



# Christchurch Bay & Harbour FCERM Strategy

Economic Appraisal

Bournemouth, Christchurch and Poole (BCP) Council,  
New Forest District Council (NFDC) and the Environment  
Agency

Project number: 60656006

March 2025

## Quality information

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## Revision History

Revision	Revision date	Details	Authorized	Name	Position
00	11/05/2022	Baseline damage assessment - draft for comment	BT	Ben Taylor	Project Manager
01	28/06/2022	Baseline damage assessment - revised following client comment	BT	Ben Taylor	Project Manager
02	24/08/2023	Updated report to include economic appraisal of short list options	BT	Ben Taylor	Project Manager
03	07/02/24	Updated report to include update base date for option costs, damages and benefits	BT	Ben Taylor	Project Manager
04	22/04/24	Updated report to be issued to BCP / NFDC councils	BT	Ben Taylor	Project Manager
05	25/10/24	Updated ahead of LPRG submission	BT	Ben Taylor	Project Manager
06	10/02/25	Updated following LPRG review	BT	Ben Taylor	Project Manager
07	31/03/25	Updated following LPRG review	BT	Ben Taylor	Project Manager

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# 1. Introduction

## 1.1 Overview

AECOM has been commissioned by Bournemouth, Christchurch and Poole (BCP) Council, working in partnership with New Forest District Council (NFDC) and the Environment Agency (EA), to develop a Flood and Coastal Erosion Risk Management (FCERM) Strategy for the coastal frontage at Christchurch Bay & Harbour (herein referred to as ‘the Strategy’). As part of the Strategy, AECOM has undertaken an economic appraisal to support the development and appraisal of options.

The aim of the Strategy is to provide an integrated plan for the Christchurch Bay & Harbour frontage, delivering sustainable and long-term management for coastal flood and erosion risks over the next 100 years. The Strategy will further develop the existing Poole & Christchurch Bay SMP2 policies adopted in 2011 and update the information provided in the 2012 Christchurch Bay & Harbour FCERM Study using the most up-to-date data and guidance. The Strategy is being developed collaboratively by AECOM, and the Project Board consisting of officers of BCP Council, New Forest District Council (NFDC) and the Environment Agency (EA).

The Strategy extent is the coastal frontage between Hengistbury Head (immediately to the east of Hengistbury Head Long Groyne) and the landward (western) end of Hurst Spit. Within Christchurch Harbour, the original Strategy extent was up to Tuckton Bridge on the River Stour and up to Knapp Mill on the River Avon (see Figure 1-1), although there have been some minor modifications to where options have been developed and benefits claimed (see Section 2.1).



Figure 1-1: Study Area

## 1.2 Economic Appraisal

The economic appraisal for the Strategy supports the option appraisal process in line with the HM Treasury and Environment Agency FCERM Appraisal Guidance (FCERM-AG, 2022). The appraisal is an integral part of building a robust flood and erosion risk management strategy for the frontage. It also provides evidence to facilitate discussions over potential contributions with major beneficiaries.

The first step in the economic appraisal was to establish the baseline 'Do Nothing' economic damages. Following this, the economic costs and benefits of the short list options were determined and the economic case of each option was established. This report covers each of these steps. The reader should refer to the Leading Options Report for more details on what the short list options involve.

Costs associated with the options include design, construction, and maintenance of the option over its design life (whole life costs). Benefits are based on the direct damages avoided (reduced flooding to property, people, assets and infrastructure) and a number of indirect damages avoided (e.g. transport disruption damages, educational damages etc.). This economic comparison is known as cost benefit analysis (CBA) and provides a rational and systematic framework for assessing the advantages and disadvantages of the options.

## 1.3 Do Nothing Baseline Scenario

As recommended by FCERM-AG (2022), the baseline for the economic appraisal for the Strategy is the Do Nothing scenario. The Do Nothing scenario represents a hypothetical 'walk away' situation where no action is taken to manage the flood and erosion risk or maintain the existing structures in the study area. Establishing what this scenario would involve is an essential part of an appraisal because it provides the baseline from which the 'Do Something' options are compared against to demonstrate their economic benefits.

With the Do Nothing approach, the existing defences would be abandoned in terms of maintenance and repair, and no remedial or additional works would be carried out. In addition, adaptation to sea level rise or other climate change responses would not be addressed. The existing defences along the frontage would fail at the end of their residual life and the properties in the erosion zones behind the defences would be at increased risk of erosion. Flood risk would be unmanaged and would increase significantly over time, resulting in significant parts of the study area becoming uninhabitable in the future.

## 1.4 National and Regional/Local Assessment

The baseline economic damages for the Do Nothing scenario comprise two types of damages;

- **National Damages:** an assessment has been undertaken to establish the economic damages that are eligible to be included as part of an FCERM-AG (2022) compliant assessment. These economic damages are associated with national losses and comprise physical damages to property and infrastructure and a range of wider economic impacts that are outlined in the Multi-coloured Manual. The national losses in this assessment can be used within the Environment Agency's Partnership Funding process and are known as 'first round' impacts. The damages established in this part of the assessment form the basis of the CBA that has been undertaken on the options. Sections 2 to 4 of this report cover the calculation of the national damages.
- **Regional / Local Damages:** an assessment has also been undertaken to establish the economic damages at the regional/local level including Gross Value Added, visitor economy, local council income, coastal recreation, health and wellbeing, natural capital and ecosystem services. The impacts considered as part of this assessment are not eligible to be included as part of an FCERM-AG compliant assessment as they represent local/regional level financial impacts that can theoretically be displaced to other parts of the country when considered on a national level. The impacts considered in this part of the assessment can be used by the project team as an evidence base to help support funding discussions with potential partners at the local level and to raise awareness of the broader risks associated with flooding and erosion along the Strategy frontage. Section 5 of this report covers this calculation of regional / local damages.

## 2. Methodology

### 2.1 Spatial Extent

The spatial extent of the economic assessment area is from Hengistbury Head (immediately to the east of Hengistbury Head Long Groyne) and the landward (western) end of Hurst Spit, encompassing Christchurch Harbour.

There are several separate flood risk management projects that are being undertaken in adjacent areas to the Strategy, for example on both the Rivers Avon and Stour in Christchurch Harbour and at Hurst Spit. Through discussions with the Environment Agency and the project teams of the adjacent projects, an agreement was made on the spatial boundaries of each project in which economic benefits of options would be claimed:

- On the River Stour within Christchurch Harbour, the Strategy includes damages and benefits up to the railway crossing (immediately to the north of Gleadow Avenue).
- On the River Avon within Christchurch Harbour, the Strategy includes damages up to Knapp Mill. However, options for managing the flood risk between Knapp Mill and Christchurch Bypass have not been included in the Strategy and will instead be undertaken by the Environment Agency in the Lower River Avon project.
- At Milford on Sea, the Strategy includes damages and benefits at Milford on Sea in the area adjacent to Sturt Pond. Damages and benefits to the area to the east of this flood cell are included in the Hurst Spit to Lymington Strategy.

For the development and appraisal of options, the Strategy area has been divided into six zones known as Strategy Management Zones (SMZs), shown in Figure 2-1. Each SMZ has similar risks and characteristics. To enable the development of options at the local level, the Strategy Management Zones were further sub-divided into smaller areas termed Option Development Units (ODUs). In total 18 ODU were identified. Table 2-1 shows the breakdown of SMZs and ODUs. Baseline economic damages have been established for each ODU and SMZ area and for the combined frontage.

The primary risks along the Strategy frontage change, as outlined below:

- Within Christchurch Harbour the land is low lying and the key risk is from coastal flooding. There are also areas of historic landfill located adjacent to the shoreline which could be at risk of erosion in the future if current defences are not maintained / replaced in the future.
- Along the majority of the open coast, between Christchurch Harbour entrance and Milford on sea, the land is higher with steep cliffs and the primary risk is therefore from coastal erosion and in some parts, land sliding.
- At the eastern end of the Strategy frontage at Milford on Sea, the land is low and therefore this area is also at risk from flooding, from wave overtopping along the open coast and also from tidal inundation from the Sturt Pond direction.

**Table 2-1: Strategy Management Zones and Option Development Units**

Strategy Management Zone	Option Development Units
SMZ 1: Mundeford Sandbank	ODU 1: Hengistbury Head east ODU 2: Mundeford Sandbank
SMZ 2: Christchurch harbour	ODU 3: Christchurch Harbour South ODU 4: Wick ODU 5: Willow Drive and the Quomps ODU 6: River Avon West Bank ODU 7: Rossiters Quay ODU 8: River Avon East Bank ODU 9: Stanpit ODU 10: Mundeford ODU 11: Mundeford Quay
SMZ 3: Christchurch beaches and cliffs	ODU 12: Avon Beach and Friars Cliff ODU 13: Highcliffe
SMZ 4: Naish Cliff and Barton on Sea	ODU 14: Naish Cliff and Barton on Sea
SMZ 5: Taddiford	ODU 15: Barton on Sea to Hordle Cliff
SMZ 6: Milford on Sea	ODU 16: Cliff Road ODU 17: Rook Cliff ODU 18: Milford on Sea frontage

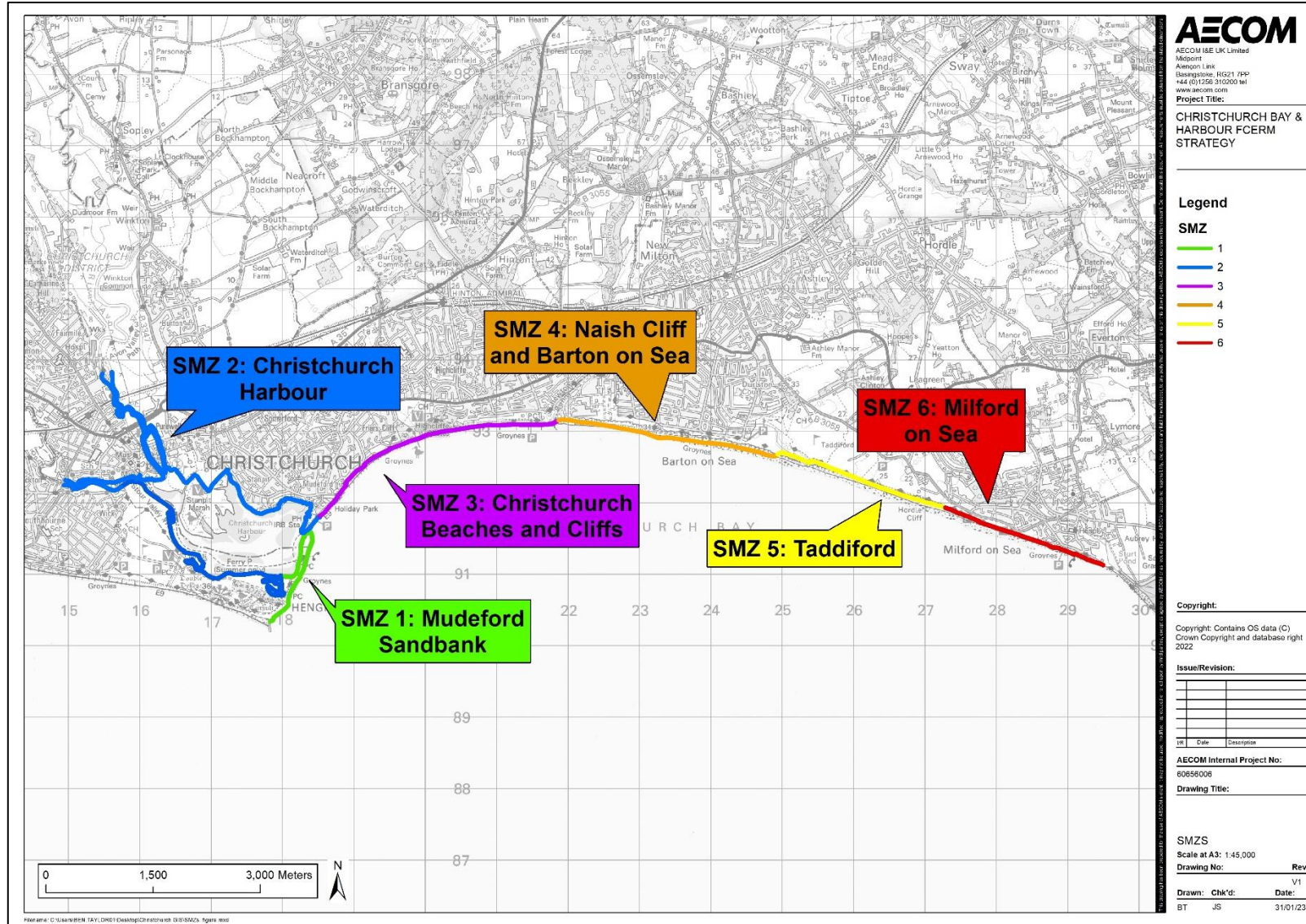


Figure 2-1: Strategy Management Zones

## 2.2 Time Epochs

The economic assessment has been undertaken for three time periods (known as epochs). These time epochs span the next 100 years and are as follows:

- Epoch 1: 2024 to 2044
- Epoch 2: 2044 to 2074
- Epoch 3: 2074 to 2124

Establishing the economic damages in each epoch has enabled option benefits to be calculated over the same periods, aiding the development and appraisal of the Strategy options that consider changing risk profiles through time.

In Epoch 1 the economic assessment is influenced by the presence of the existing coastal defences that are in place along parts of the Strategy frontage. The coastal defences reduce the flood and erosion risk compared to hypothetical situation where no defences are in place. Based on the findings of the defence condition assessment report (AECOM, 2021), it is evident that without further maintenance many of the coastal defences along the Strategy frontage would be expected to fail within epoch 1 (years 0-20). This is summarised in the table below that shows the lengths of defences along the Strategy frontage and the estimated residual life (without maintenance).

As can be seen in Table 2-2, where it has been estimated, all the defences along the frontage have a residual life < 20 years. The residual life is unknown for over 10km of defence (generally private defences that are inaccessible). Of this 10km, approximately 5.6km is for one section of defence (2O – natural verge). With the typically low residual life of the defences, it has been assumed that with the Do Nothing baseline scenario that defences would fail between present day and 2043 (Epoch 1). From 2043 onwards, it has been assumed that all defences would have failed (Epochs 2 and 3).

**Table 2-2 Summary of defence residual life along the Strategy frontage**

Residual life	Length of defence(s)	Length (%)
< 10 years	4,810m	15%
10-15 years	8,600m	27%
Up to 20 years	8,125m	26%
Unknown	10,210m	32%

## 2.3 Supporting Flood Mapping

To establish the coastal flood damages associated with the Do Nothing scenario, flood damages for the Christchurch Harbour area and the Milford on Sea area were incorporated into the assessment. No flood damages were included for the open coast area between the Christchurch Harbour and Milford on Sea given that there is minimal coastal flood risk here due to the steep coastal topography.

The flood mapping for the Christchurch Harbour area used in this assessment originates from different sources. For the present day mapping, flood mapping produced from the hydraulic modelling of the Lower River Avon & Christchurch Harbour study (Environment Agency, ongoing project) was provided to the project team. This mapping represents the combined coastal flood risk for a defended scenario from tidal inundation and wave overtopping (although it is acknowledged that wave overtopping is limited within the harbour area). Similar results were not available for future time periods so therefore a GIS based assessment was undertaken to create tidal flood mapping that considers the impact of climate change for the years 2044, 2074 and 2124 (more information provided below).

The flood mapping for the Milford on Sea area used in this assessment came from inundation model results provided by the Environment Agency for a model developed as part of the adjacent Hurst Spit to Lymington Strategy. Flood mapping results were provided for the present day and the years 2040, 2080 and 2120, which

broadly align with the Strategy time epoch boundaries. The present day flood mapping that was provided was for a defended scenario, whereas the future epochs was for an undefended scenario.

A different selection of flood map return periods were provided for the Christchurch Harbour and Milford on Sea areas as shown by Table 2-3 below.

**Table 2-3: Flood mapping return periods available for the Strategy**

Christchurch Harbour	Milford on Sea
<ul style="list-style-type: none"> <li>• 50% AEP (1:2yr)</li> <li>• 20% AEP (1:5yr)</li> <li>• 10% AEP (1:10yr)</li> <li>• 5% AEP (1:20yr)</li> <li>• 3.33% AEP (1:30yr)</li> <li>• 2% AEP (1:50yr)</li> <li>• 1.33% AEP (1:75yr)</li> <li>• 1% AEP (1:100yr)</li> <li>• 0.5% AEP (1:200yr)</li> <li>• 0.1% AEP (1:1000yr).</li> </ul>	<ul style="list-style-type: none"> <li>• 50% AEP</li> <li>• 5% AEP</li> <li>• 1.33% AEP</li> <li>• 1% AEP</li> <li>• 0.5% AEP</li> </ul>

For Christchurch Harbour, the GIS based assessment to determine the future flood extents and depths for 2044, 2074 and 2124 was undertaken by comparing the extreme water levels within Christchurch Harbour to the land levels surrounding the harbour. The extreme water levels were obtained from the Coastal Flood Boundary Dataset (Environment Agency, 2018) and were adjusted to account for sea level rise using the UKCP18 climate change projections. The sea level rise projections for the UKCP18 Representative Concentration Pathway (RCP) 8.5 70<sup>th</sup> percentile was used as per the latest Environment Agency guidance for flood and coastal risk projects. The upstream water level gradients along the Rivers Stour and Avon were included in the GIS based assessment. The gradient was derived by water elevation data provided to the team from the Environment Agency as derived from the Lower River Avon study model. Land levels were derived from the latest LIDAR survey of the area, surveyed in 2020.

An initial sense check of the GIS based mapping was undertaken by comparing the flood extent of Flood Zone 3 and the mapping from the Christchurch Level 2 SFRA (undertaken in 2019). In general there is a good match between the flood extents and there is confidence in the flood depth / extent around the Christchurch Harbour area. However, the following uncertainties exist:

- Upstream of Tuckton Bridge and Knapp Mill the confidence in the tidal flood mapping derived using the GIS based approach is reduced. This is because there are several weirs along the Rivers Stour and Avon that influence the upstream gradient in water levels. These weirs are not accounted for in the GIS based approach.
- A further uncertainty is that the GIS based approach does not include wave overtopping inputs and therefore only shows the risk from tidal inundation. This is not considered to lead to major uncertainties in the economic assessment given that Christchurch Harbour is generally sheltered from large waves.
- In the future, should sea levels rise as anticipated, towards the end of the Strategy appraisal period (towards 2124) some parts of the Mundeford Sandbank would be expected to be inundated during extreme tide events. Typically along its length the peak of the Sandbank is between 2.5-3.0m ODN and by 2123 the extreme tide levels may exceed this, with the 100% AEP tidal water level reaching around 2.5m ODN in 2123 and the 0.5% AEP tidal water level reaching around 3.0m ODN in this part of the frontage. This has the potential to lead to increased wave activity within Christchurch Harbour which is not represented in the GIS based approach to assessing flood risk. However, the impact is not expected to significantly alter the results of the economic assessment given that flood risk damages are heavily discounted so far into the future and the Sandbank would still be expected to provide a degree of wave breaking effect. This assumes that the Sandbank elevation remains unchanged over time. Further work assessing the breach risk of the Sandbank before this time period has been undertaken and is discussed further in the Strategy modelling report and the Strategy coastal processes report (AECOM, 2022).

In follow up work, a second sense check of the GIS based mapping was undertaken by comparing the GIS mapping for 2124 to preliminary flood outline results for 2120 from the Lower River Avon study modelling. Results for the 50% AEP, 5% AEP, 1.33% AEP and 0.5% AEP events in 2124 / 2120 were compared:

- Overall there was found to be good agreement between the GIS based approach and the Lower River Avon modelling, with the flood extents very similar within the Strategy area.
- Within the Strategy area the only area where substantial differences between the GIS mapping and the Lower River Avon modelling flood extents occur is on the east bank of the River Avon, just to the south of Christchurch Bypass. Here the GIS approach shows an area of flooding that is not shown in the Lower River Avon modelling. However, this area is open land / flood plain and there are minimal properties at risk from flooding here so this variation is unlikely to influence the Strategy economic or option development. The variation occurs for the 50% AEP, 5% AEP and 1.33% AEP return periods, but there is better agreement here with the 0.5% AEP return period.
- Upstream of the Strategy area there was more variation between the two approaches, due to better representation of the fluvial risk in the Lower River Avon modelling approach. However, this is outside of the Strategy area and will therefore not impact the economic or option appraisal.

Based on the above comparisons and considering the uncertainties discussed, the GIS based flood mapping is considered suitable for application within the Strategy and for informing the economic and option appraisal tasks. There is greater confidence in the flood extent and depth for the Strategy area compared to the wider area due to the weirs along the Rivers Stour and Avon and these not being represented in the GIS based approach.

The flood mapping showing the flood depths and extent for each return period were input into GIS to facilitate the inspection and attribution of flood depths for assets within the study area. Table 2-4 below provides a summary of the flood mapping used in the assessment.

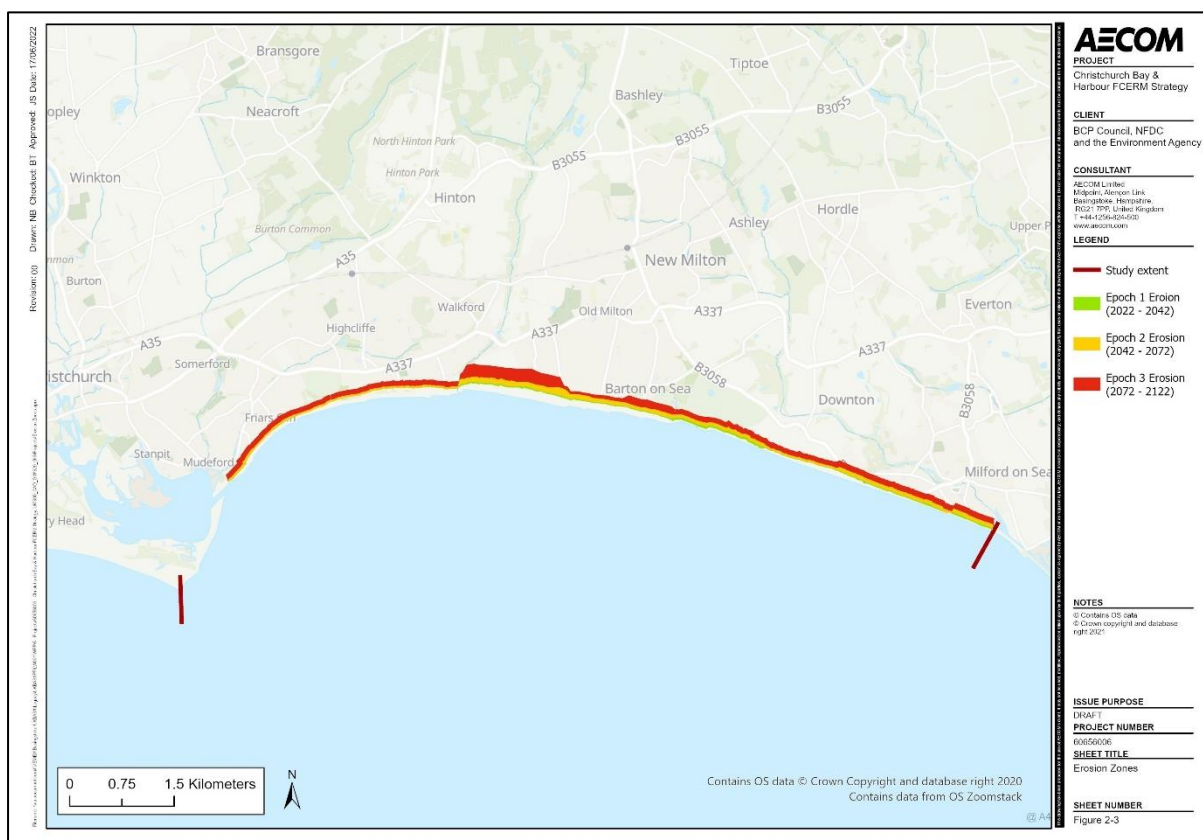
**Table 2-4: Summary of flood mapping used**

Time period	Time epoch	Dataset used – Christchurch Harbour	Dataset used – Milford on Sea	Defence scenario
Present day	Start of epoch 1	Lower River Avon & Christchurch Harbour mapping	Hurst Spit to Lympington Strategy flood model mapping	Defended
2044	End of epoch 1 / start of epoch 2	GIS based mapping	Hurst Spit to Lympington Strategy flood model mapping	Undefended
2074	End of epoch 2 / start of epoch 3	GIS based mapping	Hurst Spit to Lympington Strategy flood model mapping	Undefended
2124	End of epoch 3	GIS based mapping	Hurst Spit to Lympington Strategy flood model mapping	Undefended

## 2.4 Supporting Erosion Mapping

To establish the coastal erosion risk with the Do Nothing scenario, the No Active Intervention erosion zones from the Poole and Christchurch Bay Shoreline Management Plan 2 (SMP2, 2011) have been used. Despite the SMP erosion zones being produced in 2011, a visual check of the zones in GIS shows that the starting position of the erosion zones is generally very similar to the position of the present day coastline, with only localised exceptions to this where small amounts of erosion has been observed over the past 11 years (at Naish Cliffs, the west end of Barton on sea defences and the west end of Hordle cliffs).

The SMP erosion zones were used rather than the more recent erosion zones from the National Coastal Erosion Risk Mapping (NCERM, 2018) dataset because the NCERM dataset does not cover the full Strategy frontage (e.g. it does not currently include areas of complex cliffs such as those at Naish Cliff and also excludes some currently defended areas).



**Figure 2-2: Erosion Zones used in the Economic Assessment**

Given that there are existing coastal defences in place along the Strategy frontage, some assumptions and simplifications have been made in the assessment as to the timing of the initial erosion in epoch 1. For the Do Nothing scenario where no maintenance occurs, the existing defence assets are all expected to fail during epoch 1 (see Section 2.2 above). However, the exact timing of failure for each asset will vary and is inherently uncertain. It is likely that immediately after a defence asset fails, there would be a period of accelerated erosion (relative to long term trends) until the shoreline reaches a new state of equilibrium and a more gradual rate of erosion begins.

Once a property is eroded it is written off in the economic assessment. This involves taking the property value as a damage amount at the point in time at which the erosion is expected to occur. Once eroded, the properties are assigned no further damages in the assessment. The timing of this write-off and the assumptions made are summarised in Table 2-5.

**Table 2-5: Summary of erosion assumptions**

Time period	Dataset used	Defence assumptions	Erosion timing assumptions
Epoch 1 (2024-2044)	SMP NAI erosion zones years 0-20	Where defences are currently in place, these are expected to fail over the course of epoch 1, with all defences assumed to have failed by 2044 (with no maintenance).	Given presence of existing defences, all erosion damages (property write-off) assumed to occur at the end of the epoch in 2044. This is a conservative assumption as in most locations defences are expected to fail before year 20. Immediately after defences fail a short term period of accelerated erosion is expected and therefore adopting the full 0-20 erosion zone is considered representative of the risk.
Epoch 2 (2044-2074)	SMP erosion zones years 20-50	Undefended scenario as all defences assumed to have failed previously.	Assumed that no defences are place in this epoch and therefore erosion damages (property write-off) applied in the middle of the epoch. Depending on position of assets, some may erode before / after this point in time but assuming the mid-point is considered representative at the Strategy level.
Epoch 3 (2074-2124)	SMP erosion zones years 50-100	Undefended scenario as all defences assumed to have failed previously.	Assumed that no defences are place in this epoch and therefore erosion damages (property write-off) applied in the middle of the epoch. Depending on position of assets, some may erode before / after this point in time but assuming the mid-point is considered representative at the Strategy level.

## 2.5 Identifying Flood Depths and Properties at Risk from Erosion

To identify individual properties at risk, an address point dataset (National Receptor Database, 2014) was used. The National Receptor Database (NRD) includes the property address, post code, property type (e.g. detached residential, semi-detached residential, factory, office, shop etc.) and property coordinates for all assets within the study area. The NRD was screened to remove properties built after 2012 as per the FCERM-AG (2022).

Flood depths for each individual property were obtained in GIS by determining the flood depth for each return period that intercepts the NRD property points. The erosion risk was determined by comparing the position of the NRD datapoints to the SMP erosion zones (as described in previous section). If an NRD datapoint was within a 5m buffer of the erosion zone it was deemed to be at risk given that it would likely be uninhabitable at this distance due to safety concerns.

### 2.5.1 Data Filtering

The NRD database contains a number of properties and assets which cannot be included in the valuation of Do Nothing damages. Once the flood depths for each property had been assigned, the database was checked to remove duplicate address points. Upper floor properties were removed from the dataset where there was not a risk of erosion and were not counted in flooding damages.

Assets with no NRD classification description ('Awaiting classification' and 'Blank') were excluded from the analysis as were the following classifications with negligible susceptibility to flooding as per the guidance in the MCM Technical Note (2016):

- Advertising Hoarding
- Bus Shelter
- Mausoleum / Tomb / Grave
- Postal Box

- Caravan
- Property Shell
- CCTV
- Street Record
- Development
- Static Water
- Development Site
- Unused Land
- Hopper / Silo / Cistern / Tank
- Utility

In addition to the list above, beach huts were also removed from the direct damage assessment as they do not represent a permanent dwelling. The council income generated from beach huts can however be included as part of the non-GIA compliant wider benefits assessment and this is calculated in Section 5.4 of this report.

In the NRD dataset there were over 700 NRD 999 classified properties. The 999 classification represents properties where the land use is unknown in the dataset. A similar approach to that recommended in MCM Technical Note (2016) for reclassifying a large number of MCM 999 properties was adopted. For the MCM 999 properties with a floor area greater than 150m<sup>2</sup> (approximately 80 properties), a manual inspection on google street view was carried out to ensure the floor areas were accurate. For the remaining MCM 999 properties (i.e. < 150m<sup>2</sup> floor area), 90% of the non-residential sector average damages were applied.

No basement areas have been allowed for in the economic analysis. This was informed by a high level inspection of the area in Google Street View which suggested that the majority of properties do not have basements.

## 2.5.2 Property Thresholds

For both residential and non-residential properties, a property threshold value of 0.1m was assumed. This is slightly lower than the 0.15m that is typically assumed due to a range of factors:

- A high level visual inspection using Google Street view was undertaken for a random selection of properties in the flood risk zones (approximately 25 properties). Of the properties inspected typically there was only a nominal threshold / no threshold and therefore a value less than 0.15m is appropriate and more representative.
- Flood damages to properties were not applied to depths below the threshold value and no basement flood damages were included (the occurrence of basements was unknown). Using a slightly lower threshold therefore helped to offset not including these potential damages.
- Many properties at risk of flooding in the Christchurch area are older properties that could be more vulnerable to damage from flooding (and have higher damages). Given this is a strategic study the age of properties were not considered (average depth-damage values were used from the MCM) and therefore a slightly lower threshold helped to offset this.

A sensitivity test on the threshold assumption has been undertaken and is presented in Section 4 of this report. However, if schemes are pursued following the Strategy it is recommended that threshold surveys are undertaken in the scheme areas to refine the threshold value on a property by property basis.

## 2.6 Residential Flood Damages

Flood damages were obtained from the Multi-Coloured Manual (MCM, 2023). The value of flood damage was based on the residential property type (detached, semi-detached, terrace, flat) and the depth of flooding for each flood scenario.

Damage values for 'Short duration, salt water, major flooding' were adopted and were then adjusted by a factor of 1.056 to allow for emergency costs (as recommended in the MCM). A further uplift factor of 1.011 was applied to account for inflation between May 2023 and December 2023 based on the latest available CPI inflation data available at the time of the calculations. Salt water flooding was applied to all areas within Christchurch Harbour given the coastal / tidal source of flood risk. The direct flood damages values for different depths are summarised in Table 2-6.

## 2.7 Non-residential Flood Damages

Non-residential flood damages were also obtained from the MCM (2023). The property damages are based on the non-residential property type, the footprint area (m<sup>2</sup>) and the depth of flooding for each of the modelled return periods. For NRD 999 properties which were not reclassified, the property damages are based on the 'Non-Residential Property Sector Average' with a 10% reduction.

Damage values for 'salt water, short duration major flood' were used. An uplift factor of 1.011 was applied to account for inflation between May 2023 and December 2023 based on the latest available CPI inflation data available at the time of the calculations. Salt water flooding was applied to all areas within Christchurch Harbour given the coastal / tidal source of flood risk. The direct flood damages values for different depths are summarised in Table 2-7.

