Brighton Marina to River Adur Flood and Coastal Erosion Risk Management Scheme

Preliminary Environmental Information Report

V2

January 2019

Brighton and Hove City Council

Brighton Marina to River Adur Flood and Coastal Erosion Risk Management Scheme

Project No:	677773
Document Title:	Preliminary Environmental Information Report
Document No.:	677773/007
Revision:	2
Date:	January 2019
Client Name:	Brighton and Hove City Council
Project Manager:	Louise Oldfield-Trim
Author:	Kate Wagg
File Name:	Preliminary Environmental Information Report

Jacobs Engineering Group Inc.

1999 Bryan Street, Suite 1200
Dallas, Texas 75201
United States
T +1.214.638.0145
F +1.214.638.0447
www.jacobs.com

Document History and Status

Revision	Date	Description	By	Review	Approved
1	25/10/2018	Draft PEIR for NEAS review	KW	LA	LOT
2	03/01/2019	PEIR updated after NEAS review	KW		LOT

Executive Summary

The project

The Brighton Marina to River Adur Flood and Coastal Erosion Risk Management Scheme (proposed scheme) is being progressed by Brighton and Hove City Council (BHCC) in association with Adur District Council (ADC) to manage the risk of flooding and erosion between the River Adur and Brighton Marina.

The proposed scheme covers three locations:

1. Shoreham Port frontage: Located between Southwick Beach and the start of Western Lawns and includes frontage related to Shoreham Port, Hove Deep Sea Anglers' Buildings, and Western Esplanade.

2. Kings Esplanade: Located between the Western Lawns and Hove Lawns and includes frontage related to the King Alfred Centre and King's Esplanade.

3. Kemp Town: Located along the eastern section of the frontage between Brighton Pier and Brighton Marina and includes frontage related to the Kemp Town beaches.

These locations have been split into six areas of work. The works comprise of a combination of beach recharge and recycling, repairs to timber and concrete flood walls, construction of flood walls and rock revetments, movement of rock armour and construction of a new groyne field. This will achieve a consistent standard of flood protection along the frontage.

Consenting regime and EIA

The principle consenting regimes and Environmental Impact Assessment (EIA) requirements for the proposed scheme are as follows:

- The proposed scheme will require planning consent from BHCC and ADC under the Town and Country Planning Act 1990 (as amended).
- A marine licence from the Marine Management Organisation (MMO) will be required for the works undertaken below mean high water springs under the Marine and Coastal Access Act 2009 (as amended).
- The proposed scheme is subject to the provisions of the Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (SI 2017/517). It is a Schedule 2 development characterised as: "*Coastal work to combat erosion and maritime works capable of altering the coast through the construction, for example, of dykes, moles, jetties and other sea defence works, excluding the maintenance and reconstruction of such works*." A screening opinion from BHCC, ADC and the MMO should be requested to determine whether this is an 'EIA development' in terms of the criteria set out in Schedule 3 of the EIA Regulations. Once EIA screening opinions have been received, the scope of any further environmental assessment required should be determined. This should be progressed during the detailed design stage.

This preliminary environmental assessment also considers compliance with the Water Environment (Water Framework Directive) Regulations 2017.

Scope and content of the PEIR

The Preliminary Environmental Information Report (PEIR) has been prepared to support the Outline Business Case (OBC) submission and gain approval and funding. The PEIR:

- Describes the environmental information currently available relating to the proposed scheme;

- Provides an overview of existing conditions;
- Presents a preliminary analysis of potential issues, risk and opportunities relating to the design, construction and future operation of the proposed scheme; and
- Recommends the further assessments and actions required to address these issues.

This assessment has been informed by specific site surveys, studies, investigations, consultations and engagement.

Summary of findings and recommendations

The proposed scheme will provide material benefits to Brighton by reducing erosion and flood risk to people, property and the environment. The receptors and features that are likely to be affected by the construction or operation of the proposed scheme have been identified. Where these potential effects are considered a potential likely significant effect, or the potential effects are uncertain at present, this PEIR makes recommendations for further assessment. It should therefore be noted that potential likely significant effects captured at this preliminary stage, may be found to be not significant following completion of the mitigation strategy when reported in the ES. Subject to funding and approval of the OBC, these will be further considered during the next stages of the delivery of the proposed scheme. The potential likely significant effects, uncertainties and beneficial impacts are summarised below:

Biodiversity

- It is uncertain whether the proposed scheme will significantly impact upon Basin Road South and Black Rock Beach LWS's.
- There is potential for likely significant effects on the Priority Habitat vegetated shingle and coastal grassland habitats during construction.
- There is potential for the proposed scheme to result in likely significant effects to Protected Species Yellow horned poppy (Glaucium flavum) and Sea bindweed (Calystegia soldanella) during construction.

Cultural heritage and archaeology

- Beneficial impact to designated and non-designated cultural heritage assets and undiscovered archaeology during operation by providing them with additional protection from flooding and preserving the beach front from erosion.
- There is potential for likely significant effects to wreck sites in the area during construction.
- It is uncertain whether the proposed scheme will impact upon below ground archaeology located within the Archaeological Notification Area.
- There is potential for likely significant effects to undiscovered prehistoric and post medieval archaeology located within the Archaeological Notification Area during construction.

Townscape, seascape and visual amenity

- It is uncertain whether the proposed scheme will result in significant impacts to visual amenity for the following receptors during construction and operation:
    - Carat's Café Bar and adjacent beach huts;
    - Coastal path and cycleway;
    - Western Lawns Seaside Promenade;
    - Beach users.

Ground conditions

- It is uncertain whether the proposed scheme will result in significant impacts as a result of encountering geo-hazards during construction.

- There is potential for likely significant effects on human health (construction workers and end users), water quality and, indirectly, ecology as a result of disturbing contamination during construction.
- Should waste soils be generated during construction there is the potential for likely significant effects as a result of inert, non-hazardous and hazardous wastes being encountered.
- Beneficial impact in terms of reduced chance of release of contaminants during a flood event.

Transport and navigation

- It is uncertain whether the proposed scheme will significantly impact on local road network during construction and ongoing beach management operations.
- On completion, the improved defences will present a long term beneficial impact to the local road network as they will be protected from erosion and flooding at sustained or improved levels.
- It is uncertain whether the proposed scheme will significantly impact on navigation in the area of the proposed works as a result of marine deliveries.

Population, health and economy (including noise)

- An important benefit of the scheme is that it will protect up to 13 residential and 105 commercial properties (including Shoreham Sewage Pumping Station and Shoreham Power Station) from erosion risk and flood risk for an additional 6 residential properties and 8 commercial properties will be reduced immediately following construction, with beneficial impacts to health and well-being and the local economy.
- A beneficial impact is the sustained or improved flood risk for a number of recreational facilities including sailing and rowing clubs, yachting, pleasure boating, dingy sailing, sea angling, diving, water skiing, and many sports clubs along the promenade.
- A beneficial impact of the scheme the amenity value of beaches along the open coast will be improved.

Water and hydromorphology

- It is uncertain if there is potential for significant impacts as a result of groundwater levels introducing the risk of uplift of shallow foundations and groundwater inflow into any excavations that are required.
- Operation of the proposed scheme will result in a beneficial impact to on water quality through protection of potentially contaminated land sites and subsequent prevention of future potential pollution incidents.

Next steps

This PEIR forms part of the OBC submission required to gain approval and funding for the scheme from the Environment Agency and project partners. It is anticipated that the OBC for the proposed scheme will be submitted in early 2019. It is anticipated that the detailed design will progress following approval of the OBC.

The design of various project components will continue to be developed in parallel with the environmental assessment processes. This iterative approach will enable potential adverse impacts to be avoided or reduced and opportunities for environmental improvements to be identified.

The actions recommended to address these potential likely significant effects and uncertainties include:

Biodiversity

- A mitigation strategy should be devised to minimise the impacts upon Priority Habitat Vegetated Shingle, and protected species Yellow horned poppy (Glaucium flavum) and Sea bindweed (Calystegia soldanella). This should detail the need for sensitive working practices and outline

that works should undertaken under the supervision of a suitably qualified ecologist. The replacement of any material habitat loss should also be considered.
- It is recommended that a reptile survey is undertaken within the recommended survey period.(March – October). The results should be used to determine if any exclusion fencing and/or translocation will be required.
- Consultation with Natural England and other statutory consultees should be undertaken to discuss potential impacts on statutory and non-statutory designated sites as well as relevant mitigation measures.

Cultural heritage and archaeology

- The route of marine deliveries to Areas 2 and 5 should be further considered to avoid damage to wreck sites in the area;
- Further work is required to fully understand the nature and extent of archaeology along the Brighton to Shoreham Port area. The coastal area lacks investigation into potential palaeoenvironmental and archaeological remains. Consultation with the County Archaeologist should be undertaken to determine an appropriate programme of further archaeological investigation and mitigation in the areas of the proposed works.

Townscape, seascape and visual amenity

- Mitigation and enhancement measures should be considered as part of the detailed design of the proposed scheme.
- Due to the material value of the beach areas as a local landscape and visual amenity resource, it is recommended that a Landscape and Visual Impact Assessment (LVIA) is undertaken at detailed design. 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) (Appendix B), which will identify landscape and wider environmental mitigation and enhancement measures associated with the scheme.

Ground conditions

- Ground investigation is recommended to inform the outline geotechnical design and provide further contamination baseline data on the soils beneath the site is to be undertaken at detailed design stage. The scope and specification for the investigation should be developed once the conceptual design of the proposed defences is finalised.
- A detailed UXO threat and risk assessment should be undertaken at detailed design phase. This should be undertaken as a first step to inform any ground investigations.
- The potential for waste soils to be generated should be re-evaluated once the scheme is finalised and the ground investigation results are available.

Transport and navigation

- A transport assessment should be undertaken at the next stage of assessment. This should include a review of the anticipated volume of traffic to be generated and an estimation of plant required during construction. Any mitigation measures should be discussed with the local highway authority in line with best practice and considerate site practices should be employed to ensure minimum disruption. A detailed Traffic Management Plan is anticipated to be required prior to construction.
- Consultation should be undertaken with the relevant channel users (Shoreham Port, Brighton Marina and Brighton Sailing Club) to minimise potential impacts and to ensure that appropriate mitigation measures are put in place.

If you have any questions, please contact:

Kate Wagg
Senior Environmental Consultant

Jacobs
Endeavour House, Forder Way,
Hampton, Peterborough, Cambridgeshire, PE7 8GX
kate.wagg@jacobs.com

Contents

Appendices

Abbreviations

AEP	Annual Exceedance Probability
AOD	Above Ordnance Datum
AVDL	Annual vegetation of drift lines
BGL	Below Ground Level
BHCC	Brighton and Hove City Council
BTFU	Beach and tidal flat deposits
EIA	Environmental Impact Assessment
FCRM	Flood and Coastal Risk Management
GiA	Grant in Aid
HAT	Highest Astronomical Tide
HER	Historic Environment Records
HMWB	Heavily Modified Water Bodies
JAAP	Joint Area Action Plan
LNR	Local Nature Reserve
LVIA	Landscape and Visual Impact Assessment
LWS	Local Wildlife Site
MAGIC	Multi-Agency Geographic Information for the Countryside
MCA	Marine Character Area
MCZ	Marine Conservation Zone
MHWM	Mean High Water Mark
MMO	Marine Management Organisation
NCA	National Character Area
OBC	Outline Business Case
PEIR	Preliminary Environmental Information Report
PRoW	Public Right of Way
PVSB	Perennial vegetation of stony banks
RBMP	River Basin Management Plan
SEA	Strategic Environmental Assessment

SMP	Shoreline Management Plan
SNCI	Site of Nature Conservation Interest
SPA	Shoreham Port Authority
SSC	Suspended Sediment Content
SSSI	Site of Special Scientific Interest
STOB	Storm Beach Deposits
UXO	Unexploded Ordnance
ADC	Adur District Council
WFD	Water Framework Directive

1. Introduction

1.1 The project

The Brighton Marina to River Adur Flood and Coastal Erosion Risk Management Scheme (proposed scheme) is being progressed by Brighton and Hove City Council (BHCC) in association with Adur District Council (ADC) to manage the risk of flooding and erosion between the River Adur and Brighton Marina. This will ensure that the coastline remains a vibrant and vital focus for the area's economy in accordance with the Brighton Marina to River Adur Flood and Coastal Erosion Risk Management Strategy (the strategy) published in 2015. The proposed scheme aims to address the first phase of works from the strategy which is to provide an Improve to 0.5% Annual Exceedance Probability (AEP) (1 in 200) standard of protection for the first 15 years of the 100 year appraisal period.

The proposed scheme covers three locations:

1. **Shoreham Port frontage**: Located between Southwick Beach and the start of Western Lawns and includes frontage related to Shoreham Port, Hove Deep Sea Anglers' Buildings, and Western Esplanade.
2. **Kings Esplanade**: Located between the Western Lawns and Hove Lawns and includes frontage related to the King Alfred Centre and King's Esplanade.
3. **Kemp Town**: Located along the eastern section of the frontage between Brighton Pier and Brighton Marina and includes frontage related to the Kemp Town beaches.

These locations have been split into six areas of work further detailed in section 3.1 of this report and Figure 1.1 below. The works comprise of a combination of beach recharge and recycling, repairs to timber and concrete flood walls, construction of flood walls and rock revetments, movement of rock armour and construction of a new groyne field. This will achieve a consistent standard of flood protection along the frontage.

Plans detailing the proposed works are included with Appendix O of the OBC document.

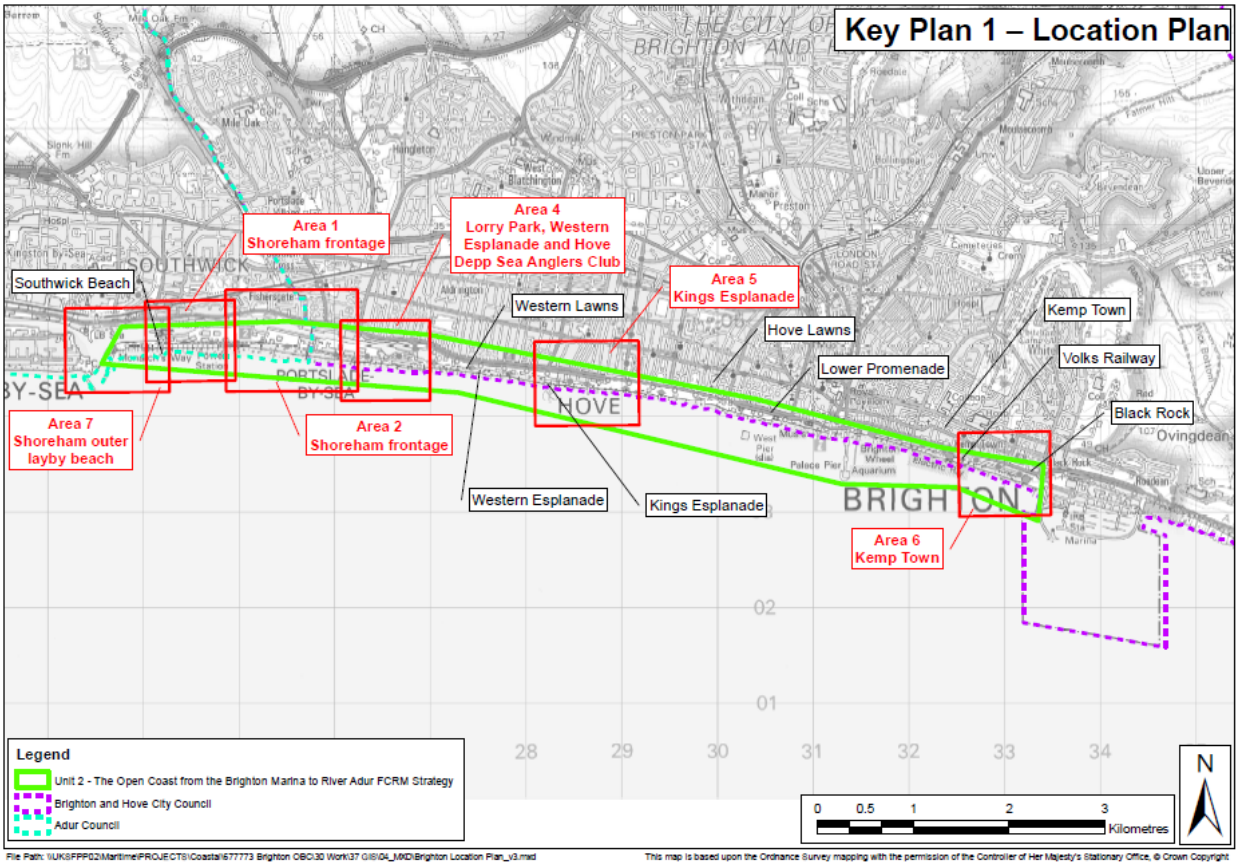

Figure 1.1 Proposed scheme location plan

1.2 Purpose of the report

This PEIR has been prepared to report on the environmental assessment works undertaken to date and as part of the process required to support the OBC submission for an application for funding and technical approval for the proposed scheme.

Specifically, this PEIR has been prepared to:

- Describe the environmental issues, constraints and opportunities relevant to the proposed scheme.
- Recommend what actions are proposed to further assess or manage environmental issues during subsequent phases of the scheme implementation.

This report does not constitute a statutory PEIR and should not be used for consultation.

1.3 Need for and development of the scheme

1.3.1 Need for the scheme

There is a natural drift of sediment along the south coast, Brighton included, from west to east. The supply of natural sediment drift material to the western beaches impeded by the mouth of the River Adur and associated training walls. Limited sediment supply, coupled with wave action, has resulted in material erosive forces at the western end of the frontage, such that the residual life of the defences is inadequate (less than 1 year in certain locations). Shoreham Port Authority, who are responsible for Shoreham Port and navigation in the River Adur, currently try to offset material losses and reduce the risk of breach in this area by moving shingle across the River Adur from the west, under Harbour Act powers. This process is known as shingle bypassing. It is predicted that without further intervention, erosion will

result in the failure of defences along Southwick beach by year 5 of the 100 year appraisal period and breach through into the locked section behind it by year 15, causing material flooding and disruption.

Conversely, beach material accretes at Kemp Town in the east of the study area due to natural bathymetry and the presence of Brighton Marina which restricts drift beyond the study area, to the east. This has resulted in larger beaches at Kemp Town, which is known to negatively impact the operation of the Southern Water outfall in this location.

The open coast frontage is also at risk of flooding from wave overtopping due to a combination of variations in defence heights and beach widths, poor maintenance and a deterioration of flood defence assets, all of which will put the hinterland at an increased risk of flooding over time due to climate change.

Overall, 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, and the bypassing across the River Adur at Shoreham is insufficient to replace the lost material. In recent years, material has been moved by BHCC and Shoreham Port Authority from Kemp Town to Southwick to address this imbalance. There is a need for a more consistent and sustained beach management strategy.

The storm events during Winter 2013/14 also caused material damage and disruption. Flooding occurred to commercial premises on Brighton seafront, with flooding to factories and warehouses within Shoreham Port and to properties on Basin Road South, shingle and debris from collapsed coast protection structures deposited along Basin Road and along large areas of the promenade through Portslade and Hove, and temporarily closure of access to the sewage works, power station, café and other port tenants. Emergency repair works were undertaken to repair breaches in seawalls and rebuild some of the more critical groynes and revetments, but 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.

1.3.2 Development of the scheme

Beachy Head to Selsey Bill Shoreline Management Plan (1997)

The Beachy Head to Selsey Bill Shoreline Management Plan (SMP) was adopted in 1997. The Policy Options set out in the SMP were all adopted by the relevant Operating Authorities in 2006. The SMP provides a large scale assessment of the risk's associated with coastal evolution in the area of the proposed scheme and presents a policy framework to address these risks in a sustainable manner.

Four generic options were considered during development of the SMP. These were:

- No Active Intervention (a decision not to invest in providing or maintaining defences)
- Hold the Line (maintaining or upgrading the level of protection provided by defences)
- Managed Realignment (allowing retreat of the shoreline, with management to control or limit movement)
- Advance the Line (building new defences seaward of the existing defence line).

The preferred option was identified as 'Hold the Line' for the three epochs (0-20,20-50 and 50-100).

