiencies Report Tool (CERT) for this OBC is included in Appendix S.

5. The Financial case

5.1. Financial summary

(Planned profile of costs for the scheme over the intended lifespan of the project in tabular form.)

5.1.1. For development of the OBC financial business case for the preferred option a 15 year benefit period is adopted. For the purposes of the PF calculator a 15 year benefit period is adopted as this is the time period between delivery of the benefits (year 2) and the next major investment (year 18), in accordance with the Partnership Funding guidance (EA, 2014).

5.1.2. Table 21 presents the financial summary for the preferred option 0.5% AEP (for the 15 year benefit period.

5.1.3. The PV Cost Grant in Aid (for Approval) is £10,253k.

Table 21 Financial Summary (15 year benefit period)

Costs	Cost for economic appraisal (PV)	Whole-life cash cost	Capital grant approval project cost
Costs up to OBC: (not including costs of approved study)			
Staff costs	Sunk costs	NA	NA
Site investigation and survey	Sunk costs	0	0
Consultants' fees	Sunk costs	141,100	141,100
Contractors' fees	Sunk costs	5,100	5,100
Cost consultants' fees	Sunk costs	0	0
Subtotal	Sunk costs	**146,200**	**146,200**
OBC to construction:			
Staff costs	90,852	96,200	96,200
Site investigation and survey	108,606	115,000	115,000
Consultants' fees	226,656	240,000	240,000
Contractors' fees	0	0	0
Cost consultants' fees	0	0	0
Other costs	51,942	55,000	55,000
Subtotal	**478,056**	**506,200**	**506,200**
Construction:			
Construction costs	16,704,205	20,216,203	20,216,202
Inflation allowance for 15 years			4,236,343
Environmental mitigation and enhancement	0	0	0
Staff costs	84,524	96,200	**96,200**
Consultants' fees	26,359	30,000	30,000
Site supervision	236,666	269,360	269,360
Cost consultants' fees	13,178	15,000	15,000
Compensation	0	0	0
Other costs	0	0	0
Subtotal	**17,064,932**	**20,626,763**	**24,863,105**
Risk contingency:			

Costs	Cost for economic appraisal (PV)	Whole-life cash cost	Capital grant approval project cost
95%ile plus Adjusted OB (represents 42% of project FSoD approval)			10,713,230
50%ile plus Adjusted OB (represents 28% of project FSoD approval)	5,023,310	6,051,274	
Future costs:			
Maintenance	943,989	1,244,700	
Future construction	0	0	
Optimism Bias (30%) – on future costs	283,197	373,409	
Project Total Costs	**23,793,484**	**28,802,346**	**36,082,535**
Project Total Costs less maintenance	**22,566,298**	**27,184,236**	**36,082,535**
Contributions - ADC	3,433,602	4,153,943	5,981,179
Contributions - BHCC	3,611,510	4,375,236	6,356,725
Contributions - Shoreham Port Authority	5,223,730	6,975,889	10,936,696
Contributions - Western Esplanade	43,901	57,885	89,936
Grant in Aid (for Approval)	**10,253,555**	**11,621,283**	**12,717,997**

5.2. Funding sources

(Set out the sources of funds available to, and achieved for the project, demonstrating broad consideration given to funding the work. Include, for instance details of the partnership funding position, any third party contributions, opportunities for EU or other bids and any state aid issues. Any detailed calculations or validity (e.g PF calculator, EU or other grant requirements) should be attached as an appendix.)

5.2.1. The Partnership Funding calculators are in Appendix I. The first funding calculator includes for the preferred option PV appraisal costs a combined 33% adjusted optimism bias and 50%ile risk contingency (28% of the total project costs). The raw score is 45% and the adjusted partnership score is 100%.

5.2.2. The second funding calculator includes for the preferred option PV appraisal costs a combined 33% adjusted optimism bias and 95%ile risk contingency (42% of the FSoD approval amount).

5.2.3. The majority of the funding for the scheme will be from partnership contributions.

5.2.4. Table 22 sets out the funding programme for the fifteen years. All values are cash costs (£) including inflation and optimism bias.