**Table 2-6: Flood damages for residential properties adopted from the MCM (2023). Values adjusted to account for emergency uplift and CPI inflation.**

Short Duration, salt water, major flood. Adapted from MCM (2023) (£)																
MCM Code	Property Type / Age / Social Grade	Component	Depth (m)													
			0	0.05	0.1	0.2	0.3	0.6	0.9	1.2	1.5	1.8	2.1	2.4	2.7	3
11	Detached	Total Damage	2,548	10,519	17,094	29,156	36,878	43,725	48,167	53,095	59,092	65,945	71,868	77,180	87,655	92,384
12	Semi-detached	Total Damage	3,389	8,599	12,404	19,232	23,221	26,782	29,026	32,058	35,999	40,373	44,470	49,105	57,410	60,704
13	Terrace	Total Damage	3,083	7,792	11,333	17,439	21,224	24,942	27,044	29,655	32,828	36,377	39,745	43,422	51,322	54,024
14	Bungalow	Total Damage	2,464	10,814	16,842	25,716	31,648	37,547	41,984	47,196	53,621	61,060	67,261	73,415	84,950	89,442
15	Flat	Total Damage	2,371	7,459	11,448	17,956	21,838	25,897	28,282	30,617	33,360	36,530	39,092	41,301	48,112	50,134

**Table 2-7: Flood damages for non-residential properties from the MCM (2023). Values adjusted to account for CPI inflation.**

Short Duration, warning, salt water, no cellar. Adapted from MCM (2023) (£)														
MCM Code	Property Type	Depth (m)												
		0	0.25	0.5	0.75	1	1.25	1.5	1.75	2	2.25	2.5	2.75	3
<b>2</b>	Retail	76	355	534	714	894	1,021	1,152	1,287	1,476	1,602	1,698	1,744	1,808
<b>3</b>	Offices	83	381	553	689	827	925	1,039	1,178	1,349	1,481	1,589	1,642	1,710
<b>4</b>	Warehouses	25	342	588	766	931	1,056	1,153	1,259	1,313	1,336	1,377	1,391	1,428
<b>6</b>	Public buildings	53	249	342	417	501	562	640	729	837	929	983	1,006	1,033
<b>8</b>	Industry	15	83	124	160	202	235	267	305	359	393	431	456	489
<b>51</b>	Leisure	364	871	1,021	1,134	1,268	1,365	1,492	1,622	1,789	1,922	2,026	2,075	2,134
<b>521</b>	Playing Field	5	12	24	25	27	28	29	30	32	33	34	35	36
<b>523</b>	Sports Centre	49	209	293	350	408	444	518	601	692	774	808	822	837
<b>525</b>	Sports Stadium	10	50	76	94	116	129	150	166	195	210	220	226	232
<b>526</b>	Marina	22	61	79	109	133	150	166	186	219	250	279	297	323
<b>960</b>	Substation	41	1,412	1,880	2,338	3,635	4,504	5,794	6,255	8,040	8,072	8,093	8,113	8,119
	NRP Sector Average (-10%)	54	375	525	666	905	1,069	1,287	1,416	1,722	1,800	1,859	1,889	1,928

## 2.7 Write-off and Capping Damages

### 2.7.1 Property Write-off

#### Flooding write-off

As recommended by FCERM-AG (2022) and the Multi-coloured Manual (2023), for the purposes of the economic appraisal, properties should be assumed from an accounting perspective to be written-off once flooded by an event of 33% AEP (1:3 yr return period) or less, as the property would no longer be habitable or functional. Once written off the present day value of the property is taken as an economic damage, but it can no longer accrue flood damages after that point.

The numerical model simulations undertaken for the study included a 50% AEP event (1:2 yr). This event is a lower return period than the 1:3 year event and was used in the assessment to determine property write-off.

#### Direct erosion write-off

In addition to write-off from flooding, in the coastal environment property write-off can also occur as a result of erosion or property loss due to collapse of supporting land, access or defences in front of a structure.

As outlined in Section 2.4, the properties at risk from erosion in epoch 1 were written off at the end of that time epoch. This is a conservative assumption from a discounting perspective and takes account of the existing defences currently in place at the start of the epoch, and that they are all likely to fail over the course of epoch 1 (without maintenance, as per the Do Nothing scenario).

The properties at risk from erosion in epochs 2 and 3 were written off at the mid-point of that time epoch. For example, if a property was located in the epoch 3 erosion zone, it has been written off at the middle of this epoch in year 75 (2097). The middle of the epoch has been used because in reality some properties would erode towards the start of the epoch, whilst others would erode towards the end. For discounting purposes, it was therefore considered most reasonable to assume the mid-point of each epoch to provide an average discounting value and reduce the risk of under or overestimating the overall erosion present value PV damages at the strategic level.

### 2.7.2 Property Capping

FCERM-AG also states that the total PV damages for a property over the duration of the appraisal period must not exceed the property market value. The cumulative annual average damages were monitored for each property and once they exceeded the property value, further damages were capped and the property did not accrue any more damages.

### 2.7.3 Property Values

The value of each property was required to incorporate write-off and capping within the economic assessment. For residential properties the Multicoloured Manual (2023) recommends using regional house price values. For residential properties, average house prices for the South West region (which includes the BCP jurisdiction) and the South East region (which includes the NFDC jurisdiction) were obtained from the UK house price index data available from the HM Land Registry. At the time of undertaking the calculations the latest data available was for November 2023 and values for different residential property types were used in the assessment (detached, semi, terraced, flat). Table 2-8 below shows the regional house prices used in the assessment. A sensitivity test has been undertaken to determine the impact on the economic damages by adopting local house prices (see Section 4.2).

**Table 2-8: House prices used in the economic assessment**

Strategy area	UK Region	Average house price (£)			
		Detached	Semi-detached	Terrace	Flat
BCP	South-west	512,269	331,127	265,549	189,087
NFDC	South-east	689,087	421,545	322,211	223,459

The non-residential property values were valued on the rateable value for their business type (provided by the valuation office). Average values for retail, offices, warehouses and industry and other were obtained and adjusted to account for inflation. In accordance with FCERM-AG, the rateable values were then divided by the business yield to provide an estimate of the market value for flood damage and capping purposes. The business yield value varies by property type was obtained from the suggested values in the MCM (2023).

## 2.7.4 Upcoming changes to Write-off and Capping Guidance

Feedback received from the Environment Agency's Large Project Review Group (LPRG) indicates that the property write-off guidance is likely to change in the future. Therefore the write-off values calculated in this assessment could be different to the values that will be calculated during scheme level appraisal using the new guidance.

Whilst the guidance changes have not been finalised and are potentially subject to change, initial correspondence from LPRG indicates that the following changes could be made to the write off and capping approach:

- Flooding write off may only take place where flood depths exceed 600mm for events equal to or less than the 1:3 year return period.
- Write off may use national average property prices.
- There may be no capping.
- Damage reducing coefficients may be applied to properties at high risk of flooding. These will be applied to individual property Annual Average Damages and will be different by standard of protection.

Table 2-9 below summarises the potential impact on the economic damages that each of these changes could make within the Strategy area.

**Table 2-9: Potential write-off and capping guidance changes and the potential impact on the assessment**

Potential guidance change	Potential impact on economic damage / benefit assessment
Flooding write-off only occurs when flood depths exceed 600mm	This change would reduce the number of properties around Christchurch Harbour (ODUs 3-11) and at Milford on Sea (ODU 18) that would be subject to write-off in the economic damages. This is because most of the properties written off in these areas have flooding <600mm depth. Whilst the vast majority of the property write-off occurs in the future and is therefore discounted, if this change was implemented in isolation it would likely still lead to a reduction in the overall damages (and potential benefits) in these areas.  In ODU 12-17 the property write off occurs due to erosion risk and therefore the proposed changes would not impact these areas.
Write off using national average property values	Based on the most recent published dataset from the UK house price index for January 2025, the national average house prices for England are as follows: detached (£475k), semi-detached (£285k), terraced (£242k) and flat (£225k). These values are less than the values for the south-east and south-west used in the economic assessment and therefore if this change were to be implemented in isolation it would likely reduce the overall damages (and benefits) for the full Strategy frontage.  It is not known whether this change of guidance would apply to both flooding write off and erosion write off.
No capping	Capping is minimal in the baseline economic damages due to property write-off. However, if fewer properties are written off due to the changes outlined above (i.e. only to properties flooding > 600mm), then capping would increase significantly, particularly in epoch 3. Eliminating capping from the assessment would remove the limit on the flood damages that can be applied to a given property and would therefore increase the economic damages (and potential benefits).
Application of damage reducing coefficients	The significance of this change is unclear as there is no further information available on the potential coefficients to be used or the method of application.

The combined impact of the potential guidance changes to write-off and capping is difficult to predict and new calculations would be needed to determine the net change that would result to the economic assessment.

However, to speculate, in an adverse scenario where the overall economic damages and benefits were reduced, this would impact different areas to a different degree:

- Generally the economic case of the leading options is stronger around Christchurch Harbour (SMZ 2) and changes to the guidance resulting in lower benefit cost ratios may not result in significant changes to the overall economic viability of the Strategy in these locations.
- Along the open coast (SMZ 3-6) there are areas where the economic case of the leading options is marginal. If the change to using the national property values is to be applied to erosion damages, then this could reduce the economic damages / benefits along the open coast (because the national property values are less than the regional values). This in turn could impact the overall economic viability of the leading options in some areas and could result in needing to follow different routes through the adaptive pathways in some locations (such as delaying schemes and following backup options until the economic case improves). Furthermore, there is a large amount of uncertainty in considering the impacts as other economic changes could offset the guidance changes, for example, if national property prices continue to rise ahead of inflation over time (as has been the long term trend).

In the future when schemes are developed or the Strategy is reviewed, it is recommended that the economic case is updated to take into account the finalised guidance once it is released by the Environment Agency.

## 2.8 Discount Rate

Discounting is a technique used to compare benefits (and costs) that occur at different points in time over the appraisal period (i.e. the next 100 years). HM Treasury standard discount rates from the Green Book (HM Treasury, 2022) have been used to convert all cash damages to Present Value (PV). This enables the whole life damages, benefits and costs of the options to be compared and also leads to a realistic assessment of the cost implications in today's terms.

According to FCERM-AG, the following variable discount rates have been used within the economic appraisal; 3.5% for the years 0 to 30, 3% for the years 31 to 75, and 2.5% for the years 76 to 99 resulting in a PV factor over 100 years at 29.9 (HM Treasury Green Book, 2022). The annual average (non-discounted, cash) damages were discounted over the appraisal period to calculate the discounted whole life Do Nothing PV damages.

As an example of discounting applied to the economics assessment, if a property values at £100k (in undiscounted cash terms) was to be written off in year 10 (i.e. towards the start of the appraisal period) the discount factor applied in year 10 is 0.71 so therefore the economic damage associated with loss of the property (in PV terms) would be £71k. If the property was instead written off in year 80 (towards the end of the appraisal period), the discount factor applied in year 80 is 0.08 so therefore the economic damage would be £8k (in PV terms).

For Loss of Life and Mental Health damages, a different discount rate has been applied using recent EA guidance<sup>1</sup> based on the Green Book recommendations for impacts associated with health and wellbeing. The following discount rates have been used: 1.5% for the years 0 to 30, 1.286% for the years 31 to 75 and 1.071% for the years 76 to 99 resulting in a PV factor over 100 years at 54.4. The annual average (non-discounted, cash) damages for Loss of Life and Mental Health were discounted over the appraisal period to calculate the discounted whole life Do Nothing PV damages.

## 2.9 Indirect Flood Damages

In addition to the direct flood damages to residential and non-residential properties, indirect flood losses have also been considered. Indirect flood losses reflect deviations from the economic theory that suggests in a perfectly competitive world, all sales or production would simply transfer to a competitor with no financial loss to the nation as a whole. In reality, deviations from the competitive model exist and trade cannot simply be transferred, leading to indirect flood damages. These indirect flood damages are eligible to be included as part of the FCERM-AG and partnership funding process.

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<sup>1</sup> Environment Agency (2020) Advice for flood and coastal erosion risk management authorities: Discount rates, price indices and capping.

The indirect flood damages that have been included in the assessment are discussed further below.

## 2.9.1 Intangible Damages

Intangible damages associated with flooding to cover potential social health impacts, loss of personal items, disruption to the community etc. were included in the assessment at a rate of £279 per residential property (MCM, 2023). Intangible health damages / benefits are not applicable to non-residential properties.

## 2.9.2 Damages to Vehicles

Flood damage to vehicles was considered at a rate of £5,600 per vehicle (MCM, 2023). For the Do Nothing scenario this damage was applied to 42% of residential properties at risk of flooding as suggested by the MCM (2023). Vehicle damages are not applicable to non-residential properties.

## 2.9.3 Evacuation / Temporary Accommodation

Damages associated with the costs of evacuation and temporary / alternative accommodation after flood events have been included. These are based on evacuation costs provided in the MCM (2023) which estimate temporary accommodation and alternative accommodation costs for each residential property at £1,370 and £3,921 respectively. At the strategic scale the distribution of properties requiring temporary or longer term accommodation is unknown and therefore it has assumed that 50% of the residential properties affected by flooding will require temporary accommodation, and 50% will require alternative accommodation. Evacuation and accommodation costs are not applicable to non-residential properties.

## 2.9.4 Traffic Disruption

Flooding can affect roads by leading to traffic disruption and increased journey durations. Traffic disruption depends on the duration of a road closure, length of diversion and volume of traffic. Under the Do Nothing scenario, flooding of the following minor roads is expected; Bridge Street and Stanpit to Mudeford. To estimate the damages generated through traffic disruption to these roads, The Delayed-Hour Method ('method 1') of the MCM was adopted. Traffic disruption damages were considered at a rate of £13.20 per vehicle per hour, where the indicative delay durations were determined according to each return period. Traffic counts provided by BCP from the BCP Drakewell C2 traffic database was used to determine the average number of vehicles passing through the roads in any given hour and this data was assumed to be representative for the assessment.

## 2.9.5 Road Damages

Flooding can damage the integrity of a road surface which will need to be repaired to ensure the safety of vehicle users after the flood event. Road reconstruction costs following flooding have been obtained from the MCM (2023); £15/m<sup>2</sup> for a quiet road and £50/m<sup>2</sup> for a busier road (busier roads typically require a thicker surface layer and road works may need to occur at night or off-peak and thus incurring overtime costs). The areas of flooding on the major roads were obtained from a GIS inspection for the range of return period events and time epochs. The minor roads inspected included Bridge Street and Stanpit to Mudeford and it was assumed that 50% of the road surface would require inspection / repair after a major flood.

## 2.9.6 Education Service Closure

Direct damages from flooding can occur due to the flooding of school buildings, the cost of temporary classroom accommodation and additional costs such as student counselling. Indirect damages may arise from a school closure leading to the loss of parents earning (or number of staff days lost to look after their children), the loss of a pupil's education or additional travel costs to alternative schools or locations. The MCM (2023) provides a number of methodologies for estimating the indirect damages to schools.

The grounds and buildings of Twynham Comprehensive School and the Priory CE Primary School are expected to flood from the Do Nothing Scenario from year 99 (2123) from events of 50% AEP (1:2 yr) or greater and from year 50 from events of 1.33% AEP (1:75 yr) or greater respectively. For the purpose of this assessment, indirect flood damages to the school have been estimated based on the loss of education days for students. The loss of parent earnings has also been calculated as both schools are primary schools and therefore it is expected that the majority of the students would not be suitable to be left at home without supervision.

For the valuation of lost education days the number of full time students at both schools (1700 and 180 respectively) has been multiplied by the cost of a lost education day, based on values of pupil expenditure for each school (£31.01 and £25.41), and then by the number of days the school is expected to be closed following a flood event. It is stated in the MCM (2023) that the disruption time for a school to be closed should be assessed as a maximum of five days.

For the valuation of loss of parent earnings, it is recommended that the number of full time students losing education days is divided by three to account for the following conditions: siblings within a school population, one parent may already be at home looking after younger siblings, one parent may be unemployed, some parents may choose to take annual leave and some may have alternative childcare arrangements. This was then multiplied by the national average daily wage (£91.55) provided in Table 6.20 of the MCM and then by the number of days the school is expected to be closed for a flood event.

## 2.9.7 Loss of Life

The indirect damages associated with potential loss of life from flood events have been estimated by following the Defra Flood and Coastal Defence appraisal guidance; Social Appraisal, Supplementary Notice to Operating Authorities – Assessing and Valuing the Risk to Life from Flooding for the Use in Appraisal of Risk Management Measures (2008).

By utilising this guidance and following the 'Risks to people' method, the loss of life (£) per magnitude of flood event was estimated. This calculation was based upon a number of variables for the appraisal area that included the flood hazard rating (variables include the depth and flow of water, and the debris factor), the area vulnerability rating (variables include a flood warning system, speed of flood onset and the nature of the area), and the people vulnerability rating (age of population, health of population). The loss of life (£) for each magnitude of flood event was then factored by the probability of the flood event occurring to determine an annual damage per year associated with loss of life.

## 2.9.8 Mental Health Damages

The costs of flooding and erosion associated with mental health have been assessed according to recent the Environment Agency guidance<sup>2</sup>. Flooding damages are calculated per adult per flood event, dependent on the depth of flooding. The average depth of flooding for each return period is less than 0.3 metres, therefore a conservative depth of 0.3 metres has been assumed giving damages of £1,878 per adult per flood event. The average number of adults per property is 1.85, therefore the total damage per residential property per flood event of £3,475 has been applied.

Erosion damages are calculated per adult per property at risk of erosion. A loss of £9,546 per adult is incurred in the same year that the property is eroded. Applying this value to the average number of adults per property as 1.85, the total damage per residential property at risk of erosion of £17,660 has been applied.

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<sup>2</sup> Environment Agency (2021) Mental health costs of flooding and erosion. Available from: <https://www.gov.uk/government/publications/mental-health-costs-of-flooding-and-erosion/mental-health-costs-of-flooding-and-erosion> [Accessed 27 April 2022]

## 3. Do Nothing Damages

### 3.1 Properties at risk

The number of properties within the Strategy area expected to be at risk from flooding for a range of return period events for the Do Nothing scenario are presented in Table 3-1.

**Table 3-1: Total number of properties at risk under the Do Nothing scenario, assuming a property threshold of 0.1m for residential and non-residential properties**

Time period	Return period	Residential properties at risk	Non-residential properties at risk	Total properties at risk
Present day	5% AEP (1:20yr)	12	14	26
	1.33% AEP (1:75yr)	27	23	50
	0.5% AEP (1:200yr)	79	41	120
2044	5% AEP (1:20yr)	166	100	266
	1.33% AEP (1:75yr)	263	138	401
	0.5% AEP (1:200yr)	382	170	552
2075	5% AEP (1:20yr)	522	191	713
	1.33% AEP (1:75yr)	770	230	1000
	0.5% AEP (1:200yr)	917	262	1179
2124	5% AEP (1:20yr)	1555	365	1920
	1.33% AEP (1:75yr)	1724	394	2118
	0.5% AEP (1:200yr)	1816	411	2227

Table 3-2 below shows the distribution of properties at risk of flooding across the different SMZs within the Strategy area defined in Section 2.1. Numbers of properties at risk are presented for the 1:20, 1:75 and 1:200 year events in 2024 and 2124.

**Table 3-2: Number of Properties at Risk of Flooding by Zone (2024 and 2124)**

SMZ	1:20 Year Residential	1:20 Year Non-Residential	1:75 Year Residential	1:75 Year Non-Residential	1:200 Year Residential	1:200 Year Non-Residential
<b>Present Day (2023)</b>						
1	0	0	0	0	0	4
2	10	14	24	23	74	36
3	1	0	1	0	1	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	1	0	2	0	4	1
<b>Total</b>	12	14	27	23	79	41
<b>2123</b>						
1	0	6	0	6	0	6
2	1512	334	1675	358	1760	371
3	2	1	4	1	9	3
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	41	24	45	29	47	31
<b>Total</b>	1555	365	1724	394	1816	411

The total number of properties at risk from erosion (non-cumulative) along the Strategy frontage are presented in Table 3-3.

**Table 3-3: Number of Properties at Risk from Erosion**

Epoch	Residential Properties at Risk	Non-Residential Properties at Risk	Total Properties at Risk
<b>Epoch 1: 2024 - 2044</b>	8	17	25
<b>Epoch 2: 2044-2074</b>	219	24	243
<b>Epoch 3: 2074-2124</b>	1185	180	1365

Table 3-4 shows the distribution of properties at risk from erosion in each epoch across each of the zones.

**Table 3-4: Number of Properties at Risk of Erosion by Zone**

SMZ	Epoch 1: Total Properties at Risk	Epoch 2: Total Properties at Risk	Epoch 3: Total Properties at Risk
1	0	0	0
2	0	0	0
3	9	41	313
4	10	120	477
5	0	0	1
6	6	82	574
<b>Total</b>	25	243	1365

## 3.2 Damages

### 3.2.1 Overall Damages

The Do Nothing damages for the appraisal period are presented below in Table 3-5 and Table 3-6 below. In the tables 'Cash' damages refer to the undiscounted damages (presented in today's cash terms) whereas the Present Value 'PV' damages are those which include discounting through time.

Table 3-5 presents the direct damages to properties associated with individual return period flood events within the Strategy area. The damages presented in this table do not include erosion or indirect damages and do not consider the probability of each flood event occurring. The impacts of property write-off and capping are also not represented in the values shown in this table.

**Table 3-5: Do Nothing cash damages (direct damages to properties only) for individual flood events**

Return Period Event	Do Nothing Cash Damage for individual flood events (£k) by Year			
	2024	2044	2074	2124
50% AEP (1:2yr)	245	2,445	7,938	46,439
20% AEP (1:5yr)	347	3,941	11,063	52,865
10% AEP (1:10yr)	418	5,702	13,957	58,323
5% AEP (1:20yr)	589	7,797	17,638	63,097
3.33% AEP (1:30yr)	746	8,639	19,074	65,074
2% AEP (1:50yr)	971	10,784	22,498	69,241
1.33% AEP (1:75yr)	1,231	12,444	25,535	71,983
1% AEP (1:100yr)	1,601	13,627	27,499	74,025
0.5% AEP (1:200yr)	2,373	16,711	32,309	78,634
0.1% AEP (1:1000yr)	4,316	25,280	41,953	87,853

Table 3-6 presents the total damages over the duration of the appraisal period for the Strategy area. These total damages consider the probabilities of the different flood events occurring, include the erosion damages, the indirect damages and also account for property write-off and capping.

For the Strategy area, the total Do Nothing undiscounted cash damages are estimated to be approximately £1.21 billion over the next 100 years. In discounted present value (PV) terms this equates to approximately £186.2 million.

**Table 3-6: Total Do Nothing damages**

Extent	Do Nothing Cash Damages (£k)	Do Nothing PV Damages (£k)
Strategy Area	1,213,479	186,237

### 3.2.2 Distribution of Damages – Type

The distribution of damages between direct flood damages, direct erosion damages and indirect damages over the 100 year appraisal period is presented in Figure 3-1 below. In PV terms, the total direct flood damages are estimated to be approximately £77 million (42%), the direct erosion damages are £62 million (33%) and the indirect damages are £47 million (25%). In undiscounted cash terms, the direct flood damages are estimated to be approximately £603 million (50%), the direct erosion damages are approximately £463 million (38%) and the indirect damages are approximately £148million (12%).

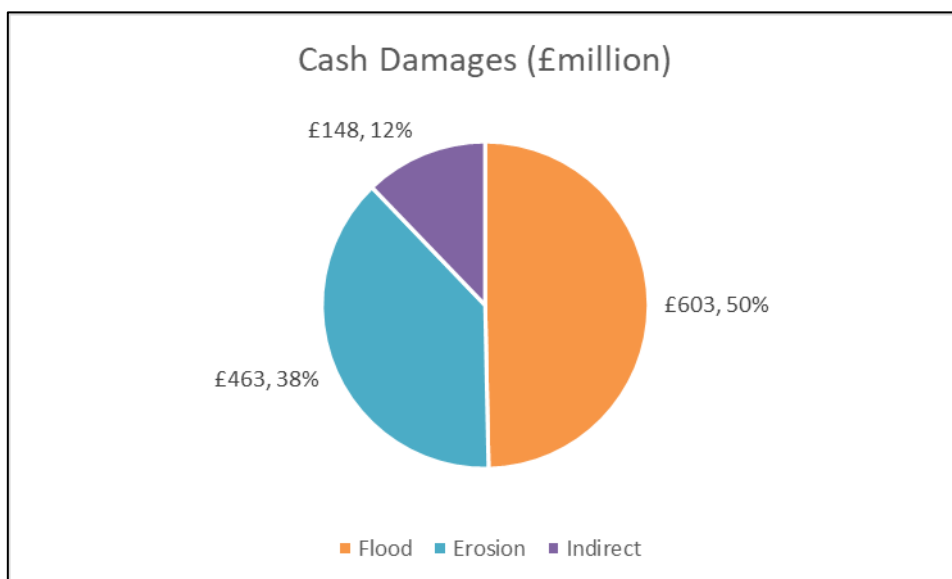


Figure 3-1: Distribution of cash damages for the Strategy area over the 100-year appraisal period

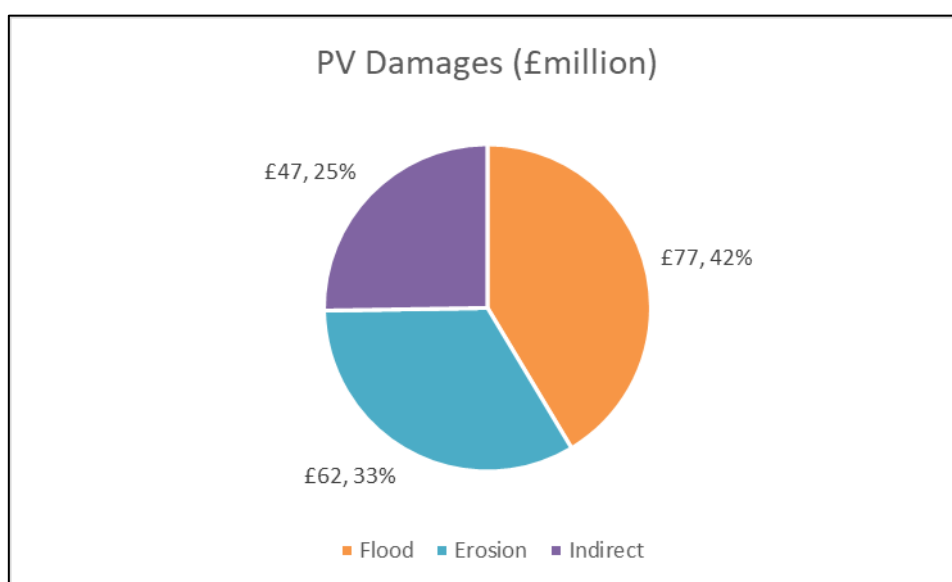


Figure 3-2: Distribution of PV damages for the Strategy area over the 100-year appraisal period

### 3.2.3 Distribution of Damages – Timing

The proportion of damages in each time epoch is presented in Table 3-7 below.

Table 3-7: Distribution of Damages by Time Epoch

Period	Do Nothing Cash Damages (£k)	Do Nothing PV Damages (£k)
Epoch 1: 2024-2044	14,135	10,618
Epoch 2: 2044-2074	151,679	57,553
Epoch 3: 2074-2124	1,047,665	118,067
Total	1,213,479	186,237

The distribution of PV damages over time is shown graphically in Figure 3-3 below.

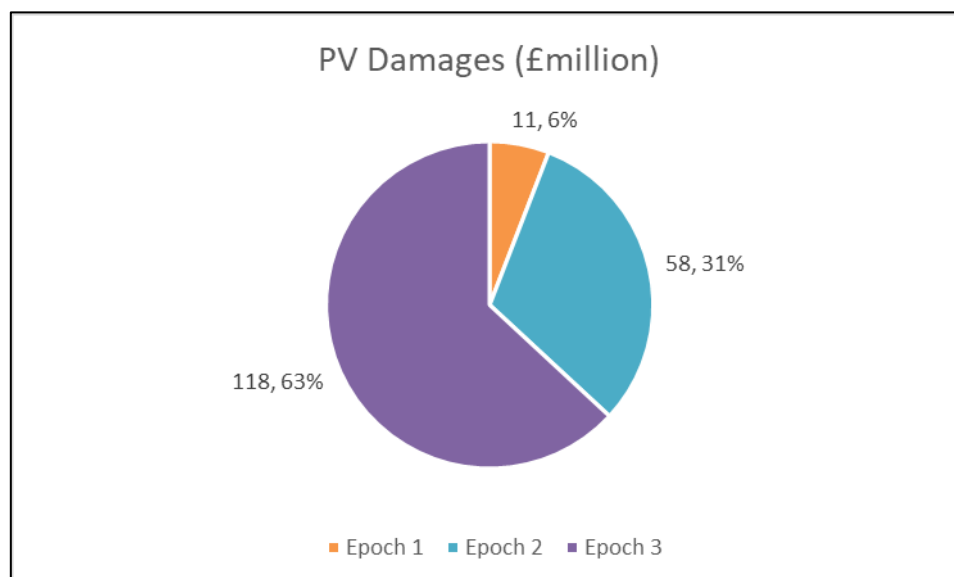


Figure 3-3: Distribution of Damages Through Time over the 100-year appraisal period

### 3.2.4 Distribution of Damages – Location

The distribution of total flood and erosion Do Nothing damages between the SMZs is presented in Table 3-8 below. As can be seen, SMZ 2 has the largest proportion of damages with over 59% in PV terms and 58% in cash terms. SMZs 1 and 5 have the lowest proportion of the damages, with only 0.1% in PV terms and 0.1% in cash terms. The distribution of damages along the Strategy frontage is a strong indicator of where schemes are likely to be most viable from a cost and funding perspective.

Table 3-8: Do Nothing Damages by SMZ

SMZ	PV Damages (£k)	PV Damages (% of total)	Cash Damages (£k)	Cash Damages (% of total)
1	153	0.1	1,227	0.1
2	111,297	59.8	708,968	58.4
3	15,935	8.6	110,221	9.1
4	28,364	15.2	184,139	15.2
5	73	<0.1	707	0.1
6	30,415	16.3	208,216	17.2
<b>Total</b>	<b>186,237</b>	<b>100</b>	<b>1,213,477</b>	<b>100</b>

### 3.2.5 Distribution of Damages – Annual average damage / write-off

Table 3-9 below shows the distribution of damages associated with AADs (counted annually) and the damages associated with property write-off (counted as a lump sum at the time of write-off). The AADs include flood damages and indirect damages. The write-off damages can be caused by both erosion and flooding.

**Table 3-9: Distribution of Damages between AAD and WO**

Period	AAD PV Damages (£k)	AAD Cash Damages (£k)	Write-off PV Damages (£k)	Write-off Cash Damages (£k)
Epoch 1: 2024-2044	7,592	11,109	3,026	3,026
Epoch 2: 2044-2074	19,208	51,326	38,344	100,353
Epoch 3: 2074-2124	42,251	191,501	75,815	856,164
<b>Total</b>	69,051	253,936	117,185	959,543

## 4. Sensitivity Testing Baseline Damages

### 4.1 Property Threshold Levels

A key uncertainty in the valuation of the Do Nothing damages is the values that have been assumed for the property thresholds. Residential and non-residential property threshold levels have been assumed to be 0.1m and refer to section 2.5.2 for more details on this. The threshold level for residential and non-residential properties has been sensitivity tested with alternative thresholds of 0, 0.05m, 0.15m, 0.2m and 0.3m. Table 4-1 presents the changes to the total PV damages with varying values of threshold for the residential properties which were not surveyed.

The test indicates that the overall Do Nothing damages are sensitive to the assumed property threshold level; an increase in property threshold to 0.3m (from 0.1m) decreases the Do Nothing damages by approximately 30%. A reduction in the property threshold to 0.0m increases the Do Nothing damages by approximately 35%. However, the difference in damages when using a 0.15m threshold is only 7% and given the absence of further information on the property threshold, the use of 0.1m is still considered to be most acceptable for this strategic level appraisal.

It is not considered necessary to obtain more information on the threshold level of properties for the Strategy. However, when schemes are progressed, it is recommended that a threshold survey is undertaken on the properties in the benefit area to obtain a more accurate representation of the threshold level.

**Table 4-1: Sensitivity test of residential threshold levels in relation to the total PV damages (£k)**

Option	Threshold level					
	0m	0.05m	0.10m (original)	0.15m	0.20m	0.30m
<b>Do Nothing (£k)</b>	250,445	234,526	186,237	173,129	144,424	129,698
<b>Percentage change from original</b>	+34.5%	+25.9%	NA	-7.0%	-22.5%	-30.4%

### 4.2 Property values

As outlined in Section 2.7.3, the MCM guidance recommends using regional house price values in the economic assessment and therefore property values for the South West region of England have been used for properties within the BCP jurisdiction and property values for the South East region of England have been used for properties within the NFDC jurisdiction. As a sensitivity test, the impact of using local property values on the Do Nothing damages has been assessed.

Two tests have been undertaken;

- using average property values for the BCP jurisdiction and the NFDC jurisdiction obtained from the HM Land Registry UK house price index dataset for November 2023.
- using average property prices for the SO41, BH25, BH23 and BH6 post code areas obtained from [Home.co.uk](https://www.home.co.uk). Average sold prices for the past three months of data (through to September 2023) were used.

Both of these tests use more locally specific property value information, particularly the second test using the average property prices for individual post code areas which is likely to more representatively account for the coastal setting of the properties in the study area.