Brighton Marina to River Adur Flood and Coastal Erosion Risk Management Strategy (2015)

The Brighton Marina to River Adur Flood and Coastal Erosion Risk Management Strategy (the strategy) published 2015 (Appendix C of the OBC) reviewed the options considered as part of the SMP and concluded that 'Hold the Line' was the most technically and economically feasible option that maintains environmentally and socially important features.

Following on from the review of the SMP, the strategy considered a number of strategic options on a sequential basis. This started with a long list of potential management options which were based on generic management solutions. A summary of this long list of options is presented below.

Table 1.1 Summary of generic options considered at strategy level

Generic option	Description
No Active Intervention	Option leaving the existing defences as they are, with no further maintenance or repair work. This option would lead to erosion of the coastline, with deterioration and eventual failure of the defences, and flooding of areas reliant on the defences. No Active Intervention is used in appraisal to act as a baseline against which all other options are tested. This option relates to an SMP No Active Intervention Policy Option.
Do Minimum	Option to undertake a minimum of intervention action, with works being undertaken in a reactive manner. This would involve repairing breaches should they occur, but not necessarily maintaining the defences in their current standard of repair or providing any improvement to the coastal flooding standard of protection. Due to the projected rise in sea levels anticipated, the condition of the defences and the standard of protection from flooding and erosion would reduce over time and the risk of flooding and erosion would increase. Do Minimum is used in appraisal to act as a baseline against which all other options are tested. This option relates to an SMP Hold the Line Policy Option.
Maintain	Option maintaining the existing defence structures in their current form and condition. This would involve undertaking repairs and maintenance works where necessary (with increasing frequency over time), but not providing any improvement to the coastal flooding standard of protection. Due to the projected rise in sea levels anticipated, the standard of protection from flooding provided by the defences would reduce over time and the risk of flooding would increase. This option relates to an SMP Hold the Line Policy Option.
Sustain	Option similar to the Maintain Option, whereby repair and maintenance work would be undertaken, but there would be additional work undertaken to sustain the existing level of flood protection in line with sea level rise over the life of the strategy. For this option, where there is a lower than desirable coastal flooding standard of protection at present, this would remain at the current level, although interim improvement works would be undertaken as required. This option relates to an SMP Hold the Line Policy Option.
Improve	Improve the defences, usually through replacement with a new structure or the addition of new structural elements. The current standard of flood protection is increased (flood risk is reduced). This option relates to an SMP Hold the Line Policy Option.

For the purpose of the strategic assessment, the strategy study area was divided into three geographic areas (units) (Figure 1.2):

- Unit 1 – the Locked Section of Shoreham Port;
- Unit 2 – the Open Coast (between the mouth of the River Adur and Brighton Marina);
- Unit 3 – Brighton Marina.

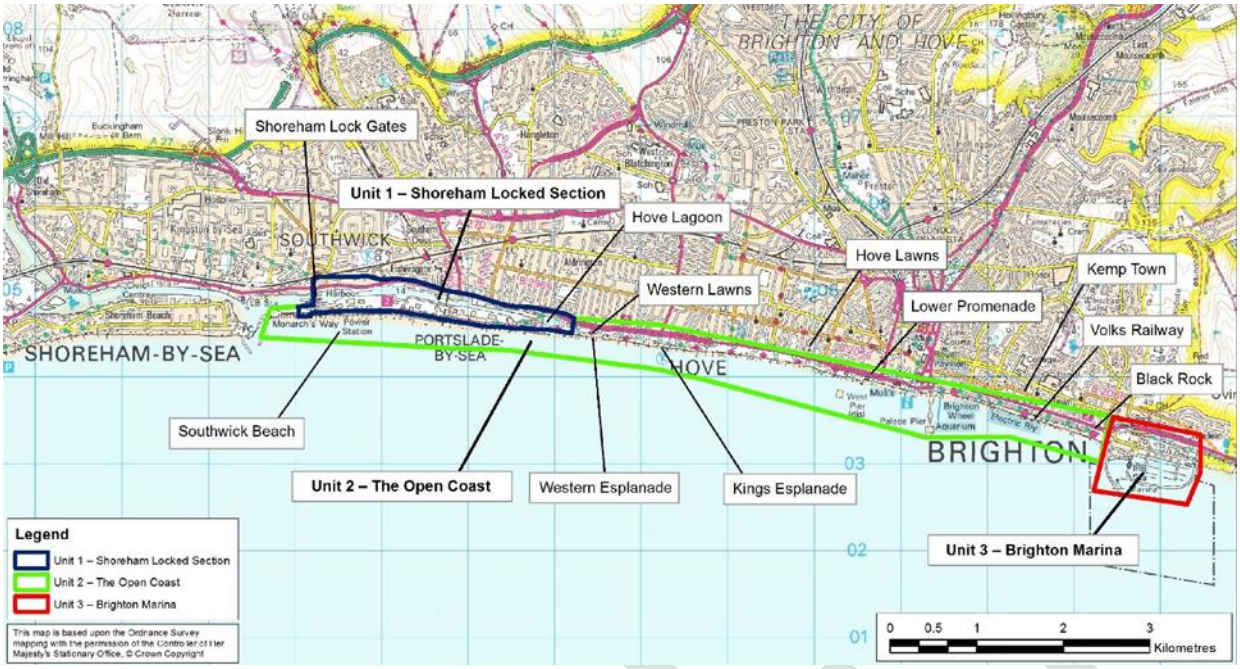

Figure 1.2 Location of strategy units

Those long list options that were considered viable for each of unit, from a technical, economic and environmental perspective, were carried through to form a short list of options. The short listed options that were taken forward for Unit 1 – Shoreham Locked Section included:

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

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;

The short listed options that were taken forward for Unit 3 – Brighton Marina included:

- Option 1 – No Active Intervention;
- Option 2 – Do Minimum;
- Option 3 – Maintain;
  Option 4 – Sustain.

Each short-listed option was then assessed against the agreed set of environmental objectives, indicators and targets. The evaluation of environmental impacts was based on a method similar to that applied during Environmental Impact Assessment (EIA) by reference to the significance of impact. The significance of impact was defined by reference to the sensitivity or value of the receptor and the magnitude of effect, using a standard matrix for all parameters, albeit using professional judgement, in a more qualitative manner than would be used for EIA.

The detailed results of the options appraisal from long list, to short list, to preferred option are summarised in the strategy Appraisal Summary Tables, which are presented in the strategy Options Appraisal Report (included as part of OBC Appendix C).

A preferred option was identified to provide a continued and improved standard of flood protection and erosion risk along the frontage of the strategy area. The preferred option comprised the following:

Locked Section of Shoreham Port (Unit 1): Improve to 0.5% AEP (1 in 200) option. The strategy proposed that the existing lock gates and the adjacent area would be raised, and an additional gate added to provide an improved standard of protection in the long term within the locked section.

Open Coast between Shoreham Port and Brighton Marina (Unit 2): Improve to 0.5% AEP (1 in 200) standard of protection along the whole frontage. The option includes beach recharge, recycling and bypassing; continued maintenance of existing structures; the construction of two new revetments and two new rock groynes along Southwick beach and wall raising at Southwick along the coast between the lock gates and the eastern limit of the Sewage Treatment Works. A number of groynes would also be lengthened/heightened to widen and increase the size of existing beaches over the 100 year horizon.

Movements of material using beach material taken from Kemp Town and Shoreham beaches will be undertaken to feed beach sections where beach widening is required. In addition, material will be bypassed from Shoreham beach and Kemp Town to the open coast on an annual basis with volumes reviewed on an annual basis. The exact location of recharge as well as the timing and quantities required will be reviewed on an annual basis to allow a sustainable and adaptable approach to long term beach management.

Brighton Marina (Unit 3): The strategy proposed the continuation of maintenance works to the outer and inner breakwaters. In addition, in the longer term, the crest level of the existing inner harbour wall and lock gates would be raised in line with sea level rise to maintain a standard of protection greater than 0.5% AEP (a 1 in 200 year event).

BHCC and ADC are only progressing the works required for Unit 2 – open coast between Shoreham Port and Brighton Marina through OBC due to the following:

- 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 Grant in Aid (GiA) funding.

- 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.

The Brighton Marina to River Adur FCRM OBC has developed the preferred strategy option to outline design. For the development of the financial business case, the OBC focusses on the first phase of works adopting a benefit period of 15 years. A 15 year benefit period is used as this is the duration of time, after works are complete, before the next major investment at year 18.

2. The proposed scheme

2.1 Description of the proposed scheme

The proposed scheme covers the three areas (Units 1,2 &3) of coastline and is split into 6 areas of work as shown on Figures 2.1 and 2.2 and described below.

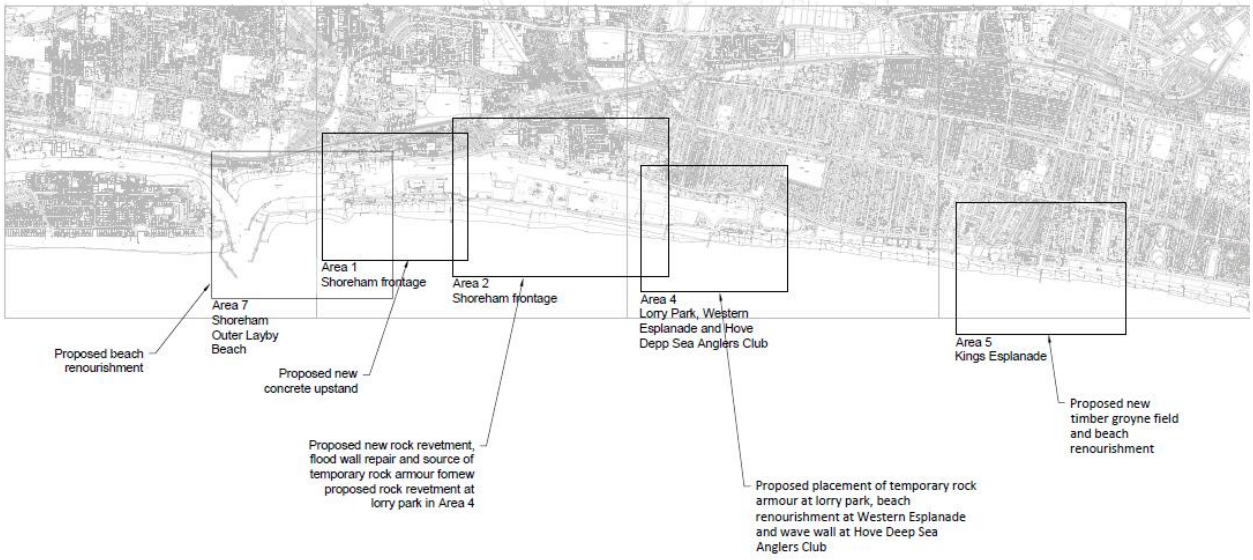

Figure 2.1 – Scheme areas, west and central

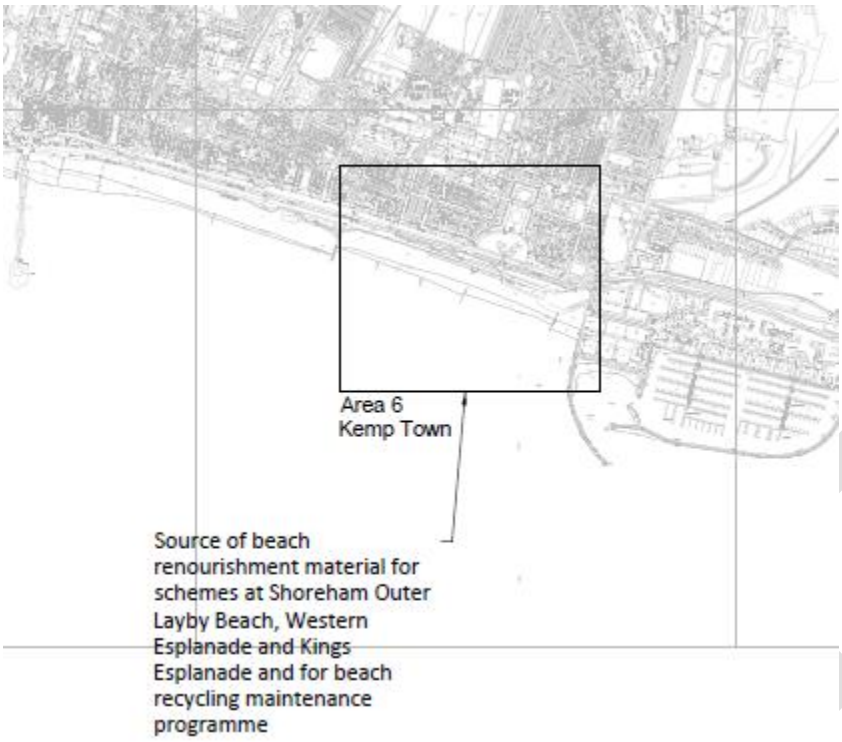

Figure 2.2 – Scheme areas, east

The first phase of works will commence construction in year 3 (2021/2022) and continue through to year 4 (2022/23). A new flood wall is also proposed for construction in year 10 (2028/2029). No construction work will be undertaken in the first two years (Years 1 and 2 - 2019/20 and 2020/21) when detailed design will be carried out and consents and approvals sought. Typical schematic cross sections are included in Technical Appendix O of the Brighton Marina to River Adur FCRM OBC.

Area 1 – Shoreham frontage

Area 1 is located along the western frontage of Shoreham Port in front of Carats Café and a row of beach huts.

The proposed defence comprises of a new concrete upstand wall along the top of existing sheet pile wall 574/3703. This will act as a flood wall providing a 0.5% AEP (1 in 200) standard of protection to the main port access road (Basin Road) and the businesses and industries behind.

The current poor condition of the 574/3703 sheet pile wall is being addressed by concrete encasement works undertaken by Shoreham Port Authority which are currently understood to be ongoing.

The western limit of the flood wall will tie into the perimeter wall surrounding the industrial area of the Shoreham Outer Layby. The eastern end will tie into the new rock revetment to be constructed in Area 2 (see below). The proposed wall height will be 7.5m OD - the design crest level required for flood defence. The wall will be encased in bricks and capped with concrete.

Timber stop logs will be installed to allow two access points from the promenade to the beach in front of Carats Café. A further aluminium stop log will be installed to allow an access point from the promenade to Basin Road.

The wall is proposed for construction in year 10.

Area 2 – Shoreham frontage

Along the central Shoreham frontage fronting Basin Road, a new rock revetment is proposed for construction in year 4. This is to be constructed along the front of defence 574/3702. The existing wall takes the form of doglegged sheet pile wall at the eastern end fronted by a beach crest consisting of a mix of rubble and sand/shingle. Along the central and western sections the defence is formed only of the rubble and sand/shingle beach crest fronting Basin Road which leaves this frontage vulnerable to breach.

The proposed alignment follows the seaward perimeter of the existing beach crest. This is to protect as far as possible existing and potential habitat for vegetated shingle.

The beach crest is currently protected by an informal rock armour revetment placed there by Shoreham Port Authority. This temporary rock armour will be relocated to Area 4 (see below).

In Area 2, works are also proposed to the existing concrete and timber walls 574/3701, 574/3817, 574/3816 and 574/3815 in year 3. Timber wall 574/3701 and concrete/timber wall 574/3815 will be replaced, and the reinforced concrete walls 574/3817 and 574/3816 will be patched and repaired. No change in crest height is proposed for any of these walls.

Area 3

Please note that due to the historical development of the scheme, Area 3 is not being used.

Area 4 – Lorry Park, Western Esplanade & Hove Deep Sea Anglers Club

Area 4 includes the eastern section of the Shoreham Port Authority frontage known as asset 574/3814 which is a beach ridge consisting of concrete rubble armour with shingle. This area between the beach and the road is known as the lorry park and is understood to be made up of debris from the demolition of the Portslade Gas Works and, possibly, the Phoenix Brewery. The ground is thought to be contaminated but is not formally recorded as such on the County Council register.

It is proposed that the rock armour sourced from Area 2 in year 4 will be used to construct a new temporary rock revetment along the seaward edge of the beach ridge. This structure has been designed to make the best use of available rock from Area 2. It is recommended that a formal rock revetment is constructed here in the next phase of works (after year 15).

Area 4 also includes the beach fronting Western Esplanade which is a row of private housing. The fronting beach is owned by the residents of Western Esplanade. It is proposed that 18,900m^3 is placed along this frontage to offset previous losses in year 3. The beach material will be sourced from the large beach in Area 6.

The eastern section of Area 4 covers the coastal frontage in front of Hove Lagoon. Along the promenade here it is proposed to construct a flood wall around the rear perimeter of the Hove Deep Sea Anglers Club car park in year 3. The proposed flood wall will tie in with the boundary wall of the end house of Western Esplanade in the west and will run around the landward boundary of the car park and tie in with the buildings of the Anglers Club in the east. The wall will provide a 0.5% AEP (1 in 200) standard of protection for the next 20 years. This will reduce flooding to the promenade and close a flood path that has been identified where wave overtopping can result in flooding over the promenade with flood water routing down into Basin Road and impacting residences and businesses. The proposed wall will be a concrete upstand wall clad on the promenade side with brick with a crest level of 7.2m Above Ordnance Datum (AOD). Access points are proposed at the entrance of the car park from the promenade and between the car park and the Anglers Club. These will be closed with aluminium stop logs.

The wall has been designed so that it may be raised in the future.

Area 5 – King's Esplanade

Area 5 covers Kings Esplanade. This is an area of residential and business properties that is located south of the A259 directly on the seafront with only a narrow promenade area between property and the beachfront.

A new timber groyne field comprising nine new groynes is proposed in front of King's Esplanade to provide a 0.5% AEP (1 in 200) standard of protection for the next 50 years. Beach re-nourishment with 85,000m^3 material from Area 6 is also proposed. The timber groyne field construction works are proposed for year 3 whilst the beach renourishment will be undertaken in year 4.

Area 6 – Kemp Town

Area 6 covers the area from Royal Crescent east to Brighton Marina in the eastern area of Brighton known as Kemp Town.

This is an area of accreting beach which has been used as a source of beach material for recycling programmes by Brighton and Hove City Council on three previous occasions in recent years - May 2010, Autumn 2013 and Spring 2017. The current scheme proposes to obtain beach material from this location to undertake recharge in Areas 4, 5 and 7.

In addition, it is proposed that this area is used as a source of beach material for the ongoing beach management programme. It is proposed that 5,000m^3 is sourced annually and 10,000m^3 sourced every other year from Kemp Town. The 5,000m^3 sourced annually can be used by Brighton and Hove City Council to address any storm drawdown or emergency reprofiling as required. In addition, 32,000m^3 is to be sourced every other year from Shoreham Beach by Shoreham Port Authority. Shoreham Port Authority have undertaken a regular shingle bypassing operation from Shoreham Beach since 1992.

The beach material will be used to replace material lost from beaches in the east by longshore drift. The net drift rate is 16,000m^3/year. It is currently considered that beach material won by Shoreham Port Authority will be placed at Shoreham Outer Layby (Area 7) and in front of wall 574/3703 (Area 1). Whilst the beach material obtained from Area 6 will be placed at Western Esplanade (Area 4). Material is currently being blocked from passing onto the Brighton frontage from Shoreham 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 Shoreham to Brighton freely again and a biennial recycling of 32,000m^3/year 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.

Area 7 – Shoreham Outer Layby Beach

Beach re-nourishment with 70,000m^3 of beach material from Area 6 is proposed in Area 7 in year 4.

2.2 Proposed construction programme and methodology

2.2.1 Access routes and site compounds

The main compound for the Kings Esplanade (Area 5) scheme in years 3 and 4 is assumed to be located on the public open space adjacent to the A259 next to the King Alfred Leisure Centre car park.

The main compound for the Shoreham Frontage (Area 2) scheme in year 3 is assumed to be located on the Shoreham Port frontage adjacent to Basin Road on the open space behind the existing rock revetment.

An alternative location for the main compound or satellite compound is assumed to be located on the Shoreham Port frontage adjacent to Basin Road on the Lorry Park west of Western Esplanade. This may be utilised for scheme works in Shoreham Frontage (Area 4) in years 3 and 4.