5.2.5. Significant partnership funding contributions of £5,981k (cash cost) from Adur District Council, £6,357k from Brighton and Hove City Council, £10,937k from Shoreham Port Authority and £90k from Western Esplanade Management Company are to be provided. These costs include a combined 33% adjusted optimism bias and 95%ile risk contingency (42% of the total project costs and inflation.

Table 22 Funding Sources (Cash costs)

Annualised funding profile (£)	Yr 0 2018/19	Yr 1 2019/20	Yr 2 2020/21	Yr 3 2021/22	Yr 4 2022/23	Yr 5-17	Total
Grant in Aid (including inflation and optimism bias)	**0**	**222,475**	**456,074**	**2,781,204**	**9,258,244**	**0**	**12,717,997**
Contributions for capital works (ADC) (including inflation and optimism bias)	0	0	0	85,771	3,215,333	1,486,643	4,787,747

Annualised funding profile (£)	Yr 0 2018/19	Yr 1 2019/20	Yr 2 2020/21	Yr 3 2021/22	Yr 4 2022/23	Yr 5-17	Total
Contributions for capital works and capital beach management (BHCC) (including inflation and optimism bias)	0	0	0	1,087,029	688,759	0	1,775,788
Contributions for asset and beach management (BHCC) (including inflation and optimism bias)	102,907	287,829	108,117	302,400	113,591	2,397,728	3,312,572
Contributions (SPA) (including inflation and optimism bias)	102,907	688,996	108,117	723,877	113,591	7,016,996	8,754,484
Contributions (WE) (including inflation and optimism bias)	3,217	3,296	3,379	3,463	3,549	55,087	71,991
Contributions subtotal	209,031	980,121	219,613	2,202,540	4,134,823	10,956,454	18,702,582
Project Total	**209,031**	**1,202,596**	**675,687**	**4,983,744**	**13,393,067**	**10,956,454**	**31,420,579**
Maintenance: BHCC (inc risk)	88,951	88,951	88,951	88,951	88,951	1,156,358	1,601,111

5.3. Impact on revenue and balance sheet

(Set out the impact on revenue and capital budgets as a result of the project in the current and over subsequent years. State whether the project will result in the creation of an asset, and if so when this will happen and the agreed balance sheet treatment.)

5.3.1. The capital funding requirement for the scheme is included in the EA's flood and coastal risk management investment programme (2021-2027). The revenue for future maintenance will be met by BHCC, SPA and Western Esplanade Management Company from their existing maintenance budgets.

5.4. Overall affordability

(Summary table showing the overall cost and impact of the project over its expected lifespan, including any extended contract period. Costs should be broken down within appropriate categories e.g. for project planning, design, development or build and operational phases of the project. Revenue, capital, VAT, and risk costs should be shown separately.)

(Summary table showing the overall cost and impact of the project over its expected lifespan. Costs should be broken down within appropriate categories e.g. for project planning, design, development or build and operational phases of the project.)

5.4.1. Total project cash costs of £36,082k are required to deliver the scheme. Significant partnership funding contributions of £5,981k (cash cost) from Adur District Council (ADC), £6,357k from Brighton and Hove City Council, £10,937k from Shoreham Port Authority and £90k from Western Esplanade Management Company are to be provided. These costs include a combined 33% adjusted optimism bias and 95%ile risk contingency (42% of the total project costs and inflation. A total of £12,718k FCRM GiA will be required.

Table 23 Spend Profile

Annualised spend profile (£)	Yr 0 2018/19	Yr 1 2019/20	Yr 2020/21	Yr 3 2021/22	Yr 4 2022/23	Yr 5 - 17	Total
Authority & Consultant fees	0	112,067	224,133	33,242	107,958	0	477,400
Construction costs	162,500	800,027	275,833	3,564,478	9,324,564	6,528,161	20,655,563
Environmental mitigation & enhancement	0	0	0	0	0	0	0
Project sub-total	**162,500**	**912,094**	**499,966**	**3,597,720**	**9,432,522**	**6,528,161**	**21,132,963**