The Do Nothing damages across the Strategy area for these sensitivity tests are shown in Table 4-2. As can be seen, the sensitivity test using the average property prices from the local post code areas leads to the largest Do Nothing damages of approximately £212million in PV terms. Using the average BCP / NFDC property values from the HM Land Registry house price index also increases the Do Nothing damages but less significantly, with the Do Nothing damages for this test just over £191million in PV terms).

Table 4-2: Sensitivity test of property valuations

Sensitivity test	Average property value (£k)				PV Do Nothing Damage (£k)
	Detached	Semi	Terraced	Flat	
<b>Original approach - Regional property value (South West and South East regional values)</b>	512,269 (BCP)	331,127 (BCP)	265,549 (BCP)	189,087 (BCP)	186,237
	689,087 (NFDC)	421,545 (NFDC)	322,211 (NFDC)	223,459 (NFDC)	
<b>Average BCP / NFDC property values</b>	562,841 (BCP)	359,235 (BCP)	289,375 (BCP)	208,237 (BCP)	191,156
	596,435 (NFDC)	398,834 (NFDC)	310,713 (NFDC)	212,366 (NFDC)	
<b>Average post code property values (SO41, BH25, BH23 and BH6)</b>	720,105 (BCP)	430,776 (BCP)	273,348 (BCP)	251,119 (BCP)	212,224
	771,936 (NFDC)	474,750 (NFDC)	361,237 (NFDC)	269,094 (NFDC)	

# 5. GVA and Wider Benefits

## 5.1 Gross Value Added (GVA) Assessment

A GVA assessment determines the wider financial impacts of the Do Nothing scenario and the potential economic benefits of FCERM interventions to the local and regional economy. These financial impacts on the local economy are not currently assessed within the FCERM appraisal process (presented in Section 2 to 4), in which impacts are considered from the national perspective. This national loss assessment or ‘first round impacts’ provides the data which feeds FCERM GiA funding appraisals; however, this excludes locally important benefits for which other funding streams may be available. The ‘first-round impacts’ assume no change in the composition of businesses or their behaviour over time. As such, the GVA assessment therefore compliments, rather than replaces, standard FCERM appraisal approaches. The findings of the GVA assessment will be of benefit for pursuing non-GiA funding contributions for FCERM Schemes under the current Partnership Funding system.

The local economy is defined as businesses and their employees located in the geographical area that is of interest; in this case, Christchurch Bay and Harbour. The size of the local economy is typically measured by the value created by businesses and their employees. FCERM schemes can alleviate the adverse impacts of flooding on the local economy, and therefore deliver benefits.

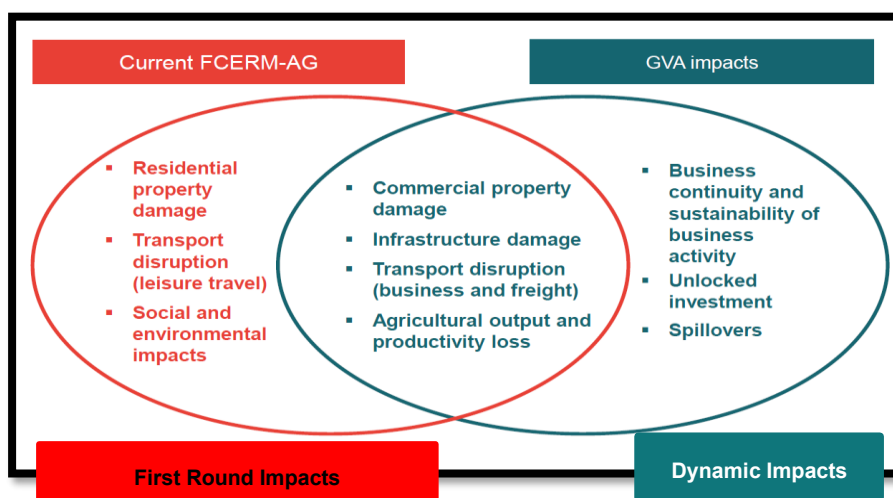
In addition to the first-round impacts, additional impacts on the local economy may arise from the flooding and erosion risk in the baseline scenario. This is because changes in flood and erosion risk could alter business decisions and behaviour over time. These impacts are referred to as ‘dynamic impacts’. Such business decisions are assumed to be driven by two key factors; adaptive capacity and location dependence:

*Adaptive Capacity:* the degree to which a business is able to prepare, respond and recover appropriately given its size, resources (financial, knowledge, experience or information), and nature of activity.

*Location dependence:* the degree to which a business is likely to consider moving to another area with lower flood risk. This would be influenced by its dependence on factors in the local area (or ‘location dependence’).

On the basis of a business’s adaptive capacity and location dependence, a business may decide to stay in its current location and Do Nothing (stay & do nothing); stay where it is but invest in adaptation (stay & adapt); move away from the flood risk to another area (move) or cease trading (shutdown).

This GVA assessment has assessed the dynamic impacts of flooding in the study area, by considering the outcomes of business behaviour change when FCERM is implemented, compared to a case when it is not (Do Nothing). The overlap between first round and dynamic impacts is illustrated in Figure 5-1.



**Figure 5-1: Overlap of current FCERM-AG (first round) economic impacts and additional (dynamic) impacts.**

## 5.1.1 First Round Impacts

The first-round impacts have been established within Section 3 for a 100-year appraisal period, in line with the Strategy. The total first-round impacts for this period equate to approximately £186,237k (PV).

## 5.1.2 Dynamic Impacts

The dynamic impacts of flooding and erosion in Christchurch Bay & Harbour have been established in this GVA assessment. The dynamic impacts reflect the outcomes for the local economy over time as businesses respond to changes in flood and erosion risk. Strategic coastal flood risk management interventions in Christchurch Bay & Harbour are likely to:

- Support business continuity and sustainability of business activity in an area;
- Help 'Unlock' investments that might otherwise have been constrained or unattractive given the flood risk; and,
- Potentially lead to 'spillover' impacts which reflect interdependencies or other intangible impacts on economic activity.

### Methodology

The GVA methodology has followed that specified in the Frontier Economics Toolkit<sup>3</sup> (2014) which was developed under the Joint Defra / Environment Agency FCERM Research and Development programme. It should be noted that the methodology to establish FCERM related GVA, and its application to FCERM projects, continue to evolve. Therefore, it is likely that the approach, data and assumptions will need to be reviewed and updated over time as a richer evidence base and refined methodology becomes available. Given the strategic level of this assessment, the 'light touch' assessment approach from the guidance has been used rather than the 'detailed' assessment approach.

Based on the Frontier Economics Toolkit, AECOM has developed a Local Economic Valuation of Impacts Tool (LEVI). The tool has been used to estimate the wider impacts on economic activity by considering business's likely responses to flood risk.

### Data

The National Receptor Database (NRD) was used to identify non-residential properties at risk of flooding and erosion within Christchurch Bay & Harbour. The onset of flooding and erosion to each of the NRD property locations was determined using a point inspection in GIS and the erosion/flood datasets outlined in Sections 2.3 and 2.4 of this report.

The key inputs to the LEVI tool include salary information and regional employment statistics, as summarised below:

- Salary information was obtained from the Office for National Statistics (ONS) dataset; EARN03, average weekly earnings by industry<sup>4</sup>. This dataset is updated on a monthly basis and the latest release available was the November 2023 dataset (released 16<sup>th</sup> January 2024). The dataset provides non-seasonally adjusted average weekly earnings, bonuses and arrears for the 24 industries in the UK (for example; manufacturing, construction, retail, education, agriculture etc.). The dataset was used to estimate average annual salaries across each of the industries.
- Regional employment statistics were obtained from the Department for Business, Energy and Industrial Strategy's 'Business Population Estimates for the UK and Regions' database (2020)<sup>5</sup>. The statistics provide data on the number of businesses and their associated employment and turnover and is grouped into categories based on the number of employees in a business.
- The number of residents in employment were obtained from the NOMIS Official Labour Market Statistics<sup>6</sup>. The statistics for BCP and NFDC were used in the GVA assessment, which provides the number of residents ages 16 to 74 who are in full time employment.

<sup>3</sup> Frontier economics; Joint Defra/EA FCERM R&D programme – project FD2662. Toolkit, March 2014

<sup>4</sup><https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/datasets/averageweeklyearningsbyindustryyear03>

<sup>5</sup><https://www.gov.uk/government/statistics/business-population-estimates-2020>

<sup>6</sup><https://www.nomisweb.co.uk/reports/lmp/la/contents.aspx>

- B2B marketing data was purchased to help inform the assessment. The data was interrogated to determine the distribution of businesses within the study area by sector and this information was used to weight the distribution of businesses in the assessment accordingly.

### **Length of Disruption**

The average length of business disruption due to flooding is an input parameter to the LEVI tool and there is a degree of uncertainty regarding how long it takes a business to recover from a flood event, especially without business specific surveys of likely response. The Frontier Economics Toolkit provides suggested disruption periods, with and without FCERM intervention. These averages are based on an assessment of published evidence and engagement with various stakeholders across England following previous flood events. The toolkit suggests that without intervention, a business could be disrupted for around 16-24 weeks because of flooding, and 2-4 weeks with the FCERM intervention.

Given the uncertainty in the time taken for each individual business affected by flooding to recover, the mid-point of the ranges provided by the toolkit have been adopted in this assessment; 20 weeks of disruption without FCERM and 3 weeks of disruption with FCERM intervention. Using the mid-point of the range is considered to be a reasonable assumption given that some businesses will recover faster and some slower than the mid-point. The length of disruption following flooding is a key assumption in the assessment and it should be sensitivity tested during scheme level appraisal. Typically there would be a strong incentive for businesses to reopen as soon as possible during a flood event, and therefore sensitivity tests of a shorter duration are recommended (e.g. 8 weeks) to determine the impact on the calculations.

The length of business disruption due to erosion has been assumed to be permanent and for the remainder of the appraisal period, as per the recommendations of the Frontier Economics Toolkit. The timing of erosion risk and the discounting has followed the same assumptions as undertaken for the baseline economic assessment described in Section 2.4 of this report.

No flood damages were applied to properties that get written-off, either due to a high frequency of flooding (i.e. from 1:3 year events or less) or from coastal erosion.

### **Business Response**

Businesses operate in the context of uncertainty about when, how, what scale, duration and frequency they may experience flooding. They have to make business decisions to manage the risks they face. In response to flood and erosion risk, businesses respond in one of four ways:

- Stay and Do Nothing;
- Stay and Adapt;
- Move; or
- Shut Down.

A key step in estimating the dynamic impacts on the local economy is to understand the likely business response to flooding. In order to determine this with most certainty it is recommended by the toolkit that detailed business questionnaires are undertaken. However, in the absence of questionnaires the toolkit provides a series of indicative look-up tables showing the likely business response for different business types and sizes which have been adopted in this assessment.

Based on the information provided in the lookup tables each of the businesses identified in the flood risk areas in the Strategy area was assigned a likely business response. Should more detail be required during subsequent scheme appraisals then it is recommended that business questionnaires are undertaken on a suitable sample size to validate or refine the estimates applied from the lookup tables.

### **Duration of assessment**

Typically, a GVA assessment is undertaken using a 10-year appraisal period, as this timeframe reflects where direct impacts can be reasonably attributed or linked to specific FCERM interventions. Beyond this period the envelope of uncertainty grows significantly, and other factors may become more influential in determining the behaviour of businesses. A 10-year appraisal period has been adopted in this study. However the potential impact has also been calculated for a longer term time period to enable comparisons with the first round impacts; calculations have been undertaken for a 50-year and 100-year appraisal period. Although there is much more uncertainty associated with

a 50-year and 100-year appraisal periods, this information can be used to provide an initial estimate of the potential impact of flooding and erosion on GVA over longer timescales in line with the Strategy appraisal period of 100 years.

The GVA estimations are based on an average annual figure for the period which is then presented as a discounted (PV) total for the whole period. The base year of appraisal used was 2023 with an annual discount rate of 3.5% for the years 0 to 20, 3% for the years 31 to 75 and 2.5% for the years 76 to 99. These discount factors have been applied according to the HM Treasury Green Book and results in a PV factor of 29.9 over 100 years<sup>7</sup>.

### National Receptor Dataset '999' properties

As outlined in Section 2.5.1, there are over seven hundred '999' classified properties in the NRD dataset. The 999 classification represents properties where the land use is unknown. Many of these properties are expected to be businesses and would therefore contribute to the GVA dynamic impacts to the local economy if flooded or eroded. However, the exact number of '999' properties that are businesses is unknown and therefore including all the '999' properties in the analysis increases uncertainty.

The dynamic impacts have therefore been calculated with and without these '999' properties included, providing an upper and lower range estimate of the impact value. **It is likely that the GVA value falls between these thresholds, but for planning, funding and investment purposes, in order to be conservative it is recommended that the lower range value is used.** Further work after the Strategy could be undertaken to more accurately calculate the number of the '999' properties that are businesses and to refine the GVA value accordingly.

### Uncertainties

There are many uncertainties associated with the GVA dynamic impact assessment. The 'light touch' approach from the Frontier Economics guidance has been used which uses regional data on size of businesses, national data on typical salaries and makes high level estimates on likely business responses, each introducing uncertainty into the assessment. In addition, there are a large number of '999' properties in the property dataset and therefore providing an exact GVA dynamic impact value is challenging at this stage. Furthermore, as outlined in the guidance, GVA assessments looking over time horizons greater than 10 years are less meaningful and highly uncertain and therefore the results for periods greater than 10 years should be considered within this context. During subsequent appraisal at ODU level, it is recommended that more detailed GVA assessments are undertaken to inform specific business cases for schemes.

## 5.1.3 Results of Dynamic Impacts Assessment

The results of the dynamic impact assessment are presented in Table 5-1 and Table 5-2 below. Results have been generated using flood extents and erosion zones for the baseline Do-Nothing scenario for a 10-year, a 50-year period and 100-year period. Two business responses have been considered; Stay and Do Nothing (for all of the businesses considered) and then the likely business response (a different response for each business; either Stay and Do Nothing, Stay and Adapt, Move, or Shut Down).

Results are presented with and without NRD '999' classified properties included in the calculations. The results with the NRD '999' properties included represents a maximum or upper limit of the impact, whereas the results with the NRD '999' properties excluded represents a minimum or lower limit of the impact. **For planning, funding and investment purposes it is recommended that the lower value is used (excluding NRD 999 properties) as there is a high amount of uncertainty with the NRD 999 properties.**

As per the Toolkit methodology, the GVA impact has been derived by estimating the value of the reduction in employee productivity (i.e. lost employee work hours/days) due to flooding which would make their workplace either unsafe, inaccessible or less efficient to work at.

The Stay and Do-Nothing business response produces the largest dynamic impact:

- For the upper range estimate (including all NRD '999' properties), over the next 10 years the total negative GVA impact due to flooding and erosion is estimated to be £8.7million in PV terms and £10.5million in undiscounted cash terms. Over 50 years this increases to over £167.3million in PV terms and £511million in

<sup>7</sup> HM Treasury (2020) *The Green Book: Central Government Guidance on Appraisal and Evaluation*. Available from: [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/938046/The\\_Green\\_Book\\_2020.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/938046/The_Green_Book_2020.pdf) [Accessed 24 February 2022]

undiscounted cash terms, and over 100 years this increases to over £419.4million in PV terms and £3.5 billion in undiscounted cash terms.

- For the lower range estimate (excluding all NRD '999' properties), over the next 10 years the total negative GVA impact due to flooding and erosion is estimated to be £3.3million in PV terms and £4million in undiscounted cash terms. Over 50 years this increases to over £66.1million in PV terms and £201million in undiscounted cash terms, and over 100 years this increases to £120.9million in PV terms and £775 million in undiscounted cash terms.

The total dynamic impact based on the most likely business response (i.e. either Stay and Do Nothing, Stay and Adapt, Move or Shut Down) is less than the Stay and Do-Nothing response for all businesses:

- For the upper range estimate (including all NRD '999' properties), over the next 10 years the negative GVA impact is estimated to be approximately £6.6million in PV terms or £8million in undiscounted cash terms. Over the next 50 years the impact would be expected to be approximately £148.2million in PV terms and over £459.5million in undiscounted cash terms, and over 100 years this increases to over £384.4million in PV terms and £3.3billion in undiscounted cash terms.
- For the lower range estimate (excluding all NRD '999' properties), over the next 10 years the negative GVA impact is estimated to be approximately £2.5million in PV terms or £3million in undiscounted cash terms. Over the next 50 years the impact would be expected to be approximately £59million in PV terms and over £181.8million in undiscounted cash terms, and over 100 years this increases to over £109.9million in PV terms and £717million in undiscounted cash terms.

**Table 5-1: Upper range estimate of dynamic impacts including NRD '999' properties (10-year, 50-year and 100-year appraisal period, based on flood and erosion risk from FCERM Do Nothing scenario, existing businesses only)**

Business response	10 year appraisal period		50 year appraisal period		100 year appraisal period	
	Cash total dynamic Impacts - £k	PV total dynamic Impacts - £k	Cash total dynamic Impacts - £k	PV total dynamic Impacts - £k	Cash total dynamic Impacts - £k	PV total dynamic Impacts - £k
Stay and Do Nothing (all businesses)	10,525	8,740	511,229	167,334	3,518,952	419,358
Likely business response (varies by business)	7,967	6,616	459,586	148,226	3,288,177	384,478

**Table 5-2: Lower range estimate of dynamic impacts excluding NRD '999' properties (10-year, 50-year and 100-year appraisal period, based on flood and erosion risk from FCERM Do Nothing scenario, existing businesses only)**

Business response	10 year appraisal period		50 year appraisal period		100 year appraisal period	
	Cash total dynamic Impacts - £k	PV total dynamic Impacts - £k	Cash total dynamic Impacts - £k	PV total dynamic Impacts - £k	Cash total dynamic Impacts - £k	PV total dynamic Impacts - £k
Stay and Do Nothing (all businesses)	3,979	3,330	201,003	66,055	775,407	120,898
Likely business response (varies by business)	3,012	2,521	181,801	59,010	717,003	109,929

## 5.1.4 Non-quantified 'Spillover' Impacts

Flooding and erosion are likely to lead to a number of additional impacts to the local economy which have not been quantified as part of the GVA assessment for this study. These impacts are known as 'spillover' impacts and include:

- *Agglomeration impacts*: should FCERM measures be put in place in Christchurch Bay & Harbour to reduce the flood and erosion risk, this could incentivise the existing businesses to remain in their current preferred location and benefit from the productivity gains associated with proximity to other similar businesses, for example, sharing ideas, knowledge, supply chains etc.
- *Interdependencies*: FCERM measures will not only protect homes and businesses, but they will also protect the key public infrastructure on which businesses and the local economy relies upon. FCERM measures would therefore help to avoid disruptions associated with power outages, transport (affecting workers, customers or deliveries), communications and water supply.
- *Business confidence*: an increase in flood risk could affect business confidence which in turn could lead to decreased business investment and reduced productivity (or increased investment and productivity if FCERM measures are implemented).
- *Insurance*: FCERM measures could lead to a reduction in the cost of insurance which in turn can affect credit because flooding insurance (in certain locations) is often required by lenders. At the time of writing this report further national research and guidance is required to investigate the link between FCERM measures and insurance to gauge the significance of this.
- *Land values*: FCERM measures could lead to an increase in land values over the longer term because of the reduction in flood risk.

In a strategic level study such as this, it was not possible to quantify any of the potential spillover impacts outlined above. However, it may be possible to quantify these in a detailed GVA assessment where further data from individual businesses is made available. Such detailed GVA assessments are typically carried out during scheme level appraisals.

Outside of the local economy, flooding and erosion to businesses in Christchurch Bay and Harbour could have a knock-on impact to regional and national supply chains. For example, products or services from businesses in the area may be essential to businesses in other parts of the country and could therefore impact on the wider economy.

## 5.2 Visitor Economy

Tourism at the seafront across Christchurch Bay and Harbour is a key contributor to the local economy, with the value of coastal day visits estimated at £25million in 2019<sup>8</sup>, and jobs in the visitor economy representing approximately 36% of businesses across the region<sup>9</sup>. As such, the risk of flooding and coastal erosion has the potential to significantly damage the local economy, through its impact on visitor attractions. The following impacts associated with the Do Nothing scenario could occur:

- Currently the beach material along large parts of the frontage are managed through a programme of beach recycling and renourishment works. Should this activity be ceased under the Do Nothing scenario, it is possible that parts of the Strategy beachfront may become inaccessible to visitors, either by loss of beach material leaving a smaller or no beach, or through the council needing to close off areas due to health and safety concerns (for example due to actively eroding cliffs). This has the potential to reduce visitor numbers to the area and having a knock on impact on the visitor economy.
- Should the cliffs erode as expected under the Do Nothing scenario, visitor amenity assets such as car parking, footpaths, public toilets and restaurants / cafés are likely to erode. Without these visitor amenities along the coastline it is likely that visitor numbers to the area would reduce, thus having a knock on impact to the visitor economy.

To estimate the impact of the Do Nothing scenario to the visitor economy in Christchurch Bay and Harbour, the data from Visit Britain (2019) for the value of coastal visits in Christchurch has been utilised (estimated day visits to coastline in Christchurch area of 860,000). Using the SMP erosion zones in GIS, the economic impact to the visitor economy for the Strategy beach frontage has been calculated, with the results presented annually and for a 20-year, 50-year and 100-year appraisal period in Table 5-4. The calculations are based on the following approach:

- On a national basis there is a lack of research surrounding the impact of coastal erosion on visitor numbers to the coastline and therefore it is difficult to predict the extent to which visitor numbers may decline with the Do Nothing scenario.
- Different parts of the frontage are likely to be affected differently and there is also potential for visitors to transfer from one part of the frontage to another if a certain area is still attractive / safe to visit.
- Therefore, rather than estimating to what extent visitor numbers may be reduced, the impact for a range of percentage reductions in visitor numbers have been quantified; from a 10% to 90% reduction. This provides values for the economic impact to the visitor economy for a range of plausible scenarios.
- Table 5-3 shows the monetary impact associated with each of these scenarios. For each of the calculations the start of the impacts has been assumed to occur from Year 10 onwards based on the onset of erosion from the SMP zones. As such, the total visitor spend per year for day visits has been taken as the damage value for each year from year 10 onwards.

<sup>8</sup> Visit Britain (2019) GB Day Visits Survey. Available from: <https://www.visitbritain.org/gb-day-visits-survey-latest-results> [Accessed 09 May 2022]

<sup>9</sup> B2B Business data for Christchurch Bay & Harbour.

**Table 5-3: Sensitivity test to determine the financial impact for a range of percentage reductions in day visitors following coastal erosion of the beach across Christchurch Bay and Harbour**

Reduction in visitor numbers	Annual damage from year 10 onwards (Cash £k)	20-year appraisal period damages		50-year appraisal period damages		100-year appraisal period damages	
		Cash (£k)	PV (£k)	Cash (£k)	PV (£k)	Cash (£k)	PV (£k)
10%	2,572	28,294	16,686	105,460	40,140	231,498	53,259
20%	5,144	56,588	33,373	210,920	80,279	462,996	106,517
30%	7,717	84,883	50,059	316,381	120,419	694,494	159,776
40%	10,289	113,177	66,745	421,841	160,559	925,992	213,034
50%	12,861	141,471	83,431	527,301	200,699	1,157,490	266,293
60%	15,433	169,765	100,118	632,761	240,838	1,388,988	319,551
70%	18,005	198,059	116,804	738,221	280,978	1,620,486	372,810
80%	20,578	226,354	133,490	843,682	321,118	1,851,984	426,069
90%	23,150	254,648	150,177	949,142	361,258	2,083,482	479,327

As an example and for illustration purposes, should day visitor numbers reduce by 20% the annual undiscounted cash value from the year of erosion is expected to be approximately £5.1million. With this scenario the total PV damages are estimated to be approximately £33.3million for 20 years and the equivalent value in undiscounted cash terms is approximately £57million. Over the next 50 years, the impacts are expected to increase with the total PV impact of £80million and the undiscounted cash damages estimated at £211million. Over 100 years this increases to £107million PV and £463million in undiscounted cash damages.

**Table 5-4: Example - damage to the visitor economy through coastal erosion under a Do Nothing scenario based on a 20% reduction in day visits**

Damages	Annual damage from year 10 onwards (Cash £k)	20-year appraisal period		50-year appraisal period		100-year appraisal period	
		Cash (£k)	PV (£k)	Cash (£k)	PV (£k)	Cash (£k)	PV (£k)
Day Visits	5,144	56,588	33,373	210,920	80,279	462,996	106,517

It should be noted that the value of coastal day visits used to make this assessment was estimated in 2019, before the COVID-19 pandemic. Since then, day tourism patterns may have changed and would therefore not be included in this assessment.

## 5.3 Car Park Income

The income to BCP and NFDC from car parks across Christchurch Bay and Harbour allows the two Councils to provide a range of services to its residents. As such, under the Do Nothing scenario, the risk of coastal erosion to car parks within the Strategy area has the potential to reduce the council income and consequently impact the amount and quality of services they can provide. The loss of car parks in the Strategy area may also result in fewer tourists visiting Christchurch Bay and Harbour, impacting the visitor economy.

There are numerous car parks within the Strategy area that have been identified as being at risk of coastal erosion over the 100-year appraisal period. The SMP erosion zones have been used to determine when either the car park itself erodes or the access roads to the car parks erode. The annual income per car park has been provided by BCP Council from 2021 and NFDC from 2019/20 and is taken as the damage value each year from the year of erosion.

The total Do Nothing PV damages over the next 20 years, 50 years and 100 years for car park income in BCP council jurisdiction are presented in Table 5-5. Total PV damages are estimated to be approximately £3.2million for 20 years and the equivalent value in undiscounted cash terms is £5.4million. Over the next 50 years, this is predicted to increase to £11.4million PV and £35.9million undiscounted cash damages, increasing to £19.6million PV and £118.0million undiscounted cash damages over the next 100 years.

**Table 5-5: Estimated impact of coastal erosion on Car Park income, under a Do Nothing scenario**

Car Park	Annual Income (£k)	20-year appraisal period		50-year appraisal period		100-year appraisal period	
		Cash (£k)	PV (£k)	Cash (£k)	PV (£k)	Cash (£k)	PV (£k)
Mundeford Quay	601	5,395	3,182	35,863	11,388	118,023	19,635
Avon Beach	237						
Avon Run Road	185						
Steamer Point	149						
Highcliffe Castle	118						
Highcliffe Top	277						
Barton on Sea – Marine Drive 3	6						
Barton on Sea – Marine Drive East	18						
Barton on Sea – Marine Drive West	20						
Milford on Sea – Hordle Cliff West	63						
Milford on Sea – Hurst Road East	115						
Milford on Sea – Hurst Road West	32						
Milford on Sea – Paddy's Gap / Hordle Cliff	42						
Milford on Sea – Sturt Pond / Hurst Road	6						

## 5.4 Beach Hut Income

Based on the NRD dataset and information obtained from New Forest District Council, there are 1005 beach huts located along the Strategy beachfront area and at risk from coastal erosion under the Do Nothing scenario. Although these beach huts are privately owned, beach hut owners must pay annual license fees to BCP Council / NFDC which provides an income to both councils. Loss of these huts would reduce the income to the council and could also result in beach hut owners visiting other coastal areas instead outside of the Strategy area, thus impacting the visitor economy.

The SMP erosion zones have been used to identify beach huts at risk of erosion over the 100-year appraisal period and all of the beach huts at risk are at risk in epoch 1 (2023-2043) under the Do Nothing scenario. To estimate the loss of beach hut income to BCP Council and NFDC, the annual income from license fees per beach hut has been taken as the damage value each year from the year of erosion. The license fees vary dependent on the location, therefore an average value of £664 per beach hut has been assumed using an average of the license fees provided for the previous coastal management Strategy for the frontage (with an uplift for inflation) and recent average values provided by NFDC for the huts at Barton on Sea, Hordle and Milford on Sea.

The total Do Nothing PV damages over the next 20 years, 50 years and 100 years for loss of beach hut income are presented in Table 5-6. Total PV damages are estimated to be approximately £4.3million for 20 years and the equivalent value in undiscounted cash terms is £7.3million. Over the next 50 years, this is predicted to increase to £10.4million PV and £27.3million undiscounted cash damages, increasing to £13.8million PV and £60.1million undiscounted cash damages over the next 100 years.

**Table 5-6: Estimated impact of coastal erosion on Beach Hut income, under a Do Nothing scenario**

Annual Income per beach hut (£)	20-year appraisal period		50-year appraisal period		100-year appraisal period	
	Cash (£k)	PV (£k)	Cash (£k)	PV (£k)	Cash (£k)	PV (£k)
664	7,341	4,329	27,360	10,414	60,059	13,817

## 5.5 Coastal Recreation

The Land, Environment, Economics and Policy Institute (LEEP) at the University of Exeter developed the ORVal tool<sup>10</sup> in 2019. This tool measures the value of currently available greenspace to the economy at various locations across the whole of the UK, including Christchurch.

In the tool the value of outdoor recreation is provided as a welfare value per year, with other information including the number of visitors per year, and transport modes of visitors to the site. The welfare value is defined as the monetary equivalent of the welfare enjoyed by individuals as a result of having access to the greenspace and outdoor recreational space, which can also correspond to a willingness to pay value for the site. This is different to the estimation of the value of the visitor economy in Section 5.2, as that measures actual visitor spend in the Strategy area rather than willingness to pay for access to outdoor spaces.

The ORVal tool has been interrogated to determine the key greenspace and recreation locations in Christchurch Bay and Harbour and their annual value to the local economy. There are a number of outdoor spaces which are used for recreation (see Table 5-7). The ORVal tool estimates that there are approximately 3,958,113 recreation visitors to the sites within the Strategy area per annum, generating a total welfare value of £21 million per year.

The SMP erosion zones and flood risk mapping have been used to identify the ORVal recreation sites at risk over the 100-year appraisal period under a Do Nothing scenario. These are presented in Table 5-7 below.

<sup>10</sup> Land, Environment, Economics and Policy (LEEP) Institute (2019) *Outdoor Recreation Valuation (ORVal) Tool*, University of Exeter. Available from: <https://www.leep.exeter.ac.uk/orval/> [Accessed 18 February 2022]

**Table 5-7: Orval recreation sites in Strategy area at risk**

Site	Flood risk	Erosion risk
Mudeford Sandbank East	x	
Mudeford Quay	x	
Stanpit Marsh	x	
Hengistbury Head	x	
Avon Beach		x
Friar's Cliff		x
Steamer Point		x
Highcliffe Castle		x
Highcliffe		x
Christchurch Bay		x
Milford on Sea		x

Given that the majority of the sites are located on the coast the sites are at either at risk from either flooding or erosion. Flooding of the sites is likely to lead to disruption and cause a short term reduction in visitor numbers and whilst the site is cleared and repaired. Erosion of the sites could lead to a permanent loss of the site and a permanent reduction in visitors and recreation in the area.

The damages associated with flooding have been estimated by determining the return period events from which each site floods. A flood event is likely to cause damage to the recreation sites at risk and is likely to lead to temporary disruption or closure due to H&S concerns. The duration of this disruption has been assumed; for a 2yr flood event a 1 week period of disruption/closure, for a 20yr flood event a 2 week period, for a 75yr flood event a 3 week period and for a 200yr event or greater a 4 week period. Due to a lack of comparable data, it has been necessary to estimate these likely disruption periods. These estimates have been based on professional judgement and are considered to be conservative; among the considerations for the disruption periods was the likely time to clear the sites of debris, to restore footpaths and repair damage, and ensure the site is safe from a public health and safety perspective. During each disruption / closure period it has been assumed that no visitors will access the site. Using data from the ORVal tool the loss of visitors has been quantified for each event and site and an Annual Average Damage for each site has been estimated.

Table 5-8 shows the estimated damages associated with flooding to those sites at flood risk, which can be summarised as showing:

- Over a 20 year appraisal period the estimated PV damages are £202k and in undiscounted cash terms are £281k.
- Over a 50 year appraisal period the estimated PV damages are £324k and in undiscounted cash terms are £685k.
- Over the longer 100 year appraisal period the PV damages are £393k and in undiscounted cash terms are £1,342k.

Table 5-8: Estimated damage to coastal recreation value due to flooding under the Do Nothing scenario

Site	ORVal estimated number of visitors per year	ORVal estimated value to economy (welfare value) per year - £k	At risk of flooding / erosion over the 100-year appraisal period	20-year appraisal period damages		50-year appraisal period damages		100-year appraisal period damages	
				Cash (£k)	PV (£k)	Cash (£k)	PV (£k)	Cash (£k)	PV (£k)
Mudeford Sandbank East	276,028	1,597	Flood risk, not included in SMP erosion zones	68	49	166	78	325	95
Mudeford Quay	382,144	2,130	Flood risk, not included in SMP erosion zones	91	65	221	105	433	127
Stanpit Marsh	151,353	806	Flood risk, not included in SMP erosion zones	34	25	84	40	164	48
Hengistbury Head	513,255	2,065	Flood risk, not included in SMP erosion zones	88	63	214	101	420	123
<b>Total</b>				<b>281</b>	<b>202</b>	<b>685</b>	<b>324</b>	<b>1342</b>	<b>393</b>

For the sites at risk from erosion, the damages associated with erosion have been estimated as a recurring annual damage from the point in time each site becomes at risk of erosion over the next 100 years.