2.2.2 Proposed construction programme and methodology

The proposed construction programme is included in Appendix L of the Brighton Marina to River Adur FCRM OBC and summarised for each area below:

Area 1 – Shoreham frontage – Flood wall

- Construction proposed for year 10 (2028/29)
- Works duration would be approximately 25 weeks.

Area 2 – Shoreham frontage –Rock revetment and repairs to timber and concrete walls

Rock revetment

- Construction of rock revetment proposed for year 4 (2022/23).
- Works duration would be approximately 21 weeks.
- Rock is to be delivered to Area 2 (Shoreham) by barge from source. Dump trucks and excavators will be used to place the rock.

Repairs of concrete and timber walls

- Repairs to timber and concrete walls proposed for year 3 (2021/2022).
- Works duration for repair to the concrete and timber walls would be approximately 13 weeks.
- Bulk materials would be re-handled from the compound at the Lorry Park.

Area 4 – Lorry Park, Western Esplanade & Hove Deep Sea Anglers Club – Flood wall, temporary rock revetment and beach recharge.

Flood wall

- Construction of the flood wall is proposed for year 3 (2021/2022).
- Works duration for construction of the flood wall would be approximately 12 weeks.
- Bulk materials would be re-handled from the compound at the Lorry Park.

Beach recharge

- Works duration for the recycling of beach material from Area 6 (Kemp Town) to Western Esplanade would be approximately 9 weeks and is programmed for year 3.

Temporary rock revetment

- Construction of temporary rock revetment proposed for year 4 (2022/2023).
- Works duration for the movement of rock armour from Area 2 to Area 4 would be approximately 6 weeks.

Area 5 – King's Esplanade – New groyne field and beach recharge

New groyne field

- Works duration for the new groyne field proposed for year 3 would be approximately 32 weeks.
- Bulk materials would be re-handled from the compound at the open space next to the King Alfreds Leisure Centre.
- See Area 7 for beach recharge.

Area 7 – Shoreham Outer Layby Beach – Beach recharge

Beach recharge for Area 5 and Area 7

- Works duration would be approximately 29 weeks in total and is programmed for year 4.
- Transport to Kings Esplanade would take approximately 12 weeks.
- Transport to Shoreham Outer Layby would take approximately 10 weeks.
- The beach material would be transported from Area 6 (Kemp Town) by barge. 2nr tracked conveyors will load the barge, and an excavated dredged hole (approximately 1m deep) would allow the barge to work at low tide. Dump trucks and bulldozers will be used to place material.

The construction programme is subject to agreement between interested parties, on securing funding for the scheme and on it's a successful progression through detailed design and the planning process.

2.2.3 Future operation

Hard structures

Maintenance of hard structures including groynes and walls will continue to be undertaken by Shoreham Port Authority, Brighton and Hove City Council and Western Esplanade Management Company in accordance with their respective maintenance programmes.

Beach maintenance

Continued by-passing of shingle beach material from west of Shoreham Breakwaters to east of Shoreham Breakwaters by Shoreham Port Authority. The proposed scheme has allowed for 32,000m^3 of beach material to be by-passed biennially.

Recycling of shingle beach material from Kemp Town to feed the beaches to the west. It is proposed that material from here will be used to feed Western Esplanade (Area 4). The proposed scheme has allowed for annual recycling of 5,000m^3 and biennial recycling of 10,000m^3 of beach material for the first ten years.

After the first ten years, the recycling can reduce to biennial recycling of 32,000m^3/year made up of material from both Shoreham beach and Kemp Town. This is in addition to the annual 5,000m^3/year sourced from Kemp Town.

It must be stressed that the required volumes of annual recycling from both sources will be carefully monitored and adjusted as required to meet maintenance needs. 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.

2.3 Decommissioning

No decommissioning works are proposed.

2.4 Consenting requirements

Planning consent – The proposed scheme will require planning consent from BHCC and ADC under the Town and Country Planning Act 1990 (as amended).

Marine Licence – A marine licence from the MMO will be required for the works undertaken below mean high water springs under the Marine and Coastal Access Act 2009 (as amended).

3. Environmental assessment context

3.1 Regulatory context and requirements

3.1.1 EIA Directive and transposing regulations

The proposed scheme is subject to the provisions of the Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (SI 2017/517). It is a Schedule 2 development characterized as:

- Coastal work to combat erosion and maritime works capable of altering the coast through the construction, for example, of dykes, moles, jetties and other sea defence works, excluding the maintenance and reconstruction of such works.

On this basis a screening opinion from BHCC, ADC and the Marine Management Organisation (MMO) should be requested to determine whether this is an 'EIA development' in terms of the criteria set out in Schedule 3 of the EIA Regulations.

3.1.2 Water Framework Directive

The EU Water Framework Directive (WFD) (Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy) and transposing national regulations requires all natural water bodies to achieve both good chemical status and good ecological status. For each River Basin District, a River Basin Management Plan (RBMP) outlines the actions required to enable natural water bodies to achieve this. Water bodies that are designated in the RBMP as Heavily Modified Water Bodies (HMWB) or Artificial Water Bodies may be prevented from reaching good ecological status by the physical modifications for which they are designated or purpose for which they were constructed (e.g. navigation, flood defence, urbanisation). Instead they are required to achieve good ecological potential, through implementation of a series of mitigation measures outlined in the applicable RBMP (and in some cases updated since the publication of the RBMP).

To ensure the proposed scheme is compliant with the WFD requirements, there is a need to assess the impact of the scheme in terms of the objectives of the relevant WFD water bodies. A preliminary compliance assessment has been undertaken to assess the impact of the proposed scheme in terms of WFD requirements. This document is provided in Appendix E and the findings are summarised in Section 4.8.

3.2 Environmental assessment stages and approach

3.2.1 Preliminary analysis (present stage)

The purpose of the preliminary analysis reported within this PEIR is to identify the environmental issues, risks and opportunities relating to the proposed scheme and recommend actions for further assessment and/or management of the identified issues. This analysis has been undertaken based upon a consideration of known impacts from similar schemes of this nature and site-specific constraints within the zone of influence of the proposed scheme.

The environmental baseline has been defined using a combination of existing web-based data and information from the Strategic Environmental Assessment (SEA) included as part of the Strategy (Appendix C of the OBC) as listed below:

- Aerial imagery, photographs and Ordnance Survey mapping;
- Consultation and engagement with statutory bodies and relevant stakeholders (see Section 3.4);
- Site visits;
- Review of web-based data, including those from the following websites:
  - Defra Multi-Agency Geographic Information for the Countryside (MAGIC), www.magic.gov.uk
  - Environment Agency Catchment Data Explorer, http://apps.environment-agency.gov.uk/wiyby/default.aspx
  - Environment Agency 'What's In Your Backyard', http://apps.environment-agency.gov.uk/wiyby/default.aspx

To supplement this existing information, a range of project-specific desk-based assessments, site assessment and surveys were undertaken as described in Section 4 and included in the appendices. These include:

- Ecological desk study (including obtaining local biological records) and UK BAP Priority Habitat vegetated shingle survey (Appendix A).
- A landscape appraisal which was inputted directly into Section 4.4 of this PEIR and production of an Indicative Landscape Plan (ILP) (Appendix B).
- An archaeological desk-based assessment which was inputted directly into Section 4.3 of this PEIR. A Historic Environment Record search and production of plans showing heritage assets (Appendix C).
- Geo-technical desk study (Appendix D).
- A preliminary WFD assessment considering the potential compliance of the proposed scheme with WFD requirements (Appendix E).

This preliminary assessment has identified all features and receptors that are likely to be affected by the construction or operation of the proposed scheme for a range of topics (Section 4). Where these potential effects are considered a potential likely significant effect, or the potential effects are uncertain at present, this PEIR makes recommendations for further assessment. It should therefore be noted that potential likely significant effects captured at this preliminary stage, may be found to be not significant following completion of the mitigation strategy when reported in the ES. After considering the baseline and an initial review of the potential effects s of the proposed scheme, those topics for which potential likely significant effects are considered unlikely or which can be avoided or managed by standard good practice are covered in less detail.

This preliminary analysis recommends actions to further assess or manage effects, and other issues requiring further assessment or management at the next stage of the development of the proposed scheme.

3.3 Uncertainties, gaps and assumptions

At this stage of the project there are some uncertainties which prevent conclusions being drawn. These are:

- The scheme designs are only available in outline. The anticipated design, construction and operation of the scheme described in section 2 are considered to be sufficient for this preliminary analysis.
- EIA screening opinions have not been obtained from BHCC, ADC and the MMO.

Subject to funding and approval of the OBC, these will be further considered during the next stages of the delivery of the proposed scheme.

3.4 Stakeholder engagement

Engagement activities to date have included the following:

- Consultation was carried out throughout the Strategy development with relevant stakeholders and the public. The public were consulted on the short-listed options in 2013. The public consultation for the proposed Strategy in 2014 included an exhibition of static displays at four locations (Hove Town Hall, Brighton Library, the King Alfred Leisure Centre and Adur Civic Centre) for a week each time. In 2014, 28 consultation responses were received from local residents and interested parties on the proposed Strategy. Natural England and English Heritage stated their support for the Strategy, whilst the Environment Agency and the Marine Management Organisation confirmed that they had no specific comments on the Strategy. Further support was provided by Brighton and Hove City Council Sustainability Officer, Brighton Marina and Shoreham Port. Shoreham Harbour Regeneration partnership also provided general support,but raised concerns about the effect on a local business along the open coastal frontage. Other consultees had no objections to the Strategy but some concerns were raised regarding the effect on Basin Road South Site of Nature Conservation Interest, views from a local café and the potential for improving provisions for cyclists.
- Issue of scheme updates on the Brighton Marina to River Adur Strategy website: https://www.brighton-hove.gov.uk/content/environment/coast-defence-and-flood-management/brighton-marina-river-adur-strategy-study
- Meetings with relevant stakeholders including:
    - BHCC;
    - Shoreham Port Authority;
    - Hove Deep Sea Anglers Club;
    - Western Esplanade Management Company (WemCo);
    - Brighton Marina;
    - ADC;
    - Kings Esplanade residents.

3.5 Mitigation

The mitigation suggested within Section 4 of this PEIR is preliminary advice which has been provided by technical experts and hence needs further investigation. It has not yet been agreed or committed to by the project team.

4. Preliminary Environmental Information

4.1 Introduction

This section provides a preliminary assessment of the environmental issues associated with the proposed scheme. For each of the topics considered, this section describes the work undertaken to date, summarises the existing baseline, presents a preliminary assessment of potential issues, constraints and opportunities and recommends any further environmental assessment and actions required.

Topics covered comprise:

- Biodiversity;
- Cultural Heritage;
- Townscape, Seascape and Visual Amenity;
- Ground Conditions;
- Transport and navigation;
- Population, health and economy;
- Water and hydromorphology;
- Cumulative effects.
- Air quality and climate;
- Materials and resources;
- Environmental hazards and incidents.

4.2 Biodiversity

4.2.1 Baseline

A Preliminary Ecological Appraisal has been undertaken for the proposed scheme (Appendix A). As part of this a request for biological information, including Statutory and Non-Statutory Designated sites and records of protected species and species of conservation importance within 2 km of the site was submitted to and received from the Sussex Biological Records Centre in October 2018. A walkover of the site and vegetated shingle survey was also undertaken in July 2016 (Appendix A).

Statutory designated sites

Statutory designated sites located within 2 km of the proposed scheme are presented in Table4.1 and illustrated on the Environmental Constraints Plan (Appendix F).

Table 4.1 Statutory designated nature conservation sites within 2 km of the proposed scheme

Site Title	Designation	Description	Distance from the Scheme
Brighton to Newhaven Cliffs	Site of Special Scientific Interest (SSSI)	The SSSI is designated for geological interest. Despite this there are some rare and uncommon plants growing on the cliffs. The cliffs support a locally important colony of breeding seabirds and a diverse community of beetles.	Adjacent to the eastern end of the Scheme
South Downs	National Park	The South Downs	The Scheme is located

Site Title	Designation	Description	Distance from the Scheme
		National Park comprises chalk grassland, heathland, river valleys and ancient woodlands. The rich mosaic of habitats supports many rare and internationally important flora and fauna.	within the South Downs National Park
Shoreham Beech	Local Nature Reserve (LNR)	Shoreham Beech LNR is a shingle spit formed over many centuries by longshore drift and the cutting action of the river Adur. The site supports a large area of rare vegetated shingle which supports a variety of wildlife.	450m west
Whitehawk/Race Hill	LNR	Whitehawk/Race Hill is an ancient site that comprises areas of species rich chalk grassland which supports colonies of Adonis Blue *Polyommatus bellargus* and Chalkhill Blue *Polyommatus coridon* butterflies.	1km north
Beachy Head West	Marine Conservation Zone (MCZ)	Beachy Head West MCZ is located from Brighton Marina to Beachy Head. The site is designated as it comprises extensive intertidal wave cut chalk platforms and subtidal chalk ridges, which are among the best examples of marine chalk habitat in the south-east. Chalk reef supports abundant wildlife, including threatened species.	Adjacent to the eastern end of the Scheme

Non-statutory designated sites

Non-statutory designated sites located within 2 km of the proposed scheme are presented in Table 4.2

Table 4.2 Non-statutory designated nature conservation sites within 2 km of the proposed scheme

Site	Designation	Description	Distance from the site
Ad03 - Shoreham Beach	Local Wildlife Site (LWS)	The site supports specialist shingle flora which is very rare in west Sussex.	450m west
BH07 - Emmaus Gardens & St Nicholas	LWS	The site supports rough grassland and secondary	1.5km north

Site	Designation	Description	Distance from the site
		broad-leaved woodland.	
BH09 - Benfield Valley	LWS	The site supports broad-leaved woodland, rough grassland, mature hedgerows and a Saxon hedgeline.	1.3km north
BH10 - Basin Road South	LWS	This vegetated shingle site is important for being the largest of only three remaining areas of this internationally threatened habitat in Brighton & Hove. The site also supports a diversity of notable species including sea kale *Crambe maritima* and yellow horned poppy *Glaucium flavum*.	Within the Scheme
BH25 - Brighton Station	LWS	The site supports secondary broad-leaved woodland, scrub and ruderal habitat and is important as a wildlife refuge area.	950m north
BH29 - Volks Railway	LWS	This site is important for being one of only three remaining sites for vegetated shingle (an internationally rare habitat) in Brighton & Hove. The site is also important for supporting a diversity of notable coastal species, including Tree Mallow *Malva arborea* (a nationally scarce plant), and Yellow horned Poppy.	Adjacent to north-eastern scheme boundary
BH30 - Woodvale, Extra-mural & Downs Cemeteries	LWS	The site comprises broad-leaved woodland, sense scrub, rough grassland and relict chalk grassland.	2km north
BH31 - Black Rock Beach	LWS	This vegetated shingle site is important for being one of only three remaining areas of this internationally rare habitat in Brighton & Hove. The site supports a diversity of notable coastal species, including Sea Kale and Tree Mallow (both nationally scarce plants). It is an important 'stopping off' point for migratory birds and there are records for breeding Ringed Plover.	Within the Scheme
BH32 - Wilson Avenue, Whitehawk	LWS	The site is in an important buffer of semi-	2km north-east

Site	Designation	Description	Distance from the site
		natural habitat to the adjacent local nature reserve and comprises rough grassland and bramble.	
BH33 - Brighton Marina	LWS	The site supports a variety of marine habitats and species.	Adjacent to the eastern end of the Scheme
BH34 - Sheepcote Valley	LWS	The site supports species rich chalk grassland, amenity grassland, rough grassland and scattered scrub. The site supports a variety of flora and fauna.	490 north-east
BH38 - Cattle Hill	LWS	The site supports remnant chalk grassland and scrub and supports a variety of flora and fauna.	2km north-east
BH59 - Roedean School Bank	LWS	The site supports ancient chalk grassland and supports a variety of flora and fauna	1.6km north-east

Habitats

The results of the ecological walkover and UK BAP Priority habitat vegetated shingle survey indicate three types of coastal habitats:

- Annual vegetation of drift lines (AVDL), typically sparse scattered pioneering shingle vegetation in patches always just above the Mean High Water Mark (MHWM). The principal species found in Sussex in this vegetation is Babington's orache (plant), which sometimes is the only species present here, although other species such as sea mayweed, sea rocket and cleavers can accompany it. This habitat relies on a certain amount of tidal disturbance for its existence, but is prone to damage through human disturbance on the beach. This is a notable "Annex 1" habitat, considered to be uncommon and of importance at the international level. This is also a UK Priority Habitat – Coastal Vegetated shingle.

- Perennial vegetation of stony banks (PVSB), a more developed shingle vegetation type which can comprise separate patches or a continuous cover of plants. It is always located higher up the beach from the MHWM. Typical species present include yellow-horned poppy, sea kale, curled dock, perennial sow-thistle and rock samphire. This habitat is highly vulnerable to human disturbance to the upper beach and is a notable "Annex 1" habitat, considered to be uncommon and of importance at the international level. This is also a UK Priority Habitat – Coastal Vegetated shingle.

- Coastal grassland, a habitat that occurs on more stabilised sections of upper beach and, although often dominated by dense growth of sea couch grass, it is often a diverse habitat which can support various shingle species as listed above, plus sandy "dune" species and grassland plants more commonly found inland, such as (in this survey) yellow-wort and kidney vetch. There is no exact fit between this habitat type and listed Annex 1 and UK Priority Habitats, but it is considered that this vegetation is potentially of notable status within these classifications,and should also fit within the Annex 1 PVSB and UK Priority Coastal Vegetated shingle.

The location of these habitats along the frontage is shown in the vegetated shingle survey report Appendix A.

Species

The local biodiversity record search identified the following records of protected and notable species within 2 km of the proposed scheme (Table 4.3).

Table 4.2 Protected and notable species records within 2 km of the proposed scheme

Species Name	Latin Name	Status	Number of records	Closest record to the Scheme
Amphibians and Reptiles				
Common Toad	*Bufo bufo*	NERC UK BAP	9	1.7km west of the Scheme
Great Crested Newts	*Triturus cristatus*	Hab Reg WCA NERC	1	1km north of the Scheme
Slow worm	*Anguis fragilis*	WCA NERC UK BAP	46	Within 2km of the Scheme
Adder	*Vipera berus*	WCA NERC UK BAP	4	440m north
Common lizard	*Zootoca vivipara*	WCA UK BAP NERC	>100	490m north-east
Plants – 135 notable species of plant were returned from the records centre. A selection are listed below				
Yellow horned poppy	*Glaucium flavum*	RedList	11	Within the Scheme
Sea Bindweed	*Calystegia soldanella*	RedList Sussex Rare	4	Within the Scheme
Bluebell	*Hyacinthoides non-scripta*	WCA	2	95m north
Mammals				
Common seal	*Phoca vitulina*	NERC UK BAP	6	180m south of the Scheme
Hedgehog	*Erinaceus europaeus*	NERC UK BAP	100	Within 2km of the Scheme
Serotine	*Eptesicus serotinus*	Hab Reg WCA	1	650m north of the Scheme
Whiskered/Brandts	*Myotis mystacinus/brandtii*	Hab Reg WCA	3	350m east
Pipisrelle sp.	*Pipistrellus sp.*	Hab Reg WCA UK BAP	2	1.3km north
Nathusius's pipistrelle	*Pipistrellus nathusii*	Hab Reg WCA	3	430m north
Common pipistrelle	*Pipistrellus pipistrellus*	Hab Reg WCA UK BAP	13	270m north
Soprano pipistrelle	*Pipistrellus pygmaeus*	Hab Reg WCA UK BAP	3	1km north
Birds – 301 species of notable birds were returned a selection are presented below.				
Oystercatcher	*Haematopus ostralegus*	BoCC - Amber	>50	800m north west
Sand martin	*Riparia riparia*	Notable bird	12	Within the Scheme
Kingfisher	*Apus apus*	BoCC - Amber Notable bird WCA	13	2.2km west
Invertebrates – 109 species of notable invertebrate species were returned a selection are presented below				
Stag Beetle	*Lucanus cervus*	WCA NERC	8	570m north
Small Blue	*Cupido minimus*	WCA NERC	>50	200m north

		UK BAP RedList		

4.2.2 Potential Effects

Statutory designated sites

The source area for the beach recycling (Area 6) is partially located within the Beachy Head MCZ. The source area is located within a closed sediment cell and therefore the extraction of material from Kemp Town (Area 6), will not affect the supply of sediment further east. This is due to the presence of Brighton Marina, which acts a physical barrier to shingle sediment transport.