Annualised spend profile (£)	Yr 0 2018/19	Yr 1 2019/20	Yr 2020/21	Yr 3 2021/22	Yr 4 2022/23	Yr 5 - 17	Total
50%ile plus Adjusted OB (represents 28% of project FSoD approval)	46,531	261,171	143,162	1,030,182	2,700,936	1,869,292	6,051,274
Inflation (2.5%)	0	29,332	32,558	355,842	1,259,609	2,559,001	4,236,343
Project Total costs	**209,031**	**1,202,596**	**675,687**	**4,983,744**	**13,393,067**	**10,956,454**	**31,420,579**
Less contributions	209,031	980,121	219,613	2,202,540	4,134,823	10,956,454	18,702,582
Capital Grant claim	**0**	**222,475**	**456,074**	**2,781,204**	**9,258,244**	**0**	**12,717,997**
Maintenance	88,951	88,951	88,951	88,951	88,951	1,156,358	1,601,111

6. The Management case

6.1. Project management

(Set out the basis to be followed in managing the project. This may include PRINCE 2 methodology, Agile etc.)

Project structure and governance

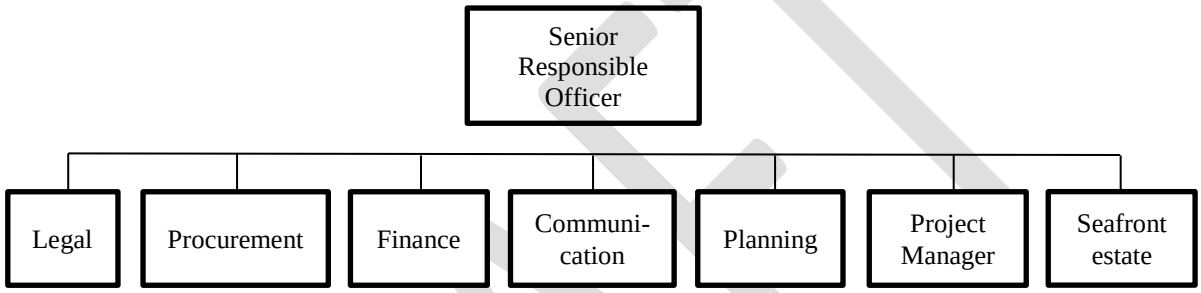
(Set out the governance arrangements and how different individuals or groups will interface and report.)

6.1.1. The Brighton Marina to River Adur scheme is managed by Brighton and Hove City Council in their capacity as the coastal erosion risk management authority.

6.1.2. This project will be managed in accordance with the PRINCE2 project management principles and methodology.

6.1.3. Governance and assurance arrangements are already in place for the project and a Memorandum of Understanding (MoU) has been put in place to support these arrangements. The project's governance structure is shown in Figure 3 below.

Figure 3 Project Governance Structure



Project roles and responsibilities

(Confirm the key roles and responsibilities for the individuals (by name) involved in the project work and delivery.)

6.1.4. The project board, chaired by the Project Executive, consists of Senior Users from the client Risk Management Authorities [RMA] of Brighton and Hove City Council [BHCC] (also the lead financial authority), Adur District Council [ADC] and the Environment Agency [EA]. Shoreham Port Authority [SPA] also hold a Senior User role on the project as a key financial contributor and private landowner within the project area.

6.1.5. The Senior Suppliers are Jacob professional services consultants appointed to work alongside BHCC to deliver the outline design / appraisal stage.

6.1.6. As the project progresses through the detailed design and construction phases it is expected that any appointed contractors for detailed design and scheme delivery will be added to the Senior Suppliers.

6.1.7. The Project Board will meet at regular intervals that coincide with key project milestones, in accordance with the project's MoU. The Project Board can also call a meeting whenever they see fit.

6.1.8. Project Steering Group

6.1.9. The Project Steering Group work in partnership to guide the development of technically, economically and environmentally sustainable coastal flood and erosion risk defences along the coastline from Brighton Marina to the River Adur.

6.1.10. The Project Steering Group consists of representatives from the following:

- Brighton and Hove City Council [BHCC]
- Adur District Council [ADC]
- Environment Agency [EA]
- Shoreham Port Authority [SPA]

- Western Esplanade Management Company [WEMC]
- Natural England [NE]
- Historic England [HE]

The organisations listed were identified due to their direct interest in this project and the key support they can provide to guide the scheme development.