There is a lack of research surrounding the impact of coastal erosion on visitor numbers to the coastline. As the coastal region in Christchurch Bay and Harbour is so large, there is potential that visitors would transfer from one area to another if it was still safe to visit. Therefore, rather than estimating to what extent visitor numbers may be reduced, the impact for a range of percentage reductions in overall visitors have been quantified; from a 10% to 90% reduction. Table 5-9 shows the monetary impact associated with each of these scenarios.

Note that the values in Table 5-9 also include the flood damages presented in Table 5-8. The values are therefore combined flood and erosion damages across the frontage but without double counting as each area is at risk from only one source. It is noticeable that the erosion damages associated with permanent % visitor losses greatly exceed the temporary damages associated with flooding. Combined with the temporary flood risk impacts, a 50% reduction in visitor numbers to the area due to erosion is estimated to lead to £47million in PV damages over a 20 year appraisal period.

**Table 5-9: Sensitivity test to determine the financial impact for a range of percentage reductions in coastal recreation visitors following coastal erosion of the recreation sites across Christchurch Bay and Harbour. Note that the values also include flood damages.**

Reduction in visitor numbers	20-year appraisal period damages		50-year appraisal period damages		100-year appraisal period damages	
	Cash (£k)	PV (£k)	Cash (£k)	PV (£k)	Cash (£k)	PV (£k)
10%	16,171	9,573	59,910	22,866	131,349	30,302
20%	32,061	18,944	119,136	45,409	261,357	60,212
30%	47,951	28,315	178,362	67,951	391,365	90,122
40%	63,841	37,686	237,587	90,493	521,373	120,031
50%	79,731	47,056	296,813	113,035	651,381	149,941
60%	95,621	56,427	356,039	135,578	781,389	179,851
70%	111,511	65,798	415,265	158,120	911,398	209,761
80%	127,401	75,169	474,491	180,662	1,041,406	239,670
90%	143,290	84,540	533,717	203,205	1,171,414	269,580

## 5.6 Health and Wellbeing

The World Health Organisation (WHO) HEAT tool for walking and cycling has been used to conduct a strategic economic assessment of the health impacts of walking and cycling in Christchurch Harbour and Bay. The HEAT tool estimates the value of reduced mortality that results from specified amounts of walking or cycling, answering the following question:

*If x people regularly walk or cycle an amount of y, what is the economic value of the health benefits that occur as a result of the reduction in mortality due to their physical activity?*

The tool can be used to assess changes over time and the 'before' and 'after' situations where measures have been taken. In the HEAT tool, a reduction in physical activity is monetised by placing a value on human life and assumes a reduction in physical activity will increase mortality levels. With the Do Nothing scenario, erosion or flooding of the coastal footpaths and cycle routes has the potential to lead to a reduction in the physical activity of the local population and visitors to the area, impacting physical health of the population and mortality rates.

For the Do Nothing scenario the key footpaths in Christchurch Bay & Harbour used for walking and cycling that are at risk of flooding and erosion have been identified from the recreation sites listed in the ORVal tool (see Section 5.5). The following values and assumptions for the key inputs within the HEAT tool have been used:

- The length of each footpath was measured using GIS;
- The age range of the adult population using the footpaths was assumed to be between 20-74 years;
- The number of walking/cycling users for each site have been inferred as 50% of the annual recreational visitor numbers from the ORVal tool;
- In the event that a path is eroded or flooded, it has been assumed that 50% of the existing users of the footpath will find an alternative site for their recreation activities and the remaining 50% of the existing users would not find an alternative route and would cease to undertake this particular physical activity. Due to a lack of guidance on this issue this assumption has been based on professional judgement. Should relevant guidance be provided then it is recommended that this assumption is revisited;
- The health and wellbeing damages/benefits have been calculated over a 10-year period, 50-year and 100-year period to facilitate a comparison with other values produced in this report.

Based on the above values and assumptions, the economic impact to health and wellbeing with the Do-Nothing scenario was calculated. Both undiscounted (cash) and discounted (present value) values are provided; all present values are in today's terms, so for example, if erosion is not expected to occur until year 5, the damages from this point in time are in today's values.

Table 5-10 below presents the results of the HEAT assessment. In summary, over a 20-year period, in present value terms the damages caused by a loss of coastal footpaths is estimated to be £7.4million. In undiscounted cash terms, this equates to approximately £12.7million. Over a 50-year period, in present value terms the damages equate to approximately £18million and in undiscounted cash terms to £47million, and over a 100-year period the present value damages equate to approximately £23.8million and in undiscounted cash terms £103.6million.

Table 5-10: Estimated damages to health and wellbeing based on HEAT tool analysis

Site	Number of visitors per year	Estimated length of footpath / beach area (m)	Annual cash damage (£k)	20-year appraisal period damages		50-year appraisal period damages		100-year appraisal period damages	
				Cash (£k)	PV (£k)	Cash (£k)	PV (£k)	Cash (£k)	PV (£k)
Mudford Sandbank East	276,028	2279	250	11	8	26	12	50	15
Mudford Quay	382,144	759	115	5	3	12	6	23	7
Stanpit Marsh	151,353	1198	72	3	2	7	4	14	4
Hengistbury Head	513,255	973	197	8	6	20	10	40	12
Avon Beach	397,760	1315	206	2,268	1,338	8,455	3,218	18,560	4,270
Friar's Cliff	412,194	596	97	1,071	632	3,989	1,519	8,755	2,015
Steamer Point	309,334	133	16	180	106	669	255	1,469	338
Highcliffe Castle	281,582	133	16	179	106	667	254	1,464	337
Highcliffe	366,490	2044	297	3,275	1,932	12,199	4,645	26,776	6,162
Christchurch Bay	420,637	2231	372	4,099	2,418	15,268	5,813	33,511	7,712
Milford on Sea Coastal path	115,579	1394	64	699	413	2,605	992	5,717	1,316
Milford on Sea Beach	331,757	609	80	882	520	3,286	1,251	7,211	1,660
<b>Total</b>				<b>12,680</b>	<b>7,484</b>	<b>47,203</b>	<b>17,977</b>	<b>103,590</b>	<b>23,846</b>

## 5.7 Ecosystem Services

### 5.7.1 Background

An Ecosystem Services (ES) Assessment has been undertaken to highlight the value of natural capital across the Strategy area in the form of ES, using a bespoke ES Assessment tool developed by AECOM; ESIVI (Ecosystem Services: Identification, Valuation & Integration). ESIVI allows for the identification of ES in the study area, and an assessment of the impacts of the Do Nothing scenario. The tool can also be used to identify potential ES benefits of scheme options.

ES provided by coastal environments are undervalued by traditional assessments within the FCERM process. Highlighting the economic, social and environmental cost of impacting ES, or the benefits of improving them, has the potential to improve the business case for FCERM interventions. This can lead to increased stakeholder contributions and provides a more comprehensive measure of the value of ecosystem functions which can be difficult to assign a monetary value to.

The ES assessment has determined the existing baseline of ES delivery in Christchurch Bay & Harbour at year 0 in a scoping process. The coastal frontage consists of a number of different environments, delivering a range of ES which are valued by the local community. The delivery of these ES will be affected by the coastal defences in place, the coastal flood and erosion risk associated with the Do Nothing scenario or the construction of new schemes as part of FCERM measures.

ES identified in this assessment are divided into three groups of services which provide different benefits:

- Provisioning Services: products that are obtained from ecosystems;
- Regulating Services: benefits obtained from the regulation of ecosystem processes; and,
- Cultural Services: non-physical benefits that people obtain from ecosystems.

Each of these groups of services, and the specific ES identified within them, has different beneficiaries. Only those ES with significant beneficiaries are recognised by the assessment. ESIVI provides a high level assessment of the ES provided in the study area, although some ES can be measured further using different methods, to provide both monetary and non-monetary values.

### 5.7.2 Methodology

The ESIVI tool has been used to assess the impact of the Do Nothing scenario on the delivery of ES in the Strategy area. The potential ES delivered have been identified from a pre-determined list based on the type of ecosystem selected. For Christchurch Bay & Harbour, the ecosystem that has been selected is 'Coastal', given that this is expected to be the major ecosystem along the coastline where flooding and erosion will occur. A scoping process has been undertaken to determine the baseline ES delivery in the present day, as well as the impact of the Do Nothing scenario (from an FCERM perspective) on the ES.

### 5.7.3 Baseline

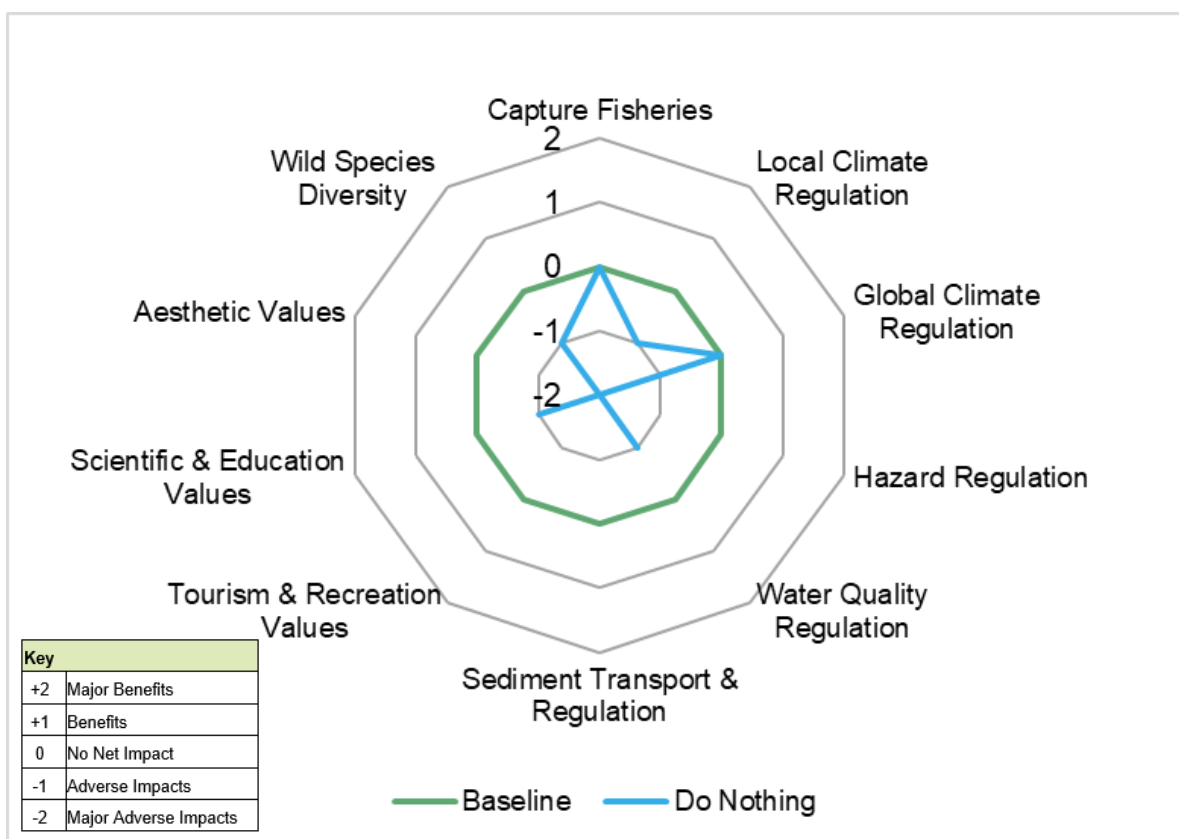
The ES provided by Christchurch Bay & Harbour under the current baseline have been established in Table 5-11 below, including provisioning services, regulating services and cultural services.

**Table 5-11: Ecosystem Services scoped in to the assessment for the baseline scenario**

Type of service	Service	Description
Provisioning service	Capture Fisheries	Capture fishery refers to all kinds of harvesting of naturally occurring living resources in both marine and freshwater environments. This includes industrial, small-scale and recreational fishing.
Regulating service	Local climate regulation	Local climate regulation occurs through variations in land cover which can affect local temperature, wind, precipitation and shading through evapotranspiration and surface albedo. The presence of vegetation throughout the coastal areas contributes to the delivery of this service, as well as some of the formal hard defences at Christchurch Bay & Harbour.
	Global climate regulation	Global climate regulation refers to carbon sequestration through active vegetation in the ecosystem, reducing the effects of climate change. Along the coastline there are areas of vegetation which contribute to the delivery of this service, such as the vegetated natural banks in undefended areas, areas of saltmarsh at Stanpit Marsh Local Nature Reserve and grassed areas behind the shoreline.
	Hazard regulation	Hazard regulation is delivered along the coastline where coastal defences are in place, limiting the impact of flooding and coastal erosion and maintaining the integrity of the ecosystem.
	Water quality regulation	Water quality regulation is delivered in areas along the coastal frontage where formal coastal defences prevent the erosion of areas of potentially contaminated land.
	Sediment transport & regulation	Sediment Transport Regulation is delivered at the Frontage where maintenance of soil cover, levels of suspended sediment loads and shoreline stabilisation occurs. Similarly to hazard regulation, this takes place where formal coastal defences are in place to prevent coastal erosion and aid shoreline stabilisation.
Cultural services	Tourism and recreation values	Tourism and recreation is one of the most important services delivered on the coastline, as with many coastal areas which provide activities that are attractive to visitors of the site. Several areas along the Frontage are recognised for Tourism and Recreation – as identified in Section 5.5.
	Cultural and spiritual values	The Frontage delivers cultural and spiritual value in the historical and cultural benefits seen at different sites.
	Scientific and education values	Scientific and educational value is delivered through opportunities for scientific learning, for both research and educational purposes. This is present in the numerous environmentally designated areas around the coastline.
	Aesthetic values	Aesthetic Value is provided through the appearance of the site at several locations along Christchurch Bay & Harbour.
	Wild species diversity	Numerous different ecosystems around the coastline help to increase the diversity of wild species.

## 5.7.4 Do Nothing Scenario

In the Do Nothing scenario, the existing coastal defences are left to fail over time and no new defences are constructed. This scenario is expected to lead to increased coastal flood and erosion risk and would have an overall negative impact on the delivery of ES, affecting the ES which are currently protected. Figure 5-2 presents the impact of the Do Nothing scenario on ES provision.



**Figure 5-2: Summary of impact of Do Nothing scenario on ES provision**

The Do Nothing scenario would have an adverse impact on the provisioning services in the Strategy area; coastal areas which are currently used for fishing would be flooded more frequently, reducing the delivery of these services. Not only would this affect the ES provided, but it could also impact the livelihood of the fishermen directly affected.

The Do Nothing scenario would also have an adverse impact on the regulating services on the area. Local climate regulation and global climate regulation would be affected by the loss of vegetation along the coastline due to erosion. In addition, coastal hazards would increase due to an increased frequency of flooding and a loss of land due to erosion. This could also lead to an increased risk of public health and safety issues associated with the failure of coastal defences and footpaths. By allowing potentially contaminated land sites to erode, the water quality regulation service would be compromised as potentially contaminated materials would be released into the sea. Furthermore, reduced maintenance of coastal defences would impact sediment transport and reduce shoreline stabilisation.

The cultural services in the Strategy area would also be negatively impacted by the Do Nothing scenario. A major adverse impact would be expected on tourism and recreation and also on aesthetic value. A number of sites on the coastline that are key to tourism and recreation would be at risk of flooding and erosion. These are outlined in Section 5.5, including Mundeford Quay, Stanpit Marsh, Hengistbury Head, Avon Beach, Friar’s Cliff, Highcliffe and Milford-on-Sea. A number of these sites are also environmentally designated, and valued for their aesthetics which would be reduced should these sites be flooded or eroded. Both scientific and educational value and wild species diversity would be adversely impacted by the Do Nothing scenario, where opportunities for scientific learning at sites with high biodiversity (Stanpit Marsh and Hengistbury Head) would be lost through coastal flooding and erosion impacts.

Although it has not been possible to monetarise the Ecosystem services impacts at this initial stage, the baseline has been established to allow the local ecosystem benefits or impacts which may be facilitated by FCERM intervention to be assessed going forward as the Strategy is developed. This may include qualitative and quantitative assessment using the CIRIA B&EST tool when assessing potential option benefits, depending on the services and availability of necessary data to monetarise the impacts.

## 6. Option Benefits

The monetary benefits of each short list option in each ODU have been calculated to facilitate the appraisal of these options in line with the FCERM-AG. The monetary benefits have been calculated against the National economic Do Nothing damages presented in Section 3 as these are the benefits that are eligible for inclusion as per FCERM-AG and the FCERM Partnership Funding criteria.

To understand how the benefits of each option have been calculated, it is first necessary to outline the intent and key assumptions of each of the short list options. Full details of each short list option in each ODU can be found in the Leading Options Report (AECOM, 2024). A high level summary is provided in Section 6.1 below.

The first stage in calculating the option benefits was to calculate the flood and erosion risk residual damages associated with the options. Residual damages are the damages that would still be expected to occur with the options in place. A description of how the residual damages have been calculated is provided in Sections 6.2 and 6.3 below.

### 6.1 Option Intent

A high level summary of the intent of the short list options is provided below. Note that this is a general summary and there are some variations between ODUs. A full description is provided in the Leading Options Report (AECOM, 2024).

- **Do Nothing:** the baseline scenario for the assessment. A hypothetical 'walk away' scenario whereby no further maintenance is undertaken.
- **Do Minimum:** undertaking reactive and small scale maintenance to the existing defences with the aim of extending the service life of the defences where possible. It has typically been assumed that with this option the existing service life of the defences would be extended by around 5-10 years. Extending the life of the defences by more than this with this option is not realistic, owing to the age of the structures combined with the typically minimal investment as part of this option.
- **Maintain:** undertaking proactive capital refurbishments / replacements of existing defences to ensure that they continue to perform an FCERM function for the duration of the Strategy appraisal period. There are some variations with this approach between the ODUs, as outlined in the Leading Options Report (AECOM, 2024). The defences would be refurbished on a like-for-like basis and the geometry / configuration of the defences would not be significantly changed (i.e. no defence raising or lengthening). This will mean that over time the standard of protection (SoP) provided by the defences would gradually reduce due to sea level rise and climate change. This could lead to an increase in both flood and erosion risk over time with this option.
- **Sustain:** incrementally upgrading the flood risk SoP provided by the existing defences, or constructing new defences over time. The upgrades would be done in increments to a target SoP for a given year. For example, the sustain option may involve initially upgrading the SoP to 1.33% AEP (1 in 75 yr) in 2044, then going back in 2044 and raising it further to provide the same standard for 2074, and then finally returning in 2074 to upgrade to the same standard for 2124. Different standards and timings have been considered in each ODU (e.g. standards for 1.33% AEP and 0.5% AEP). The focus of the sustain option is on managing flood risk, and therefore sustain options have not been considered where erosion risk is the dominant source of risk.
- **Improve:** upgrading the flood risk SoP and/or the erosion risk protection to a 2124 standard. This could be done by upgrading existing defences or constructing new defences and is a precautionary approach whereby the upgrades would be done in one intervention (rather than successive interventions as per the Sustain option). With respect to erosion risk along the open coast part of the frontage, in some areas it may not be possible to completely stop the erosion of the cliffs which has been factored into the residual damage / benefit calculations (see section 6.3 for more details).
- **Managed Realignment:** in some ODUs a managed realignment option has been included. The intent of this option varies significantly by ODU but generally involves aiming to control a gradual evolution of the shoreline position over time with defences / other techniques. Refer to the Leading Options Report (AECOM, 2024) for more details.
- **Adaptation / Resilience:** using techniques such as property level protection / resilience measures, community awareness, flood warnings and planning regulations to help communities adapt to the risk of

flooding and erosion over time. These techniques may also be combined with maintenance of existing defences.

## 6.2 Flood Risk Residual Damages

Flood risk residual damages for the short list options have been calculated in ODUs 3-12 and ODU 18. These are the ODUs with assets at risk from flooding in the baseline and with suitable baseline flood modelling available to inform the assessment. A summary of the approach for calculating the residual damages for the options is provided below:

- Do Minimum:** For the Do Nothing baseline scenario, the flood damages increase over time once the existing defences fail (represented by a transition between 'defended' and 'undefended' flood modelling). To calculate the residual damages from flooding for the Do Minimum option, in ODUs where there are existing defences, the transition between the 'defended' and 'undefended' modelling has been delayed by 5-10 years to represent the increased service life of the defences with this option. This typically leads to slightly lower flooding residual damages for the Do Minimum option compared to the baseline Do Nothing scenario. In ODUs where there are no existing raised defences (e.g. ODU 6), there are no flood risk benefits associated with the Do Minimum scenario.
- Maintain:** To calculate the residual damages from flooding for the Maintain option, in ODUs where there are existing raised defences that would be maintained, the damage values associated with the 'defended' flood modelling have been applied through the appraisal period (rather than transitioning to the 'undefended' modelling as per the baseline). The standard of protection provided by the defences falls over time (as the defences are not raised with sea level rise) and this has been accounted for in the residual damage calculations. In ODUs where there are no existing raised defences (e.g. ODU 6), there are no flood risk benefits associated with the Maintain scenario.
- Sustain:** First the likely scheme benefit areas were identified in GIS. For the residual flood damage calculations, the properties within the benefit area had all flood damages removed for below design events, but retained flood damages for above design events. For example, to calculate the residual damages of an option that involved upgrading the defences to provide a 1.33% AEP (1 in 75 year) SoP, the baseline flood damages up to and including the 1.33% AEP events were removed, but the damages for events greater than this were retained (i.e. from the 0.5% and 0.1% AEP return periods). With the sustain option the changing SoP in response to sea level rise was considered in the residual damage calculations. For properties outside of the scheme benefit area, the baseline flood damages were retained as residual damages.
- Improve:** First the likely scheme benefit areas were identified in GIS. For the residual flood damage calculations, the properties within the benefit area had all flood damages removed for below design events, but retained flood damages for above design events. This was based on the target SoP of the scheme for 2124. For properties outside of the scheme benefit area, the baseline flood damages were retained throughout as residual damages.

Some additional considerations were made when calculating the flood risk residual damages:

- For the Sustain and Improve options, residual damages were calculated for two different standards of protection (SoP), the 1.33% AEP (1 in 75 year) SoP and the 0.5% AEP (1 in 200 year) SoP.
- Changes in SoP and the timing of schemes recommended by the options were considered. For example, if an option involved improving defences to a 0.5% AEP (1 in 200 year) SoP for 2044, the SoP would initially start out higher and then gradually fall to the intended SoP between present day and 2044 due to sea level rise.
- Property level flood resilience measures are typically most effective at reducing flood damage for more frequent return periods and the MCM suggests different approaches for calculating the benefits of these measures. To calculate the residual damages / benefits, in line with the MCM a simple approach has been applied whereby the flood damages have been reduced for the more frequent return periods with a low average depth of flooding (< 5% AEP). In 2124 most return periods have much higher depths of flooding and therefore it has been conservatively assumed there would be no benefits associated with property level resilience measures for this time period.

## 6.3 Erosion Risk Residual Damages

Erosion risk residual damages for the short list options have been calculated in ODUs 12-18. These are the ODUs with assets at risk from erosion in the baseline and with sufficient datasets to inform the assessment.

The erosion risk within the Strategy area varies and the complex cliffs, particularly around Barton on Sea and Highcliffe. This meant that different assumptions for working out the residual damages / benefits associated with erosion had to be made across the Strategy frontage. Furthermore, the intent of the short list options varies in each unit, for example, some options seek to minimise the rate of future erosion leading to minimal residual erosion risk to assets, whereas other options look to control the rate of erosion, accepting that there will be some erosion risk to properties in the future, but at a reduced level relative to the baseline.

The key assumptions for calculating the erosion residual damages for each of the short list options in ODUs 12-18 are outlined in Table 6-1 below. Based on the erosion damage assumptions set out, the properties at residual risk of erosion were identified for each option. The timing of erosion risk was also considered and residual erosion damages were applied in the economic calculations based on the property value and discount factor in the anticipated year of loss.

**Table 6-1: Erosion benefit key assumptions**

ODU	Option	Option intent / erosion risk	Residual damage assumptions
12	Maintain	Maintain existing defences, SoP falling over time. Erosion could occur in the future as SoP falls but would be delayed relative to the baseline scenario.	- Baseline erosion damages in epochs 1 and 2 delayed and applied to the start of epoch 3 as a residual damage. - Baseline erosion damages in epoch 3 applied to end of epoch 3 as a residual damage.
	Improve	Minimise further erosion through provision of new defences	- No residual erosion damages.
13	Maintain	Maintain existing defences, SoP falling over time. Erosion could occur in the future as SoP falls but would be delayed relative to the baseline scenario.	- Baseline erosion damages in epochs 1 and 2 delayed and applied to the start of epoch 3 as a residual damage. - Baseline erosion damages in epoch 3 applied to end of epoch 3 as a residual damage.
	Improve	Minimise further erosion through provision of new defences	- No residual erosion damages.
	Managed Realignment	Varies but some erosion of the eastern end of the unit could occur, subject to further appraisal if option taken forward.	- Erosion of café in east end of the unit
14	Maintain	Maintain existing defences but due to complex nature of cliffs erosion would continue and properties would be lost.	- In defended areas, baseline erosion damages in epochs 1 and 2 delayed and applied to the start of epoch 3 as residual damage. - In defended areas, baseline erosion damages in epoch 3 applied to the end of epoch 3 as a residual damage. - In undefended areas, baseline damages apply.
	Improve	New defences aiming to minimise erosion. However, erosion would not be stopped entirely, and erosion would still occur (albeit much less than the baseline / Maintain options).	- Loss of properties seaward of Marine Drive and Marine Drive West roadway, but damages delayed relative to the baseline scenario. Assumed loss of these properties at the start of epoch 3.

ODU	Option	Option intent / erosion risk	Residual damage assumptions
	Managed Realignment A & B	New defences aiming to minimise erosion from the western end of Marine Drive West to the east. Due to complex cliff geology, erosion in this area would not be stopped entirely and it would still occur (albeit much less than the baseline / Maintain options).	<ul style="list-style-type: none"> <li>- 20% of damages in Marine Drive West assumed to occur for Managed Realignment A, same timing as the baseline.</li> <li>- 50% of damages in Marine Drive West assumed to occur for Managed Realignment B, same timing as the baseline.</li> <li>- Loss of properties seaward of Marine Drive roadway, but damages delayed relative to the baseline scenario. Assumed loss of these properties at the start of epoch 3.</li> </ul>
	Managed Realignment C & D	Upgraded defences aiming to minimise erosion from the Cliff House hotel to the east. Due to complex cliff geology, erosion in this area would not be stopped entirely and it would still occur (albeit much less than the baseline / Maintain options).	<ul style="list-style-type: none"> <li>- 100% of damages in Marine Drive West assumed to occur, same timing as the baseline.</li> <li>- Loss of properties seaward of Marine Drive roadway, but damages delayed relative to the baseline scenario. Assumed loss of these properties at the start of epoch 3.</li> </ul>
	Managed Realignment E & F	Upgraded defences aiming to minimise erosion from Barton Court Avenue to the east. Due to complex cliff geology, erosion in this area would not be stopped entirely and it would still occur (albeit much less than the baseline / Maintain options).	<ul style="list-style-type: none"> <li>- 100% of damages in Marine Drive West assumed to occur, same timing as the baseline.</li> <li>- Loss of properties seaward of Marine Drive roadway, but damages delayed relative to the baseline scenario. Assumed loss of these properties from the start of epoch 3.</li> <li>- Loss of properties in the central area of Barton on Sea (i.e., north of Marine Drive), but damages delayed relative to the baseline scenario. If the properties lost in the baseline during epoch 2, then assumed loss of these properties from the start of epoch 3.</li> </ul>
15	All Do Something options	H&S compliance and beach management – unlikely to slow erosion	- Assumed baseline erosion risk for each option
16	Maintain	Maintain existing defences and beach management. Erosion could occur in the future as SoP provided by the beach is reduced, but would be delayed relative to the baseline scenario.	<ul style="list-style-type: none"> <li>- Baseline erosion damages in epochs 1 and 2 delayed and applied to the start of epoch 3 as a residual damage.</li> <li>- Baseline erosion damages in epoch 3 applied to end of epoch 3 as a residual damage.</li> </ul>
	Improve	Minimise further erosion through provision of new defences	- No residual erosion damages.
	Managed Realignment	Beach management and construction of strong point to help control future erosion. Erosion would still occur but in controlled manner.	- One property seaward of B3058 assumed to be lost to erosion. No other residual damages
17	Maintain	Maintain existing defences. Erosion could occur in the future as SoP	- Baseline erosion damages in epochs 1 and 2 delayed and

ODU	Option	Option intent / erosion risk	Residual damage assumptions
		provided by the defences is reduced, but would be delayed relative to the baseline scenario.	applied to the start of epoch 3 as a residual damage. - Baseline erosion damages in epoch 3 applied to end of epoch 3 as a residual damage.
	Improve	Minimise further erosion through provision of new defences	- No residual erosion damages.
	Managed Realignment	Transition coastline into a landward position to provide space for beach, potentially creating small embayment between hard points at either end of the unit.	- Assumed loss of 16 properties to erosion as a result of movement of shoreline inland during first 3 epochs. - No losses during epoch 3 as shoreline assumed to be stable.
18	Maintain	Maintain existing defences and continue with small scale periodic beach renourishment. Due to falling beach levels future defence failure and erosion could still occur, although this is uncertain and could potentially be avoided with defence refurbishments.	- No residual erosion damages assumed.
	Improve	Minimise further erosion through provision of new defences	- No residual erosion damages.
	Managed Realignment	Transition coastline into a landward position to provide space for beach, potentially creating small embayment between hard points at either end of the unit.	- Uncertainty around alignment of new defence and potential catch-up erosion. Conservatively assumed loss of 54 properties to erosion as a result of movement of shoreline inland, although number could be less if new defence constructed early. - No losses during epoch 3 as shoreline assumed to be stable.

## 6.4 Option Benefits

Once the residual damages from flood and erosion risk had been calculated for each option and SoP, the residual damages were subtracted from the baseline economic damages to establish the economic benefits of the options.

## 7. Option Costs

The whole life costs of the short list options in each ODU have been estimated. The option cost estimates are comprised of the following aspects:

- Capital construction costs
- Maintenance / operation costs
- Optimism bias / risk.

### 7.1 Capital Construction Costs

The strategic level costs for capital construction works were estimated using a variety of sources and information, including:

- Typical cost build-ups from engineering price books such as SPONS (2024)
- Actual construction costs from relevant and previous projects
- Contractor price estimates from relevant and previous projects
- Estimated costs provided by the BCP / NFDC, for example, for beach nourishment
- Environment Agency guidance (2015) on the cost of coastal and fluvial defences.<sup>11</sup>

The majority of costs were developed from SPONS (2024) and the base date for unit rates is May/June 2023. At the time of writing this date is over six months old and therefore the Construction Price Index from the Office for National Statistics was checked to determine whether there had been any inflation in the index for new infrastructure construction. At the time of writing, the latest Construction Price Index release from the Office for National Statistics was September 2023 and between May/June 2023 and September 2023 the index fell by 0.4%. Given the small magnitude of change downwards no adjustment to the SPONS unit rates were provided. The base date for the costs in the Strategy is therefore accurate to September 2023.

The short list option descriptions provided in the Strategy Leading Options report (AECOM, 2023) provide details of the type of defences (the defence measures) that are anticipated to be used in each of the short list options. The option costs have therefore been developed for these defence types.

For the different defence types, the cost is likely to vary with the geometry (such as defence height, length or volume of material). Therefore, it was necessary to estimate the geometry of the defences that would be required for the short list options (such as the height, length etc.). This information was attained by undertaking analysis in GIS by creating indicative defence alignments and using land elevations obtained from LiDAR and extreme water level information to determine approximate defence heights required.

Table 7-1 provides a summary of the indicative costs used in the assessment for each of the defence types. Information is included on the key assumptions, as well as the primary source used to estimate the costs.

The indicative costs in Table 7-1 include an allowance for preliminaries (assumed to be 35%), appraisal costs (assumed to be 10%) and optimism bias and risk. More details on the optimism bias and risk build-up are provided in Section 7.3.

Given that this is a strategic level assessment, it was necessary for the costing approach to be suitably high level. It is not proportionate, or possible, to provide detailed / bespoke costing on a scheme by scheme basis. Therefore, in the first instance the indicative cost ranges shown in Table 7-1 for the different defence types were applied universally across the Strategy area. However, in specific locations along the Strategy frontage where the project team felt there was additional construction risk or potential for more complex solutions to be required, additional risk contingency / uplift was applied to account for these uncertainties.