The boundary of the MCZ falls approximately 100m west of the Marina breakwater in alignment with the most easterly groyne on the Kemp Town frontage. Consultation with Natural England will be undertaken during development of the scheme to confirm whether this section should be included or excluded from the recycling source material area. There is no significant technical impact of excluding the area if required. A potential benefit of including the MCZ section of the beach in this area is that the initial capital recycling works and ongoing beach recycling programme will ensure that the size of the shingle beach is managed and will reduce its encroachment onto the underlying wave cut chalk platform which is an important element of the designation. Leaving the sediment in the small section is likely to result in its local redistribution once the majority of the sediment is removed.

Marine collection of material during the initial capital recycling works can be managed such that navigation routes avoid the area, and, driving on the foreshore by plant during shingle extraction can be prohibited within the MCZ to prevent damage to the foreshore.

The shingle extracted as part of the beach recycling will be sourced from the active and recently accreted ridges of beach. As such vegetated areas on the crest will not be touched and again driving on the foreshore by plant during works will be carefully managed to avoid any disruption to vegetated areas.

Using material from the active area effectively means that the content of fines is low. This means that during the shingle extraction only a negligible increase in Suspended Sediment Content (SSC) are anticipated. This increase would be expected to disappear within a few tidal cycles. Any increase in SSC will be localised and no significant adverse impact to the designated intertidal, subtidal or species features is anticipated, i.e. smoothing by fine sediment are not anticipated.

There is potential for the proposed scheme to impact upon the integrity of Brighton Cliff SSSI as a result of its close proximity. Concerns are noted by Natural England that the sea wall on the east side of the marina is being undercut due to a lack of sediment protecting the toe of the seawall, which may lead to the requirement for re-enforcement and hence may impact the SSSI wave cut platform, with a wider footprint for the repaired sea wall. However, as discussed above and in Section 4.8.1, the beaches east of Brighton Marina including the Brighton Cliff SSSI do not rely on sediment inputs from the Brighton beach frontage as the Shoreham to Brighton frontage is a closed sediment system. Thus, any changes to sediment volumes on the western side of Brighton Marina will have no impact on beaches to the east and thus, there are considered to be no impacts to the Brighton Cliff SSSI due to the scheme.

The proposed scheme is unlikely to impact upon any other statutory designated sites located within 2 km of the proposed scheme due to the nature of the proposed works and absence of pathway for impact.

Non-statutory designated sites

There is potential for the proposed scheme to impact upon Basin Road South and Black Rock Beach LWS's which are located within the scheme area. Basin Road South LWS will be directly impacted by the construction of a new revetment. The potential for likely significant effects are uncertain at this stage. Consultation with the relevant stakeholders with therefore be needed to determine if there is potential for likely significant effects.

The proposed scheme is unlikely to impact upon any other non-statutory designated sites located within 2 km of the proposed scheme due to the nature of the proposed works and absence of pathway for impact.

Habitats and species

There is potential for likely significant effects on the Priority Habitat vegetated shingle and coastal grassland habitats which will be directly impacted by the construction of the proposed revetment and floodwalls across the Scheme and beach recharge operations. It is recommended that a mitigations strategy is devised to minimise the impacts on vegetated shingle and coastal grassland habitats. Suggested mitigation should include sensitive working practices and works undertaken under the supervision of a suitably qualified ecologist. The replacement of lost habitat should also be considered at the next stage of assessment.

There is potential for the proposed scheme to result in likely significant effects to Protected Species Yellow horned poppy (Glaucium flavum) and Sea bindweed (Calystegia soldanella) which have been identified by the data search as occurring within the scheme area. It is recommended that a mitigation strategy is devised to minimise the impacts on these species. Mitigation should include sensitive working practices and works undertaken under the supervision of a suitably qualified ecologist.

There is potential for reptiles to be present in the area of the proposed scheme. To avoid any potential likely significant effects it is recommended that a reptile survey is undertaken within the recommended survey period (March – October). The results should be used to determine if any exclusion fencing and/or translocation will be required.

4.2.3 Next steps

A mitigation strategy should be devised to minimise the impacts upon Priority Habitat Vegetated Shingle, and protected species Yellow horned poppy (Glaucium flavum) and Sea bindweed (Calystegia soldanella). This should detail the need for sensitive working practices and outline that works should undertaken under the supervision of a suitably qualified ecologist. The replacement of any material habitat loss should also be considered at the next stage of assessment.

It is recommended that a reptile survey is undertaken within the recommended survey period.(March – October). The results should be used to determine if any exclusion fencing and/or translocation will be required.

Consultation with Natural England and other statutory consultees will be undertaken throughout the next stage to discuss potential impacts on statutory and non-statutory designated sites as well as relevant mitigation measures.

4.3 Cultural heritage and archaeology

4.3.1 Baseline

Cultural Heritage baseline information has been collated from a review of the strategy, baseline data collection and archaeological appraisal during the preparation of this PEIR. This has included an examination of the Historic Environment Record (HER).[1]

The study area for the archaeological appraisal focused on three areas: Shoreham Ports' coastline and the sea fronts at Kings Esplanade and Kemp Town in east Brighton. These incorporate the six areas of work (as described in Section 2.1 of this PEIR). The study areas and full list of archaeological and cultural heritage assets is provided in Appendix C. Features of interest are summarised in Table 3.4 and Table 4.4 below. Plans showing the locations of these heritage assets are included in Appendix C (Figures 1-3).

[1] West Sussex County Council HER search, September 2016.

Designated Cultural Heritage assets

Table 3.4 Designated cultural heritage assets located within the scheme areas

Asset	Description
Designated cultural heritage assets – Shoreham Port frontage (Project Areas 1, 2, 4 & 7)	
Shoreham Fort Scheduled Monument	The only Scheduled Monument in this area is Shoreham Fort, on the western edge of Area 7. The monument includes a 19th century artillery fort, surviving as upstanding and below-ground remains. It overlooks Shoreham Harbour, at the mouth of the River Adur.
Designated cultural heritage assets – Kings Esplanade (Area 5)	
Kemp Town Conservation Area	Includes Sussex Square, Lewes Crescent, Kemp Town Place, Arundel and Chichester Terraces. The extent of the area includes the beach front in front of these buildings. The area was originally planned as a separate town to Brighton, but was subsumed over the course of the 20th century. The area is characterised by its elegant Regency buildings and views over the sea.
East Cliffe Conservation Area	Comprises the main conservation area in the study area stretching from the east side of the Palace Pier to the western edge of Kemp Town. As with Kemp Town, this area is defined by its architecture, particularly on the seafront, which is very typical of the Regency style and by the survival of the historic street pattern, as well as by its historic relationship with the sea.
Valley Gardens Conservation Area	Incorporates Palace Pier and an area of beach to its west side and then stretches back to the centre of Brighton; this area forms the central historic spine of Brighton. Only a small section of the area intersects with the study area, which consists of the Palace Pier and a small area of beach to the west of the pier.
Kemp Town Enclosures	Registered Park and Garden Georgian garden designed during the 1820s for the occupants of nearby terrace houses and the Grade II listed **Temple** (**1380996**) added to the garden in 1835.
Arundel House	Grade 1 Listed Buildings (Refs 1379917, 1381659, 1381658, and 1380256 respectively) The cultural heritage assets in this area primarily consist of historic terrace houses on the sea front. These date from the town's development into one of the most prominent resort towns in England during the Georgian period and the early Victorian period. All four Grade I and one Grade II* listed features are terraced houses of this date.
Numbers 15-28 and attached railings	
Numbers 1-14 and attached railings	
Numbers 1-14 and Chichester House and attached railings	
Numbers 1-14 and attached railings	Grade II* Listed Buildings (Refs (1380838) and (1381700) respectively) See description above.
The Palace Pier	The Palace Pier was constructed in early 20th Century.
87, Various	Grade II Listed Buildings Sea defences in the area have been listed alongside the seaside amusements and include two Groynes: Groyne on the beach to the west of The Palace Pier (1381695) (the Albion Groyne) and Banjo groyne on the beach at the bottom of Paston Place (1381693). Other utilitarian assets include a large volume of lamp-posts (1379916, 1381660, 1381661, 1380704, 1381697, 1381759 and 1381694) and K6 Telephone Kiosks (1381753 and 1392289).
Designated cultural heritage assets – Kemp Town (Area 6)	

Table 3.4 Designated cultural heritage assets located within the scheme areas

Asset	Description
Cliftonville Conservation Area	Located between The Avenues and Old Hove Conservation Areas and characterised 'by predominantly residential area, with pockets of small scale workshop use and Victorian shop frontages along the main routes through the area. The area illustrates the changing architectural fashions of the period. Classical stucco facades are common and semi-detached villas prevail. The early terraces are still evocative of the Regency period, the later streets have a more varied, and less refined classical detail, sometimes called 'Italianate railway architecture.'
Old Hove Conservation Area	Follows on from Cliftonville to the eastern boundary of Pembroke & Princes Conservation Area. Falls along the line of the original Hove village and, as with other Conservation Areas between Brighton Marina and the River Adur, its character (where it intersects with the study area) is predominantly defined by 19th century seaside resort development, with some 20th century developments.
Pembroke & Princes Conservation Area	Lies between the Old Hove and Sackville Conservation Areas and characterised by the 'only large group of Victorian and Edwardian red brick developments in Hove. The area south of New Church Road followed the development of the northern half of the area, much being built in the interwar years.'
Sackville Gardens Conservation Area	Western border terminates on the line of gardens to the rear of Walsingham Road. The area is primarily residential in nature, with most houses and villas dating to the 19th century. Those buildings facing the sea are generally much larger and grander than the smaller domestic buildings away from the seafront. The area has strong visual and physical links through Walsingham Road, Sackville Gardens and Westbourne Villas from New Church Road to the sea.
The Avenues Conservation Area	The most easterly Conservation Area. As only a very limited area is included in the study area, it has been excluded from further consideration.
19, Various	Grade II Listed Buildings Primarily sea-side villas and terraces in the east end of the scheme, which date to the rise of Hove as a seaside resort during the 19th century. Outside of this area is dominated by mid-19th century **shelters along the seafront** (**1210002, 1292365, 1187598**).

Non-designated cultural heritage assets

Table 4.4 Non-designated cultural heritage assets

Asset	Description
Non-designated cultural heritage assets – Shoreham Port frontage (Project Areas 1, 2, 4 & 7)	
Some non-designated cultural heritage assets - these are shared with the Kings Esplanade area at The Lagoon (see below)	
Non-designated cultural heritage assets – Kings Esplanade (Area 5)	
The non-designated historic assets are more varied in type than the designated heritage assets. A range of early 19th century residential properties in Kings Esplanade have not been designated, but are locally listed (LLHA0195, LLHA0093, LLHA0102) as well as some later examples, which are also locally listed (MES26537). There are some assets relating to the pre-modern period of the area, with a possible Sea Henge (MES33122) (though it may be a groyne) and the possible sites of Hove during the medieval period (MES1040, MES16720), though much of the earlier traces have been removed by modern expansion and inundations from the sea. Other heritage assets include 19th century lawns on the Western Esplanade (MES28901) and the site of former brickyards (MES29380). There are two locally listed shelters in the Kings Esplanade area that are not Grade II listed (LLHA0098) and locally listed post-boxes (MES28961, MES29047) and a locally listed lamp-post (MES29043). An Archaeological Notification Area (ANA) covers some of this study area (see **Figure 1, Appendix C**): Old town and Shoreham Harbour. This covers the western half of the beach front and extends into the area of Portslade-By-Sea. The ANA contains potential prehistoric sea beds and a post-medieval harbour. The ANA indicates the existence, or probable existence, of archaeological heritage assets. It has been created from the information held on the West Sussex Historic Environment Record (HER). The purpose of the ANAs is to identify where there is a likelihood of archaeological work being necessary, when land development of any kind is planned (West Sussex County Council, 2018). The HER shows that there is one non-designated wreck site immediately west of Area 5 (Cargo Vessel: MES415). This is shown on **Figure 2, Appendix C**.	
Non-designated cultural heritage assets – Kemp Town (Area 6)	

Table 4.4 Non-designated cultural heritage assets

Asset	Description
The non-designated historic assets are more varied in type than the designated cultural heritage assets. Assets relate to prehistoric (Bronze Age) period and the original Saxon/early medieval core of the town, with military and industrial assets as well. There are two electric railways in the area, the now demolished 19th century Brighton – Rottingdean Railway (MES33491) and the extant Volk's Electric Railway, which was the first public electric railway in Britain, built in 1883 (MES145). The two main asset types recorded in the HER are late 19th/early 20th century lamp-posts (MES29048, MES29014, MES29027, MES29028) and wrecks off Palace Pier (MES441, MES442, MES433, MES429, MES1137)(see **Figure 3, Appendix C**). The lamp-posts are locally listed as well as 19th /20th century post boxes (of which there is one in the area (MES29011)).	

Undiscovered archaeology

The study area in general has a high potential for undiscovered archaeological remains. The whole study area has Saxon/Early medieval origins and human occupation is known in the wider area during the prehistoric period. Such a long continuity of human presence increases the potential of archaeological remains in the area. The rapid expansion of urban development in the 19th to 20th centuries may have diminished the quantity of earlier remains or damaged them.

Paleoenvironmental potential

The potential of our present-day shorelines to provide palaeoenvironmental material is well known and the topic of many books and journals[2]. As coastal areas change over time, palaeoenvironmental deposits, such as gravel beds, mud flats or tidal wetland (as well as potential archaeological deposits), become part of coastal stratigraphic sequences and, when found, can be invaluable in understanding the processes that formed the current coastal regions and provide information on where they may head in future.

There is currently limited evidence of palaeoenvironmental remains in the whole study area (all three sections). Brighton and Hove form part of the South East Rapid Coastal Zone Assessment Survey[3] (Coastal Stretch 18). The assessment concluded that there are palaeoenvironmental remains along the scheme alignment, but further investigation is required to better understand the extent of these remains.

4.3.2 Potential Effects

Designated Cultural Heritage Assets

There is potential for the construction of the new groyne field in Area 5 to result in indirect impacts to the setting of designated cultural heritage assets due to works disrupting the sea views that form much of the character of Hove's cultural heritage. This impact will be temporary and is unlikely to be significant as no direct physical impacts are anticipated to the cultural heritage assets themselves.

On completion, the improved defences will present a long term beneficial impact to designated cultural heritage assets by providing them with additional protection from flooding and will preserve the beach front from erosion, which forms an important part of the setting of most cultural heritage assets in the study area.

There is potential for the works in Area 6 to result in indirect impacts to the settings of designated cultural heritage assets. These impacts are unlikely to be significant as the works will be temporary and intermittent and no direct impacts are anticipated to the heritage assets themselves. Many of the designated cultural heritage assets are located on the promenade (a level above where the works) and, would have limited views of the works.

There is potential for the proposed works to impact upon the setting of Kemp Town Conservation Area, Cliffe Conservation Area and The Valley Gardens Conservation Area. These impacts are unlikely to be a significant change as shingle recycling works already take place in these areas.

[2] E.g. Anthony, E.J. (2008) Shore Processes and their Palaeoenvironmental Applications; *Volume 4 of Developments in Marine Geology*.

[3] Wessex Archaeology (2013) South East Rapid Coastal Zone Assessment Survey: Phase 1, Desk-Based Assessment. Source: https://historicengland.org.uk/images-books/publications/se-rczas-phase1-desk-based-assessment/se-rczas-phase1-desk-based-assessment/, accessed 12/10/18.

There is potential for marine deliveries of shingle from Area 6 to Areas 2 and 5 to result in likely significant effects to wreck sites in the area. The route of such deliveries should be considered further to avoid damage as far as possible.

Non-designated cultural heritage assets

There is potential for the proposed works in Areas 2,4 and 5 to impact upon below ground archaeology located within the Archaeological Notification Area. The ground disturbance associated with previous developments, reduces the possibility of archaeological remains being uncovered in most of this area however it is uncertain whether there is potential for likely significant effects and therefore further investigation should be undertaken.

There is potential for construction works in Area 5 to impact upon the settings of non-designated cultural heritage assets located along the sea front. This impact will be temporary and is unlikely to be significant as no direct physical impacts are anticipated to the heritage assets themselves. On completion, no potential likely significant effects on the setting of these cultural heritage assets are anticipated, as the beach front is defined by the presence of groynes, and the proposed works to the existing groynes and construction of similar structures, will not materially change the setting of the area.

There is potential for the proposed works in Area 6 to impact upon the setting of non-designated cultural heritage assets during the proposed extension to existing shingle collections and associated works in this area. It is anticipated that any impact will not be significant as most of the assets are on the promenade, which is on a higher level than the beach.

Beneficial effect to non-designated cultural heritage assets due to the improved flood protection as a result of the operation of the proposed scheme. The scheme will also prevent beach erosion, thereby preserving a vital aspect of the setting of all extant historic assets.

Undiscovered archaeology

There is potential for the construction of the concrete flood wall at Hove Deep Sea Anglers Club (Area 4) and rock armour revetment at Lorry Park to result in direct impacts to undiscovered prehistoric and post medieval archaeology as these works are located within the Archaeological Notification Area. The ground disturbance associated with previous developments reduces the possibility of archaeological remains being uncovered in most of this area however it is uncertain whether there is potential for likely significant effects. Further work is required to fully understand the nature and extent of archaeology in this area.

There will be a beneficial effect for undiscovered archaeology due to the improved flood protection which will result from operation of the proposed scheme. The scheme will also prevent beach erosion, thereby preserving a vital aspect of the setting of all extant historic assets.

There is potential for the proposed works to impact upon unknown archaeological sites or artefacts. It is uncertain whether there is potential for likely significant effects and therefore further investigation should be undertaken.

Paleoenvironmental potential

There is potential for the deep piling required to construct the groynes in Area 5 to have a potential likely significant effect upon paleo-environmental remains. A similar construction footprint to the existing groyne field should be used to reduce likelihood of damage and logs of ground investigations should be used to determine the presence and depth of such remains. The coastal area lacks investigation into potential palaeoenvironmental and archaeological remains. A scheme of Geotechnical ground investigations, consisting of boreholes would provide a greater understanding of possible palaeoenvironmental remains.

4.3.3 Next steps

The following actions are recommended to inform the next stage of environmental assessment:

- The route of marine deliveries to Areas 2 and 5 should be further considered to avoid damage to wreck sites in the area;

- Further work is required to fully understand the nature and extent of archaeology along the Brighton to Shoreham Port area. The coastal area lacks investigation into potential palaeoenvironmental and archaeological remains.
- Consultation with the County Archaeologist should be undertaken to determine an appropriate programme of further archaeological investigation and mitigation in the areas of the proposed works.

4.4 Townscape, seascape and visual amenity

4.4.1 Baseline

Townscape, Seascape and visual amenity baseline information has been collated from a review of the following documents:

- Strategic Environmental Assessment, Environmental Report, Brighton Marina to River Adur Flood and Coastal Erosion Risk Management Study, Brighton and Hove City Council (CH2M Hill /Halcrow, June 2014).
- Sussex Extensive Urban Survey, Brighton and Hove Historic Character Assessment Report (Roland B Harris, March 2007).
- The Urban Characterisation Study (B&HCC, 2009, https://www.brighton-hove.gov.uk/content/planning/heritage/urban-characterisation-study).
- Landscape character assessment of West Sussex (West Sussex County Council, 2003, https://www.westsussex.gov.uk/land-waste-and-housing/landscape-and-environment/landscape-character-assessment-of-west-sussex/).
- Seascape Assessment for the South Marine Plan Areas; MCA 7: Selsey Bill to Seaford Head (Marine Management Organisation https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/321936/1037g.pdf
- A site survey undertaken in July 2016.