6.1.11. The Project Objectives were agreed at the outset by the Steering Group and Project Board.

6.1.12. Project plan

(Summarise the key stages and timings from the project plan and append more detail in support as necessary.)
The project is working through a typical project progress of outline design followed by detailed design and construction. The key stages are outlined in the table below. The detailed project programme is available to view in Appendix L.

Table 24 Summary project programme

Activity	Start	End
Detailed Design	August 2019	February 2020
EIA & HRA	August 2019	February 2020
Planning Consent, Marine Licence & Consents	February 2020	June 2020
Construction Award (Notice to Proceed to Stage 2)	September 2020	
Construction Yr 1 (2021/22)	April 2021	March 2022
Construction Yr 2 (2022/23)	April 2022	February 2023
Construction Yr 10	April 2028	September 2028

6.2. Communications and Stakeholder engagement

(Summarise the approach to communicating plans and progress of the project. Identify areas where engagement with external parties, stakeholders, statutory consultees and others is needed, explain how this has been carried out. You should use our Working with Others approach to analyse stakeholders with an interest in your project and consider a mix of different methods to engage a diverse range of people with different needs, priorities and interests. Identify any key issues raised, either positive or negative, and if relevant to support this append correspondence.)

6.2.1. Extensive liaison with Shoreham Port Authority and Adur District Council has been necessary to both negotiate an appropriate financial contribution towards the project and to ensure agreement on the combined programme of beach management proposed. This close partnership will continue through the detailed design and construction phases.

6.2.2. Continued wider engagement, with the local community, will also be necessary to inform residents and business of key activities being planned where any construction work may cause significant disruption to the local area.

6.2.3. Further information will also be available to view on the BHCC's website (www.brighton-hove.gov.uk/content/environment/coast-defence-and-flood-management).

6.2.4. A letter of support from Natural England is included in Appendix R.

6.3. Change management

(Provide details of the strategy, framework and plan for implementing the change within the business including business acceptance and any contingency management arrangements.)

6.3.1. In accordance with PRINCE2 the Project Board are ultimately responsible for reviewing and approving requests for change.

6.3.2. Contract changes will be managed in accordance with the NEC3 suite of contracts, and administered by the Project Manager with approval from the financial lead authority Senior User.

6.4. Benefits realisation

(Summarise the strategy, framework and plan for managing the delivery of benefits, setting out who is responsible for the delivery of specific benefits, how and when they will be delivered, including tracking efficiency savings compared with target. The project benefits roadmap, benefits profiles/benefits register as relevant can be included in the appendices.)

6.4.1. The erosion risk benefits can be realised during the first year of construction of the scheme.

Table 25 Outcome Measures

Outcome Measure (OM)	Yr 1 2018/19	Yr 2 2019/20	Yr 3 2020/21	Yr 4 2021/22	Yr 5+	Total
OM2 Households at reduced risk (number – nr)			6			6
OM2b – Households moved from very significant or significant risk to moderate or low (nr)			6			6
OM2c – Proportion of households in 2b that are in the 20% most-deprived areas (nr)						
OM3 – Households with reduced risk of erosion (nr)			8			8
OM3b – Proportion of those in 3 protected from loss within 20 years (nr)			8			8
OM3c – Proportion of households in 3b that are in the 20% most-deprived areas (nr)			8			8
OM4a – Hectares of water-dependent habitat created or improved (ha)						
OM4b – Hectares of intertidal habitat created (ha)						
OM4c –						

Outcome Measure (OM)	Yr 1 2018/19	Yr 2 2019/20	Yr 3 2020/21	Yr 4 2021/22	Yr 5+	Total
Kilometres of river protected (km)						

6.5. Risk management

(Summarise the strategy, framework and plan for the management of risk, setting out who is responsible and the required counter measures. A copy of the project risk register should be attached as an appendix.)

6.5.1. A risk register has been developed to identify and manage risks, refer to Appendix J. The risk register has been used in the review of the risk contingency for the scheme.

6.5.2. As the project progresses the risk register will be developed to assign risks to customer or contractor and risks will be monitored and updated with regular risk workshops.

6.5.3. The management of risk will be undertaken by the Delivery Team with the strategic level of risk being managed by the project board.