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<sup>11</sup> Environment Agency (2015) costing guidance. Available at: [https://assets.publishing.service.gov.uk/media/6034ee168fa8f5432c277c23/Cost\\_estimation\\_for\\_coastal\\_protection.pdf](https://assets.publishing.service.gov.uk/media/6034ee168fa8f5432c277c23/Cost_estimation_for_coastal_protection.pdf) and [https://assets.publishing.service.gov.uk/media/6034ed2ed3bf7f264f23eb51/Cost\\_estimation\\_for\\_fluvial\\_defences.pdf](https://assets.publishing.service.gov.uk/media/6034ed2ed3bf7f264f23eb51/Cost_estimation_for_fluvial_defences.pdf)

Table 7-1: Summary of unit costs used in the economic assessment

Defence type / measure	Cost range used in assessment (including OB, risk, prelim uplifts)	Primary source of cost estimate	Cost range in Environment Agency guidance (2015)	Cost range in Environment Agency guidance (2015), adjusted for inflation*	Notes / Assumptions
Sheet pile wall	<ul style="list-style-type: none"> <li>- £3.6k to £9.4k per m length of defence</li> <li>- Between 1m to 4m wall height</li> </ul>	Cost build-up using SPONS (2024), including: <ul style="list-style-type: none"> <li>- Site clearance</li> <li>- Sheet pile setup and installation</li> <li>- Minor ground anchors</li> <li>- Fill and compaction behind new pile</li> <li>- Concrete reinforced capping beam</li> </ul>	<ul style="list-style-type: none"> <li>- Urban reach &lt;100m in length: average rate of £9.1k per m length</li> <li>- Urban reach &gt;100m in length: average rate of £2.5k per m length</li> <li>- Rural reach: average rate of £1.8k per m length</li> <li>- <b>Note that the urban reach &gt; 100m length is most applicable to the Strategy options</b></li> </ul>	<ul style="list-style-type: none"> <li>- Urban reach &lt;100m in length: average rate of £14.6k per m length</li> <li>- Urban reach &gt;100m in length: average rate of £4k per m length</li> <li>- Rural reach: average rate of £2.9k per m length</li> <li>- <b>Note that the urban reach &gt; 100m length (£4k) is most applicable to the Strategy options</b></li> </ul>	<ul style="list-style-type: none"> <li>- Sheet pile costs very sensitive to location of scheme (plant access) and cost of materials. Recommended that specialist piling contractors engaged for scheme cost estimates.</li> <li>- Indicative wall heights assumed, lengths based on GIS analysis</li> </ul>
Concrete floodwall (L-shaped)	<ul style="list-style-type: none"> <li>- £1.9k to £6.0k per m length of defence</li> <li>- Between 0.5 – 2.5m wall height</li> </ul>	Cost build-up using SPONS (2024), including: <ul style="list-style-type: none"> <li>- Site clearance</li> <li>- Excavation</li> <li>- Concrete, formwork and reinforcement</li> <li>- Masonry cladding</li> <li>- Benchmarked cost against recent contractor price estimates</li> </ul>	<ul style="list-style-type: none"> <li>- £1.4k per m length for height less than 1.2m</li> <li>- £2.9k per m length for height between 1.2m and 2.1m</li> <li>- £3.6k per m length for height between 2.1m and 5.3m</li> </ul>	<ul style="list-style-type: none"> <li>- £2.2k per m length for height less than 1.2m</li> <li>- £4.7k per m length for height between 1.2m and 2.1m</li> <li>- £5.8k per m length for height between 2.1m and 5.3m</li> </ul>	<ul style="list-style-type: none"> <li>- Assumed structure would not be a retaining wall</li> <li>- Structure geometry in costing based on GIS analysis of lengths / heights required for indicative alignments.</li> </ul>
Crest raising of existing structures	<ul style="list-style-type: none"> <li>- £0.7k to 2.9k per m length of defence</li> <li>- Between 0.5 – 2.5m wall height</li> </ul>	Cost build-up using SPONS (2024), including: <ul style="list-style-type: none"> <li>- Site clearance</li> <li>- Dowel connection to existing structure</li> </ul>	<ul style="list-style-type: none"> <li>- 1k per m length for height less than 1.2m (fluvial)</li> <li>- 2.2k per m length for height between 1.2 and 2.1m (fluvial)</li> <li>- 0.6k per m length (coastal)</li> </ul>	<ul style="list-style-type: none"> <li>- 1.6k per m length for height less than 1.2m (fluvial)</li> <li>- 3.5k per m length for height between 1.2 and 2.1m (fluvial)</li> <li>- 1k per m length (coastal)</li> </ul>	<ul style="list-style-type: none"> <li>- Assumed structure would not be a retaining wall</li> <li>- Assumed existing structures would not require structural modifications to enable crest raising to be undertaken</li> </ul>

Defence type / measure	Cost range used in assessment (including OB, risk, prelim uplifts)	Primary source of cost estimate	Cost range in Environment Agency guidance (2015)	Cost range in Environment Agency guidance (2015), adjusted for inflation*	Notes / Assumptions
		<ul style="list-style-type: none"> <li>- Concrete, formwork and reinforcement</li> <li>- Masonry cladding</li> </ul>			<ul style="list-style-type: none"> <li>- Structure geometry in costing based on GIS analysis of lengths / heights required for indicative alignments.</li> </ul>
Seawall	<ul style="list-style-type: none"> <li>- £3.3k to 12.0k per m length of defence</li> <li>- Between 1m to 2.5m wall height</li> </ul>	Cost build-up using SPONS (2024), including: <ul style="list-style-type: none"> <li>- Site clearance</li> <li>- Excavation</li> <li>- Sheet pile setup and installation for toe</li> <li>- Concrete, formwork and reinforcement</li> <li>- Fill</li> </ul>	- £0.7 to £5.4k per m length	- £1.1 to £8.7k per m length	<ul style="list-style-type: none"> <li>- Assumed sheet pile toe protection required and included in the cost build-up</li> <li>- Structure geometry in costing based on GIS analysis of lengths / heights required for indicative alignments.</li> </ul>
Rock revetment	<ul style="list-style-type: none"> <li>- £5.7k to £12.1k per m length of defence</li> <li>- Between 2m and 4m defence height</li> </ul>	Cost build-up using SPONS (2024), including: <ul style="list-style-type: none"> <li>- Site clearance</li> <li>- Excavation and reprofiling</li> <li>- Geotextile base</li> <li>- Rock armour secondary and primary layers</li> <li>- Rock placement</li> <li>- Rock armour uplift for potential for non-local sources</li> </ul>	- £1.3k to 6k per m length of defence (rock armour)	- £2.1k to 9.6k per m length of defence (rock armour)	<ul style="list-style-type: none"> <li>- Sourcing of rock likely to be key driver of cost</li> <li>- Structure geometry in costing based on GIS analysis of lengths / heights required for indicative alignments.</li> </ul>
Rock groyne	- £6.9k per m length of groyne	Cost build-up from SPONS (2024), including: <ul style="list-style-type: none"> <li>- Site clearance</li> <li>- Excavation</li> <li>- Geotextile base and around core</li> <li>- Rock core</li> </ul>	- £0.2k to £2.5k per m length of groyne	- £0.3k to £4k per m length of groyne	<ul style="list-style-type: none"> <li>- Sourcing of rock likely to be key driver of cost</li> <li>- Structure geometry in costing based on indicative groyne field layout, that would need further consideration and be subject to change during further appraisal.</li> </ul>

Defence type / measure	Cost range used in assessment (including OB, risk, prelim uplifts)	Primary source of cost estimate	Cost range in Environment Agency guidance (2015)	Cost range in Environment Agency guidance (2015), adjusted for inflation*	Notes / Assumptions
		<ul style="list-style-type: none"> <li>- Rock armour layer</li> <li>- Rock placement</li> <li>- Rock uplift for potential for non-local sources</li> </ul>			- Typically rock groyne length of 70m was assumed
Rock breakwater	- £18.4k per m length of breakwater	Cost build-up from SPONS (2024), including: <ul style="list-style-type: none"> <li>- Site clearance</li> <li>- Excavation</li> <li>- Geotextile base</li> <li>- Rock core</li> <li>- Rock armour layer(s)</li> <li>- Rock placement</li> <li>- Rock armour uplift for potential for non-local sources</li> </ul>	- £1.7k to £4.3k per m length	- £2.7k to £6.9k per m length	<ul style="list-style-type: none"> <li>- EA guidance outlined complexity in cost estimate for these structures and also didn't have a large sample size for the cost database. Therefore the rate provided in EA guidance is particularly uncertain.</li> <li>- Assumed breakwater height of 4.5m in SPONS cost buildup which would be subject to change if more detailed design calculations were undertaken.</li> </ul>
Cliff slope drainage (generic)	<ul style="list-style-type: none"> <li>- £6.3k per m length of cliff</li> <li>- Based on 20m cliff height and cost scaled according to cliff height (for example 40m high cliff, like at Barton on Sea, would be double)</li> </ul>	Cost build-up from SPONS (2024), including: <ul style="list-style-type: none"> <li>- Site clearance</li> <li>- Plant and drilling into cliff</li> <li>- Geotextile installation</li> <li>- Grout installation</li> <li>- Perforated pipe installation</li> <li>- Geological watchmen supervision</li> </ul>	- Not included in EA guidance	- Not included in EA guidance	<ul style="list-style-type: none"> <li>- Increased the rate for larger / complex cliffs (i.e. Barton on Sea) based on cliff height</li> <li>- Cliff heights estimated from LiDAR datasets</li> <li>- Length of drainage based on GIS analysis of option alignments</li> </ul>
Cliff slope drainage (Barton on)	-£10k per m length of cliff	Cost build-up from SPONS (2024), including: <ul style="list-style-type: none"> <li>- Site clearance</li> </ul>	- Not included in EA guidance	- Not included in EA guidance	- SPONS rates not available for long lengths of horizontal drilled drainage

Defence type / measure	Cost range used in assessment (including OB, risk, prelim uplifts)	Primary source of cost estimate	Cost range in Environment Agency guidance (2015)	Cost range in Environment Agency guidance (2015), adjusted for inflation*	Notes / Assumptions
Sea Trial approach)	- Based on horizontal drilled drainage solution trial	- Plant and horizontal drilling into cliff - Geotextile installation - Perforated pipe installation - Geological watchmen supervision			therefore number of assumptions needed to be made - Recommended that contractor cost estimates provided by specialists during business case development - Length of drainage, positioning and frequency alongshore assumed from preliminary discussions with NFDC, but these will be subject to change.
Beach nourishment	- £33.3 per m <sup>3</sup> of material	Correspondence with BCP Council based on anticipated rates. Benchmarked against actual costs from similar schemes on the south coast (Hayling Island in 2019 and 2018).	- £9 to £32 per m <sup>3</sup>	- £15 to £51 per m <sup>3</sup>	- Beach design not part of strategic assessment, therefore a number of assumptions required when estimating volume of material required for costing. - High level approach was used whereby existing beach profile from Highcliffe was assumed to be the target profile for beach nourishment works along frontage (given it is success in managing toe erosion). - Beach profile / LiDAR used to determine volume of material needed in each location to deliver target profile.
Beach recycling	- £5.7 per m <sup>3</sup> of material moved	Actual costs from similar beach recycling schemes on the south coast (Hayling Island between 2017-2021) adjusted for inflation	- £1 per m <sup>3</sup>	- £2 per m <sup>3</sup>	- Typically assumed volume of 2,500m <sup>3</sup> per beach recycling intervention - However, this would need to be informed by a beach management plan and would be subject to change

Defence type / measure	Cost range used in assessment (including OB, risk, prelim uplifts)	Primary source of cost estimate	Cost range in Environment Agency guidance (2015)	Cost range in Environment Agency guidance (2015), adjusted for inflation*	Notes / Assumptions
Embankment	<ul style="list-style-type: none"> <li>- £1.3k to £6.9k per m length of defence</li> <li>- Between 0.5m and 2.5m defence height</li> </ul>	Cost build-up from SPONS (2024), including: <ul style="list-style-type: none"> <li>- Site clearance</li> <li>- Excavation and disposal</li> <li>- Core fill and compaction</li> <li>- Topsoil import and compaction</li> <li>- Seeding</li> <li>- Drainage</li> </ul>	<ul style="list-style-type: none"> <li>- £0.6k to £3.4k per m length</li> <li>- Cost subject to volume of embankment, with &gt;15,000m<sup>3</sup> being £0.6k and &lt;500m<sup>3</sup> being £3.8k</li> </ul>	<ul style="list-style-type: none"> <li>- £1k to £5.5k per m length</li> <li>- Cost subject to volume of embankment, with &gt;15,000m<sup>3</sup> being £1k and &lt;500m<sup>3</sup> being £5.5k</li> </ul>	<ul style="list-style-type: none"> <li>- Structure geometry in costing based on GIS analysis of lengths / heights required for indicative alignments.</li> </ul>
Armoured embankment	<ul style="list-style-type: none"> <li>- £2.3k to £10.3k per m length of defence</li> <li>- Between 0.5m and 2.5m defence height</li> </ul>	Cost build-up from SPONS (2024), including: <ul style="list-style-type: none"> <li>- Site clearance</li> <li>- Excavation and disposal</li> <li>- Core fill and compaction</li> <li>- Topsoil import and compaction</li> <li>- Seeding</li> <li>- Drainage</li> <li>- Slope armouring</li> </ul>	<ul style="list-style-type: none"> <li>- Not provided</li> </ul>	<ul style="list-style-type: none"> <li>- Not provided</li> </ul>	<ul style="list-style-type: none"> <li>- Assumed reno-mattress cost for slope armouring and greater excavation requirements.</li> <li>- Structure geometry in costing based on GIS analysis of lengths / heights required for indicative alignments.</li> </ul>
Land raising	<ul style="list-style-type: none"> <li>- £0.3k to £1.1k per m<sup>3</sup> of raising</li> </ul>	Cost build-up from SPONS (2024), including: <ul style="list-style-type: none"> <li>- Site clearance</li> <li>- Excavation and reprofiling</li> <li>- Fill import and compaction</li> <li>- Surface layers – sub base, binding course and surface</li> </ul>	<ul style="list-style-type: none"> <li>- Not provided</li> </ul>	<ul style="list-style-type: none"> <li>- Not provided</li> </ul>	<ul style="list-style-type: none"> <li>- Volume of raising estimated from GIS based on areas requiring raising, land levels and water levels.</li> </ul>
Verge / bank armouring (small scale)	<ul style="list-style-type: none"> <li>- £0.3k per m length</li> </ul>	Cost build-up from SPONS (2024), including: <ul style="list-style-type: none"> <li>- Site clearance</li> <li>- Excavation</li> </ul>	<ul style="list-style-type: none"> <li>- £50 to £500 per m length</li> </ul>	<ul style="list-style-type: none"> <li>- £80 to £800 per m length</li> </ul>	<ul style="list-style-type: none"> <li>- Assumed reno-mattress cost for slope armouring</li> <li>- Length of defence based on GIS analysis of defence alignment length</li> </ul>

Defence type / measure	Cost range used in assessment (including OB, risk, prelim uplifts)	Primary source of cost estimate	Cost range in Environment Agency guidance (2015)	Cost range in Environment Agency guidance (2015), adjusted for inflation*	Notes / Assumptions
		- Slope armouring			
Property level protection / resilience measures	- £10k per property	Environment Agency guidance	- £4k to £8k per property for protection measures - £8k to £12k per residential property for resilience measures	- £6.4k to £12.9k per property for protection measures - £12.9k to £19.3k per residential property for resilience measures	- Assumed mid point of EA property level protection cost, adjusted for inflation - For scheme delivery, each property would require bespoke solution and therefore costs will vary on property by property basis - Properties requiring PLP / PLR determined from GIS analysis using NRD dataset and flooding model results.

\* Cost base for EA guidance is 2007 and inflation between 2007-2023 is estimated to be approximately 60%. This is based on:

- Consumer Price Index (CPI) inflation is approximately 60% between 2007-2023.
- The Construction Output Price Index (OPIs) are available from 2014-September 2023. However, these do not extend back to 2007 therefore an inflation calculation for the period 2007-2023 using this index is not possible.
- Using rates of inflation from the Consumer Price Index for the period 2007-2014, and then Construction Price Index (new infrastructure type) for the period 2014-September 2023, the overall rate of inflation is approximately 58% between 2007-2023.

## 7.2 Maintenance Costs

In addition to the capital construction costs, the option costs also included costs for ongoing asset maintenance. For the purposes of the Strategy, maintenance refers to the periodic or annual maintenance works that are required to maintain the structural integrity of the coastal defences.

For the Strategy costing, it has been assumed that maintenance can be undertaken in one of two ways:

- Small scale patch / repair maintenance to defences, typically undertaken on an annual basis. This involves repairing small sections of defence length, such as resealing joints, repairing cracks, or moving rock back into place.
- Larger scale defence refurbishment, undertaken on a much less frequent basis. This would vary by structure type but would typically involve rebuilding or replacing part of the defence structure that had failed so that it can continue to perform its FCERM function.

The costs for small scale patch / repair maintenance were estimated using the Environment Agency cost guidance. The guidance provides typical annual maintenance costs per metre for a range of defences and for the purposes of the Strategy an average rate was calculated and applied annually for each option in each ODU. The length of defences in each ODU was obtained in GIS and used to work out the annual cost to be applied. Table 7-2 provides details of this annual maintenance cost (£2.25k per km/year).

The deterioration of defences is typically not a linear process and generally occurs following storm events or other notable events. Therefore, whilst the small scale patch-repair maintenance costs have been applied annually, in some years the amount would be expected to be lower, and in other years higher.

**Table 7-2: Small scale patch-repair annual maintenance costs**

Defence type	Annual maintenance cost in Environment Agency guidance (2015)	Annual maintenance cost in Environment Agency guidance (2015), uplifted for inflation*
Embankment	- £80 to £5,430 per km/year - Based on target condition grade 2 - Mid-point of range £2,755 per km/year	- Mid-point: £4,428 per km/year
Concrete wall	- £210 to £855 per km/year - Based on target condition grade 2 - Mid-point of range £533 per km/year	- Mid-point: £857 per km/year
Steel sheet pile wall	- £160 to £530 per km/year - Based on target condition grade 2 - Mid-point of range £345 per km/year	- Mid-point: £554 per km/year
Brick / masonry wall	- £355 to £1,020 per km/year - Based on target condition grade 2 - Mid-point of range £688 per km/year	- Mid-point: £1,106 per km/year
Average		- Average of structure types above is £1,736 per km/year
Uplift with risk allowance**		- £2,250 per km/year

\* Cost base for EA guidance is 2007 and 60% inflation assumed between 2007-2023 based on CPI inflation between this time.

\*\*30% risk allowance applied to small scale patch-repair costs. These maintenance costs from the guidance are based on EA as-built database and therefore a smaller overall risk allowance has been applied to these compared to capital construction costs and capital refurbishment maintenance.

In ODUs 14, 16 and 18, NFDC have provided typical annual maintenance costs for these sections of frontage. For these units these costs provided by NFDC have been used as the basis for the maintenance costs rather than the values shown in Table 7-2.

The costs for larger scale refurbishments and replacement of defences have also been estimated. When estimating these costs, it is difficult to predict what proportion of a defence would require refurbishment / replacement. This is because the condition of defences will not deteriorate linearly along the full length of defence, with some sections deteriorating faster and other sections much slower. The deterioration would also be subject to future levels of annual maintenance and the occurrence of storms.

For the purposes of the Strategy costing, it has typically been assumed that for a refurbishment intervention, 50% of a defence length would require refurbishment / replacement. For the 50% of a defence that needs refurbishment, the cost of refurbishing / replacing the defence has been conservatively assumed to be the same as constructing a new defence and therefore the capital cost rates provided in Table 6-1 have been used. In some locations different percentage lengths that require refurbishment have been assumed (i.e. not 50%), based on the defence condition assessment.

## 7.3 Optimism Bias and Risk

Optimism bias is the demonstrated systematic tendency for appraisers to be over-optimistic about key project parameters, including capital costs, operating costs, project duration and benefits delivery. The Green Book recommends applying specific adjustments for this at the outset of an appraisal. The aim of adjusting for optimism bias is to provide a more realistic assessment of the initial estimate of costs (HM Treasury Green Book, 2022<sup>12</sup>).

The FCERM appraisal guidance recommends that different amounts of optimism bias are applied to option costs at different stages of appraisal. For strategic studies such as this, the guidance recommends applying 60% optimism bias and therefore this amount has been applied to the option costs.

In addition to the 60% optimism bias adjustment, a further risk adjustment of 30% has also been applied to take into account known risk factors associated with the Strategy frontage, such as tidal working, the potential need for temporary works and potential buried services.

Note that the unit cost values presented in Sections 7.1 and 7.2 include optimism bias and risk allowances.

## 7.4 Whole-life Costs

The capital construction costs, and maintenance costs associated with each short list option were combined and sequenced through the appraisal period (100 years) to develop the whole life cost estimates of the options. The assumed timing of interventions for the leading options are shown in Appendix B.

Future costs in the appraisal period were discounted using the same approach outlined in Section 2.8; 3.5% for the years 0 to 30, 3% for the years 31 to 75, and 2.5% for the years 76 to 99 resulting in a PV factor over 100 years at 29.9 (HM Treasury Green Book, 2022). Discounting converts the whole life cash cost of the option into a present value, ensuring that the whole life costs can be directly compared to the whole life damages / benefits of options in present value terms.

## 7.5 Uncertainties and limitations

There are several uncertainties and limitations in the short list option cost estimates that should be considered. These uncertainties and limitations are typical for a strategic level project and could result in changes to the option costs over time. The uncertainties should be considered during subsequent scheme development and appraisal and work undertaken to improve cost certainty as schemes get closer to construction.

- **Type of defence measure:** each of the short list options includes details on the defence measures that are recommended. These defence measures are based on the option appraisal undertaken as part of the Strategy. However, as schemes get closer to construction, the defence measures will be reappraised during subsequent design work and there is potential for changes to the scheme / defence measures to occur when local opportunities and constraints are considered in more detail. Any changes to the defence measures being used to deliver the schemes is likely to alter the overall cost of the options.
- **Defence alignments and geometry:** for the purposes of costing, indicative defence alignments and geometry (e.g. length, height etc.) have been identified for the options. It is likely that there will be

<sup>12</sup> HM Treasury (2022) Green Book. Available at: <https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-government/the-green-book-2020#a5-uncertainty-optimism-bias-and-risk>

modifications to these alignments when they are appraised in more detail during subsequent scheme development following the Strategy. This has the potential to alter the overall cost of the options.

- **Inflation / deflation:** the base year for the cost estimates is 2023/24 to align with the Strategy appraisal period and time the costing work was undertaken. Macro-economic factors over time such as inflation / deflation will change the cost of the options. For example, the material and labour costs associated with coastal defence construction and maintenance change over time in response to supply / demand and broader macro-economic factors.
- **Site specific conditions:** being part of a strategic assessment, the option costs are suitably high level, and it was beyond scope to consider the site specific conditions of each area along the Strategy frontage. The optimism bias and risk uplifts applied to the option costs help to cover this uncertainty and in areas where the project team felt that there were greater risks or constraints, further uplifts were applied to the costs to account for these. However, it is likely that when schemes are designed and developed in more detail the costs will need to change to reflect site specific design decisions and construction approaches. In addition, specific legal / consenting / compensation costs are also not included in the cost estimates at this stage as these will be site specific and would need to be assessed during more detailed business case development.
- **Maintenance requirements:** costs for annual small scale maintenance and larger less frequent refurbishments have been included in the option costs. However, there is uncertainty around the future maintenance requirements as defence deterioration is not linear. For example, large amounts of damage can occur during stormy periods and the frequency of this occurring is not predictable. Therefore, there is potential for maintenance costs in any given year to be more or less than the costs included in the Strategy costing.
- **Service life of existing / new defences:** in the whole life costing of options, it has been necessary to assume when defences may come to the end of their service life. For existing defences this has been based on information from the defence condition assessment, and for new defences design lives appropriate to the defence measure type have been assumed. However, the residual service life of existing defences or the design life of new defences will be impacted by the existing condition, frequency of storms, the amount of maintenance undertaken, and design decisions taken during scheme design. Each of these factors will impact when new defences are required and the timings for interventions assumed in the option costing is likely to change.

## 8. Economic Appraisal of Options

The economic appraisal of the short list options is a key stage in the overall option development and appraisal process. As per the FCERM appraisal guidance, the National Economic Leading Options have been identified in each ODU using the process set out in the guidance. The key steps for selecting the National Economic Leading Option are outlined below.

As outlined in the FCERM appraisal guidance, it is typical to use cost benefit analysis (CBA) to appraise options at the strategic level where multiple FCERM problems across a large, interconnected area are being considered. CBA balances the range of costs and benefits allowing the appraiser to identify the nationally leading option. CBA has therefore been used to appraise the options.

The use of cost effectiveness analysis (CEA) for some parts of the Strategy frontage was also considered. However, through discussions with the Environment Agency and a steer from the Environment Agency's Large Project Review Group, CEA was not used as it was not deemed suitable.

There are two different approaches (A and B) that can be used for CBA, depending on the risks at the location being considered. These two different approaches have both been used depending on the location, and they are outlined below.

### **Approach A:**

For options that are primarily focussed on creating a reduction in the flood risk, the CBA approach to selecting the National Economic Leading Option is as follows:

- 1. Establish the whole life costs and benefits of the options:** Remove any options with an average benefit cost ratio (ABCR) <1 from the remainder of the appraisal. Take forward the options with an ABCR >1.
- 2. Organise the options and select the leading economic option:** Organise the options with an ABCR >1 into a list based on reducing Annual Exceedance Probability of flooding (AEP) – improving Standard of Protection (SoP). The AEP for the onset of flooding will vary depending on where it is in a floodplain. The AEP can either be defined by the event probability that the economic impacts start (typically used in inland flood options and sheltered coastal areas) or the event probability that exceeds allowable overtopping rates (typically applied to coastal frontages with significant wave action).

Once organised, the incremental benefit cost ratio (IBCR) between options is then used to select the SoP that provides best value for money. The selected option (and SoP) is classified as the provisional leading economic option.

The IBCR is calculated as the difference in option benefits between two options divided by the difference in option costs between the options.

- 3. Test for uncertainty:** Using results from a sensitivity analysis, consider whether the choice of the leading economic option needs to change to account for the uncertainties. If the provisional leading economic option stays the same in the sensitivity tests, do not change the option choice. However, if the sensitivity tests are showing that the choice of the provisional leading economic option changes under the test, consider a range of next steps, including whether to change choice of the leading option or to adapt the option to minimise the impact of uncertainties.
- 4. Determine National Economic Leading Option:** The leading economic option at the end of step 3 is identified as the provisional National Economic Leading Option.

For Approach A (appraising options that manage flood risk), two different standards of protection (SoPs) were considered in the CBA in step 2; a 1.33 % AEP (1 in 75 year) standard and a 0.5% AEP (1 in 200 year) standard. These standards were used as they represent the boundaries of the IBCR thresholds in the FCERM-AG and a recommendation for the SoP can therefore be made in the Strategy. In order to select the 0.5% AEP (1 in 200 year) standard as the leading economic option, the IBCR needs to be greater than 3 relative to the 1.33% AEP (1 in 75 year) standard.

## **Approach B:**

For options that cannot be ordered by AEP, there is a different CBA approach to selecting the National Economic Leading Option. In this alternative approach, step 2 uses Net Present Value (NPV) to organise the options rather than reducing probability of flooding. Examples of options that cannot be ordered by AEP within the Strategy are coastal erosion focussed options (where a flood risk SoP is not provided) or strategic based options that deal with different areas within an ODU or other risk factors such as defending historic landfill sites. For this approach, step 2 involves:

- 2. Organise the options and select the leading economic option:** Organise the options with an ABCR >1 into a list based on increasing NPV. The leading economic option is the option with the highest NPV.

Steps 1, 3 and 4 remain the same for options that are reducing the erosion risk.

## **Social and Environmental Considerations**

As outlined above, the choice of National Economic Leading Option is solely based on the economic merits of an option. Some of the short list options are unlikely to be deliverable due to major negative environmental or social impacts and therefore the project team added in an additional step into the identification of the National Economic Leading options:

- Once the provisional National Economic Leading Option had been selected using the CBA approaches outlined in Approach A and B, the results of the Strategic Environmental Appraisal (SEA) and Social Appraisal were considered.
- If the provisional National Economic Leading Option was likely to have major negative environmental impacts that could not be reasonably mitigated, then the choice of option was revisited, and the next best National Economic Option was identified. Similarly, if the provisional National Economic Option was likely to have major negative social impacts and not be supported by stakeholders then the choice of option was revisited.

Where there has been a change in the choice of the National Economic Leading Option, this report provides details of the key reasons why.

## **Key uncertainties**

The main uncertainties when identifying the National Economic Leading Options relate to the option costs. Sensitivity tests on the option costs have therefore been undertaken as part of the appraisal process. Broader uncertainties, such as property threshold levels (see Section 4 of this report) could also influence the economic case of options but are unlikely to change the choice of option given there would likely be a consistent impact across all short list options considered if different thresholds were applied.

## **Local Aspirational and Backup options**

In some ODUs, the National Economic Leading Option may not be preferable for local decision makers or communities, and there may be compelling local reasons to choose an alternative option from the short list. Two different types of options have been identified in some ODUs; the Local Aspirational Option and a Backup Option.

For the Local Aspirational Option, the FCERM appraisal guidance outlines how a local choice option can be selected as the overarching leading option to replace the National Economic Leading Option if the additional expenditure for the local option is fully funded. Given that the Strategy represents the initial part of the overall appraisal process and funding for subsequent projects has yet to be secured, where selected the local choice option has been termed the 'Local Aspirational Leading Option'. This reflects the intent of the project team to secure funding if possible but acknowledges that at this stage the Local Aspirational Leading Option does not fully replace the National Economic Leading Option.

Backup Options have been identified where there is a large amount of uncertainty as to the funding of the National Economic and Local Aspirational Options.

This economics report is focussed on selecting the National Economic option, as determined by the economic appraisal. More information on the next steps and how the Strategy has identified Local Aspirational and Backup options is provided in the Leading Options Report (AECOM, 2023).

This section of the report

This section of the report presents the economic case of the short list options in each ODU and identifies the National Economic Leading option for each location. More details on what each short list option involves can be found in the Leading Options Report (AECOM, 2023).

## 8.1 ODU 1 – Hengistbury Head East

ODU 1 is 400m long and is located immediately to the east of Hengistbury Head Long Groyne. There are four short list options for ODU 1; Do Nothing, Do Minimum, Managed Realignment and Improve.

### 8.1.1 Benefit cost comparison

Table 8-1 below presents the economic costs, damages and benefits of each option. Given that there are no calculated national damages or benefits for any of the options in this location it has not been possible to calculate the ABCR or NPV. The lowest cost option in this location is Do Nothing and therefore this has been selected as the provisional National Economic Leading Option.

**Table 8-1: ODU 1 economic appraisal**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV (£k)	Leading Economic Option
Do Nothing	-	0	0	-	-	X
Do Minimum	340	0	0	-	-	
Managed Realignment	2,823	0	0	-	-	
Improve	3,240	0	0	-	-	

### 8.1.2 Testing uncertainty

The main uncertainty with the options in this location relate to option cost. However, given that there are no option benefits in this location there is little merit in sensitivity testing the option costs as it would not impact the choice of provisional National Economic Leading Option (no option cost less than Do Nothing).

### 8.1.3 National Economic Leading Option

The economic appraisal in Table 8-1 provisionally identified the Do Nothing option as being the National Economic Leading Option.

Both the Do Nothing and Do Minimum options are likely to have negative environmental impacts across a variety of categories. The main impacts will relate to an eroding cliff face in the future. This could impact the amenity value of the area which could reduce the numbers of visitors / recreation users as well as impact the land based environmental designations at the top of the cliff. The health and safety risks of an eroding cliff face could be mitigated through health and safety provisions to limit access. From a historic environment perspective, erosion of the cliff could impact the 'Multi-period landscape of the Hengistbury Head scheduled monument', although the long term evolution is uncertain.

From a social perspective, the Do Nothing option is unlikely to be acceptable as it would involve walking away from existing defences that are currently providing an FCERM function. The Do Minimum option may be a better solution as it involves only a relatively small investment (small scale patch-repairs as required) and may have better support by the local community and stakeholders in the short term. In the long term there is unlikely to be much difference between the two options as small scale patch-repair will not be able to maintain the condition of the defences in the medium / long term and they will eventually fail.

Overall, due to the presence of existing defences that are in working order and providing an FCERM function, it is not considered acceptable to recommend the Do Nothing option as the National Economic Leading Option in this location. The next lowest cost option is the Do Minimum option and therefore this has been identified as the National Economic Leading option in ODU 1. It is not appropriate to select a higher cost option (i.e. Managed Realignment or Improve) as the National Economic Leading Option due to the significant additional investments required for these options which are not justified as no economic benefits are generated by these options on a national basis.