Landscape designations

The following designations have been identified by the desk study:

- There are no statutory or local landscape designations within the proposed works areas.
- The boundary of the South Downs National Park extends to within 570 metres of the proposed beach material extraction area (Area 6) at the eastern end of Kemp Town beach.
- Registered Park and Gardens are a non-statutory designation intended to safeguard landscapes of special historic importance. The southern boundary of Kemp Town Enclosures Registered Park and Garden (Grade II (of national importance)) extends to within 50 metres of the beach material extraction area (Area 6).

Landscape character – regional overview

The proposed works are located within National Character Area (NCA) 126, South Coast Plain. The NCA description notes that "*there is significant urban development, with settlements along the coast dominated by..an extensive string of seaside towns between Brighton and Southampton. Modern marinas and harbours have also added to the harbor landscape. Although heavily developed and highly populated, there is a feeling of openness, particularly where seas views reveal wide expanses of sea and sky..Long, linear shingle beaches…are important coastal features. The area is generally very low lying and heavily*

defended against flooding and erosion with various schemes in place..Protection against flooding remains a priority to encourage growth…"

The western end of the proposed works, adjacent to Shoreham Harbour, is mentioned in West Sussex County Council's landscape character assessment (2003). The land management guidelines for SC1: South Coast Shoreline, describe the long narrow South Coast Shoreline character area as a "*distinctive, low, open and exposed landscape which has an overriding visual and physical association with the sea*". Characteristics include the "*Influence of extensive linear urban coastal resort development. Relatively narrow undeveloped sections of coastline behind beaches…Shingle habitats of national importance, notably at Shoreham…Frequent wooden and rock groynes and breakwaters*."

Seascape character

The characteristics of the seascape are described in Marine Character Area (MCA) 7 include:

- Long shingle beaches characterising the western section of the MCA, serving as the focal point for a number of popular seaside resorts including Bognor Regis, Worthing and Brighton.
- Sea-based recreational activities are popular, including watersports around Brighton, diving off Selsey Bill, bird watching at Pagham Harbour and fossil hunting on the beaches at Bognor Regis.
- Some of Britain's largest coastal resorts at Brighton, Worthing, Littlehampton and Bognor Regis. Coastal towns form a colourful and busy focus along the coast with hotels, attractions, piers and recreational activities
- Brighton's niche as a cosmopolitan cultural centre continues a long tradition from the Prince Regent's 18th -19th century visits which produced the iconic Royal Pavilion.
- Coastal defences are a key feature of the coastline, including groynes, concrete defences at cliff bases
- Views seaward are frequently to an unbroken horizon with the main shipping traffic being located at a greater distance into the channel. This creates a large scale and open sense of space.

The MCA description states "*The coastline of the MCA is almost entirely developed, with a mixture of residential and coastal resorts including Brighton, Worthing, the iconic Butlins at Bognor Regis and Littlehampton. Brighton is a historic seaside city which expanded rapidly following the arrival of the railway in 1841. Groynes are used extensively across the coast from Selsey Bill to Brighton Marina and sea walls from Brighton to Littlehampton and around Newhaven, extending the influence of landward development into the sea. There are also piers at Brighton and Worthing which provide a focus of activity, movement and light along the coastline*".

Local landscape/townscape character areas and visual amenity

Local landscape/townscape character areas have been defined in relation to the six proposed works areas. The character of the coastal frontage throughout these sites has been heavily influenced by the development, both industrial and urban, of the adjacent land backing onto the seafront. The existing character and visual amenity of the seven proposed works areas is summarised as follows, presented from west to east:

<u>Area 7: Shoreham Outer Layby Beach</u>

This area comprises the eastern end of Southwick Beach and is characterised by a Seabee revetment fronted by a narrow pebble beach. This frontage is bounded in the west by East Breakwater and in the

east by a rock groyne. The beach is backed by a substantial seawall behind which is a located fencing fronting industrial warehousing associated with Shoreham Harbour.

Area 1: Shoreham frontage

This area comprises the Southwick Beach and is characterised by a pebble beach of varying gradient and width (approximate average width c. 40-55m), backed by substantial sea defences in the form of sheet pile and mass concrete walls and revetments, behind which is located industrial warehousing associated with Shoreham Harbour. Industrial storage tanks and plant, steel palisade security fencing, car parking, wind-turbines and an imposing smoke stack are detracting features and further strengthen the industrial character of the landward side of the frontage. This becomes particularly pronounced at the eastern end of the area where Basin Road South, the main access road serving the harbour industrial area, runs immediately adjacent to the beach seawalls. Towards the western end of the area, a row of beach huts and a beach café (Carats Café Bar), set down behind the tarmac pedestrian promenade which runs directly adjacent to the seawalls, and small areas of unmaintained ornamental shrub planting lend a softer seaside influence to the character of the immediate beach frontage. Rock and timber groynes are a regular feature along the beach and KeyKlamp balustrades form a continuous barrier along the seaward edge of the promenade. Building materials in the vicinity include corrugated steel sheeting, brick, rendered concrete and timber cladding. Despite the strongly industrial and generally dilapidated character of the area, the beach has a tranquil and remote feel to it and it appears to be fairly well used for recreation and relaxation in appropriate weather. Visual receptors comprise beach users, pedestrians and cyclists using the coastal promenade, visitors to the Carats Café Bar, workers in adjacent industrial premises and vehicular users of Basin Road South.

Area 2: Shoreham frontage

This character of this area is similar to the western end of Area 1 but has a more neglected and desolate feel and is of generally lower landscape quality. Moving eastwards, the beach becomes wider overall (approximate average width c. 60-75m with some narrower sections). The western section is split by a rock revetment into a higher, landward linear platform of shingle and rubble and a lower pebble beach. Timber groynes are replaced with more widely spaced rock and rusting steel groynes and piles of rubble waste and a steel palisade fenced area further detract from the character of the frontage. Some parts of a bund on the landward wide of the beach are vegetated with maritime scrub.

Moving eastwards this area becomes physically and visually separated from the adjacent access road and industrial development by a continuous concrete wall, approximately 2.2m high, that runs along the back of the beach. The wall forms a vertical extension to a smaller sheet pile wall in front on the beach side. Towards the eastern end of the western section of beach, the wall is replaced by a high, timber reinforced shingle bank. Groynes are largely absent along this section which has a relatively remote and tranquil feel to it due to this separation and appears to be moderately well used as a result.

The beach area appears far less popular for recreation than Area 1 although it is known locally to attract nudist visitors. Visual receptors comprise occasional beach users, workers in adjacent industrial premises and vehicular users of Basin Road South.

Area 4: Lorry park, Western Esplanade and Hove Deep Sea Angler's Club

At the western end of this area, Basin Road deviates further away from the beach and an open, gravel surfaced linear platform has been created above a vegetated bank which drops down to the pebble beach. This platform, known as the Lorry Park, extends for some 270 metres eastwards where it terminates adjacent to a large rock groyne at the western end of Western Esplanade. The beach area at this end (approximate average width c. 40-65m), appears less used for recreation than the western end of Area 2 and Area 1. Due to the physical barriers separating the beach from the hinterland, visual receptors in this area are limited to occasional beach users.

At Western Esplanade, the industrial harbour-side development to the west ceases to influence the character of the sea frontage and the beach (approximate average width c. 50-65m) assumes a more

urbanised feel due to the presence of a contiguous row of beachside residential properties, behind which runs Western Esplanade road and, to the east of this, the commencement of the beachside promenade adjacent to Western Lawns. The western end is protected by a short length of rock revetment and dilapidated timber groynes are frequent along the terraced pebble beach, including a 115m long, degrading timber structure than runs along the low water line at the western end of the beach. The section of beach adjacent to the properties is privately owned and is closed to the public. The beach at the eastern end of Area 4 adjacent to Western Lawns is public. Visual receptors include the residents of the properties that line the beach and users of the adjacent private beach, users of Hove Deep Sea Anglers Club and recreational users of the promenade and adjacent public beach.

Area 5: King's Esplanade

This section of seafront in Hove has a distinctly urban character due to the presence of the wide tarmac promenade (which ranges in width from c. 8.5m to 22m) and cycleway (National Cycle Route 2) which are backed by Hove Street and a large open car park at the western end and the King Alfred Leisure Centre and a series of seafront blocks of flats to the east. These residential buildings are largely modern but they include some historic late Victorian buildings such as the flamboyant St Aubyns Mansions. The beach is backed by a flint and mortar clad concrete seawall which is capped by dressed and shaped granite blocks on top of which run some cast iron seafront railings. Granite steps and slipways provide access to the beach at regular intervals to generally coincide with approximately 8 concrete groynes that are located along Area 5. The seawall and railings date from approximately 1885 and have value not only as historic features but as distinctive landscape features that lend a strong sense of place to the locality and also provide a unifying element with other areas along the seafront, notably the matching railings present on sections of the Brighton seafront. Traditionally styled cast iron bench seats populate the promenade at intervals and overlook the beach. The pebble beach shelves down to the water from the seawall and undulates in width (approximate average width c. 50-65m), and level between the groynes. To the east of the junction between King's Esplanade and Medina Terrace, the seafront promenade widens materially (to c.22m) and a Victorian seafront shelter is located within a bay extension in the promenade and seawall. The promenade and the beach in Area 5 are popular for general leisure time and are well used, particularly in summer months. Visual receptors include recreational users of the promenade, cycleway and beach, residential receptors in the numerous flats which overlook the beach and vehicular users of Hove Street and King's Esplanade.

Area 6: Kemp Town

The eastern end of Kemp Town beach is substantially wider (ranging from c. 80m to c.115 metres in width) and topographically more varied than the beaches in Areas 1-5. The beach drops in level from the back of beach to the waterline in a series of platforms and a substantial raised bund of pebbles runs along the landward side of the section designated as a naturist beach. The beach is immediately backed along its landward edge by a steel 3-rail balustrade which marks the edge of a tarmac footway beyond which is a narrow strip of grassland and low vegetation and the small scale Volks Electric Railway (including the associated Black Rock Station building). Madeira Drive runs adjacent to the railway and this is in turn backed by the linear beachside extension of the Kemp Town Enclosures Registered Park and Garden which comprises areas of mown grass bank, shrub planting, the Old Reading Room listed building, tarmac paths and an extensive scrub covered bank at its western end. This area is backed by formidable retaining walls which support Marine Parade. In the east, the local character is influenced by the adjacent presence of Black Rock car park, an extensive raised concrete promenade which extends for some 280 metres to the east of the Black Rock Railway Station and the substantial concrete seawalls around Brighton Marina and its associated development. A large concrete groyne with flint and mortar cladding on the raised walls on its upper landward segment is located close to the eastern end of the beach. Some 140 metres to the west of this is another substantial groyne which at present is buried under shingle except for its seaward end. The beach and promenade area appear to be popular areas for leisure. Visual receptors include recreational users of the promenade and beach, cyclists along National Cycle Route 2 and vehicular users of Madeira Drive and Black Rock car park. There are longer distance elevated views over the beach from the residential receptors in the flats on the two top floors of Arundel Terrace (some 135m to the north) as well as views from the pedestrian footways that run along Marine Drive and lower down along the top of the Kemp Town Enclosures embankment and retaining wall.

4.4.2 Potential Effects

Landscape designations

There is no inter-visibility between the South Downs National Park and the proposed works areas due to existing topography and therefore no significant effect on the visual amenity of the National Park is anticipated.

There are no views between the principal part of the Kemp Town Enclosures Registered Park and Garden to the north of Marine Parade and the proposed works areas due to existing topography. There are views from the southern part of the asset south of Marine Parade over the proposed source area of beach material extraction on Kemp Town Beach. These views from the southern part of the asset will be intermittently and temporarily affected by the shingle extraction works as and when these take place but the magnitude of these impacts are likely to be minor. No significant effects on the visual amenity of the Registered Park and Garden are anticipated.

Landscape character and visual amenity

Due to the limited scale and nature of the proposed works, no significant effects on the character of National Character Area 126 or SC1: South Coast Shoreline are anticipated.

Potential effects on local landscape character areas and the visual amenity of people within the study area are summarised below:

Area 7: Shoreham Outer Layby Beach

Potential temporary adverse impacts on visual amenity of users of beach and coastal path / cycleway users during recharge and recycling operations are unlikely to be significant. No potential likely significant impact on visual amenity is anticipated.

No potential likely significant effect on landscape/ townscape character are anticipated due to high capacity of receiving character to accommodate proposed works and pre-existence of similar operations. No potential likely significant effect on seascape character are anticipated beyond slight benefits due to the widening of the beach as a result of recharge.

Area 1: Shoreham frontage

Potential temporary adverse impacts on visual amenity of users of Carat's Café Bar, beach huts, beach and coastal path / cycleway users during construction of new flood wall are unlikely to be significant. No potential likely significant effect on visual amenity is anticipated.

Potential long-term adverse impacts on visual amenity of users of Carat's Café Bar and adjacent beach huts due to reduction in visibility of sea as a result of new flood wall and intermittent temporary impacts due to beach recharge operations. It is uncertain if there is potential for likely significant effects. Further assessment of visual amenity will be required to confirm the potential effect.

Potential long-term minor adverse impacts on visual amenity of users of coastal path/cycleway due to reduction in visibility of beach as a result of new flood wall and intermittent temporary impacts due to annual beach recharge operations. It is uncertain if there is potential for likely significant effects. Further assessment of visual amenity will be required to confirm the potential effect.

Potential long-term minor adverse impacts on visual amenity of beach users due to increased sense of landward enclosure as a result of new flood wall and intermittent temporary impacts due to annual beach recharge operations are unlikely to be significant. No potential likely significant effect on visual amenity is anticipated.

No potential likely significant effect on landscape/ townscape character are anticipated due to high capacity of receiving character to accommodate proposed works and pre-existence of similar features. No potential likely significant effect on seascape character are anticipated beyond slight benefits due to the widening of the beach as a result of recharge.

Area 2: Shoreham frontage

Potential temporary adverse impacts on visual amenity of users of beach and Basin Road South (vehicle users, cyclists and pedestrians) during construction of new revetment are unlikely to be significant. No potential likely significant effect on visual amenity is anticipated.

Potential long-term minor adverse impacts on visual amenity of beach users due to new rock revetment anticipated to be offset by beneficial impacts of removal of tipped waste and rationalisation of existing degrading revetments. No potential likely significant effect on visual amenity is anticipated.

Potential beneficial impacts on landscape/townscape due to rationalisation of existing degrading revetments and neutral effects of new revetment due to high capacity of receiving character to accommodate proposed works and pre-existence of similar features. No potential likely significant effect on seascape character are anticipated.

Area 4: Lorry Park, Western Esplanade and Hove Deep Sea Angler's Hut

Potential temporary adverse impacts on visual amenity of users of beach, coastal path / cycleway users, Western Lawns seaside promenade and Hove Deep Sea Angler's Hut during construction of new temporary rock revetment and new flood wall are unlikely to be significant. No potential likely significant effect on visual amenity is anticipated.

Potential long-term minor adverse impacts on visual amenity of users of Western Lawns seaside promenade due to reduction in visibility of sea as a result of new flood wall and due to increased sense of landward enclosure as a result of new flood wall. It is uncertain if there is potential for likely significant effects. Further assessment of visual amenity will be required to confirm the potential effect.

Potential long-term minor adverse impacts on visual amenity of beach users due to partial replacement of existing vegetated embankment with new temporary rock revetment along western section. It is uncertain if there is potential for likely significant effects. Further assessment of visual amenity will be required to confirm the potential effect.

Potential temporary adverse impacts on visual amenity of residents in adjacent beachside properties (Western Esplanade), users of private and public sections of beach and users of Western Lawns seaside promenade during beach recharge operations are unlikely to be significant. No potential likely significant effect on visual amenity is anticipated.

Potential minor adverse impacts on landscape/townscape due to partial replacement of existing vegetated embankment with new temporary rock revetment anticipated to be offset by beneficial impacts of removal of tipped waste and rationalisation of existing degrading revetments and high capacity of receiving character to accommodate proposed works and pre-existence of similar features. No potential likely significant effect on seascape character are anticipated.

Potential minor adverse impacts on landscape/townscape due to new flood wall and beach recharge anticipated to be offset by the high capacity of receiving character to accommodate proposed works and pre-existence of similar features. No potential likely significant effect on seascape character are anticipated beyond slight benefits due to the widening of the beach profile as a result of recharge.

Area 5: Kings Esplanade

Potential temporary adverse impacts on visual amenity of residents in adjacent beachside properties, beach users, pedestrians, cyclists and other users of beachside promenade and vehicular users on Hove Street and King's Esplanade during construction of new timber groyne field on beach are unlikely to be significant. No potential likely significant effect on visual amenity is anticipated.

Potential long-term minor adverse impacts on visual amenity of visual receptors listed above due to visual intrusion caused by new timber groyne field anticipated to be offset to some extent by beneficial impacts of the burying of existing concrete groynes under beach recharge and resulting grading out of beach profile. No potential likely significant effect on visual amenity is anticipated.

Potential adverse impacts of new timber groyne field anticipated to be offset by beneficial impacts of the burying of existing concrete groynes under beach recharge and high capacity of receiving character to accommodate proposed works and pre-existence of similar features. No potential likely significant effect on seascape character are anticipated beyond slight benefits due to the widening of the beach profile as a result of recharge.

Area 6: Kemp Town

Potential long-term minor adverse impacts on visual amenity of users of the promenade and beach, cyclists along National Cycle Route 2 and vehicular users of Madeira Drive and Black Rock car park due to intermittent beach extraction operations. Beach extraction operations may also intermittently affect visual amenity of residents in the two top floors of Arundel Terrace. No potential likely significant effect on visual amenity is anticipated.

Potential minor adverse impacts on landscape/townscape due to beach recharge operations anticipated to be minor due to high capacity of receiving character to accommodate proposed works and pre-existence of similar operations. No potential likely significant effect on seascape character are anticipated beyond slight benefits due to the lowering and slackening of the beach profile as a result of beach extraction operations.

4.4.3 Next steps

The following mitigation and enhancement measures should be considered as part of the detailed design of the proposed scheme. Wall sections are illustrated on the technical drawings in Appendix O to the OBC:

Area 1: Shoreham frontage

Potential mitigation measures

In Wall Sections A-A to D-D, the cladding of the concrete flood wall in brick to match the existing brick types in the area would assist to visually soften and integrate the appearance of the wall. A concrete capping to the flood wall would be practicable and would reflect the extensive use of concrete in the existing sea defences.

On the flood wall face adjacent to the beach huts and Carat's Café Bar (Wall Section A-A and B-B) and the planting area (Wall Sections C-C and D-D) timber cladding could be an option to create a softer, less urban appearance but the disadvantages of its shorter service life; and additional maintenance requirements would need to be considered against this potential benefit.

In Wall Section E-E, a plain concrete finish would most effectively integrate the seawall vertical extension in to the strongly industrial environs.

Existing seating and litter bins along the line of the proposed defence would be reinstated or replaced.

Potential enhancement options

The following measures would assist to enhance the seaside character and visual amenity in the environs of the proposed defence works:

- The removal of some visually intrusive yellow and black barriers and stored concrete revetment blocks at the western end of Section A-A.
- The replacement of any retaining concrete bollards across the coastal path in Section A-A with timber bollards.
- The refurbishment of the existing steel railings on top of the seawall along the back of the beach where dilapidated.
- Additional and/or replacement planting with suitable maritime species in the existing planted area in Section C-C and D-D.

Area 2: Shoreham frontage

Potential mitigation measures

The covering over and infilling of the voids in the proposed rock revetment with beach shingle, including the crest of the revetment, will assist to visually integrate the revetment with the beach.

Locally regrading beach shingle material to bury exposed rusting steel sheet piling that forms the lower part of the seawall at the western end of Area 2.

Wherever feasible, the retention of existing vegetated areas along the back of the beach and replacement of vegetation where removal is unavoidable.

Repairs to timber seawall structure along western end of Area 2 to be undertaken in timber where viable to retain naturalistic seaside character.

Potential enhancement options

The following measures would assist to enhance the seaside character and visual amenity in the environs of the proposed defence works:

- The provision of a more formalised shared use footpath / cycleway which runs along or adjacent to the crest of the new rock revetment (avoiding vegetated areas) would materially improve safe public access along the seafront. The route could also incorporate occasional seating and planting areas to provide points of interest and amenity along the way.
- The removal of dumped piles of rubble on the level platform behind the existing revetment and other detritus including wayward revetment rocks and exposed tops of rusting sheet piles from the beach.