Table 26 High Priority Risks

Key Risks	Proposed Mitigation
Funding availability - OBC does not receive FCRM GiA.	Ongoing review of MTP submissions and close working with the EA Area Team to profile funding.
Beach material no longer available from Shoreham bypassing. Alternative source required for recycling/beach widening	Confirmation of source and grading at detailed design. Liaison with Shoreham Port Authority and Environment Agency.
Variation in inflation (Client)	Monitor inflation and allow risk budget
Unacceptable quality/grading of rock	Certificates of quality to be approved by client. Known source of rock.
More frequent defence failure leads to more reactive maintenance than planned	Regular defence surveys to identify key areas for potential failure and areas which have already failed. React quickly if failure occurs.
Changes to wall design	Detailed planning permission application. Detailed samples and 3D images of final works to be consulted on at detailed design.
Early defence failure leads to works being more significant than planned	Continue monitoring programme, in particular pre and post storms. React quickly if defence condition rapidly deteriorates.
Increased volume of shingle required for beach widening	Volume designed against conservative case beach profiles.
Unforeseen ground conditions (eg contaminated material, voids, steel, etc) that affect the detailed design or construction costs.	Undertake further detailed site / ground investigations as part of the detailed design phase. SI at site of existing defences. Redesign of proposed defences as necessary.
Site security on site becomes issue due to unforeseen event	Consultation with public and local authorities to determine any issues before reaching site.

6.6. Contract management

(Summarise the strategy, framework and plan for contract management setting out who is responsible over the life of the contract.)

6.6.1. As outlined in the commercial case it is proposed that NEC PSC and ECC contracts will be put in place to undertake the detailed design and construction. Potential options for staffing these roles are BHCC staff or through use of a suitable professional services contract.

6.7. Assurance

(Set out the arrangements for reviewing the project through peer reviews, assurance boards (LPRG & NPAS) and other bodies including any Defra or OGC reviews etc.)

6.7.1. LPRG will review the project OBC as it completes the Outline Design Stage and ahead of the detailed design and construction.

6.7.2. The project manager will continue to produce highlight reports (which will include progress, finance, risk and key issues) to the Project Board at frequent intervals (currently bimonthly). Any matters outside of the Change Authority (see Change Management section above) will need to be authorised by a member of the Project Board.

6.7.3. Where necessary, and as agreed with the Project Board, impartial Project Assurance will be provided by BHCC's Finance, Legal, Audit and Procurement teams. In accordance with BHCC's Constitution procurement may, subject to its contract value, be subject to separate Procurement Gateway(s). These Gateways ensure that any procurement is fair and in accordance with EU Procurement Law.

6.8. Post project evaluation

(Identify the arrangements for post project appraisal, including post implementation review (PIR) and project evaluation review (PER) in accordance with best practice and any longer term monitoring needs beyond the project life.)

6.8.1. At the end of the project, the Project Manager will produce;

6.8.2. An 'End Project Report' that includes all End Stage Reports and confirms the handover of all products. This report will provide an update of how well the project has done against the original business case and project specific objectives.

6.8.3. A 'Lessons Report' that builds on the lesson logs produced during the project. The Lessons Report documents all lessons that could be applied to other projects and integrated in to the organisations way of working (particularly to avoid any future pitfalls).

6.8.4. A 'Benefits Review Plan' that reviews the delivery of the planned benefits and outcomes from the project.

6.9. Contingency plans

(Set out the arrangements in place to guarantee continued delivery of required outputs in the event that this project or part of it fails.)

6.9.1. In the event that a coastal flood event occurs before the project is completed, then current procedures will be followed covering flood warning, and the monitoring of flood defence assets. Professional partners (including emergency services, local authorities and the Environment Agency) will respond as dictated by their own procedures already in place; at the extreme this may require the evacuation of residents.

6.9.2. As part of the detailed design any areas that will need to be temporarily lowered will be identified. It will be a requirement, before works commence, for the contractor to ensure that suitable mitigation is in place in any areas that would require the temporary lowering of SoP. During the pre-construction phase a more detailed contingency plan will be developed.

6.9.3. In the interim the existing defences would continue to be maintained and the current flood warning system operated.

6.9.4. If failure of a defence should occur ahead of scheme implementation, any emergency works required will consider the outline design for the failure location. The works undertaken will endeavour to implement the proposed solution or utilise materials which can be reused in the final scheme, such as rock.