## 8.1.4 Local Aspirational / Backup Options

As outlined in the Leading Options Report (AECOM, 2024), the Managed Realignment option has been identified as the Local Aspirational Option for ODU 1. This option will help to manage the rate of future erosion in a more effective way and will reduce uncertainty around the long-term success of Hengistbury Head Long Groyne and the integrity of Mudeford Sandbank. The Managed Realignment option includes increased spending on defence maintenance through refurbishments and the total PV cost of the option is estimated to be around £2.8million.

## 8.1.5 Local Economic Wider Benefits

Table 8-2 below outlines the potential local economic damages in ODU 1 for the Do Nothing scenario.

It is likely that these damages would be avoided by the Local Aspirational Option (Managed Realignment) over the Strategy duration and would therefore turn into an economic benefit. However, these benefits are unlikely to be realised with the National Economic Leading Option (Do Minimum) as erosion would still be expected to occur in the medium and long term.

The values shown in Table 8-2 are based on the damage calculations presented in Section 5 of this report, broken down to the ODU 1 level. These are not nationally eligible and cannot be included in an FCERM-GiA application. See Section 5.1 for description of GVA calculations and treatment of NRD '999' classified properties. For planning, investment and funding decisions it is recommended that the GVA values excluding the '999' properties are used as a guide.

**Table 8-2: Local economic wider damages for ODU 1**

Local benefit category	Appraisal period	PV Do Nothing Damage (£k)	Commentary
GVA – stay and do nothing scenario, <b>excluding</b> 999 classified properties	10 years	0	Do Nothing damage will be avoided (creating economic benefits) with the Local Aspirational Option (Managed Realignment).  National Economic Leading Option (Do Minimum) not expected to lead to significant damages avoided.
GVA – stay and do nothing scenario, <b>excluding</b> 999 classified properties	100 years*	0	
Visitor economy (assuming 20% reduction in visitor numbers)**	100 years	5,918	
Car park income	100 years	0	
Beach hut income	100 years	0	
Coastal recreation (assuming 20% reduction in recreation users)	100 years	1,053	
Health and wellbeing	100 years	783	

\*as outlined in Section 5.1, calculating GVA values over a 100 year appraisal period is highly uncertain and a 10 year appraisal period is more accurate.

\*\*the visitor economy values are based on tourism economy values for visits to Christchurch as a whole, obtained from Visit Britain (2019) and is not separated into site specific details. Each of the ODUs along the Strategy frontage has features and characteristics that attract tourists to the area and therefore the Do Nothing value for the visitor economy for the Strategy frontage has been divided equally across each of the 18 ODUs.

## 8.2 ODU 2 – Mundeford Sandbank

ODU 2 covers the entirety of Mundeford Sandbank (including the open coast and harbour side. There are six short list options; Do Nothing, Do Minimum, Maintain, Managed Realignment, Maintain / Adaptation and Improve.

### 8.2.1 Benefit cost comparison

Table 8-3 below presents the economic costs, damages and benefits for each option. As can be seen, the option costs outweigh the option benefits for each of the Do Something options. This is due to the lack of economic damages / benefits that can be counted for Mundeford Sandbank on a national basis. Other local economic benefits are associated with the Do Something options but are not eligible to be counted in this comparison. Each of the Do Something options has a negative NPV and therefore the Do Nothing option has been selected as the provisional National Economic Leading Option.

**Table 8-3: ODU 2 economic appraisal**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV (£k)	Leading Economic Option
Do Nothing	-	153	0	-	-	X
Do Minimum	680	153	0	-	-680	
Maintain and Adaptation	5,456	64	89	0.02	-5,367	
Maintain	5,382	153	0	-	-5,382	
Managed Realignment	5,382	153	0	-	-5,382	
Improve	6,933	8	145	0.02	-6,788	

### 8.2.2 Testing uncertainty

The main uncertainty with the options in this location relate to option cost. However, given that the leading economic option is the Do Nothing option (which does not have a cost), there is little merit in sensitivity testing the option costs of the other options as it would not impact the choice of the provisional National Economic Leading Option (as no option will cost less than Do Nothing).

### 8.2.3 National Economic Leading Option

The economic appraisal in Table 8-3 provisionally identified the Do Nothing option as being the National Economic Leading Option.

The Do Nothing option is likely to have a range of negative impacts, including to the environment, flood risk and to navigation. The morphological changes to the harbour that could arise with this options is very uncertain. Due to the risks to properties, infrastructure (e.g. utilities connections etc.) and the potential for broader morphological impacts, doing nothing is not an acceptable solution in this location and would not be in line with the SMP policy for the area.

There are existing defences on the Sandbank that currently provide an FCERM function and therefore it is not considered acceptable to recommend walking away and identifying the Do Nothing option as the National Economic Leading Option in this location. Instead the next lowest cost option is the Do Minimum option and this has therefore been identified as the National Economic Leading Option in ODU 2.

The Do Minimum option would aim to use small scale maintenance (e.g. patch-repair) to extend the service life of the existing defences for as long as possible. However, in the medium and long term, this may not be sustainable and as the existing defences fail the risks associated with the Do Nothing scenario would be expected to occur

with Do Minimum. Despite this the Do Minimum option appears to be a better solution than the Do Nothing option as it involves only a relatively small investment and may have better support by the local community and stakeholders in the short term. It is not appropriate to select a higher cost option (i.e. Maintain or Improve) as the National Economic Leading Option due to the significant additional investments required for these options which are not justified on economic grounds.

## 8.2.4 Local Aspirational / Backup Options

As outlined in the Leading Options Report (AECOM, 2024), the Maintain with Adaptation option has been identified as the Local Aspirational Option for ODU 2. This option would reduce the flood risk to the permanent properties on the Sandbank as well as maintain the form of the Sandbank over time to reduce the risks to navigation, buried services and environment. The Maintain with Adaptation option includes increased spending on defence maintenance through refurbishments and the total PV cost of the option is estimated to be around £5.5million.

## 8.2.5 Local Economic Wider Benefits

Table 8-4 below outlines the potential local economic damages in ODU 2 for the Do Nothing scenario.

It is likely that these damages would be partially avoided by the Local Aspirational Option (Maintain with Adaptation) over the Strategy duration through the maintenance of existing defences to prevent erosion and the implementation of property level resilience and protection measures to reduce flood risk. This would create an economic benefit, however, there would still be a residual risk of flooding that remains so the damages would not be completely avoided.

Local economic benefits are unlikely to be realised with the National Economic Leading Option (Do Minimum) as significant flooding and erosion would still be expected to occur.

The values shown in Table 8-4 are based on the damage calculations presented in Section 5 of this report, broken down to the ODU 2 level. These are not nationally eligible and cannot be included in an FCERM-GiA application. See Section 5.1 for description of GVA calculations and treatment of NRD '999' classified properties. For planning, investment and funding decisions it is recommended that the GVA values excluding the '999' properties are used as a guide.

**Table 8-4: Local economic wider damages for ODU 2**

Local benefit category	Appraisal period	PV Do Nothing Damage (£k)	Commentary
GVA – stay and do nothing scenario, <b>excluding</b> 999 classified properties	10 years	168	Do Nothing damages will be partially avoided (creating economic benefits) with the Local Aspirational Option (Maintain with Adaptation).  National Economic Leading Option (Do Minimum) not expected to lead to significant damages avoided.
GVA – stay and do nothing scenario, <b>excluding</b> 999 classified properties	100 years*	1,421	
Visitor economy (assuming 20% reduction in visitor numbers)	100 years	5,918	
Car park income	100 years	0	
Beach hut income	100 years	4,839	
Coastal recreation (assuming 20% reduction in recreation users)	100 years	1,025	
Health and wellbeing	100 years	786	

\*as outlined in Section 5.1, calculating GVA values over a 100 year appraisal period is highly uncertain and a 10 year appraisal period is more accurate.

*\*\*the visitor economy values are based on tourism economy values for visits to Christchurch as a whole, obtained from Visit Britain (2019) and is not separated into site specific details. Each of the ODUs along the Strategy frontage has features and characteristics that attract tourists to the area and therefore the Do Nothing value for the visitor economy for the Strategy frontage has been divided equally across each of the 18 ODUs.*

## 8.3 ODU 3 – Christchurch Harbour South

ODU 3 is over 5km long and covers the south side of Christchurch Harbour. There are several list options for ODU 3; Do Nothing, Do Minimum and variations of Maintain and Adaptation / Resilience.

### 8.3.1 Benefit cost comparison

#### Cost benefit analysis

Table 8-5 below presents the economic costs, damages and benefits of each option and the average benefit cost ratios. All costs and benefits are presented in discounted present value (PV) terms. The options on ODU 3 cannot be ordered based on AEP and have therefore been ordered according to the NPV. The Adaptation / Resilience A option has the highest NPV and is therefore selected as the provisional National Economic Leading Option.

**Table 8-5: ODU 3 economic appraisal**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV (£k)	Leading Economic Option
Adaptation / Resilience A	118	331	669	5.67	551	X
Adaptation / Resilience B	253	331	669	2.64	416	
Adaptation / Resilience C	776	189	811	1.05	35	
Do Nothing	-	1,000	0	-	-	
Do Minimum	44	1,000	0	-	-44	
Maintain A	204	1,000	0	-	-204	
Maintain B	727	857	143	0.20	-584	

### 8.3.2 Testing uncertainty

The main uncertainty with the options in this location relate to option cost. A sensitivity test has been undertaken to test the choice of options in ODU 3 with a cost uplift of 10% and 25% for Adaptation / Resilience A (the provisional National Economic Leading Option). Results are presented in Table 12-1 and Table 12-2 in Appendix A.

The sensitivity tests indicate that with a 10% and 25% cost increase for this option, the choice of National Economic Leading Option would remain unchanged. The Adaptation / Resilience A option would still have an ABCR of 4.5 for a 25% increase in cost. The choice of Adaptation / Resilience A as the provisional National Economic Leading Option has therefore not been changed as a result of the sensitivity tests.

### 8.3.3 National Economic Leading Option

The economic appraisal has provisionally identified the Adaptation / Resilience A option as the National Economic Leading Option.

The SEA did not identify any major negative environmental impacts for this option and the option has similar positive impacts to the other Do Something options. There is, however, uncertainty with the contamination status of the historic landfill site at Wick. Further site investigations are required to confirm the contaminated status. If the land is found to be contaminated then there could be a negative impact associated with erosion of the historic landfill site on the land, soil and water resources category. However, this impact is uncertain at this stage and therefore the findings of the SEA do not lead to a change of the choice of the provisional National Economic Leading Option.

The social appraisal indicated that there are likely to be more favourable options from a social perspective for example, Adaptation B or Adaption C. However, these options would require additional funding and are therefore considered as a Local Aspirational Leading Option.

Based on the above points, the Adaptation / Resilience A option is confirmed as the National Economic Leading Option.

### 8.3.4 Local Aspirational / Backup Options

As outlined in the Leading Options Report (AECOM, 2024), the Adaptation / Resilience C option has been identified as the Local Aspirational Option for ODU 3. This option would defend the road access to Hengistbury Head and also reduce erosion risk to Wick historic landfill site. The Adaptation / Resilience C option includes increased spending on defence upgrades and the total PV cost of the option is estimated to be around £0.8million.

### 8.3.5 Local Economic Wider Benefits

Table 8-6 below outlines the potential local economic damages in ODU 3 for the Do Nothing scenario.

For ODU 3 the local economic damages are primarily based on flood risk. These damages would be partially avoided by the Local Aspirational Option (Adaptation / Resilience C) and National Economic Leading Option (Adaptation / Resilience A) over the Strategy duration as property level resilience / protection measures would help reduce flood risk. This would create an economic benefit. however, there would still be a residual risk of flooding that remains so not all the damages would be avoided.

The values shown in Table 8-6 are based on the damage calculations presented in Section 5 of this report, broken down to the ODU 3 level. These are not nationally eligible and cannot be included in an FCERM-GiA application. See Section 5.1 for description of GVA calculations and treatment of NRD '999' classified properties. For planning, investment and funding decisions it is recommended that the GVA values excluding the '999' properties are used as a guide.

**Table 8-6: Local economic wider damages for ODU 3**

Local benefit category	Appraisal period	PV Do Nothing Damage (£k)	Commentary
GVA – stay and do nothing scenario, <b>excluding</b> 999 classified properties	10 years	10	Do Nothing damages will be partially avoided (creating economic benefits) with the Local Aspirational Option (Adaptation / Resilience C) and the National Economic Leading Option (Adaptation / Resilience A).
GVA – stay and do nothing scenario, <b>excluding</b> 999 classified properties	100 years*	496	
Visitor economy (assuming 20% reduction in visitor numbers)*	100 years	5,918	
Car park income	100 years	0	
Beach hut income	100 years	0	
Coastal recreation (assuming 20% reduction in recreation users)	100 years	0	
Health and wellbeing	100 years	0	

\*as outlined in Section 5.1, calculating GVA values over a 100 year appraisal period is highly uncertain and a 10 year appraisal period is more accurate.

\*\*the visitor economy values are based on tourism economy values for visits to Christchurch as a whole, obtained from Visit Britain (2019) and is not separated into site specific details. Each of the ODUs along the Strategy frontage has features and characteristics that attract tourists to the area and therefore the Do Nothing value for the visitor economy for the Strategy frontage has been divided equally across each of the 18 ODUs.

## 8.4 ODU 4 – Wick

ODU 4 spans the south side of the River Stour up to Tuckton Bridge around Wick. There are multiple short list options in this unit including Do Nothing, Do Minimum, Maintain, and variations of Sustain and Improve.

### 8.4.1 Benefit cost comparison

Table 8-7 below presents the economic costs, damages and benefits of each option and the average benefit cost ratios. All costs and benefits are presented in discounted present value (PV) terms. The options in ODU 4 cannot be ordered based on AEP as different areas are being defended in each of the options and the options include erosion defences. The options have therefore been ordered according to the NPV. The Sustain C option has the highest NPV and is therefore selected as the provisional National Economic Leading Option. Only three of the options considered have benefit cost ratios greater than unity (Sustain C, Improve C and Sustain B).

The main difference between Sustain C and Sustain B, is that Sustain B includes a series of capital refurbishments of the frontline quay wall in the west part of the unit. This would help to reduce the risk of the quay wall failing in the future, protecting the historic landfill site behind from erosion. The PV cost for these refurbishments is the difference in cost between the options (£2,031k).

**Table 8-7: ODU 4 economic appraisal**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV (£k)	Leading Economic Option
Sustain C (75yr SoP)	1,468	598	3,586	2.44	2,118	X
Improve C (75yr SoP – end of appraisal period)	2,889	334	3,850	1.33	961	
Sustain B (75yr SoP)	3,499	546	3,638	1.04	139	
Do Nothing	-	4,184	0	-	-	
Do Minimum	340	4,176	8	0.02	-332	
Improve B (75yr SoP – end of appraisal period)	4,919	282	3,902	0.79	-1,017	
Maintain	2,684	4,145	39	0.01	-2,645	
Sustain A (75yr SoP)	6,301	546	3,638	0.58	-2,663	
Improve A (75yr SoP – end of appraisal period)	10,818	282	3,902	0.36	-6,916	

The Sustain C option involves upgrading the flood defences at the eastern part of the unit by raising and lengthening the embankment. Two different SoPs have been considered for this option, a 1.33% AEP (75yr) SoP and a 0.5% AEP (200yr) SoP. The IBCR between these standards has been calculated and is shown in Table 8-8.

The Improve C option has also been included in the IBCR comparison in Table 8-8 because Improve C is the same as the Sustain C approach, with the exception that the defences would be initially constructed to the 2123 SoP rather than raised and lengthened over time. The Improve C (0.5% AEP, 200yr SoP) option would initially provide a much higher SoP at the time of construction, in excess of 0.1% AEP (1 in 1000 years).

As per FCERM appraisal guidance, in order to move from the Sustain C (1.33% AEP, 75yr SoP) option to the Sustain C (0.5% AEP, 200yr SoP) option the IBCR needs to exceed a value of 3. As can be seen, the IBCR between these standards is 14.18 which is greater than the IBCR threshold and therefore the Sustain C (0.5% AEP, 200yr SoP) is selected as the provisional National Economic Leading Option.

In order to increase the SoP further still and deliver the Improve C (0.5% AEP, 200yr SoP) option, the IBCR value needs to exceed a value of 5 given the much higher initial SoP of the Improve C option. As can be seen, the IBCR between Sustain C (0.5% AEP, 200yr SoP) and Improve C (0.5% AEP, 200yr SoP) is below unity so Sustain C (0.5% AEP, 200yr SoP) remains the provisional National Economic Leading Option.

**Table 8-8: ODU 4 IBCR comparison for the Sustain C option**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	IBCR	Leading Economic Option
Sustain C (75yr SoP)	1,468	598	3,586	2.44	-	
Sustain C (200yr SoP)	1,490	286	3,898	2.62	14.18	X
Improve C (200yr SoP – end of appraisal period)	3,124	155	4,029	1.29	0.08	

## 8.4.2 Testing uncertainty

The main uncertainties with the options in this location relate to option cost and the design water level of the defences to provide the desired SoP against flooding. The design water level be influenced by changes to sea level rise projections or updated understanding of the flood risk at the site.

A range of sensitivity tests have been undertaken to address these uncertainties. Sensitivity tests for this area include a cost uplift of 10% or 25% and also updated costs to account of for an additional 0.9m of sea level rise over the next century. This equates to the difference between the H++ sea level scenario and the sea level rise value used in the Strategy appraisal. Results are presented in Table 12-3 to Table 12-5 in Appendix A.

The cost increase sensitivity tests of 10% and 25% have been applied to just the Sustain C option to determine how the cost increase would alter the choice of leading options. These sensitivity tests indicate that with both scenarios the choice of the National Economic Leading Option would remain unchanged.

In the sensitivity test focused on design crest level, the crest level increase of 0.9m has been applied to each of Sustain and Improve options to determine whether the cost of any of these options would be more or less sensitive to such design parameter changes and whether this would change the choice of option. As can be seen Sustain C remains the provisional National Economic Leading Option. The economic case of each of the Sustain / Improve options is significantly weaker, with Sustain C being the only of these options with an ABCR greater than unity. However, with such an increase in sea level rise the benefits provided by the options would also increase, which is not included in the comparison and could make more of the options economically viable.

The choice of Sustain C as the provisional National Economic Leading Option has not been changed as a result of the sensitivity tests.

## 8.4.3 National Economic Leading Option

The economic appraisal has provisionally identified the Sustain C option as the National Economic Leading Option. The IBCR comparison for this option indicates that the 0.5% AEP (1 in 200 year) SoP is justified, rather than the 1.33% AEP (1 in 75 year) SoP.

From an environmental perspective, there is uncertainty with the contamination status of the historic landfill site in ODU 4. Further site investigations are required to confirm the contaminated status. If the land is found to be contaminated then there could be a negative impact associated with erosion of the historic landfill site on the land, soil and water resources category. However, this impact is uncertain at this stage and therefore the findings of the SEA do not lead to a change the choice of the provisional National Economic Leading Option.

A major negative impact on population and communities was identified in the SEA with the Sustain C option. However this could reasonably be mitigated. For example, following failure of the existing quay wall the site could be made safe from a health and safety perspective and modifications to the public realm (non FCERM related) could be undertaken to ensure the area can continue to be used for recreation / parkland.

Given the uncertainty around the contamination status of the landfill and potential for mitigation of social impacts, the Sustain C option is confirmed as the National Economic Leading Option but a Local Aspirational Option has also been selected for this ODU that is focussed on reducing the risk of erosion to the historic landfill (see Leading Options Report, AECOM 2024).

## 8.4.4 Local Aspirational / Backup Options

As outlined in the Leading Options Report (AECOM, 2024), the Sustain B option has been identified as the Local Aspirational Option for ODU 4. This option would reduce the risk of the quay wall in the west part of the unit failing in the future via a series of refurbishments and would ensure that the historic landfill site are not eroded. This would not be the case with the Sustain C option as the quay wall would not be refurbished. The Sustain B option includes increased investment on quay wall maintenance and the total PV cost of the option is estimated to be around £3.5million.

## 8.4.5 Local Economic Wider Benefits

Table 8-9 below outlines the potential local economic damages in ODU 4 for the Do Nothing scenario.

It is likely that these damages would be avoided by the Local Aspirational Option (Sustain B) over the Strategy duration and would therefore create an economic benefit. However, not all of the damages are likely to be avoided with the National Economic Leading Option (Sustain C) as erosion of the land adjacent to the quay wall could lead to reduction in visitor numbers to the area.

The values shown in Table 8-9 are based on the damage calculations presented in Section 5 of this report, broken down to the ODU 4 level. These are not nationally eligible and cannot be included in an FCERM-GiA application. See Section 5.1 for description of GVA calculations and treatment of NRD '999' classified properties. For planning, investment and funding decisions it is recommended that the GVA values excluding the '999' properties are used as a guide.

**Table 8-9: Local economic wider damages for ODU 4**

Local benefit category	Appraisal period	PV Do Nothing Damage (£k)	Commentary
GVA – stay and do nothing scenario, <b>excluding</b> 999 classified properties	10 years	0	Do Nothing damages would be avoided (creating economic benefits) with the Local Aspirational Option (Sustain B) after scheme construction.  National Economic Leading Option (Sustain C) not expected to lead to the same level of damages avoided as the potential erosion of the land adjacent to the quay wall could lead to reduced use of the area impacting the overall visitor economy.
GVA – stay and do nothing scenario, <b>excluding</b> 999 classified properties	100 years*	37	
Visitor economy (assuming 20% reduction in visitor numbers)*	100 years	5,918	
Car park income	100 years	0	
Beach hut income	100 years	0	
Coastal recreation (assuming 20% reduction in recreation users)	100 years	0	
Health and wellbeing	100 years	0	

\*as outlined in Section 5.1, calculating GVA values over a 100 year appraisal period is highly uncertain and a 10 year appraisal period is more accurate.

\*\*the visitor economy values are based on tourism economy values for visits to Christchurch as a whole, obtained from Visit Britain (2019) and is not separated into site specific details. Each of the ODUs along the Strategy frontage has features and characteristics that attract tourists to the area and therefore the Do Nothing value for the visitor economy for the Strategy frontage has been divided equally across each of the 18 ODUs.

## 8.5 ODU 5 – Willow Drive and the Quomps

ODU 5 is located on the north side of the River Stour, from Tuckton Bridge to the eastern end of the Christchurch Quay. There are a large number of short list options for this ODU, including Do Nothing, Do Minimum, Maintain, a variety of Sustain and Improve options and then Adaptation / Resilience.

### 8.5.1 Benefit cost comparison

Table 8-10 below presents the economic costs, damages and benefits of each option and the average benefit cost ratios. All costs and benefits are presented in discounted present value (PV) terms. The options in ODU 5 cannot be ordered based on AEP as different areas are being defended in each of the options and the options include erosion defences. The options have therefore been ordered according to the NPV.

As outlined in FCERM appraisal guidance, if many options have similar NPVs, then each of the options can be taken forward for the next step for further consideration. The Improve D, E and F options all have relatively similar NPVs (in relation to the scale of the option costs / benefits) and therefore each has been taken forward as a provisional National Economic Leading Option. The difference in NPVs between Improve D-F is approximately £1.2million, or approximately 5% of the NPV.

**Table 8-10: ODU 5 economic appraisal**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV (£k)	Leading Economic Option
Improve F (75yr SoP – end of appraisal period)	11,383	3,532	34,424	3.02	23,041	X
Improve E (75yr SoP – end of appraisal period)	13,953	1,532	36,424	2.61	22,471	X
Improve D (75yr SoP – end of appraisal period)	14,553	1,532	36,424	2.50	21,871	X
Improve C (75yr SoP – end of appraisal period)	13,660	3,517	34,439	2.52	20,779	
Sustain F (75yr SoP)	11,059	6,204	31,752	2.87	20,693	
Sustain E (75yr SoP)	13,943	4,507	33,449	2.40	19,506	
Sustain D (75yr SoP)	16,547	4,507	33,449	2.02	16,902	
Sustain C (75yr SoP)	15,398	6,187	31,769	2.06	16,371	
Improve B (75yr SoP – end of appraisal period)	20,908	1,424	36,532	1.75	15,624	
Improve A (75yr SoP – end of appraisal period)	22,507	1,424	36,532	1.62	14,025	
Sustain B (75yr SoP)	21,130	4,475	33,481	1.58	12,351	
Sustain A (75yr SoP)	24,435	4,475	33,481	1.37	9,046	

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV (£k)	Leading Economic Option
Adaptation / Resilience	11,927	21,430	16,526	1.39	4,599	
Do Minimum	340	37,136	820	2.41	480	
Do Nothing	-	37,956	0	-	-	
Maintain	9,079	30,280	7,676	0.85	-1,403	

Two different SoPs have been considered for the Improve Options, the 1.33% AEP (1 in 75 year) SoP and the 0.5% AEP (1 in 200 year) SoP. Table 8-11 to Table 8-13 show a comparison of the IBCR of these two standards for the Improve D-F options.

For the Improve D-F options the IBCR between the standards is consistently greater than the FCERM appraisal guidance IBCR threshold of 3 for moving from a 1.33% AEP (1 in 75 year) SoP to a 0.5% AEP (1 in 200 year) SoP. This indicates that there is a robust economic case to increase the SoP to 0.5% AEP (1 in 200 years) for each of the options. However, given the potential visual impacts a higher defence crest level could have on the landscape in this location, moving to a higher SoP may not be the preferred solution and will need to be investigated during the outline design / business case.

**Table 8-11: ODU 5 IBCR comparison for the Improve D option**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	IBCR	Leading Economic Option
Improve D (75yr SoP – end of appraisal period) (A)	14,553	1,532	36,424	2.50	-	
Improve D (200yr SoP – end of appraisal period)	14,702	650	37,306	2.54	5.92	X

**Table 8-12: ODU 5 IBCR comparison for the Improve E option**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	IBCR	Leading Economic Option
Improve E (75yr SoP – end of appraisal period) (B)	13,953	1,532	36,424	2.61	-	
Improve E (200yr SoP – end of appraisal period)	14,059	650	37,306	2.65	8.32	X

**Table 8-13: ODU 5 IBCR comparison for the Improve F option**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	IBCR	Leading Economic Option
Improve F (75yr SoP – end of appraisal period)	11,383	3,532	34,424	3.02	-	
Improve F (200yr SoP – end of appraisal period)	11,397	2,750	35,206	3.09	55.86	X

## 8.5.2 Testing uncertainty

The main uncertainties with the options in this location relate to option cost and the design water level of the defences to provide the desired SoP against flooding. The design water level could be influenced by changes to sea level rise projections or updated understanding of the flood risk at the site.

A range of sensitivity tests have been undertaken to address these uncertainties. Sensitivity tests for this area include a cost uplift of 10% or 25% and also updated costs to account of for an additional 0.9m of sea level rise over the next century. This equates to the difference between the H++ sea level scenario and the sea level rise value used in the Strategy appraisal. The results are presented in Table 12-6 to Table 12-8 in Appendix A.

The cost increase sensitivity tests of 10% and 25% have been applied to just the Improve D, E and F options to determine how the cost increase would alter the choice of leading options. The sensitivity tests indicate that the Improve D-F options would remain among the options with the highest NPV.

In the sensitivity test focused on design crest level, the crest level increase of 0.9m has been applied to each of Sustain and Improve options to determine whether the cost of any of these options would be more or less sensitive to such design parameter changes and whether this would change the choice of option. As can be seen Improve D-F options remain the provisional National Economic Leading Option with this test and the ABCR of each of these options remains above unity. The majority of cost build-up for these options is in below ground aspects of the defences (e.g. piling) and therefore increases in crest height have a less significant influence on the option cost. Whilst there appears to be a robust economic case with a large increase in crest height, the visual / landscape impact of such a crest level could lead to significant environmental / social impacts and therefore may not be a viable route forward. Further engagement would be required in the future if sea level rise progressed in line with the H++ scenario to determine the approach.

The choice of the Improve D-F options as the provisional National Economic Leading Option has not been changed as a result of the sensitivity tests. Each of these options has a benefit cost ratio much greater than unity (typically around 3:1) and therefore each option would still be economically viable with a substantial cost increase (e.g. of 2-3 times).

## 8.5.3 National Economic Leading Option

The economic appraisal above has identified that the Improve D-F options all have similar economic cases and NPVs and therefore could all reasonably be selected as the provisional National Economic Leading Option.

The SEA has identified that all three of the Improve D-F options generally have positive impacts on the environment and the overall magnitude of impacts is likely to be similar for each option. There are no major negative environmental impacts associated with these options and therefore the SEA does not rule out taking any of the Improve D-F options forward as the National Economic Leading Option. The social appraisal does not clearly identify a preferred solution and there does not appear to be any major negative social impacts for the Improve D-F options.

For this location the decision is primarily around the preferred defence alignment. There may be a stakeholder preference for a frontline or setback defence in both parts of the unit (west / east), but further engagement is required during outline design work to determine the community and local preference on the alignment. Choice of

alignment should consider mitigation such as landscaping that could make some options more feasible to the local community and stakeholders.

Based on the points above, the Strategy has not identified a single National Economic Leading Option for ODU 5. Instead, each of the Improve D-F options have been taken forward. The leading alignment would need to be determined during business case / outline design development when further, more detailed engagement would take place.

## 8.5.4 Local Aspirational / Backup Options

As outlined in the Leading Options Report (AECOM, 2024), the Improve A-C options have been identified as the Local Aspirational Option for ODU 5. These options would provide increased benefits over the course of the Strategy and would also provide more reassurance / confidence in the condition of the quay wall in the east part of the unit during epoch 1. The Improve A-C options have a higher PV cost than Improve D-F due to an earlier capital intervention, with their costs estimated to be between £13.6million to £22.5million.

Adaptation / Resilience has been identified as the Backup Option if funding for the National or Local Aspirational options cannot be found.

## 8.4.5 Local Economic Wider Benefits

Table 8-14 below outlines the potential local economic damages in ODU 5 for the Do Nothing scenario.

It is likely that these damages would be avoided by the National Economic Options (Improve D-F) and Local Aspirational Options (Improve A-C) over the Strategy duration and would therefore create economic benefits. However, it is likely that these damages would not be fully avoided with the Backup Option (Adaptation / Resilience).

The values shown in Table 8-14 are based on the damage calculations presented in Section 5 of this report, broken down to the ODU 5 level. These are not nationally eligible and cannot be included in an FCERM-GiA application. See Section 5.1 for description of GVA calculations and treatment of NRD '999' classified properties. For planning, investment and funding decisions it is recommended that the GVA values excluding the '999' properties are used as a guide.

**Table 8-14: Local economic wider damages for ODU 5**

Local benefit category	Appraisal period	PV Do Nothing Damage (£k)	Commentary
GVA – stay and do nothing scenario, <b>excluding</b> 999 classified properties	10 years	957	Do Nothing damages would be avoided (creating economic benefits) with the Local Aspirational Option (Improve A-C) and National Economic Option (Improve D-F) after scheme construction.  Backup Option (Adaptation / Resilience) not expected to lead to the same level of damages avoided.
GVA – stay and do nothing scenario, <b>excluding</b> 999 classified properties	100 years*	6,200	
Visitor economy (assuming 20% reduction in visitor numbers)*	100 years	5,918	
Car park income	100 years	0	
Beach hut income	100 years	0	
Coastal recreation (assuming 20% reduction in recreation users)	100 years	0	
Health and wellbeing	100 years	0	

\*as outlined in Section 5.1, calculating GVA values over a 100 year appraisal period is highly uncertain and a 10 year appraisal period is more accurate.

*\*\*the visitor economy values are based on tourism economy values for visits to Christchurch as a whole, obtained from Visit Britain (2019) and is not separated into site specific details. Each of the ODUs along the Strategy frontage has features and characteristics that attract tourists to the area and therefore the Do Nothing value for the visitor economy for the Strategy frontage has been divided equally across each of the 18 ODUs.*

## 8.6 ODU 6 – River Avon West Bank

ODU 6 spans the west bank of the River Avon, from Quay Road (just to the east of the Christchurch Quay to Knapp Mill). There are a variety of short list options for ODU 6, including Do Nothing, Do Minimum, Maintain, variations of Sustain and Improve and Adaptation / Resilience.

### 8.6.1 Benefit cost comparison

Table 8-15 presents the economic costs, damages and benefits of each option and the average benefit cost ratios. All costs and benefits are presented in discounted present value (PV) terms. The options in ODU 6 cannot be ordered based on AEP as different areas are being defended in each of the options with different strategic approaches. The options have therefore been ordered according to the NPV. The Sustain B option has the highest NPV and is therefore selected as the provisional National Economic Leading Option.