Area 4: Lorry Park, Western Esplanade and Hove Deep Sea Angler's Hut

Potential mitigation measures

The covering over and infilling of the voids in the proposed temporary rock revetment at the eastern end of Area 4 with beach shingle, including the crest of the revetment, will assist to visually integrate the revetment with the beach.

Installing new rock revetment along an alignment that requires removal of existing deposits of poured concrete and screening of exposed edge of rubble platform along back of beach.

Wherever feasible, the retention of existing vegetated areas along the back of the beach and replacement of vegetation where removal is unavoidable.

Potential enhancement option

The following measures would assist to enhance the seaside character and visual amenity in the environs of the proposed defence works:

- The provision of improved beach access points (steps and paths).
- The removal of tipped rubble waste on the level platform behind the existing revetment and other items including wayward revetment rocks, exposed tops of rusting sheet piles from the beach and seawall structures and removal or re-use of defunct large timbers in the timber seawall structure.
- The removal of exposed sections of the defunct degrading timber structure than runs along the low water line at the western end of the beach should beach recharge operations in Year 4 fail to bury it fully.
- The provision of a more formalised shared use footpath / cycleway which runs along or adjacent to the crest of the new rock revetment (avoiding vegetated areas) between the termination of an existing tarmac path at the western end of the existing concrete seawall adjacent to Basin Road South and the eastern termination of the new rock revetment at the eastern end of Area 2 would materially improve safe public access along the seafront. The route could also incorporate occasional seating and planting areas to provide points of interest and amenity along the way.

Area 5: King's Esplanade

Potential mitigation measures

Reduction of the period between completion of construction works and beach recharge operations will reduce the time that adverse visual impacts resulting from the proposed groyne field are anticipated to be experienced by the identified receptors.

Potential enhancement options

The following measures would assist to enhance the seaside character and visual amenity in the environs of the proposed defence works:

- The refurbishment and repainting of the existing cast iron railings on top of the seawall along the back of the beach and down the steps to the beach where dilapidated.
- The refurbishment and repainting of the two Victorian seafront shelters in Area 5.

Due to the material value of the beach areas as a local landscape and visual amenity resource, it is recommended that a Landscape and Visual Impact Assessment (LVIA) is undertaken at detailed design. 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) (Appendix B), which will identify landscape and wider environmental mitigation and enhancement measures associated with the scheme.

4.5 Ground conditions

4.5.1 Baseline

Ground Condition baseline information has been collated from a review of the strategy and from the assessment of coastal processes - Coastal Processes Report - Technical Addendum, April 2018 (Appendix D and the Geotechnical desk Study (November 2016) which was produced for the proposed scheme (Appendix D). The geotechnical desk study divided the frontage into three ground condition study area sections as shown in Figure 4.1 below. These are:

- Section 1 Brighton Peir to Brighton Marina.
- Section 2 Hove Western Lawns to Kings Esplanade.
- Section 3 Shoreham Port Frontage.

Designated sites

Brighton to Newhaven Cliffs SSSI is located approximately 200m from Area 6 of the proposed scheme. This coastal site comprises the length of chalk cliff stretching from Black Rock, Brighton in the west to Castle Hill, Newhaven in the east and includes the wave cut platform at the cliff base. The site provides the best and most extensive exposure of the Offaster pilula zone in England. It is an important collecting site for fauna of the upper Santonian and Lower Campanian due to the excellent accessibility of the cliff base. The cliffs are also an important reference section for the Upper Cretaceous. Black Rock, has attracted scientific interest for over 150 years as a section of outstanding importance for Quaternary Stratigraphy. The landforms, stratigraphy and mammal deposits at Black Rock provide a very valuable record of former sea levels and changing environmental conditions.

Geology

A review of the 1984 and 2006 1:50,000 scale BGS geological map sheet 318/333 (Brighton and Worthing) (Ref 2; 3) was undertaken for the Geotechnical Desk Study. This was supplemented with information from the geological memoir for this sheet, the hydrogeological report series for the South Downs aquifer and the BGS Lexicon of named rock units.

The 1:50,000 geological maps show the proposed scheme to be underlain by two to six units:

- Made Ground
- Beach and Tidal Flat Deposits
- Storm Beach Deposits
- Head
- Lambeth Group

- White Chalk Subgroup

The units listed above are discussed in further detail below:

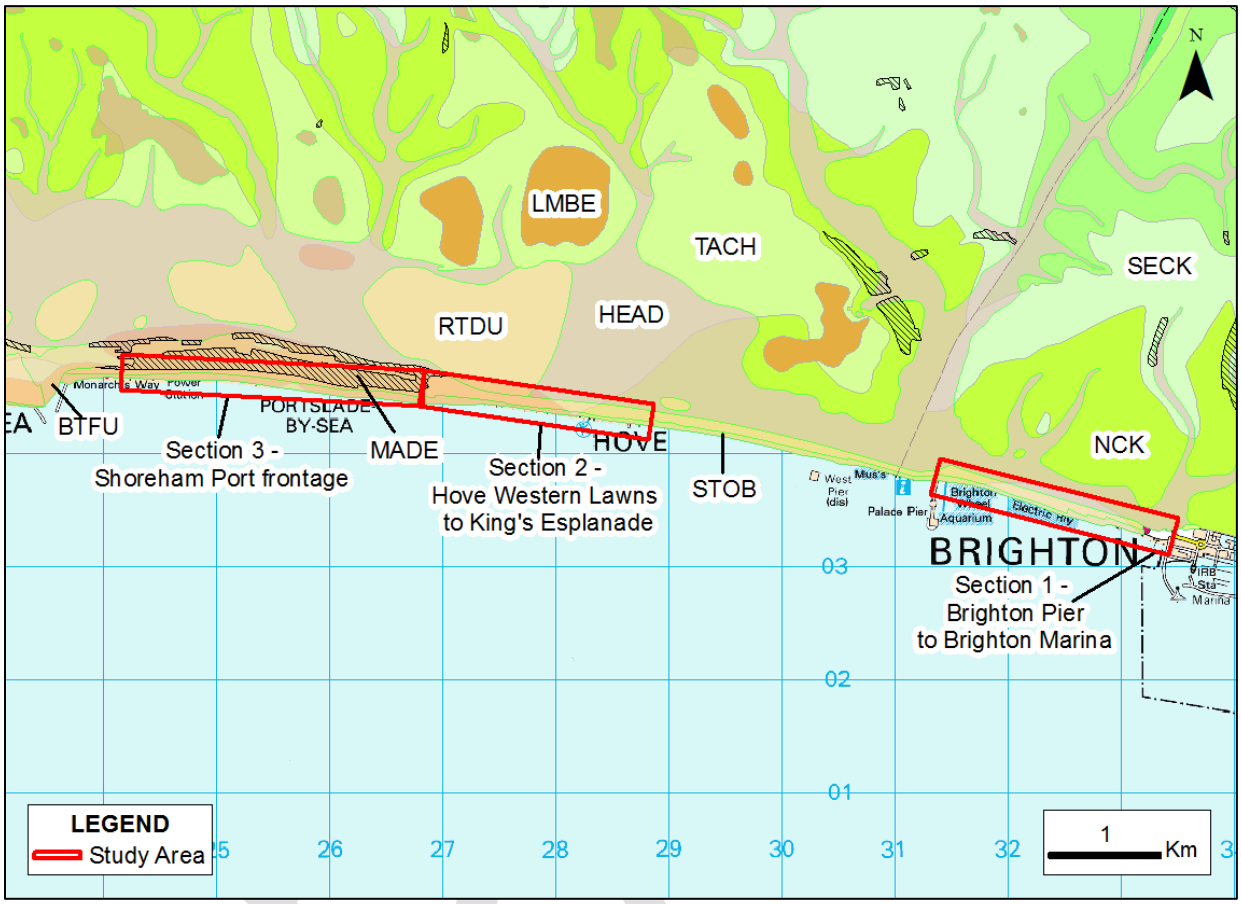

Figure 4.1 Geological map of study area from BGS 1:50,000 geological map

Note large area of made ground mapped in the area of Shoreham Port.

Made Ground

Made ground is mapped as present in Shoreham Port frontage (Section 3) directly north of the current sea defences. It is anticipated that made ground would also be presented along the esplanade directly north and inland of the sea defences between Brighton Pier and Brighton Marina (Section 1) and from Hove Western Lawns to King's Esplanade (Section 2). Made ground is not documented as being present along the foreshore.

Superficial Deposits

Superficial deposits are shown to underlie all of the area and are of Quaternary age (<2.58 million years old). Beach and Tidal Flat Deposits (BTFU) and Storm Beach Deposits (STOB) are the most extensive and consistently overlie the bedrock geology, with BTFU being present on the foreshore below the high water mark and STOB above normal high tide levels. Head deposits may possibly be present locally near to Brighton Marina (Section 1), associated with the Raised Beach Deposits at Black Rock located in land to the north and east of the frontage, and also in Hove (Section 2). They are expected to be largely absent in the Shoreham area beneath the coastal strip south of the railway line.

Superficial Deposits - Beach and Tidal Flat Deposits

Beach and Tidal Flat deposits were encountered in exploratory holes reviewed in the 2016 Desk Study at Shoreham Port (Section 3). They typically occur down to 6 mbgl and are described as black sand and gravel, grey clayey silt, soft grey sandy clay, soft black clay with traces of gravel, and peat. The commonly occur above or below the Storm Beach Deposits.

Superficial Deposits – Storm Beach Deposits

Storm Beach Deposits were encountered in all exploratory holes reviewed in the 2016 Desk Study from Brighton Marina to Shoreham Port frontage (Sections 1 to 3). They typically occur down to 8 - 10 m below ground level (BGL) but at Shoreham Port frontage were recorded to > 11 m bgl.

They are typically described as a variation of loose to dense brown or orangish brown fine to coarse gravel and sand, with the gravels being rounded to subangular.

Superficial Deposits - Head

Head deposits were possibly encountered in two exploratory holes near to Brighton Marina (Section 1), but located >15 m inland from the sea defences, and in Hove (Section 2). They were 0.5 – 1.10 m in thickness and described as “Firm yellowish brown slightly silty, sandy calcareous CLAY with much fine to coarse angular gravel of chalk and occasionally flint.” and “Clay flints” respectively.

Bedrock

The BGS mapping shows that superficial deposits, from Brighton Marina to Shoreham Port, are underlain by the Seaford Chalk Formation, the Newhaven Chalk Formation, the Tarrant Chalk Member of the Culver Chalk Formation, and the Lambeth Group. This transition eastwards, from older to younger strata, is due to the transition between two geological structures – the Old Steine Anticline and the Shoreham Syncline..

Bedrock- Lambeth Group

The Lambeth Group was encountered in exploratory holes reviewed in the 2016 Desk Study from Hove Western Lawns (Section 2) to Shoreham Port frontage (Section 3) with thicknesses increasing westwards from 2.21 m to 10.52 m respectively. Descriptions typically refer to a variation on firm, stiff or very stiff laminated grey, brown, black or blue clay, silty clay, sandy clay, silty sandy clay or carbonaceous clay, with lignite or gravel; and lignite. The lignite interval is also sometimes referred to as “Stromboli” in the exploratory hole records.

Bedrock – White Chalk subgroup

The White Chalk Subgroup was encountered in exploratory holes from Brighton Marina (Section 1) to Shoreham Port (Section 3), with the Chalk directly underlying the superficial deposits from Brighton Marina to King’s Esplanade in Hove. The descriptions of the Chalk from the exploratory hole records reviewed were typically basic, one record (TQ30SW120) at Brighton Marina (Section 1) provided an engineering description, for 5.9 to 10 m bgl, that indicated that the chalk was materially weathered:

“Structureless CHALK composed of a matrix of white sandy silt size fragments with some subrounded gravel size fragments with some subrounded gravel size highly weathered fragments. (Grade VI)”

It should be noted that drilling disturbance in weathered chalk can be material, leading to additional degradation. This can result in logged descriptions that may appear to underestimate the strength of the in-situ material.

Soils and geo-environmental risk (from land)

Along the Shoreham Port frontage, material reclamation and development of the land directly north of the coastal frontage took place from 1863 to 2016. Land use has principally consisted of industrial north of the coastal frontage and comprised fuel and power generation, sewage treatment, industry associated

with the port, construction and waste. Structures on the beach have principally consisted of coastal protection structures and outfalls.

From Hove Western Lawns to King Alfred's Parade, minor reclamation and moderate development of land directly north of coastal frontage took place from 1898 to 1932 with little change up to 2016. Land uses have principally consisted of recreational or residential north of the coastal frontage and structures on the beach have consisted of defence structures, small buildings, marine access structures and outfalls.

Between Brighton Pier and Brighton Marina, moderate development took place directly north of the coastal frontage, on the beach and across the foreshore from 1875 to 1991. Land use has principally been recreational north of the coastal frontage and structures on the beach consist of defence structures, commercial buildings associated with the esplanade, piers, electric railways and the marina.

A number of sites with potential for contamination have been identified in close proximity to the scheme. Past activities within the study area that with the potential to cause land contamination include two coal fired power stations, each with an outfall, two gas works, wharves handling coal, wharves handling timber where timber treatment could have occurred, chemical works using town gas by-products as raw material, engineering works, a roadstone coating plant, a mortuary, a sewage treatment works , landfill sites at Ropetackle (east side of the River Adur) and Adur Recreation Ground (west side of the River Adur) and shipyards along river's edge in Shoreham-by-Sea.

Southwick beach to the south of the former gas works has been subject to much investigation by a variety of agencies working together. As a result, a number of public announcements regarding public safety and health have been made, and statements have advised the public not to collect and eat shellfish from this area.

Present activities within the study area that could cause contamination include an old gasholders site north of Brighton Marina and the A259, three fuel storage depots, which have, in the past, suffered a major spill, a scrap metal wharf, the sewage treatment works at Shoreham, the current gas fired power station, which now uses one of the outfalls previously associated with the coal fired power station and an aggregates business. A further site of potential contamination is at the site located to the east of the power station at the Parker Steel site.

No registered licenced waste management facilities, registered landfills or waste transfer sites or waste treatment or disposal sites are located in the vicinity of the coast, except in the Shoreham Port section, where there are two licenced waste management facilities and registered waste transfer sites, one current and one surrendered, located directly north of Basin Road South.

A preliminary UXO risk assessment undertaken by 6 Alpha (included as Appendix C of the Geotechnical Desk Study, November 2016 – Appendix D) noted a medium probability of UXO encounter.

The Environment Agency Flood Risk Map indicates that areas of Western Lawns, Hove Lagoon and Shoreham Port are affected by flooding and lie within Flood Zone 2 (0.1% or greater annual probability of flooding from the sea) or 3 (0.5% or greater annual probability of flooding from the sea).

A review of groundwater designations and vulnerability maps show the White Chalk Subgroup to be a Principal aquifer, the Lambeth Group to be a Secondary A aquifer and the superficial deposits to be Secondary A and Secondary undifferentiated aquifers.

The outcrop area of both the White Chalk Subgroup and Lambeth Group are depicted as high groundwater vulnerability zones. Close to the coast, groundwater levels are anticipated to be in continuity with tidal levels.

4.5.2 Potential Effects

Designated sites

The cliffs of Brighton to Newhaven Cliffs SSSI form the landward boundary to Brighton Marina and as such are protected from any coastal defence works that may occur within the vicinity of the marina. No potential likely significant effect on this designated site is anticipated.

Geohazards

There is potential for the proposed scheme to impact upon the following geohazards which may be present in the area of the proposed scheme as they are associated with the ground conditions likely to be encountered at the site:

- Made Ground: Variable characteristics, including presence of cobbles and boulders;
- Beach and Tidal Flat Deposits: Very low strength, highly compressible. Lateral and vertical variability in characteristics, e.g. possible presence of 'historic' drainage channels with organic/ peat infill;
- Storm Beach Deposits: High permeability. Lateral and vertical variability in characteristics, especially grading and density;
- Chalk (structureless and structured): Weak rock, presence of large flints, high permeability, dissolution features;
- High groundwater levels/ tidal influence;
- Unexploded ordnance.
- The superficial deposits may vary along the sea defences from soft clay with lenses and pockets of peat and organic clays, to sand and gravel. Given the length of the defences compared with the spacing of existing (and any potential future boreholes), further lateral and vertical variability of superficial deposits should be anticipated, including localised pockets and/or channels of weathered or soft deposits (such as peat lenses) that are not encountered in the ground investigation.

It is uncertain if there is potential for likely significant effects and therefore this should be further considered at detailed design

Soils and geo-environmental risk (from land)

There is potential for construction of the proposed scheme to result in disturbance of any contamination present in the ground. This could result in potential likely significant effects on human health (construction workers and end users), water quality and, indirectly, ecology. Further sampling and analysis should be undertaken on the Made Ground and underlying soils in order to fully quantify the risks.

The nature of the scheme is such that material volumes of waste soils are not anticipated to be generated. Should waste soils be generated there is the potential for likely significant effects as a result of inert, non-hazardous and hazardous wastes being encountered. Testing of this material for disposal and reuse purposes is required to ensure excavated spoil is environmentally suitable for reuse in the scheme or appropriately classified for offsite disposal.

The northern bank of Shoreham Port will be protected from failure and other areas along the open coast subject to elevated levels of flood risk will be better protected from erosion such that the risk of release of contaminants from potentially contaminated sites (such as the sewage works and the power station or storage tanks) as flood protection is improved as a result of the scheme. This will result in a long term beneficial impact both in terms of flood risk and any associated risk from the release of contaminants.

4.5.3 Next steps

The following actions are recommended to inform the next stage of environmental assessment:

- Ground investigation is recommended to inform the outline geotechnical design and provide further contamination baseline data on the soils beneath the site is to be undertaken at detailed

design stage. The scope and specification for the investigation should be developed once the conceptual design of the proposed defences is finalised.

- A detailed UXO threat and risk assessment should be undertaken at detailed design phase. This should be undertaken as a first step to inform any ground investigations.

- The potential for waste soils to be generated should be re-evaluated once the scheme is finalised and the ground investigation results are available.

4.6 Transport and navigation

4.6.1 Baseline

Transport

A desk based assessment which included the review of Ordnance Survey mapping, aerial photography and local authority websites, plus site visits during 2017, were used to inform the existing baseline for this preliminary analysis.

The A259 runs immediately north of the proposed scheme. It runs along the south coast connecting, as part of the main east-west road along the south coast, Worthing in the west to Pevensey in the east. It is the main coastal road within the area of the proposed scheme with residential and commercial properties stepped back from the road mainly on the northern side. Basin Road at the western extent of the scheme connects the A259 to Shoreham Port, and is heavily used by port traffic as well as domestic traffic and beach users.

Road accessible tipper lorries are regularly used as the method of transporting bypassed beach material from Shoreham Beach to Shoreham Outer Layby Beach and Southwick Beach by Shoreham Port Authority. In the past, beach material sourced from Kemp Town has also been collected by tipper lorry and transported along the A259 to the feed location.

Vehicle access to the beach and shoreline can be made at specific access points via Madeira Drive, Kingsway (A259) and King's/Western Esplanade or Basin Road South. Along Madeira Drive access locations are present either side of the Volk's Railway Halfway (Paston Place) station with a demountable bollard present at the eastern location. Along King's Esplanade access ramps are located opposite the junction with Medina Terrace and opposite the car park adjacent to the King Alfred Leisure Centre. Along Western Esplanade, the beach directly adjoins the esplanade without a wall and access is possible in multiple locations. Along Basin Road South access may be possible via the car parks and work sites on the south side of the road.

A plan of access routes is included in Appendix B to the Outline Design Report (Appendix N to the OBC).

Navigation

Receptors which utilize the channel in the area of the proposed scheme are:

- Brighton Marina: located adjacent to the proposed works in area 6. It is an artificial marina which features a working harbor and is also home to Brighton Marina Yacht Club and Lagoon Watersports.

- Shoreham Port: An active shipping port which handles a wide diversity of imported and exported cargoes.

- Brighton Sailing Club: Located between areas 5 and 6.