**Table 8-15: ODU 6 economic appraisal**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV (£k)	Leading Economic Option
Sustain B (75yr SoP)	3,278	3,771	3,666	1.12	388	X
Adaptation / Resilience	2,802	4,560	2,877	1.03	75	
Do Nothing	-	7,437	0	-	-	
Do Minimum	170	7,437	0	-	-170	
Improve B (75yr SoP – end of appraisal period)	4,988	3,654	3,783	0.76	-1,205	
Maintain	1,519	7,437	0	-	-1,519	
Sustain A (75yr SoP)	7,877	2,918	4,519	0.57	-3,358	
Improve A (75yr SoP – end of appraisal period)	10,252	1,663	5,774	0.56	-4,478	

Two different SoPs have been considered for the Sustain B option, the 1.33% AEP (1 in 75 year) SoP and the 0.4% AEP (1 in 200 year) SoP. The IBCR between these two standards has been calculated and is shown in Table 8-16.

The Improve B option has also been included in the IBCR comparison in Table 8-16 because Improve B is the same as the Sustain B approach, but with the exception being that the defences would initially be constructed to the 2123 SoP. rather than raised and lengthened over time. The Improve B (0.5% AEP, 200yr SoP) option would initially provide a much higher SoP at the time of construction, in excess of 0.1% AEP (1 in 1000 years).

As per the FCERM appraisal guidance, in order to move from the Sustain B (1.33% AEP, 75yr SoP) option to the Sustain B (0.5% AEP, 200yr SoP) option the IBCR needs to exceed a value of 3. As can be seen, the IBCR between these standards is 10.2 which is greater than the IBCR threshold and therefore the Sustain B (0.5% AEP, 200yr SoP) is selected as the provisional National Economic Leading Option.

In order to increase the SoP further still and deliver the Improve B (200yr SoP) option, the IBCR value needs to exceed a value of 5 given the much higher initial SoP of the Improve B option. As can be seen, the BCR between Sustain B (0.5% AEP, 200yr SoP) and Improve B (0.5% AEP, 200yr SoP) is below unity so Sustain B (0.5% AEP, 200yr SoP) remains the provisional National Economic Leading Option.

**Table 8-16: ODU 6 IBCR comparison for the Sustain B option**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	IBCR	Leading Economic Option
Sustain B (75yr SoP)	3,278	3,771	3,666	1.12	-	
Sustain B (200yr SoP)	3,303	3,516	3,921	1.19	10.2	X
Improve B (200yr SoP – end of appraisal period)	5,063	3,446	3,991	0.79	0.04	

## 8.6.2 Testing uncertainty

The main uncertainty associated with the Sustain B (0.5% AEP, 200yr) option in ODU 6 is whether the different parts of the option would be deliverable in isolation. This is of particular importance in this unit given the different pathways and funding mechanisms that could be followed to deliver the different parts of this option.

In the south part of the unit, the property level protection could be delivered by individual property owners with support / coordination from BCP Council. The property owners may have access to flood resilience grants to help with funding. However, the flood defences in the north part of the unit would be a capital scheme, most likely with an aspiration to use FCERM-GiA if available and other funding sources.

If the benefits / costs from the property level protection in the south part of the unit were removed from the overall option, the economic viability of the flood defences in the north part of the unit is uncertain, which would impact FCERM-GiA availability. Therefore a sensitivity test has been undertaken to determine the economic case of the flood defences in the north part of the unit in isolation.

Table 8-17 shows that ABCR for the Sustain B (0.5% AEP, 200yr SoP) option in the north part of the unit only. As can be seen the ABCR is less than unity which indicates that if delivered in isolation, there would be no economic justification to proceed with this part of the option. This is largely due to the relatively long length of new defence required relative to the number of properties being defended. With an ABCR of less than unity, the scheme in the north part of the unit would not be deliverable or eligible for FCERM-GiA.

**Table 8-17: ODU 6 sensitivity test on Sustain B**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV
Sustain B (200yr SoP) – full option	3,303	3,516	3,921	1.19	618
Sustain B (200yr SoP) – north part of unit only (no PLP costs or benefits in south part of unit included)	2,352	6,381	1,056	0.45	-1,296

Based on the results of the sensitivity test, the choice of National Economic Leading Option has been amended. The next best option in the economic comparison (Table 8-15) is Adaptation option and this has therefore been selected as the new provisional National Economic Leading Option. This is the option next in the list with an ABCR and NPV greater than unity. No other options have an ABCR greater than unity.

## 8.6.3 National Economic Leading Option

After considering the sensitivity tests in the economic appraisal, the Adaptation / Resilience option has been provisionally identified as the National Economic Leading Option.

The SEA indicates that the Adaptation / Resilience option could have negative impacts in a range of categories in the future such as climate change, population and communities, and transport and movement. This is mainly due to property level protection not defending public open spaces (limited to individual properties) so there would be

impacts to undefended areas during flood events. However, the impacts are expected to be minor and therefore the SEA does not rule out this option from proceeding.

Based on the feedback obtained from engagement round 4, the defence measures in the Adaptation / Resilience option (Maintain and deployable defences as part of property level protection) appeared to have general support from a stakeholder perspective. In addition, the Adaptation / Resilience option would not impact waterside access (which the Sustain A / Improve A option has the potential to do).

Based on the above points the Adaptation / Resilience option is retained as the National Economic Leading Option. Whilst there are likely to be some negative environmental impacts associated with the option, there are no viable alternative options from an economic standpoint.

## 8.6.4 Local Aspirational / Backup Options

As outlined in the Leading Options Report (AECOM, 2024), no Local Aspirational or Backup options were identified for ODU 6.

## 8.6.5 Local Economic Wider Benefits

Table 8-18 below outlines the potential local economic damages in ODU 6 for the Do Nothing scenario.

These damages would be partially avoided with the National Economic Option if local businesses installed property level protection / resilience measures. This would create economic benefits, however, there would still be a residual flood risk with these measures in place so not all of the Do Nothing damages would be avoided.

The values shown in Table 8-14 are based on the damage calculations presented in Section 5 of this report, broken down to the ODU 6 level. These are not nationally eligible and cannot be included in an FCERM-GiA application. See Section 5.1 for description of GVA calculations and treatment of NRD '999' classified properties. For planning, investment and funding decisions it is recommended that the GVA values excluding the '999' properties are used as a guide.

**Table 8-18: Local economic wider damages for ODU 6**

Local benefit category	Appraisal period	PV Do Nothing Damage (£k)	Commentary
GVA – stay and do nothing scenario, <b>excluding</b> 999 classified properties	10 years	62	Do Nothing damages will be partially avoided (benefits) with the National Economic Leading Option (Adaptation / Resilience).
GVA – stay and do nothing scenario, <b>excluding</b> 999 classified properties	100 years*	630	
Visitor economy (assuming 20% reduction in visitor numbers)*	100 years	5,918	
Car park income	100 years	0	
Beach hut income	100 years	0	
Coastal recreation (assuming 20% reduction in recreation users)	100 years	0	
Health and wellbeing	100 years	0	

\*as outlined in Section 5.1, calculating GVA values over a 100 year appraisal period is highly uncertain and a 10 year appraisal period is more accurate.

\*\*the visitor economy values are based on tourism economy values for visits to Christchurch as a whole, obtained from Visit Britain (2019) and is not separated into site specific details. Each of the ODUs along the Strategy frontage has features and characteristics that attract tourists to the area and therefore the Do Nothing value for the visitor economy for the Strategy frontage has been divided equally across each of the 18 ODUs.

## 8.7 ODU 7 – Rossiters Quay

ODU 7 covers the Rossiters Quay island in the River Avon. Bridge Street passes west to east across the Island with properties on either side of the roadway. To the south of the road the Rossiters Quay area is used as a boatyard / waterside access point. There are a several short list options for this ODU, including Do Nothing, Do Minimum, Maintain, a variety of Sustain and Improve options and then Adaptation / Resilience.

### 8.7.1 Benefit cost comparison

Table 8-19 presents the economic costs, damages and benefits of each option and the average benefit cost ratios. All costs and benefits are presented in discounted present value (PV) terms. For ODU 7 it is possible to order the options by reducing probability of flooding because each option has the same benefit area and the options are focussed on how to reduce flood risk. The options have therefore been ordered in this manner. As per the FCERM appraisal guidance, when ordering by reducing probability of flooding, the provisional National Economic Leading Option is selected as the option with the highest ABCR, in this case Improve A (0.5% AEP, 200yr SoP).

As can be seen, the costs for the Sustain A and Improve A options are very similar. For costing purposes, costs for a sheet pile with a capping wall / parapet have been used for the frontline parts of the option alignment at the water's edge. The majority of the cost for this type of structure is below ground and therefore relatively small increases in the height of the structure above ground lead to small changes in the cost build-up.

**Table 8-19: ODU 7 economic appraisal**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV (£k)	Leading Economic Option
Do Nothing	-	5,388	0	-	-	
Do Minimum	340	5,075	313	0.92	-27	
Maintain	1,975	3,716	1,672	0.85	-303	
Adaptation / Resilience	2,630	2,135	3,253	1.24	632	
Sustain A (75yr SoP)	4,031	645	4,743	1.18	712	
Sustain A (200yr SoP)	4,090	210	5,178	1.27	1,088	
Improve A (75yr SoP – end of appraisal period)	4,060	144	5,244	1.29	1,184	
Improve A (200yr SoP – end of appraisal period)	4,118	59	5,329	1.29	1,211	X

Improve A provides the highest SoP of the options considered and whilst it is identified as the provisional National Economic Leading Option, for completeness a comparison of the IBCR between the lower SoP options has been undertaken in Table 8-20.

The Sustain A (0.5% AEP, 200yr SoP) option would provide an initial 200 year SoP when constructed in epoch 2 and this would be sustained through time through via a series of defence raises. However the Improve A option (0.5% AEP, 200yr SoP) would be constructed to a 0.5% AEP (1 in 200 year) SoP for the end of the appraisal period, which would mean that initially at the time of construction the SoP would far exceed the 0.5% AEP (1 in 200 year) SoP and would be in excess of a 0.1% AEP (1 in 1000 year).

The table shows how the IBCR between the Sustain A (1.33% AEP, 75yr SoP) and the Sustain A (0.5% AEP, 200yr SoP) is 7.37, which is greater than the FCERM-AG IBCR threshold of 3 required to select the 0.5% AEP (200yr) SoP as the leading standard.

The SoP for the Improve A (0.5% AEP, 200yr SoP) would be in excess of 0.1% AEP (1 in 1000 year) when initially constructed, and therefore as per FCERM-AG, an IBCR of >5 is required to move from the Sustain A (0.5% AEP,

0.5% AEP, 200yr SoP) to the Improve A (0.5% AEP, 200yr SoP) option. As shown, the IBCR between Sustain A (0.5% AEP, 200yr) and Improve A is 5.39, which results in Improve A (0.5% AEP, 200yr SoP) being retained as the provisional National Economic Leading Option.

**Table 8-20: ODU 7 IBCR comparison**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	IBCR	Leading Economic Option
Sustain A (75yr SoP)	4,031	645	4,743	1.18	-	
Sustain A (200yr SoP)	4,090	210	5,178	1.27	7.37	
Improve A (200yr SoP – end of appraisal period)	4,118	59	5,329	1.29	5.39	X

## 8.7.2 Testing uncertainty

The main uncertainties with the options in this location relate to option cost and the design water level of the defences to provide the desired SoP against flooding. The cost is uncertain in this location as there are space constraints in this unit which could lead to construction challenges and there is potential for cost increases when site specific details are considered during outline design / business case development. The design water level of the option could be influenced by changes to sea level rise projections or updated understanding of the flood risk at the site.

A range of sensitivity tests have been undertaken to address these uncertainties. Sensitivity tests for this area include a cost uplift of 10% or 25% and also updated costs to account of for an additional 0.9m of sea level rise over the next century. This equates to the difference between the H++ sea level scenario and the sea level rise value used in the Strategy appraisal. The results are presented in Table 12-10 to Table 12-12 in Appendix A.

The cost increase sensitivity tests of 10% and 25% have been applied to just the Improve A (0.5% AEP, 200yr SoP) option to determine how the cost increase would alter the choice of leading options. The sensitivity tests indicate that the Improve A (0.5% AEP, 200yr SoP) option would retain an ABCR greater than unity with these level of cost increases but the choice of provisional National Economic Leading Option would change to the Improve A (1.33% AEP, 75yr SoP). However, given that each of the Sustain and Improve options follows a very similar approach, any scenario leading to a cost increase for the Improve (0.5% AEP, 200yr SoP) option would likely also lead to a similar scale of cost increase to the Improve A (1.33% AEP, 75yr SoP) and Sustain A options. Therefore the cost increase sensitivity test does not indicate that a change of option choice is required.

In the sensitivity test focused on design crest level, the crest level increase of 0.9m has been applied to each of Sustain and Improve options to determine whether the cost of any of these options would be more or less sensitive to such design parameter changes and whether this would change the choice of option. As can be seen Improve A (0.5% AEP, 200yr SoP) remains the provisional National Economic Leading Option with this test. The majority of cost build-up for the options in this unit is in below ground aspects of the defences (e.g. piling) and therefore increases in crest height have an underweighted influence on the option cost. Whilst there appears to be a robust economic case with a large increase in crest height, the visual / landscape impact of such a crest level could lead to significant environmental / social impacts and therefore may not be a viable route forward. Further engagement would be required in the future if sea level rise progressed in line with the H++ scenario to determine the approach.

The sensitivity tests that have been undertaken do not lead to a change in choice of the provisional National Economic Leading Option in this unit.

## 8.7.3 National Economic Leading Option

The economic appraisal in Table 8-19 identified the Improve A option with a 0.5% AEP (1 in 200 year) SoP as the provisional National Economic Leading Option.

The SEA and the social appraisal have not identified any major negative impacts with this option and therefore it is retained as the National Economic Leading Option. However, there would need to be some design considerations

for the upgraded defences in epoch 2 to ensure this option is viable, such as ensuring continued access to the boatyard area and aiming to avoid / minimise encroachment into the river channel.

Furthermore, the potential visual impact of raising defences to the 2123 0.5% AEP (1 in 200 year) SoP could be identified as an issue for the local community and stakeholders during engagement. If this is the case different approaches could be followed to reduce the impact, such as incorporating glass top structures into the design, or shifting the approach to the Sustain A (0.5% AEP, 200yr SoP) option instead. The Sustain A option is economically viable and the defence height would be raised in increments over time, reducing the potential visual impact over the short and medium. Whilst this is not the National Economic Leading Option, it is similar in nature and could be implemented if there is local preference.

## 8.7.4 Local Aspirational / Backup Options

As outlined in the Leading Options Report (AECOM, 2024), no Local Aspirational options was identified for ODU 7. However, the Adaptation / Resilience Option was identified as a Backup option in case funding for the National Economic Option could not be secured. The Adaptation / Resilience option PV cost is estimated to be just over £2.6million which is lower cost than the Improve A option.

## 8.7.5 Local Economic Wider Benefits

Table 8-21 below outlines the potential local economic damages in ODU 7 for the Do Nothing scenario.

It is likely that these damages would be avoided by the National Economic Option (Improve A) over the Strategy duration and would therefore create economic benefits. However, it is likely that these damages would not be fully avoided with the Backup Option (Adaptation / Resilience).

The values shown in Table 8-21 are based on the damage calculations presented in Section 5 of this report, broken down to the ODU 7 level. These are not nationally eligible and cannot be included in an FCERM-GiA application. See Section 5.1 for description of GVA calculations and treatment of NRD '999' classified properties. For planning, investment and funding decisions it is recommended that the GVA values excluding the '999' properties are used as a guide.

**Table 8-21: Local economic wider damages for ODU 7**

Local benefit category	Appraisal period	PV Do Nothing Damage (£k)	Commentary
GVA – stay and do nothing scenario, <b>excluding</b> 999 classified properties	10 years	247	Do Nothing damages would be avoided (creating economic benefits) with the National Economic Option (Improve A) after scheme construction.  Backup Option (Adaptation / Resilience) not expected to lead to the same level of damages avoided.
GVA – stay and do nothing scenario, <b>excluding</b> 999 classified properties	100 years*	2,056	
Visitor economy (assuming 20% reduction in visitor numbers)*	100 years	5,918	
Car park income	100 years	0	
Beach hut income	100 years	0	
Coastal recreation (assuming 20% reduction in recreation users)	100 years	0	
Health and wellbeing	100 years	0	

\*as outlined in Section 5.1, calculating GVA values over a 100 year appraisal period is highly uncertain and a 10 year appraisal period is more accurate.

\*\*the visitor economy values are based on tourism economy values for visits to Christchurch as a whole, obtained from Visit Britain (2019) and is not separated into site specific details. Each of the ODUs along the Strategy frontage has features and characteristics that attract tourists to the area and therefore the Do Nothing value for the visitor economy for the Strategy frontage has been divided equally across each of the 18 ODUs.

## 8.8 ODU 8 – River Avon East Bank

ODU 8 spans 1.1km along the east bank of the River Avon, from Knapp Mill to Christchurch Bypass. This area is within the original Strategy boundaries, but through discussions with the Environment Agency's Partnership and Strategic Overview Team (who are developing the Lower Avon and Harbour Modelling) it was agreed that the options for managing the flood risk in ODU 8 would be developed through any future Environment Agency Lower River Avon project, rather than the Christchurch Bay and Harbour Strategy.

The total PV damages for this area are £1,419k over the appraisal period.

## 8.9 ODU 9 – Stanpit

ODU 9 covers the east bank of the River Avon and the north side of Christchurch Harbour, from Christchurch Bypass to Stanpit Marsh car park. There are a several short list options for this ODU, including Do Nothing, Do Minimum, Maintain, a variety of Sustain and Improve options and then Adaptation / Resilience.

### 8.9.1 Benefit cost comparison

Table 8-22 presents the economic costs, damages and benefits of each option and the average benefit cost ratios. All costs and benefits are presented in discounted present value (PV) terms. For ODU 9 it is possible to order the options by reducing probability of flooding because each option has the same benefit area. The options have therefore been ordered in this manner. As per the FCERM appraisal guidance, when ordering by reducing probability of flooding, the initial National Economic Leading Option is selected as the option with the highest ABCR, in this case Sustain A (0.5% AEP, 200yr SoP).

**Table 8-22: ODU 9 economic appraisal**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV (£k)	Leading Economic Option
Do Nothing	-	39,803	0	-	-	
Do Minimum	510	38,510	1,293	2.54	783	
Maintain	7,087	33,103	6,700	0.95	-387	
Adaptation / Resilience	8,271	27,249	12,554	1.52	4,283	
Sustain A (75yr SoP)	10,859	5,519	34,284	3.16	23,425	
Sustain A (200yr SoP)	10,960	1,994	37,809	3.45	26,849	X
Improve A (75yr SoP – end of appraisal period)	11,760	2,171	37,632	3.20	25,872	
Improve A (200yr SoP – end of appraisal period)	12,082	796	39,007	3.23	26,925	

For the options presented in Table 8-22, the Sustain A (0.5% AEP, 200yr SoP) option would provide an initial 200 year SoP when constructed in epoch 2 and this would be sustained through time through via a series of defence raises. However the equivalent Improve A option (0.5% AEP, 200yr SoP) would be constructed to a 0.5% AEP (1 in 200 year) SoP for the end of the appraisal period, which would mean that initially at the time of construction the SoP would far exceed the 0.5% AEP (1 in 200 year) SoP and would be in excess of a 0.1% AEP (1 in 1000 year).

A comparison of the IBCR between Sustain A (1.33% AEP, 75yr SoP and 0.5% AEP, 200yr SoP) and Improve A (0.5% AEP, 200yr SoP) is provided below in Table 8-23.

The table shows how the IBCR between the Sustain A (1.33% AEP, 75yr SoP) and the Sustain A (0.5% AEP, 200yr SoP) is 34.9, which is greater than the FCERM-AG IBCR threshold of 3 required to select the 200yr SoP as the leading standard.

The SoP for the Improve A (200yr SoP) would be in excess of 0.1% AEP (1 in 1000 year) when initially constructed, and therefore as per FCERM-AG, an IBCR of >5 is required to move from the Sustain A (0.5% AEP, 200yr SoP) to the Improve A (0.5% AEP, 200yr SoP) option. As shown, the IBCR between Sustain A (0.5% AEP, 200yr) and Improve A is 1.07, which results in Sustain A being retained as the provisional National Economic Leading Option.

**Table 8-23: ODU 9 IBCR comparison**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	IBCR	Leading Economic Option
Sustain A (75yr SoP)	10,859	5,519	34,284	3.16		
Sustain A (200yr SoP)	10,960	1,994	37,809	3.45	34.90	X
Improve A (200yr SoP – end of appraisal period)	12,082	796	39,007	3.23	1.07	

## 8.9.2 Testing uncertainty

The main uncertainties with the options in this location relate to option cost and the design water level of the defences to provide the desired SoP against flooding. The design water level of the option could be influenced by changes to sea level rise projections or an updated understanding of the flood risk at the site.

A range of sensitivity tests have been undertaken to address these uncertainties. Sensitivity tests for this area include a cost uplift of 10% or 25% and also updated costs to account of for an additional 0.9m of sea level rise over the next century. This equates to the difference between the H++ sea level scenario and the sea level rise value used in the Strategy appraisal. The results are presented in Table 12-13 to Table 12-15 in Appendix A.

The cost increase sensitivity tests of 10% and 25% have been applied to just the Sustain A (0.5% AEP, 200yr SoP) option to determine how the cost increase would alter the choice of leading options. The sensitivity tests indicate that the Sustain A (0.5% AEP, 200yr SoP) option would retain an ABCR greater than unity with these level of cost increases, but the choice of provisional National Economic Leading Option would change to the Improve A (0.5% AEP, 200yr SoP). However, given that each of the Sustain and Improve options follows a very similar approach, any scenario leading to a cost increase for the Sustain A (0.5% AEP, 200yr SoP) option would likely also lead to a similar scale of cost increase to the Improve A (0.5% AEP, 200yr SoP). Therefore this sensitivity test does not indicate that a change of option choice is required.

In the sensitivity test focused on design crest level, the crest level increase of 0.9m has been applied to each of Sustain and Improve options to determine whether the cost of any of these options would be more or less sensitive to such design parameter changes and whether this would change the choice of option. As can be seen, similar to the cost increase sensitivity tests discussed above, the Improve A (0.5% AEP, 200yr SoP) would be selected as the provisional National Economic Leading Option with this test. The test also indicates how the ABCR for the Sustain A (0.5% AEP, 200yr Sop) option would remain above unity and this would remain a viable economic approach.

Whilst there appears to be a robust economic case with a large increase in crest height, the visual / landscape impact of such a crest level could lead to significant environmental / social impacts and therefore may not be a viable route forward. Further engagement would be required in the future if sea level rise progressed in line with the H++ scenario to determine the approach.

Considering the points above, there does not appear to be an overriding reason to change the choice of the provisional National Economic Leading Option in ODU 9 from the sensitivity tests undertaken. The sensitivity tests build a stronger case for selecting the Improve A (0.5% AEP, 200yr SoP) as the leading option but given that this is more precautionary than the Sustain A (0.5% AEP, 200yr SoP) and would lead to more significant landscape impacts initially, on balance the choice of provisional National Economic Leading Option is unchanged and is retained as Sustain A (1.33% AEP, 75yr SoP).

## 8.9.3 National Economic Leading Option

The economic appraisal in Table 8-22 identified the Sustain A option as the provisional National Economic Leading Option with a 0.5% AEP (1 in 200 year) SoP.

The SEA has not identified any major negative impacts with this option and it has the potential to create many environmental benefits relative to the baseline by reducing the flood and erosion risk. The Sustain A option would

involve defence measures that had overall support from the public and stakeholders during the previous round of engagement. In addition, it would defend the public open space which may be seen as a positive for the recreational benefits.

Based on the points above, the Sustain A option is confirmed as the National Economic Leading Option.

## 8.9.4 Local Aspirational / Backup Options

As outlined in the Leading Options Report (AECOM, 2024), no Local Aspirational options was identified for ODU 9. However, the Adaptation / Resilience Option was identified as a Backup option in case funding for the National Economic Option could not be secured. The Adaptation / Resilience option PV cost is estimated to be just over £8.3million which is lower cost than the Sustain A option.

## 8.9.5 Local Economic Wider Benefits

Table 8-24 below outlines the potential local economic damages in ODU 9 for the Do Nothing scenario.

It is likely that these damages would be avoided by the National Economic Option (Sustain A) over the Strategy duration and would therefore create economic benefits. However, it is likely that these damages would not be fully avoided with the Backup Option (Adaptation / Resilience).

The values shown in Table 8-24 are based on the damage calculations presented in Section 5 of this report, broken down to the ODU 9 level. These are not nationally eligible and cannot be included in an FCERM-GiA application. See Section 5.1 for description of GVA calculations and treatment of NRD '999' classified properties. For planning, investment and funding decisions it is recommended that the GVA values excluding the '999' properties are used as a guide.

**Table 8-24: Local economic wider damages for ODU 9**

Local benefit category	Appraisal period	PV Do Nothing Damage (£k)	Commentary
GVA – stay and do nothing scenario, <b>excluding</b> 999 classified properties	10 years	948	Do Nothing damages would be avoided (creating economic benefits) with the National Economic Option (Sustain A) after scheme construction.  Backup Option (Adaptation / Resilience) not expected to lead to the same level of damages avoided.
GVA – stay and do nothing scenario, <b>excluding</b> 999 classified properties	100 years*	9,500	
Visitor economy (assuming 20% reduction in visitor numbers)*	100 years	5,918	
Car park income	100 years	0	
Beach hut income	100 years	0	
Coastal recreation (assuming 20% reduction in recreation users)	100 years	48	
Health and wellbeing	100 years	0	

\*as outlined in Section 5.1, calculating GVA values over a 100 year appraisal period is highly uncertain and a 10 year appraisal period is more accurate.

\*\*the visitor economy values are based on tourism economy values for visits to Christchurch as a whole, obtained from Visit Britain (2019) and is not separated into site specific details. Each of the ODUs along the Strategy frontage has features and characteristics that attract tourists to the area and therefore the Do Nothing value for the visitor economy for the Strategy frontage has been divided equally across each of the 18 ODUs.

## 8.10 ODU 10 – Mundeford

ODU 10 spans the north side of Christchurch Harbour between Two Riversmeet and Stanpit Recreation Ground and Chichester Way. There are a several short list options for this ODU, including Do Nothing, Do Minimum, Maintain, a variety of Improve options and then Adaptation / Resilience.

### 8.10.1 Benefit cost comparison

Table 8-25 presents the economic costs, damages and benefits of each option and the average benefit cost ratios. All costs and benefits are presented in discounted present value (PV) terms. For ODU 10 it is possible to order the options by reducing probability of flooding because each option has the same benefit area. The options have therefore been ordered in this manner. As per FCERM-AG, when ordering by reducing probability of flooding, the initial leading economic option is selected as the option with the highest ABCR, in this case Improve A (0.5% AEP, 200yr SoP).

**Table 8-25: ODU 10 economic appraisal**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV (£k)	Leading Economic Option
Do Nothing	-	12,747	0	-	-	
Do Minimum	340	12,747	0	-	-340	
Maintain	3,526	12,747	0	-	-3,526	
Adaptation / Resilience	5,473	9,970	2,777	0.51	-2,696	
Improve A (75yr SoP from epoch 3)	8,319	2,254	10,493	1.26	2,174	
Improve B (75yr SoP from epoch 3)	9,003	2,254	10,493	1.17	1,490	
Improve A (200yr SoP from epoch 3)	8,373	1,623	11,124	1.33	2,751	X
Improve B (200yr SoP from epoch 3)	9,071	1,623	11,124	1.23	2,053	

A comparison of the IBCR between Improve A (1.33% AEP, 75yr SoP) and Improve A (0.5% AEP, 200yr SoP) is provided below in Table 8-26.

The table shows how the IBCR between the Sustain A (1.33% AEP, 75yr SoP) and the Sustain A (0.5% AEP, 200yr SoP) is 11.69, which is greater than the FCERM-AG IBCR threshold of 3 required to select the 0.5% AEP (200yr) SoP as the leading standard. This ratifies the choice of the Improve A (0.5% AEP, 200yr SoP) as the leading economic option. An option with an even higher SoP has not been considered but it is recommended that this undertaken during outline design / business case development.

**Table 8-26: ODU 10 IBCR comparison**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	IBCR	Leading Economic Option
Improve A (75yr SoP)	8,319	2,254	10,493	1.26	-	
Improve A (200yr SoP)	8,373	1,623	11,124	1.33	11.69	X

## 8.10.2 Testing uncertainty

The main uncertainties with the options in this location relate to option cost and the design water level of the defences to provide the desired SoP against flooding. The design water level of the option could be influenced by changes to sea level rise projections or an updated understanding of the flood risk at the site.

A range of sensitivity tests have been undertaken to address these uncertainties. Sensitivity tests for this area include a cost uplift of 10% or 25% and also updated costs to account of for an additional 0.9m of sea level rise over the next century. This equates to the difference between the H++ sea level scenario and the sea level rise value used in the Strategy appraisal. The results are presented in Table 12-16 to Table 12-18 in Appendix A.

The cost increase sensitivity tests of 10% and 25% have been applied to just the Improve A (0.5% AEP, 200yr SoP) option to determine how the cost increase would alter the choice of leading options. The sensitivity tests indicate that the choice of option would shift to Improve A (1.33% AEP, 75yr SoP). However, given that this option is the same option but with just a lower SoP, any scenario leading to a cost increase for the Improve A (0.5% AEP, 200yr SoP) option would likely also lead to a similar scale of cost increase to the Improve A (1.33% AEP, 75yr SoP). Therefore this sensitivity test does not indicate that a change of option choice is required.

In the sensitivity test focused on design crest level, the crest level increase of 0.9m has been applied to each of the Improve options to determine whether the cost of any of these options would be more or less sensitive to such design parameter changes and whether this would change the choice of option. As can be seen Improve A (0.5% AEP, 200yr SoP) would remain the provisional National Economic Leading Option with this test. The majority of cost build-up for the options in this unit is in below ground aspects of the defences (e.g. piling) and therefore increases in crest height have an underweighted influence on the option cost. Whilst there appears to be a robust economic case with a large increase in crest height, the visual / landscape impact of such a crest level could lead to significant environmental / social impacts and therefore may not be a viable route forward. Further engagement would be required in the future if sea level rise progressed in line with the H++ scenario to determine the approach.

From the sensitivity tests it is apparent that with a cost increase of 25% or greater the economic case of all the Improve options would be marginal with ABCRs being just above unity with this scale of cost increase. If costs were to increase further, for example, by 50%, each of the options would have an ABCR less than 1 and would not be economically viable. The choice of provisional National Economic Leading Option has not changed as a result of the sensitivity tests, but lower cost solutions could be required in the future if costs increase.

## 8.10.3 National Economic Leading Option

The economic appraisal has identified the Improve A option as the provisional National Economic Leading Option with a 0.5% AEP (1 in 200 year) SoP.

The SEA has not identified any major negative impacts with this option and it has potential to lead to many environmental benefits relative to the baseline by reducing the flood and erosion risk. The Improve A option would involve defence measures that had overall support from the public and stakeholders during the previous round of engagement. However, design of the scheme would need to consider access and landscaping to minimise social impacts on the local community.

Based on the points above, Improve A is confirmed as the National Economic Leading Option.

## 8.10.4 Local Aspirational / Backup Options

As outlined in the Leading Options Report (AECOM, 2024), no Local Aspirational options was identified for ODU 9. However, the Adaptation / Resilience Option was identified as a Backup option in case funding for the National Economic Option could not be secured. The Adaptation / Resilience option PV cost is estimated to be approximately £5.5million which is lower cost than the Improve A option.

## 8.10.5 Local Economic Wider Benefits

Table 8-27 below outlines the potential local economic damages in ODU 10 for the Do Nothing scenario.

It is likely that these damages would be avoided by the National Economic Option (Improve A) over the Strategy duration and would therefore create economic benefits. However, it is likely that these damages would not be fully avoided with the Backup Option (Adaptation / Resilience).

The values shown in Table 8-24 are based on the damage calculations presented in Section 5 of this report, broken down to the ODU 10 level. These are not nationally eligible and cannot be included in an FCERM-GiA application. See Section 5.1 for description of GVA calculations and treatment of NRD '999' classified properties. For planning, investment and funding decisions it is recommended that the GVA values excluding the '999' properties are used as a guide.

**Table 8-27: Local economic wider damages for ODU 10**

Local benefit category	Appraisal period	PV Do Nothing Damage (£k)	Commentary
GVA – stay and do nothing scenario, <b>excluding</b> 999 classified properties	10 years	110	Do Nothing damages would be avoided (creating economic benefits) with the National Economic Option (Improve A) after scheme construction.  Backup Option (Adaptation / Resilience) not expected to lead to the same level of damages avoided.
GVA – stay and do nothing scenario, <b>excluding</b> 999 classified properties	100 years*	1,374	
Visitor economy (assuming 20% reduction in visitor numbers)*	100 years	5,918	
Car park income	100 years	0	
Beach hut income	100 years	0	
Coastal recreation (assuming 20% reduction in recreation users)	100 years	0	
Health and wellbeing	100 years	0	

\*as outlined in Section 5.1, calculating GVA values over a 100 year appraisal period is highly uncertain and a 10 year appraisal period is more accurate.