4.6.2 Potential Effects

Transport

Potential for impact on local road network during construction (due to increased traffic volume, construction vehicles accessing and leaving site and the need to establish safe working areas) and during ongoing beach management operations. It is uncertain whether there is potential for likely significant effects. A transport assessment should be undertaken at the next stage of assessment. This should include a review of the anticipated volume of traffic to be generated and an estimation of plant required during construction. Any mitigation measures should be discussed with the local highway authority in line with best practice and considerate site practices should be employed to ensure minimum disruption.

On completion, the improved defences will present a long term beneficial impact to the local road network (particularly the A259) as they will be protected from erosion and flooding at sustained or improved levels.

Navigation

Potential for impacts on navigation in the area of the proposed works as a result of marine deliveries to Areas 2 and 5 and the marine movement of beach material from Area 6 to Areas 5 and 7. Impacts include the creation of new hazards as a result of additional vessels and water-based plant being present in the channel both at the works sites and potential physical changes to conditions within the channel. It is uncertain whether there is potential for likely significant effects. Consultation with affected parties and consideration of potential mitigation measures should be undertaken at the next stage.

There is not anticipated to be any potential likely significant effect on navigation as a result of the operation and maintenance of the proposed scheme.

4.6.3 Next steps

The following actions are recommended to inform the next stage of environmental assessment:

- A transport assessment should be undertaken at the next stage of assessment. This should include a review of the anticipated volume of traffic to be generated and an estimation of plant required during construction. Any mitigation measures should be discussed with the local highway authority in line with best practice and considerate site practices should be employed to ensure minimum disruption. A detailed Traffic Management Plan is anticipated to be required prior to construction.
- Consultation should be undertaken with the relevant channel users (Shoreham Port, Brighton Marina and Brighton Sailing Club) to minimise potential impacts and to ensure that appropriate mitigation measures are put in place.

4.7 Population, health and economy (including noise)

4.7.1 Baseline

A desk based assessment, which included the review of ordnance survey mapping, aerial photography and local authority (BHCC and ADC) and other websites, as well as site visits during 2017 were undertaken to inform the existing baseline.

Local population

Brighton and Hove is a busy and thriving urban community with a relatively high population density. The conurbation is of regional socio-economic importance, with a heavy reliance on tourism and recreation. The appearance of and good access to the seafront and coastal recreation are important factors contributing to the wellbeing of local communities and the local economy.

A large proportion of the Strategy's coastal urban fringe falls within the 40 % most deprived Super Output Areas in the UK. Only Kings Esplanade and Brighton Marina are outside this threshold. Three areas, to the east and west of Palace Pier and Fishersgate fall within the 20 % most deprived areas in the UK.

Under a No Active Intervention scenario it is predicted that 13 residential properties would be lost to erosion within the first 20 years. This increases to 260 residential properties by Year 100. In addition,

under a No Active Intervention scenario a further 6 residential properties would also be at flood risk under a 0.5 % AEP (1 in 200) event today, rising to 10 residential properties in 100 years. Many properties affected by both erosion and flooding are lost to erosion before they come under flood risk.

There are a number of residential properties located in close proximity to the proposed scheme on Kingsway (A529) and Kings Esplanade.

Local economy

There are a number of business's and industrial premises (including Shoreham Port and Shoreham Power Station and sewage treatment works) located in close proximity to the proposed scheme along Kingsway, Kings Esplanade (and adjoining roads), Western Esplanade and Basin Rd S.

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

Under a No Active Intervention scenario a further 8 commercial properties would also be at flood risk under a 0.5 % AEP (1 in 200) event today, rising to 2 commercial properties in 100 years. Many properties affected by both erosion and flooding are lost to erosion before they come under flood risk.

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. 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.

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.

Tourism and recreation

The coastline provides valuable resources for informal recreation and amenity resources, including land-based recreation (e.g., use of the beach for bathing and swimming, tennis courts, the King Alfred's leisure centre, walking and cycling on Brighton Promenade, etc) and water-based recreation (e.g., rowing, canoeing, surfing, scuba diving, sailing, yacht cruising, motor boating, sea angling, mooring, etc) as well as tourism. Some of these resources are located in areas at risk of flooding.

The coastline between Brighton Marina and the River Adur features some of the country's most iconic tourist beaches. Latest figures released by Tourism South East show the city attracted a total of 11,234,000 visitors in 2016, with total expenditure by visitors to Brighton & Hove estimated to have been in the region of £885.9 million in 2016. The data also shows the city had 9,627,000 day trippers in 2016, while the amount of money spent during their trip increased to £353 million. The city's tourism businesses contribute materially to the local economy and provides employment equivalent to almost 16,000 full time jobs. (Ref - https://www.brighton-hove.gov.uk/content/press-release/latest-tourism-figures-show-citys-pulling-power). Although it cannot be determined how many visitors visit Brighton solely to visit the beach front, it must be agreed that the wide amenity beaches protecting a number of seafront businesses is a vital draw of this seaside town.

A national trail (Monarch's Way) runs along the promenade and coastal frontage from Brighton Pier to the River Adur. Pedestrian access is also available along Madeira Drive between Brighton Pier and Brighton Marina.

National Cycle Network route 2 passes in close proximity to the proposed scheme. When complete this route will link Dover in Kent with St Austell in Cornwall via the South Coast of England.

As further detailed in section 4.9.1 there are 6 Bathing Waters located within 2 km of the proposed scheme.

Noise environment

The main existing sources of noise in the area of the proposed scheme are from the Shoreham Port operations, navigation of the channel by ships and road traffic.

The receptors which will be sensitive to any increase in noise in the area include nearby residents on Kingsway and Kings Esplanade, tourists and recreational users of the beach and bathing waters, Monarchs Way National Trail and National Cycle Network Route 2.

4.7.2 Potential Effects

Local population (including noise receptors)

There is potential for limited short-term impacts on nearby receptors due to an increase in noise levels as a result of piling and other activities during construction as well as during operation as a result of maintenance activities and the movement of beach material from Kemp Town and Shoreham Beach by road using tipper lorries required for ongoing beach management. This increase is anticipated to be minor and temporary and will be controlled using best practice measures. As such this potential impact is not anticipated to be significant. Local communities should be informed, in advance of the works starting, of the extent and nature of the proposed scheme, including timing, and possible impacts.

As an important benefit of the scheme the flood risk for up to 6 residential properties will be reduced immediately following construction, with beneficial impacts to health and well-being.

Local economy

As a potential beneficial impact of the scheme the flood risk for up to 8 commercial properties (including Shoreham Port buildings) and infrastructure such as Shoreham Power Station and sewage treatment works will be reduced immediately following construction, with material beneficial impact to the local economy. This improved protection is anticipated to encourage future development and investment in the local economy along the coast and within Shoreham Port. This will support the planning policy objectives for Brighton and Hove and result in a material net beneficial impact on the local communities and economy over the long term.

Impacts on navigation and associated port operations are considered within Section 4.7.

There will be a temporary beneficial impact as a result of additional income generated for local businesses during the construction period. For example, many construction workers are likely to require temporary accommodation during the construction period. In the context of the Brighton economy this impact will not be significant.

Tourism and recreation

Access to the Hove Deep Sea Anglers car park will be temporarily restricted during construction of the wall around the car park. Consultation has been undertaken with the club and access to the main building will not be restricted. Alternative parking is available for the club members on Basin Rd. As such this potential impact is not anticipated to be significant.

Access to working areas are likely to be restricted during construction. This will result in short term potential adverse impacts as a result of restricted access to and use of beaches during construction of the proposed scheme and beach maintenance operations. There is also potential for temporary disruption to/closure of the Monarchs Way National trail, National Cycle Network Route 2 and other footpaths. Access to the beaches should be maintained as far as practicable and consultation with the relevant bodies should be undertaken to ensure that appropriate diversion routes are in place. As such this potential impact is not anticipated to be significant.

A material beneficial impact is the sustained or improved flood risk for a number of recreational facilities including sailing and rowing clubs, yachting, pleasure boating, dingy sailing, sea angling, diving, water skiing, and many sports clubs along the promenade.

A material beneficial impact of the scheme the amenity value of beaches along the open coast will be improved as the beaches will be widened due to overall increase in beach material from bypassing at Shoreham.

Access to the water and associated water-based recreation facilities along the coast will be maintained and as such this potential impact is not anticipated to be significant.

There is potential for the increase in suspended sediment levels during beach nourishment works and the beach recycling maintenance programme to temporarily impact upon the adjacent bathing waters. This is likely to be a very localized and short lived effect as any fines released by disturbing the material will be quickly distributed by the sea and will naturally settle out in the water column and therefore the effect is unlikely to be significant. The proposed works should be undertaken in early spring or autumn to avoid peak season. Potential impacts on water quality are further considered in Section 4.8 of this report.

Impacts on recreational water users are considered within section 4.8.

4.7.3 Next steps

The following actions are recommended to inform the next stage of environmental assessment:

- Consultation with East Sussex County Council Highways department should be undertaken to ensure that appropriate diversion routes are in place if required.
- There may be opportunities to provide enhanced access for pedestrians and cyclists in accordance with Shoreham Harbour Regeneration and Shoreham Port Authority aspirations in consultation with BHCC, ADC and SPA. These should be further explored during the detailed design stage.
- Access to the beaches should be maintained as far as practicable.
- Local communities should be informed, in advance of the works starting, of the extent and nature of the proposed scheme, including timing, and possible impacts.

4.8 Water and hydromorphology

4.8.1 Existing baseline

The following studies have been used to inform this section of the PEIR:

- A preliminary WFD assessment (Appendix E) has been undertaken to assess the impact of the proposed scheme on the associated WFD waterbodies in terms of changes in biology, water quality and hydromorphology. This has been informed by a review of the Environment Agency Catchment Data Explorer[4] and use of expert judgement to determine impacts at a water body level.
- A 'Geotechnical Desk Study Report' (Appendix D) was produced in November 2016 for the proposed scheme. It summarises the existing ground conditions at the site (including groundwater bodies) from available information and outlines the associated potential geo-technical and geo-environmental risks/implications to the proposed scheme.
- Baseline information on hydromorphology and coastal processes has been collated from a review of the strategy (Technical Appendix to the Strategy – Appendix I. Coastal Processes Report)

[4] http://environment.data.gov.uk/catchment-planning/

(Strategy is included in Appendix C to the OBC) and from the assessment of coastal processes undertaken during the current study - Coastal Processes Report - Technical Addendum, April 2018 (Appendix D).

Flood risk

Flooding by seawater can occur as a result of either overflow or overtopping of coastal or river structures (within tidal range). Overflow is experienced when water levels exceed the height of flood prevention structures; overtopping is experienced when water passes over the flood prevention structures due to wave action.

Shoreham Locked Section is at risk of flooding from the River Adur due to opening and overflow of the lock gates. The gates work such that when the water level outside is greater than that in the basin the gates are pushed open. The water level in the basin is therefore usually kept at the level of the highest astronomical tide (HAT) to ensure the gates do not open. Although the lock gates are not flood defence assets, the opening of the gates can lead to exceedance of the water level in the basin which has been known to cause localised flooding on the northern edge of the basin. The flood extent maps for both a medium sea level rise scenario and upper end sea level rise scenario for the Shoreham Locked Section are included in Appendix B of the 2014 Strategy No Active Intervention Report (Technical Appendix J) (included in Appendix C to the OBC). The level of the lock gates is at approximately a 100% AEP (1 in 1 year return period) water level. Therefore, the current standard of protection, of the locked section of Shoreham Port, taking into account the lock gates, is <100 % AEP which equates to a 1 in 100 year event.

On the open coast the 2014 Strategy noted that none of the defences are expected to experience overflow, either now or following 50 years of sea level rise. Only defences in Kemp Town along Madeira Drive were found to be exceeded by a 0.2% Annual Exceedance Probability (AEP) (1 in 500 year return period) in Year 100 assuming sea level rise. Therefore, the majority of flooding on this frontage during the 100 year horizon will be as a result of wave overtopping.

Rates of wave overtopping under extreme events were calculated during the 2014 Strategy for current conditions (year 0), the process being repeated for anticipated sea levels 20, 50 and 100 years hence. Based on current defence heights, flood extents and depths due to wave overtopping were modelled using TUFLOW and are presented in a series of plans in Appendix C of the 2014 Strategy No Active Intervention (Technical Appendix J) (included in Appendix C to the OBC). The assessment of wave overtopping volumes, defence cross sections and land topography behind defences indicated that breach due to wave overtopping alone would be unlikely along the frontage.

The current Standard of Protection along the open coast ranges from a 100% AEP (1 in 1) to a 0.5% AEP (1 in 200).

Coastal Erosion

The onset of erosion along the frontage is determined by the timings of failure of key defences. In the Strategy, failure of the defences along the Shoreham Port frontage area was estimated to occur by year 10 of the 100 year appraisal period with the locked section of the Shoreham Port being compromised by year 20.

A review of the condition and residual lives of erosion defences along the proposed scheme area has been undertaken for the Outline Business Case and is documented in the No Active Intervention Report – Technical Addendum (Appendix G to the OBC).

Since the 2014 Strategy, despite some refurbishment works undertaken by Shoreham Port Authority to coastal erosion assets along the frontage, continued deterioration of some key assets since 2012 has reduced their expected residual lives and it is predicted that the onset of erosion damages are anticipated earlier than determined in the Strategy.

Under the updated No Active Intervention scenario, failure of the defences along the Shoreham Port frontage area is now estimated to occur by year 5 with the locked section of the Shoreham Port being compromised by year 15. Breaching of the basin to the open sea will result in the previously 'locked' section of Shoreham Port being subject to tidal water levels. A constant water level currently maintained in the basin will no longer be feasible.

Communications with Shoreham Port Authority have highlighted a concern that if the water is allowed to drain out of the basin, then wall failure within the lock would be likely. The water pressure provided by the filled basin currently provides support to the quay walls.

Exposure of the locked section to open water conditions, would result in wide spread flooding and potential failure of the supporting land at the back of the port. This would put property along the north bank of the port and the A259 road at risk of failure. Shoreham Port Authority stated that a recent reclamation on the north bank near the gates was undertaken to prevent a landslide and that neighbouring banks are maintained to prevent slumping.

After breach into the 'locked' section in year 15, by year 25 it is estimated that the made ground of the port will have receded to meet the road on higher land. By year 45 it is predicted there will have been a further 8m retreat and by year 95 there will have been a further 20m retreat.

Groundwater

A review of groundwater designations and vulnerability maps in the area of the proposed scheme show the White Chalk Subgroup (underlying the scheme area) to be a Principal aquifer, the Lambeth Group (underlying the scheme area) to be a Secondary A aquifer and the superficial deposits to be Secondary A and Secondary undifferentiated aquifers. The definitions of these terms, taken from the EA website, are provided below:

- Principal Aquifer: Layers of rock or drift deposits that have high intergranular and / or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and / or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer.

- Secondary A Aquifer: Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers

- Secondary Undifferentiated: Assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.

The outcrop area of both the White Chalk Subgroup and Lambeth Group are depicted as high groundwater vulnerability zones.

Close to the coast, groundwater levels are likely to be in continuity with tidal levels.

Surface water, WFD

The following surface water bodies (as classified under WFD) are located within the immediate vicinity of the proposed scheme:

- Adur (Water Body ID: GB540704116000): this is a heavily modified transitional waterbody with a current overall potential of moderate (unfavourable balance of costs and benefits; action to get to good is disproportionately expensive; and good status is prevented by A/HMWB designations). It is meeting its objective of moderate potential by 2015. It also includes a protected area under the urban waste water treatment directive.

- Sussex (Water Body ID: GB640704540003): this is a heavily modified coastal waterbody with a current overall potential of moderate (disproportionate burdens). It has an objective of achieving good by 2027. It also includes a protected area under the Bathing Water Directive.

The following bathing waters are located within 2 km of the proposed activities:

- Southwick (TQ2435804728);
- Shoreham Beach (TQ2184804429);
- Lancing Beach (TQ2184804429);
- Hove (TQ2922504232);
- Brighton Central (TQ2922504232);
- Brighton Kemptown (TQ3238403503).

Hydromorphology and coastal dynamics

Throughout the frontage of the proposed scheme, the hinterland is protected from the actions of the sea by a shingle beach overlying a fine/medium sand lower beach. The shingle beach reduces wave energy impacting on the shoreline and protects the hinterland from flooding and erosion. Possible sediment inputs to the system are alongshore drift, fluvial inputs and onshore transport of sediment. Possible losses from the system are alongshore transport and the offshore transport of material.

Alongshore drift along the Shoreham to Brighton frontage moves beach material from west to east where it accumulates on the beaches of east Brighton (Kemp Town). This has resulted in narrow and low beaches along the west of the frontage – along the Shoreham reach - and wider and higher beaches in the east.

Material is prevented from moving onto the frontage from the west by the presence of Shoreham Harbour breakwaters. The supply of shingle to the east is similarly interrupted by the presence of Brighton Marina which forms a terminal control structure and defines the eastern boundary of the system. The 2014 Strategy Technical Appendix I - Coastal Processes Report notes that the only part of the frontage where the barrier beach underlain by sand is not the natural state is the area today covered by Brighton Marina. Here the shoreline naturally comprises a chalk wave-cut platform (Black Rock Ledge) with a thin beach deposit at the toe of the cliff. The platform historically had little sediment drift across it, with most shingle being absorbed into the beaches of Kemp Town. This lack of sediment drift is today exacerbated by the presence of the marina breakwaters.

From an analysis of beach profiles during the 1973 to 2017 period and taking account as far as possible the changes to the shoreline due to development of the coastal frontage and beach material bypassing and recycling, it has been determined that there has been approximately 600m^3/yr loss during the 1973 to 2017 period (see Appendix D to the OBC). Considering the confidence limits of the data this confirms that the frontage is fairly stable with little net loss from the frontage and no significant transport of material east of Brighton Marina.

The annual alongshore drift rate from west to east is approximately 16,000m^3 per year (Technical Appendix to the Strategy – Appendix I. Coastal Processes Report).

Offshore the sediments are noted to consist of a mixture of sand and slightly gravelly sand overlying chalk. There are no bedforms, for example, sand banks or bars, of note in the offshore sediments, with the coverage noted as being discontinuous with generally less than 0.5 m thickness overlying the bedrock. There are no material accumulations of coarse sediments in the nearshore area and therefore, it is unlikely that there is a material contemporary exchange of coarse sediments between the beach and offshore.

There are no known shingle inputs from fluvial sources to the Shoreham to Brighton frontage. Therefore, the Shoreham to Brighton frontage presents a naturally closed system with respect to shingle beach material.

The exception to this naturally closed system is the shingle bypassing operations undertaken by Shoreham Port Authority. Under the Shoreham Harbour Acts, Shoreham Port Authority have powers to 'remove, use, sell or dispose of any shingle on West Beach' in Shoreham (on the west side of the River Adur), which is land owned by the Port. The Shoreham Port Authority is not, permitted to deplete the reserve of shingle 'unreasonably' and uses these powers only to reduce excessive beach build up on the western frontage with its possible impacts on navigation, and to replenish beach levels to the east of the harbour entrance.

Since 1992, a regular shingle bypassing operation by the Shoreham Port Authority has replaced some of the shingle that would have been transported from the west. The material is extracted from the shingle bank immediately adjacent to the western Shoreham harbour wall (Figure 4.2) and transported by road to the east of the River Adur mouth. Figure 4.3 shows where the material is deposited to the east of the Shoreham harbour breakwaters in the groyne bays. Approximately two-thirds of the material is deposited in section A, and one-third in Section B.

Figure 4.2 Location of shingle extraction from Shoreham Harbour

Figure 4.3 Location of shingle deposition Areas A and B at Shoreham

During the 1992 to 2017 period, the annual volume of beach material by-passed from west of the Shoreham Breakwaters to east of Shoreham Breakwaters across the mouth of the River Adur has ranged from approximately 11,000m^3/yr to 33,700m^3/yr with an average rate of 17,600m^3/yr. These operations are managed to maintain the status quo along the coast.

Figure 4.4 shows the location of the sourced material at Black Rock in the vicinity of the Southern Water outfall, west of Brighton Marina. In 2010, 2013 and 2017, additional material (approximately 7,500 m^3, 9,250m^3 and 6,650m^3 respectively) was moved from Black Rock (to the west of Black Rock SNCI) in Kemp Town to Southwick beach, and to the east of the breakwater of Shoreham Harbour. This was intended to prevent blockage of the outfall pipe by shingle accretion which is an ongoing issue.

In 2015, additional material (3,300 m^3) was also moved westwards from the i360 site (located at the site of the West Pier near Regency Square in Brighton) and deposited along the coast in front of Shoreham Port.

Figure 4.4 Location of shingle extracted from Black Rock

In addition to the shingle bypassing activities, Shoreham Port Authority undertakes maintenance dredging within the River Adur twice a year, in spring and autumn. This fine alluvial material is deposited at sea approximately ½ mile east of the east breakwater and is not suitable for placement on the shingle beach.

In 2014/2015, Shoreham Port Authority undertook improvement works to groynes PG2 and PG4 (Figure 4.5) 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.

Figure 4.5 Location of rock groynes PG2 and PG4 and Western Esplanade beach

4.8.2 Potential Effects

Flood risk

Construction of the proposed scheme will not result in a material increase in flood risk during construction.

Operation of the scheme will provide flood and erosion protection to a 0.5% AEP (1 in 200) standard of protection along the open coast between the River Adur and Brighton Marina for the next 100 years benefitting residences, businesses and the local community. This is a beneficial effect.

Ground water

Given the tidal influence, groundwater levels may introduce the risk of uplift of shallow foundations, especially if founded directly on granular strata such as the Beach and Tidal Flat or Storm Beach Deposits. It is uncertain if there is potential for likely significant effects and therefore this should be further considered during detailed design.

Groundwater inflow may also occur into any excavations that are required and this is likely to require groundwater control measures. It is uncertain if there is potential for likely significant effects. Further assessment of the location, thickness and permeability of such strata and proposed excavations should be undertaken.

Surface water, WFD, hydromorphology and coastal dynamics

The preliminary WFD assessment reviewed the potential for impacts on WFD elements of the relevant coastal and transitional water bodies as a result of construction and operation of the proposed scheme. This assessment concluded that:

- The flood walls to be constructed or refurbished in Areas 1, 2 and 4 are above the high watermark and will not impact on hydromorphology or sediment within the Sussex coastal waterbody. Each flood wall is, or will be, on an existing sub-structure and require no intrusive work in the water body's substrate, or disturbance to any habitat or fish, or open up any new pathways for mobilising any historic contamination. Therefore, any existing HMWB pressures from coastal protection will not change and the water body will not deteriorate.

- Revetments at the upper tidal limit have the potential to alter processes within the Sussex coastal waterbody during storm conditions and at the very highest of tides but any such changes are considered to be negligible when considering the scale of the water body and the processes already in action along this high energy frontage.

- There is potential for impacts on hydromorphology within the Sussex Coastal waterbody as a result of piling activities required to construct the groynes in Area 5. However these will be localised and temporary and not of a magnitude substantially different to background conditions. Post construction, the timber groynes will offer protection to the shoreline and whilst there could be some changes to local tidal flows and wave exposure these are considered to be localised and negligible in the context of the existing coastal processes.

- Both the groynes and revetment are likely to provide a stable substrate for invertebrates and macrophytes to colonise, and likely to improve biodiversity locally.

- The beach renourishment will provide a solution to sediment loss,and prevent erosion of the substrate.

- Any risks to higher sensitivity habitats off-shore will be not significant. Nevertheless, it is recommended that during detailed design the higher sensitivity habitats are mapped in enough detail to ensure that works can be designed and delivered to avoid any impacts such as from the movement of marine plant.

- There is potential for construction of the proposed scheme to impact upon fish within the Sussex coastal and Adur transitional waterbodies. These potential impacts are not considered to be significant however it is recommended that further assessment is carried out during detailed

design to identify how the works can be designed, timed and delivered to avoid impact impact to fish including any migratory species associated with the Adur.

- There is potential for construction of the proposed scheme and renourishment activities to impact upon the water quality of the Sussex coastal water body. This can be mitigated by applying a sediment management plan and use of best practice pollution avoidance measures.

- Given the already modified shoreline, overall the scheme will provide benefits and therefore will support the WFD requirement of no deterioration to any water body.

The proposed scheme includes for the construction of a new groyne field at Kings Esplanade and the movement of beach material from Kemp Town to create wider beaches at Area 7 - Shoreham Outer Layby, Area 4 – Western Esplanade and Area 5 – Kings Esplanade. This will offset material lost from these beaches by alongshore drift and improve the standard of flood protection for property and people in these areas.

The new groyne field at Kings Esplanade will maintain a wider beach in place to provide a 0.5% AEP (1 in 200) standard of protection for the next 50 years. The new groyne field and recharged beach will not provide a greater or lesser impediment to alongshore drift than the existing groyne field.

The only effects on coastal morphology outside of the system will be due to the removal of beach material from west of the Shoreham breakwaters and movement east of the breakwaters which removes beach material from a neighbouring sediment unit. This practice has been ongoing since 1992 and manages beach levels at Shoreham beach, where if no bypassing were to take place, it is anticipated that beach material would eventually be transported and lost offshore. Irrespective of this scheme, Shoreham Port Authority will continue with this practice, but the proposed scheme and the use of Kemp Town as a secondary source of material for the Shoreham frontage together with ongoing monitoring of beach accretion or erosion will ensure that any over extraction of beach material from Shoreham beach is prevented.

Water quality/geo-environmental risk

It is considered that the highest risks to water quality / groundwater are associated with the construction phase of the project, with the potential for construction workers to be exposed to potentially harmful contaminants, and the potential for poor site management practices to create a short or long term pathway to controlled waters receptors. Construction risks, can typically be managed effectively if appropriate health and safety, and environmental management procedures are implemented during site operations and therefore no likely significant effects are anticipated.

Operation of the proposed scheme will result in a beneficial impact to on water quality through protection of potentially contaminated land sites and subsequent prevention of future potential pollution incidents

4.8.3 Next steps

The following actions are recommended to inform the next stage of environmental assessment:

- Monitoring of beach profiles should be undertaken on an on-going basis as part of the scheme in order to evaluate the effectiveness of the beach bypassing and recycling operations to maintain the beach widths and standard of defence. This monitoring will also determine the volumes of recycling and/or bypassing required. Beach profile information is collected approximately four times a year along the Shoreham and Brighton frontage by the Channel Coastal Observatory and it is recommended that this data is reviewed at least annually by BHCC and ADC as coast protection authorities to inform the annual maintenance programme.

- The required volumes of annual recycling from both sources will be carefully monitored and adjusted as required to meet maintenance needs taking into account the net change of the Shoreham beach and Kemp Town areas. Varying the proportion of annual material recycled from

Kemp Town and by-passed from Shoreham will ensure that local accretion or erosion may be monitored and managed.

- Further ground investigation is recommended to further define the level of potential contamination in the ground and further refine the risk classification to assess the potential for contamination of groundwater during construction. Further refinement of the risk classification is recommended at the detailed design stage and future ground investigation should be targeted towards areas of the scheme where ground disturbance is likely.

- Risk of uplift of shallow foundations as a result of groundwater levels should be further considered at detailed design.

- Further assessment of the location, thickness and permeability strata and proposed excavations should be undertaken.

- A sediment management plan should be developed.

- Further assessment should be carried out during detailed design to identify how the works can be designed, timed and delivered to avoid impact to fish including any migratory species associated with the Adur.

- Higher sensitivity marine habitats should mapped in enough detail to ensure that works can be designed and delivered to avoid any impacts such as from the movement of marine plant.

4.9 Cumulative effects

Cumulative impacts result from the combined impacts of multiple developments or the combined effect of individual impacts from different projects e.g. where different project elements in different locations have a cumulative impact on a particular receptor. The impacts resulting from a single scheme may not be significant on their own but when combined with impacts resulting from other schemes, these could become significant.

Cumulative effects can also be considered as effects resulting from incremental change caused by other past, present or reasonably foreseeable activities, developments or plans together with the scheme i.e. multiple projects acting in combination. 'Reasonably foreseeable' is interpreted to include other proposals that already have consent or are awaiting determination in the planning process with design information in the public domain.

A cumulative effects assessment should be undertaken at the next stage of environmental assessment. The following types of projects/plans should be considered:

- Approved but uncompleted projects;

- Ongoing activities;

- Plans or projects for which an application has been made and which are under consideration by the consenting authorities;

- Plans or projects which are reasonably foreseeable, i.e. projects for which an application has not yet been submitted, but which are likely to progress before completion of the development and for which sufficient information is available to assess the likelihood of cumulative and in-combination effects.

Advice should be sought from BHCC and ADC and other relevant parties such as the MMO on the list of projects/plans to be considered.

4.10 Air quality and climate

4.10.1 Air quality

Part of the proposed scheme is located within the Brighton Portslade and Rottingdean 2013 Air Quality Management Area.

There are likely to be localized and temporary impacts on air quality as a result of construction activities from all components of the proposed scheme, including dust from earthworks and gases from exhaust emissions. These are likely to be short term and will be managed through good site practice.

4.10.2 Climate

Construction of the proposed scheme will have an associated carbon footprint related to materials usage and fuels for construction vehicles and plant. Due to the nature and scale of the proposed scheme, the effects of construction in terms of climate change are not expected to be significant. Once operational the proposed scheme will not contribute to the increasing effects of climate change.

The scheme has been designed to take into account climate change considerations, ensuring that the proposals are adaptable where possible and make provision for increasing sea level rise. Overall, by proactively managing flood risk, the proposed scheme is considered an important method of climate change adaptation for the local area.

4.11 Materials and resources

4.11.1 Use of natural resources

A range of materials will be required to build the components of the scheme. The main construction materials comprise timber, rock, reinforced concrete and brickwork. Additional materials are the aluminum and timber stop logs installed at access points through the new concrete upstand walls. Appropriate selection of materials to maximise the use of sustainably sourced and recycled materials will be considered through the design development and construction approach.

4.11.2 Waste

The likely waste streams arising from the construction works required for the proposed scheme should be considered and managed. In accordance with the waste hierarchy, waste minimisation, management and use of recycled materials should be considered throughout the development of the scheme. The contractor should implement environmental good practice on site which should include production of a Site Waste Management Plan. Particular attention should be given to the waste hierarchy as applied to construction materials packaging.

4.12 Environmental hazards and incidents

The requirement for ‘Major Accidents’ to be specifically considered in environmental impact assessment (EIA) was introduced by the Infrastructure Planning (EIA) Regulations 2017. The major accidents chapter covers the vulnerability of the project to a major accident or disaster during the construction and operation phases.

Major accidents or disasters are listed below with justification as to why they do not require further detailed assessment. For those accidents or disasters that could impact on the proposed scheme the main environmental consequence is that the scheme would fail to prevent flooding, and therefore would be no different to the baseline situation without the proposed scheme in place.

- **War and terrorism**: The proposed scheme is located in a place which is not anticipated to attract warfare or terrorist activities.
- **Natural disasters: flooding**: The proposed scheme is designed to reduce the risk of flooding to the local area and will be designed to a certain maximum flood event. Measures will be put in

place to mitigate against any damage to structures that could result from flooding greater than the design flood event.

- **Natural disasters: earthquakes, hurricanes, tornadoes, tsunami, volcanic eruptions, drought, landslides and avalanches**: Natural disasters such as earthquakes, hurricanes, tornadoes, tsunami, volcanic eruptions, drought, landslides and avalanches are either non-existent or extremely rare in the UK.
- **Manmade disasters such as rail or motorway accidents**: The proposed scheme is not located within the immediate vicinity of any motorways or railways and the likelihood of any major incident on these routes affecting operation is negligible.
- **Industrial accidents such as explosions, chemical spills or fires**: Whilst there is a potential risk of fire, explosion or chemical spillage from ships entering the port in the vicinity of the scheme, the potential for impacts in relation to the scheme itself is considered to be very low.

There is no predictable mechanism by which the following events could impact on the operation of the proposed scheme. For each of these, the reduction in flood risk will reduce the potential for these types of events to arise, as indicated below:

- **Disease outbreaks**: The reduced flood risk will result in a reduced risk of the local population being affected by waterborne disease or contamination during and after a flood event.
- **Events resulting in disruption of: communication systems, transport facilities and health services:** The proposed scheme will reduce risk to communication, transport and health infrastructure from flooding.
- **Events resulting in disruption of: supply of money, food, water, energy or fuel:** The proposed scheme will reduce the risk of disruption to the local economy, distribution of goods including food and fuel, water supply infrastructure and energy supply infrastructure that would otherwise be associated with flooding.
- **Events resulting in: loss of human life, human illness or injury, and homelessness:** The proposed scheme will reduce the risk to vulnerable people from flooding and will therefore reduce the likelihood of loss of life, illness, injury and homelessness.
- **Damage to property:** The aim of the proposed scheme is to reduce the probability of flooding which could otherwise damage property. Additionally, the proposed scheme will be constructed from materials which have a limited vulnerability to structural damage during flood events.

5. Conclusions

The proposed scheme will require planning consent from BHCC and ADC under the Town and Country Planning Act 1990 (as amended).

A marine licence from the MMO will be required for the works undertaken below mean high water springs under the Marine and Coastal Access Act 2009 (as amended).

The proposed scheme is subject to the provisions of the Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (SI 2017/517). It is a Schedule 2 development characterized as: Coastal work to combat erosion and maritime works capable of altering the coast through the construction, for example, of dykes, moles, jetties and other sea defence works, excluding the maintenance and reconstruction of such works. A screening opinion from BHCC, ADC and the Marine Management Organisation (MMO) should be requested to determine whether this is an 'EIA development' in terms of the criteria set out in Schedule 3 of the EIA Regulations. Once EIA screening opinion's have been received, the scope of any further environmental assessment required will be determined.

The proposed scheme will provide beneficial impact to Brighton by reducing flood risk to people, property and the environment.

The receptors and features that are likely to be affected by the construction or operation of the proposed scheme have been identified. Where these potential effects are considered to be a potential likely significant effect, or the potential effects are uncertain at present, this PEIR makes recommendations for further assessment. It should therefore be noted that potential likely significant effects captured at this preliminary stage, may be found to be not significant following completion of the mitigation strategy when reported in the ES. Subject to funding and approval of the OBC, these will be further considered during the next stages of the delivery of the proposed scheme. The potential likely significant effects, uncertainties and beneficial impacts are summarised overleaf:

Biodiversity

- It is uncertain whether the proposed scheme will significantly impact upon Basin Road South and Black Rock Beach LWS's.
- There is potential for likely significant effects on the Priority Habitat vegetated shingle and coastal grassland habitats during construction.
- There is potential for the proposed scheme to result in likely significant effects to Protected Species Yellow horned poppy (Glaucium flavum) and Sea bindweed (Calystegia soldanella) during construction.

Cultural heritage and archaeology

- Beneficial impact to designated and non-designated cultural heritage assets and undiscovered archaeology during operation by providing them with additional protection from flooding and preserving the beach front from erosion.
- There is potential for likely significant effects to wreck sites in the area during construction.
- It is uncertain whether the proposed scheme will impact upon below ground archaeology located within the Archaeological Notification Area.
- There is potential for likely significant effects to undiscovered prehistoric and post medieval archaeology located within the Archaeological Notification Area during construction.

Townscape, seascape and visual amenity

- It is uncertain whether the proposed scheme will result in significant impacts to visual amenity for the following receptors during construction and operation:
    - Carat's Café Bar and adjacent beach huts;
    - Coastal path and cycleway;
    - Western Lawns Seaside Promenade;
    - Beach users.

Ground conditions

- It is uncertain whether the proposed scheme will result in significant impacts as a result of encountering geo-hazards during construction.
- There is potential for likely significant effects on human health (construction workers and end users), water quality and, indirectly, ecology as a result of disturbing contamination during construction.
- Should waste soils be generated during construction there is the potential for likely significant effects as a result of inert, non-hazardous and hazardous wastes being encountered.
- Beneficial impact in terms of reduced chance of release of contaminants during a flood event.

Transport and navigation

- It is uncertain whether the proposed scheme will significantly impact on local road network during construction and ongoing beach management operations.

- On completion, the improved defences will present a long term beneficial impact to the local road network as they will be protected from erosion and flooding at sustained or improved levels.
- It is uncertain whether the proposed scheme will significantly impact on navigation in the area of the proposed works as a result of marine deliveries.

Population, health and economy (including noise)

- An important benefit of the scheme is that it will protect up to 13 residential and 105 commercial properties (including Shoreham Sewage Pumping Station and Shoreham Power Station) from erosion risk and flood risk for an additional 6 residential properties and 8 commercial properties will be reduced immediately following construction, with beneficial impacts to health and well-being and the local economy.
- A material beneficial impact is the sustained or improved flood risk for a number of recreational facilities including sailing and rowing clubs, yachting, pleasure boating, dingy sailing, sea angling, diving, water skiing, and many sports clubs along the promenade.
- A material beneficial impact is the amenity value of beaches along the open coast will be improved.

Water and hydromorphology

- It is uncertain if there is potential for significant impacts as a result of groundwater levels introducing the risk of uplift of shallow foundations and groundwater inflow into any excavations that are required.
- Operation of the proposed scheme will result in a beneficial impact to on water quality through protection of potentially contaminated land sites and subsequent prevention of future potential pollution incidents.

Other identified issues that are not considered to be potentially significant will not require further detailed assessment. These include the topics of air quality, climate, materials and resources, and environmental hazards/accidents; and all potential impacts identified as not anticipated to be significant.

6. Next Steps

The actions recommended to address these potential likely significant effects and uncertainties include:

Biodiversity

- A mitigation strategy should be devised to minimise the impacts upon Priority Habitat Vegetated Shingle, and protected species Yellow horned poppy (Glaucium flavum) and Sea bindweed (Calystegia soldanella). This should detail the need for sensitive working practices and outline that works should undertaken under the supervision of a suitably qualified ecologist. The replacement of any material habitat loss should also be considered.
- It is recommended that a reptile survey is undertaken within the recommended survey period.(March – October). The results should be used to determine if any exclusion fencing and/or translocation will be required.
- Consultation with Natural England and other statutory consultees should be undertaken to discuss potential impacts on statutory and non-statutory designated sites as well as relevant mitigation measures.

Cultural heritage and archaeology

- The route of marine deliveries to Areas 2 and 5 should be further considered to avoid damage to wreck sites in the area;
- Further work is required to fully understand the nature and extent of archaeology along the Brighton to Shoreham Port area. The coastal area lacks investigation into potential palaeoenvironmental and archaeological remains. Consultation with the County Archaeologist

should be undertaken to determine an appropriate programme of further archaeological investigation and mitigation in the areas of the proposed works.

Townscape, seascape and visual amenity

- Mitigation and enhancement measures should be considered as part of the detailed design of the proposed scheme.
- Due to the material value of the beach areas as a local landscape and visual amenity resource, it is recommended that a Landscape and Visual Impact Assessment (LVIA) is undertaken at detailed design. 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) (Appendix B), which will identify landscape and wider environmental mitigation and enhancement measures associated with the scheme.

Ground conditions

- Ground investigation is recommended to inform the outline geotechnical design and provide further contamination baseline data on the soils beneath the site is to be undertaken at detailed design stage. The scope and specification for the investigation should be developed once the conceptual design of the proposed defences is finalised.
- A detailed UXO threat and risk assessment should be undertaken at detailed design phase. This should be undertaken as a first step to inform any ground investigations.
- The potential for waste soils to be generated should be re-evaluated once the scheme is finalised and the ground investigation results are available.

Transport and navigation

- A transport assessment should be undertaken at the next stage of assessment. This should include a review of the anticipated volume of traffic to be generated and an estimation of plant required during construction. Any mitigation measures should be discussed with the local highway authority in line with best practice and considerate site practices should be employed to ensure minimum disruption. A detailed Traffic Management Plan is anticipated to be required prior to construction.
- Consultation should be undertaken with the relevant channel users (Shoreham Port, Brighton Marina and Brighton Sailing Club) to minimise potential impacts and to ensure that appropriate mitigation measures are put in place.

If you have any questions or comments relating to the scheme proposals and this assessment please contact:

Kate Wagg

Senior Environmental Consultant

Jacobs

Endeavour House

Forder Way

Hampton

Peterborough

Cambridgeshire

PE7 8GX

kate.wagg@jacobs.com