\*\*the visitor economy values are based on tourism economy values for visits to Christchurch as a whole, obtained from Visit Britain (2019) and is not separated into site specific details. Each of the ODUs along the Strategy frontage has features and characteristics that attract tourists to the area and therefore the Do Nothing value for the visitor economy for the Strategy frontage has been divided equally across each of the 18 ODUs.

## 8.11 ODU 11 – Mundeford Quay

ODU 11 spans the frontage around Mundeford Quay between Chichester Way in the harbour and Mundeford Quay car park entrance on the open coast. There are a several short list options for this ODU, including Do Nothing, Do Minimum, Maintain, a variety of Sustain and Improve options and then Adaptation / Resilience.

### 8.11.1 Benefit cost comparison

Table 8-28 below presents the economic costs, damages and benefits for each option. As can be seen, the option costs outweigh the option benefits for each of the Do Something options. This is due to the lack of economic damages / benefits that can be counted for Mundeford Quay on a national basis. Other local economic benefits are likely to be associated with the Do Something options but are not eligible to be counted in this comparison. Each of the Do Something options has a negative NPV and therefore the Do Nothing option has been selected as the provisional National Economic Leading Option.

**Table 8-28: ODU 11 economic appraisal**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV (£k)	Leading Economic Option
Do Nothing	-	1,362	-	-	-	X
Do Minimum	340	1,362	0	0	-340	
Adaptation / Resilience	9,530	682	680	0.07	-8,850	
Maintain	9,350	1,352	10	0.00	-9,340	
Improve A (75yr SoP – end of appraisal period)	10,765	36	1,326	0.12	-9,439	
Sustain A (75yr SoP)	10,688	174	1,188	0.11	-9,500	
Sustain B (75yr SoP)	11,615	174	1,188	0.10	-10,427	
Improve B (75yr SoP – end of appraisal period)	11,801	36	1,326	0.11	-10,475	

### 8.11.2 Testing uncertainty

The main uncertainty with the options in this location relate to option cost. However, given that the leading economic option is the Do Nothing option (which does not have a cost), there is little merit in sensitivity testing the option costs of the other options as it would not impact the choice of the provisional National Economic Leading Option (as no option will cost less than Do Nothing).

### 8.11.3 National Economic Leading Option

The economic appraisal provisionally identified the Do Nothing option as being the National Economic Leading Option.

The Do Nothing option is likely to have a range of negative impacts, including to the environment, flood risk, navigation and buried services. The morphological changes to the harbour that could arise with this option is very uncertain. Due to the risks to properties and infrastructure (e.g. utilities connections and car parks), doing nothing is not an acceptable solution in this location and would not be in line with the SMP policy for the area.

There are existing defences and quay walls on and around the quay that currently provide an FCERM function and therefore it is not considered acceptable to recommend walking away and identifying the Do Nothing option as the National Economic Leading Option in this location. Instead the next lowest cost option is the Do Minimum option and this has therefore been identified as the National Economic Leading Option in ODU 11.

The Do Minimum option would aim to use small scale maintenance (e.g. patch-repair) to extend the service life of the existing defences for as long as possible. However, in the medium and long term, this will not be sustainable and as the existing defences fail the risks associated with the Do Nothing scenario would be expected to occur with Do Minimum. Despite this the Do Minimum option appears to be a better solution than the Do Nothing option as it involves only a relatively small investment and may have better support by the local community and stakeholders in the short term. It is not appropriate to select a higher cost option (i.e. Maintain, Adaptation, Sustain, Improve) as the National Economic Leading Option due to the significant additional investments required for these options which are not justified on economic grounds.

A Local Aspirational Option has also been identified for this ODU, as outlined in the Leading Options Report (AECOM, 2023).

### 8.11.4 Local Aspirational / Backup Options

As outlined in the Leading Options Report (AECOM, 2024), the Adaptation / Resilience option has been identified as the Local Aspirational Option for ODU 11. This option would provide property level protection / resilience measures as well as maintaining the existing quay walls through refurbishments. The Adaptation / Resilience has a total PV cost estimated to be around £9.5million, with the vast majority of this cost associated with quay wall maintenance over the next 100 years.

### 8.2.5 Local Economic Wider Benefits

Table 8-29 below outlines the potential local economic damages in ODU 11 for the Do Nothing scenario.

It is likely that these damages would be partially avoided by the Local Aspirational Option (Adaptation / Resilience) over the Strategy duration through the maintenance of existing defences to prevent erosion and the implementation of property level resilience and protection measures to reduce flood risk. This would create an economic benefit, however, there would still be a residual risk of flooding that remains so the damages would not be completely avoided.

Local economic benefits are unlikely to be realised with the National Economic Leading Option (Do Minimum) as significant flooding and erosion would still be expected to occur.

The values shown in Table 8-29 are based on the damage calculations presented in Section 5 of this report, broken down to the ODU 11 level. These are not nationally eligible and cannot be included in an FCERM-GiA application. See Section 5.1 for description of GVA calculations and treatment of NRD '999' classified properties. For planning, investment and funding decisions it is recommended that the GVA values excluding the '999' properties are used as a guide.

**Table 8-29: Local economic wider damages for ODU 11**

Local benefit category	Appraisal period	PV Do Nothing Damage (£k)	Commentary
GVA – stay and do nothing scenario, <b>excluding</b> 999 classified properties	10 years	810	Do Nothing damages will be partially avoided (creating economic benefits) with the Local Aspirational Option (Adaptation / Resilience).  National Economic Leading Option (Do Minimum) not expected to lead to significant damages avoided.
GVA – stay and do nothing scenario, <b>excluding</b> 999 classified properties	100 years*	1,460	
Visitor economy (assuming 20% reduction in visitor numbers)	100 years	5,918	
Car park income	100 years	5,347	
Beach hut income	100 years	0	
Coastal recreation (assuming 20% reduction in recreation users)	100 years	1,056	
Health and wellbeing	100 years	778	

\*as outlined in Section 5.1, calculating GVA values over a 100 year appraisal period is highly uncertain and a 10 year appraisal period is more accurate.

\*\*the visitor economy values are based on tourism economy values for visits to Christchurch as a whole, obtained from Visit Britain (2019) and is not separated into site specific details. Each of the ODUs along the Strategy frontage has features and characteristics that attract tourists to the area and therefore the Do Nothing value for the visitor economy for the Strategy frontage has been divided equally across each of the 18 ODUs.

## 8.12 ODU 12 – Avon Beach and Friars Cliff

ODU 12 spans the open coast frontage between Mudeford Quay and Steamer Point. The primary risk in ODU 12 is from erosion, and there are a several short list options for this ODU, including Do Nothing, Do Minimum, Maintain and a variety of Improve options.

### 8.12.1 Benefit cost comparison

Table 8-30 below presents the economic costs, damages and benefits of each option and the average benefit cost ratios. All costs and benefits are presented in discounted present value (PV) terms. The options on ODU 12 cannot be ordered based on AEP because they are primarily focussed on managing the erosion risk and have therefore been ordered according to the NPV. The Improve A option has the highest NPV and is therefore selected as the provisional National Economic Leading option.

All the other options considered in this unit have ABCRs below unity and negative NPVs. This reflects the low benefits available in this unit relative to the costs of maintaining the existing defences or constructing new linear defences in this location.

The Improve C option which involves broader public realm improvements and promenade raising has an ACBR marginally below unity (0.78). However costs with this option are uncertain as there is wide scope for what public realm improvements may be and therefore how much they may cost.

**Table 8-30: ODU 12 economic appraisal**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV (£k)	Leading Economic Option
Improve A	8,443	11	8,978	1.06	535	X
Do Nothing	-	8,989	-	-	-	
Do Minimum	510	8,827	162	0.32	-348	
Improve B	11,398	11	8,978	0.79	-2,420	
Improve C	14,030	11	8,978	0.64	-5,052	
Maintain	9,412	5,535	3,454	0.37	-5,958	

### 8.12.2 Testing uncertainty

The main uncertainties with the options in this location relate to the option cost and changes to the estimated costs could influence the choice and viability of different options. Given the large role of beach nourishment in the Improve A and Improve C options, the specific cost of this intervention is likely to have a significant influence on the viability of these options as a whole and the selection process.

A range of sensitivity tests have been undertaken to address these uncertainties. Sensitivity tests for this area include generic cost uplift of 10% or 25% and also amended costs for the beach nourishment element of the options. The results of the sensitivity tests are shown in Table 12-19 to Table 12-21 in Appendix A.

The cost increase sensitivity tests of 10% and 25% have been applied to just the Improve A option to determine how the cost increase would alter the choice of leading options. The sensitivity tests indicate that with a 10% or 25% cost increase the ABCR of the Improve A option falls below unit and therefore it may not be a viable economic option in this scenario. With a 10% or 25% cost increase there are no alternative viable options and therefore it is not recommended to change the choice of National Economic Leading option from Improve A based on this test result.

The original beach nourishment cost applied in the cost estimates was £33.3 per m<sup>3</sup> of material which is considered to be a reasonable, mid-level estimate of nourishment costs at the Strategy level. However there could be potential to reduce this cost if local sources of material were to be used or with optimisations to the dredging / placement

approach (e.g. combining operations with beach nourishment works in adjacent parts of Poole Bay). In addition, smaller quantities of material or material with different characteristics (e.g. coarser material) could also be used to achieve a similar FCERM function.

The sensitivity test on beach nourishment costs undertaken assumes a 50% cost reduction in the beach nourishment interventions. This has been applied to all options that include beach nourishment. As can be seen in Appendix A, the choice of the provisional National Economic Leading Option in this scenario would remain unchanged, however, the economic case of the C option is improved with the ABCR still below but approaching unity. Further cost reductions in beach nourishment may make it more viable to pursue this option as a Local Aspirational Option.

### 8.12.3 National Economic Leading Option

The economic appraisal in Table 8-30 provisionally identified the Improve A option as being the National Economic Leading Option. The SEA and social appraisal have not identified any major negative impacts associated with this option and therefore it is confirmed as the National Economic Leading Option.

The Improve A option would provide defence against erosion whilst also ensuring the recreational and amenity value of the beach is sustained, as per the SMP policy for the area. It would also provide a strategic benefit to adjacent areas, such as ODU 13 which are downdrift of ODU 12 and would be fed by the beach nourishment material over time.

### 8.12.4 Local Aspirational / Backup Options

As outlined in the Leading Options Report (AECOM, 2024), the Improve C option has been identified as the Local Aspirational Option for ODU 12. This option would provide broad public realm improvements and enhancements, such as promenade raising but at a higher cost (provisionally estimated to be over £14million but subject to change depending on public realm enhancements undertaken).

As a backup option, a lower cost Improve A option with smaller scale beach nourishment has been identified.

### 8.12.5 Local Economic Wider Benefits

Table 8-31 below outlines the potential local economic damages in ODU 12 for the Do Nothing scenario.

It is likely that these damages would be fully avoided by the National Economic, Local Aspirational and Backup options, creating an economic benefit. It is noticeable that when these local benefits are considered, the benefit cost of the Local Aspirational option would far exceed unity (which is not the case when just national benefits are considered). In addition, additional placemaking benefits may be available for the Local Aspirational Option (Improve C) should extensive public realm enhancements be undertaken.

The values shown in Table 8-31 are based on the damage calculations presented in Section 5 of this report, broken down to the ODU 12 level. These are not nationally eligible and cannot be included in an FCERM-GiA application. See Section 5.1 for description of GVA calculations and treatment of NRD '999' classified properties. For planning, investment and funding decisions it is recommended that the GVA values excluding the '999' properties are used as a guide.

**Table 8-31: Local economic wider damages for ODU 12**

Local benefit category	Appraisal period	PV Do Nothing Damage (£k)	Commentary
GVA – stay and do nothing scenario, <b>excluding</b> 999 classified properties	10 years	2	Do Nothing damages will be avoided (creating economic benefits) with the National Economic (Improve A), Local Aspirational Option (Improve C) and Backup option after scheme construction.
GVA – stay and do nothing scenario, <b>excluding</b> 999 classified properties	100 years*	30,090	
Visitor economy (assuming 20% reduction in visitor numbers)	100 years	5,918	
Car park income	100 years	7,872	
Beach hut income	100 years	1,966	
Coastal recreation (assuming 20% reduction in recreation users)	100 years	26,734	
Health and wellbeing	100 years	7,394	

\*as outlined in Section 5.1, calculating GVA values over a 100 year appraisal period is highly uncertain and a 10 year appraisal period is more accurate.

\*\*the visitor economy values are based on tourism economy values for visits to Christchurch as a whole, obtained from Visit Britain (2019) and is not separated into site specific details. Each of the ODUs along the Strategy frontage has features and characteristics that attract tourists to the area and therefore the Do Nothing value for the visitor economy for the Strategy frontage has been divided equally across each of the 18 ODUs.

## 8.13 ODU 13 – Highcliffe

ODU 13 covers the frontage between Steamer Point and Chewton Bunny. The risk in ODU 13 is from erosion, and there are a several short list options for this ODU, including Do Nothing, Do Minimum, Maintain, a variety of Improve options and Managed Realignment.

### 8.13.1 Benefit cost comparison

Table 8-32 below presents the economic costs, damages and benefits of each option and the average benefit cost ratios. All costs and benefits are presented in discounted present value (PV) terms. The options on ODU 13 cannot be ordered based on AEP because they are primarily focussed on managing the erosion risk and have therefore been ordered according to the NPV. The Improve C option has the highest NPV and is therefore selected as the provisional National Economic Leading Option.

**Table 8-32: ODU 13 economic appraisal**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV (£k)	Leading Economic Option
Improve C	5,431	0	6,946	1.28	1,515	X
Improve A	6,689	0	6,946	1.04	257	
Do Nothing	-	6,946	0			
Do Minimum	177	6,946	0	-	-177	
Improve B	7,918	0	6,946	0.88	-972	
Managed Realignment A	7,562	369	6,577	0.87	-985	
Maintain	5,310	4,401	2,545	0.48	-2,765	
Managed Realignment B	11,474	369	6,577	0.57	-4,897	

### 8.13.2 Testing uncertainty

The main uncertainties with the options in this location relate to option cost and changes to the estimated costs could influence the choice and viability of different options. Given the large role of beach nourishment in the Improve A, Improve C and Managed Realignment options, the specific cost of this intervention is likely to have a significant influence on the viability of these options as a whole and the selection process.

A range of sensitivity tests have been undertaken to address these uncertainties. Sensitivity tests for this area include generic cost uplift of 10% or 25% and also amended costs for the beach nourishment element of the options. The results of the sensitivity test are presented in Table 12-22 to Table 12-24 in Appendix A.

The cost increase sensitivity tests of 10% and 25% have been applied to just the Improve C option to determine how the cost increase would alter the choice of leading options. The sensitivity tests indicate that the Improve C option remains the provisional National Economic Leading Option with a 10% cost increase. With a 25% cost increase for Improve C, the NPV is very similar to Improve A and the benefit cost ratio is just above unity (1.02).

The original beach nourishment cost applied in the cost estimates was £33.3 per m<sup>3</sup> of material which is a reasonable, mid-level estimate of nourishment costs at the Strategy level. However there could be potential to reduce this cost if local sources of material were to be used or with optimisations to the dredging / placement approach. In addition, smaller quantities of material or material with different characteristics (e.g. coarser material) could also be used to achieve a similar FCERM function.

The sensitivity test on beach nourishment costs undertaken assumes a 50% cost reduction in the beach nourishment interventions. This has been applied to all options that include beach nourishment. As can be seen in Appendix A, the choice of the provisional National Economic Leading Option in this scenario would remain unchanged, however, the economic case of the each of the options would improve and the cost required to deliver options with an intervention sooner (e.g. Improve A) would reduce.

### 8.13.3 National Economic Leading Option

The economic appraisal provisionally identified the Improve C option as being the National Economic Leading Option. The social appraisal or SEA has not identified any major negative impacts for this option and therefore it is confirmed as the National Economic Leading Option.

The Improve C option would provide defence against erosion whilst also ensuring the recreational and amenity value of the beach is sustained in the long term. There would also potentially be a benefit to areas downdrift of this location such as Naish Cliff which could see an increased feed of material following the beach nourishment in ODU 13. This would be subject to the design of the refurbished / new groynes as part of this option. There may be opportunities for the combined groyne / beach nourishment scheme design to sustain the level of protection to Highcliffe, whilst improving the feed of material to the east.

### 8.13.4 Local Aspirational / Backup Options

As outlined in the Leading Options Report (AECOM, 2024), the Improve A option has been identified as the Local Aspirational Option for ODU 13. The Improve A option is similar to Improve C, but would involve undertaking the major beach nourishment scheme in epoch 2 rather than epoch 3. The estimated PV cost for Improve A is approximately £6.7million.

As a backup option, an Improve option with smaller scale beach nourishment has been identified. This would involve doing more frequent smaller scale nourishment rather than larger less frequent nourishment. This is unlikely to reduce the overall option cost but it may be more feasible to source non-GiA funding if the requirement is on more frequent / smaller scale interventions.

### 8.13.5 Local Economic Wider Benefits

Table 8-33 below outlines the potential local economic damages in ODU 13 for the Do Nothing scenario.

It is likely that these damages would be avoided by the National Economic, Local Aspirational and Backup options, creating an economic benefit. There could be differences in the extent to which the coastal recreation damages are avoided between options. For example, the Local Aspirational Option (Improve A) involves an earlier beach nourishment intervention and therefore the full damage would likely be avoided. However, the National Economic Option (Improve C) does not include a major beach nourishment scheme until epoch 3 and therefore is a risk that in the short and medium term and changes to beach levels could impact the recreation value of the site.

The values shown in Table 8-33 are based on the damage calculations presented in Section 5 of this report, broken down to the ODU 13 level. These are not nationally eligible and cannot be included in an FCERM-GiA application. See Section 5.1 for description of GVA calculations and treatment of NRD '999' classified properties. For planning, investment and funding decisions it is recommended that the GVA values excluding the '999' properties are used as a guide.

**Table 8-33: Local economic wider damages for ODU 13**

Local benefit category	Appraisal period	PV Do Nothing Damage (£k)	Commentary
GVA – stay and do nothing scenario, <b>excluding</b> 999 classified properties	10 years	0	Do Nothing damages will be avoided (creating economic benefits) with the National Economic (Improve A), Local Aspirational Option (Improve C) and Backup option after scheme construction.  There could potentially be differences in the extent to which coastal recreation damages are avoided between the different options.
GVA – stay and do nothing scenario, <b>excluding</b> 999 classified properties	100 years*	5,749	
Visitor economy (assuming 20% reduction in visitor numbers)	100 years	5,918	
Car park income	100 years	724	
Beach hut income	100 years	0	
Coastal recreation (assuming 20% reduction in recreation users)	100 years	16,013	
Health and wellbeing	100 years	7,270	

\*as outlined in Section 5.1, calculating GVA values over a 100 year appraisal period is highly uncertain and a 10 year appraisal period is more accurate.

\*\*the visitor economy values are based on tourism economy values for visits to Christchurch as a whole, obtained from Visit Britain (2019) and is not separated into site specific details. Each of the ODUs along the Strategy frontage has features and characteristics that attract tourists to the area and therefore the Do Nothing value for the visitor economy for the Strategy frontage has been divided equally across each of the 18 ODUs.

## 8.14 ODU 14 – Naish Cliff and Barton on Sea

ODU 14 is an open coast environment between Naish Cliff and Barton on Sea, characterised by steep topography and an active cliff face. The main risk in this area is from coastal erosion caused by cliff toe erosion and groundwater induced cliff slope instability. There are a range of short list options for ODU 14, including Do Nothing, Do Minimum, Maintain, Improve and a variety of Managed Realignment options.

### 8.14.1 Benefit cost comparison

Table 8-34 below presents the economic costs, damages and benefits of each option and the average benefit cost ratios. All costs and benefits are presented in discounted present value (PV) terms. The options for ODU 14 cannot be ordered based on AEP because they are focussed on managing the erosion risk and have therefore been ordered according to the NPV. The Managed Realignment A option has the highest NPV and is therefore selected as the provisional leading Economic Leading Option.

Managed Realignment B, Managed Realignment D and Maintain also have ABCRs greater than unity and are the only other Do Something options that are viable from an economic standpoint. Neither of the Improve A or Improve B options have an ABCR greater than unity which indicates that providing cliff slope stabilisation / robust toe defences to the full length of the frontage is unviable.

**Table 8-34: ODU 14 economic appraisal**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV (£k)	Leading Economic Option
Managed Realignment A	22,211	4,875	23,489	1.06	1,278	X
Managed Realignment B	19,718	8,287	20,077	1.02	359	
Managed Realignment D	14,218	13,973	14,391	1.01	173	
Maintain	5,927	22,405	5,959	1.01	32	
Do Nothing	-	28,364	-	-	-	
Managed Realignment C	15,317	13,973	14,391	0.94	-926	
Do Minimum	1,228	28,078	286	0.23	-942	
Managed Realignment F	11,750	19,150	9,214	0.78	-2,536	
Managed Realignment E	11,836	19,150	9,214	0.78	-2,622	
Improve B	46,061	1,089	27,275	0.59	-18,786	
Improve A	55,527	1,089	27,275	0.49	-28,252	

### 8.14.2 Testing uncertainty

The main uncertainties with the options in this location relate to option cost and how changes to the estimated costs could influence the choice and viability of different options.

A sensitivity test has been undertaken to test the choice of options with a cost uplift of 10% and 25% for Managed Realignment A (the provisional Leading Economic Option). The results of the sensitivity tests are shown in Table 12-25 in Table 12-26 Appendix A. Discussion around the alternative options and broader uncertainty in this unit is provided below.

The sensitivity tests show that with a 10% and 25% increase in costs, Managed Realignment A would not remain as the leading economic option and would be replaced by the Managed Realignment B option. However, given the similarities between Managed Realignment A and Managed Realignment B (they are the same option but with different timings of intervention), any scenarios leading to a cost increase for Managed Realignment A would also likely produce a similar, if not larger, cost increase for Managed Realignment B. As outlined in the Barton on Sea Option Review Technical Note (AECOM, 2024), on balance Managed Realignment A is considered a less risky option than Managed Realignment B with greater buildability (owing to the earlier intervention and more space available at the top of the cliff).

If costs for both Managed Realignment A and B were to rise, Managed Realignment D would be identified as the provisional leading economic option. Managed Realignment D is similar to Managed Realignment A / B but involves defending a shorter stretch of frontage and excludes new defences at Marine Drive West. Managed Realignment D has a benefit cost ratio above unity, but in a scenario where the costs increase for Managed Realignment A / B, a similar cost increase would also be anticipated for Managed Realignment D which would impact its economic viability in a similar way.

It is recognised that there is a significant funding shortfall for capital schemes at Barton on Sea due to a lack of FCERM-GiA relative to option costs. Therefore, an additional sensitivity test specific to the option funding has been undertaken and is shown in Appendix C. This sensitivity test considers how the potential GiA funding availability may change if the capital scheme is delayed until year 50 or year 75 in the appraisal period. The test indicates that whilst the funding case would improve, there would still be a large funding shortfall at this time and therefore irrespective of when a capital scheme is delivered, significant amounts of non-GiA funding will be needed. See Appendix C for more details.

### 8.14.3 National Economic Leading Option

Managed Realignment A has the highest net present value and can therefore be identified as the National Economic Leading Option on this basis. Uncertainty has been considered to determine whether alternative options, such as Managed Realignment B or Managed Realignment D, that have similar net present values would be better choices. In summary:

- Managed Realignment B has not been selected because as outlined in the Barton Option Review Technical Note (AECOM, 2024), intervening sooner with Managed Realignment A has many advantages in terms of risk reduction and buildability which reduce cost uncertainty compared to Managed Realignment B. Any increase in costs impacting Managed Realignment A would also be expected to alter costs for Managed Realignment B in a similar way. Therefore, there is no justification for selecting Managed Realignment B instead of Managed Realignment A on the basis of uncertainty.
- Managed Realignment D has not been selected because it is the aspiration to defend as many properties as possible at Barton on Sea within the confines of the economic case and therefore Managed Realignment A would be preferable. A scenario leading to an increase in costs for Managed Realignment A/B would also be expected to impact Managed Realignment D in a similar way and lead to an increase in costs for this option too, therefore, selecting Managed Realignment D as the National Economic Leading Option on the basis of cost uncertainty is not justified. There is uncertainty around the technical viability of defences at Marine Drive West, but this does not impact the choice of National Economic Option and can be managed with the inclusion of Backup options in the Adaptive Pathways.

Managed Realignment A would reduce the rate of erosion to the part of the ODU 14 frontage with properties located at the cliff top, from the western end of Marine Drive West to the eastern end of Marine Drive East. This would be achieved through a combination of improved cliff drainage and cliff toe protection (rock revetment). Due to the complex cliffs in this location and the current angle of repose (being greater than the stable angle), it is not realistic to stop the erosion entirely and therefore some risk would remain, particularly to the properties currently at the top of the cliff seaward of the road. However, relative to a Do Nothing scenario the onset of erosion for these properties is likely to be delayed.

The SEA has not identified any major negative impacts for this option and relative to the other Managed realignment Options it would be expected to have more positive impacts. The social appraisal indicated that the choice of

defence measures are in line with those that were supported during the previous round of stakeholder engagement and relative to the other Managed Realignment Approaches (C-F) this option would include defences along the largest length of the frontage.

Based on the above points the Managed Realignment A option is confirmed as the National Economic Leading Option.

## 8.14.4 Local Aspirational / Backup Options

### Requirement for Backup options

Given the relatively low ABCR of the Managed Realignment A option (just above 1), the sensitivity tests on option cost highlight how sensitive the viability of this option is to cost increases. With a 10% cost increase, the ABCR falls below unity and the economic viability of the option would be uncertain.

There is also uncertainty around funding for Managed Realignment A, with funding for the majority of the initial scheme cost needing to come from non-GiA sources. This is a significant amount (approximately £23million in cash terms) that would need to be secured in years 0-10 in order to undertake construction in the first part of epoch 1. Whilst it is the aspiration of NFDC to work with potential funding partners to secure this funding, it is recognised that this is uncertain and may not be achievable.

In addition to the cost and funding uncertainties, it is outlined in the Leading Options Report (AECOM, 2024) how there is uncertainty around the effectiveness of drainage / toe defences at Marine Drive West that requires further investigation when developing a scheme design at Barton on Sea. These defences are included in Managed Realignment A and B, but not in Managed Realignment D.

Each of these factors indicate that it would be prudent to identify Backup options in case of funding risks, cost increases in the future or findings from further appraisal during scheme design.

### Backup options

Three Backup options have been identified and allow a range of adaptive pathways to be implemented.

The first Backup option is Managed Realignment B. This option is the same as Managed Realignment A, but the initial capital scheme (cliff drainage and toe protection) would be undertaken at the start of epoch 2 (rather than in the first part of epoch 1 with Managed Realignment A). This option has been identified as a Backup option in case of a scenario in which not enough non-GiA funding could be secured during the first part of epoch 1 to implement Managed Realignment A, and more time is needed to secure all the funding contributions.

The second Backup option is Managed Realignment D. Both Managed Realignment A and B include cliff drainage and toe defences at Marine Drive West, but the effectiveness of cliff drainage and toe defences here is uncertain due to this area being within the slump zone of Naish Cliffs. Managed Realignment D does not include defences at Marine Drive West and could be implemented as a Backup Option if further appraisal work during scheme development determines that defences at Marine Drive West are not likely to be effective.

The third Backup option is Maintain. This has been identified in case the scheme costs for either Managed Realignment A, B or D increase, leading to the benefit cost ratios of these options falling below unity.

## 8.14.5 Local Economic Wider Benefits

Table 8-35 below outlines the potential local economic damages in ODU 14 for the Do Nothing scenario.

It is likely that these damages would be partially avoided by the National Economic and Backup options, creating an economic benefit:

- The greatest number of damages avoided (benefits) would be expected to occur with the National Economic Option (Managed Realignment A). This is because this has the earliest scheme intervention and a greater amount of the open space at the top of the cliff would be expected to be retained during the appraisal period (leading to more benefits in visitor economy, car park income, coastal recreation and health and wellbeing).

With respect to the GVA damages, the majority of these damages are associated with businesses on the seaward side of Marine Drive Road that are expected to erode during the first two epochs of the Strategy

under the Do Nothing scenario. Whilst Managed Realignment A would be expected to delay the onset of erosion of these properties relative to the Do Nothing scenario, the option would not stop the erosion risk entirely and some erosion risk would remain after the scheme is implemented. Therefore it is possible that these properties could still be lost in the long term and therefore some of the GVA damages would still occur (i.e. not all the GVA damages would be avoided).

- The Managed Realignment B and D Backup Options would be expected to lead to a significant proportion of the damages being avoided (benefits) but a lesser amount than with Managed Realignment A. This is because there would be expected to be a greater amount of cliff top erosion over the appraisal period, leading to less benefits in the visitor economy, car park income, coastal recreation and health and wellbeing categories.

With respect to the GVA damages, a similar situation to Managed Realignment A would be expected, whereby some of the GVA damages would be avoided but not all of them due to the ongoing erosion risk anticipated after scheme construction.

- The Maintain Backup Option would likely still lead to significant erosion risk over the appraisal period and therefore would only be expected to lead to minor damages avoided, with the majority of the Do Nothing damages still expected to occur.

The values shown in Table 8-35 are based on the damage calculations presented in Section 5 of this report, broken down to the ODU 14 level. These are not nationally eligible and cannot be included in an FCERM-GiA application. See Section 5.1 for description of GVA calculations and treatment of NRD '999' classified properties. For planning, investment and funding decisions it is recommended that the GVA values excluding the '999' properties are used as a guide.

**Table 8-35: Local economic wider damages for ODU 14**

Local benefit category	Appraisal period	PV Do Nothing Damage (£k)	Commentary
GVA – stay and do nothing scenario, <b>excluding</b> 999 classified properties	10 years	0	Do Nothing damages will be partially avoided (creating economic benefits) with the National Economic (Managed Realignment A) and Backup Options (Managed Realignment B, Managed Realignment D and Maintain).  Managed Realignment A expected to lead to the greatest proportion of damages avoided (benefits) across the local benefit categories.
GVA – stay and do nothing scenario, <b>excluding</b> 999 classified properties	100 years*	44,453	
Visitor economy (assuming 20% reduction in visitor numbers)	100 years	5,918	
Car park income	100 years	921	
Beach hut income	100 years	1,334	
Coastal recreation (assuming 20% reduction in recreation users)	100 years	930	
Health and wellbeing	100 years	771	

\*as outlined in Section 5.1, calculating GVA values over a 100 year appraisal period is highly uncertain and a 10 year appraisal period is more accurate.

\*\*the visitor economy values are based on tourism economy values for visits to Christchurch as a whole, obtained from Visit Britain (2019) and is not separated into site specific details. Each of the ODUs along the Strategy frontage has features and characteristics that attract tourists to the area and therefore the Do Nothing value for the visitor economy for the Strategy frontage has been divided equally across each of the 18 ODUs.

## 8.15 ODU 15 – Barton on Sea to Hordle Cliff

ODU 15 covers the undefended area between Barton on Sea and Hordle Cliff. The cliffs here are actively eroding but there are minimal properties / significant assets at risk from erosion in this unit. As a result, fewer short list options have been considered in ODU 15, and they include Do Nothing, Do Minimum and Managed Realignment.

### 8.15.1 Benefit cost comparison

Table 8-36 below presents the economic costs, damages and benefits of each option and the average benefit cost ratios. All costs and benefits are presented in discounted present value (PV) terms. The options on ODU 15 cannot be ordered based on AEP because they are focussed on managing the erosion risk and have therefore been ordered according to the NPV. None of the Do Something options have an ABCR greater than unity therefore Do Nothing is identified as the provisional National Economic Leading option.

**Table 8-36: ODU 15 economic appraisal**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV (£k)	Leading Economic Option
Do Nothing	-	73	-	-	-	X
Do Minimum	44	73	-	-	-44	
Managed Realignment	110	73	-	-	-110	

### 8.15.2 Testing uncertainty

The main uncertainty with the options in this location relate to option cost. However, given that the leading economic option is the Do Nothing option (which does not have a cost), there is little merit in sensitivity testing the option costs of the other options as it would not impact the choice of the provisional National Economic Leading Option (as no option will cost less than Do Nothing).

### 8.15.3 National Economic Leading Option

The economic appraisal above provisionally identified the Do Nothing option as being the National Economic Leading Option. The social appraisal and SEA have not identified any major negative impacts associated with this option and therefore it is confirmed as the National Economic Leading Option. This approach aligns with the SMP policy for the area.

### 8.15.4 Local Aspirational / Backup Options

As per the Leading Options Report (AECOM, 2024), no Local Aspirational or Backup options were identified for ODU 15.

### 8.15.5 Local Economic Wider Benefits

Table 8-37 below outlines the potential local economic damages in ODU 15 for the Do Nothing scenario.

As the National Economic Leading Option is Do Nothing, none of the damages presented in Table 8-37 would be expected to be avoided.

The values shown in Table 8-37 are based on the damage calculations presented in Section 5 of this report, broken down to the ODU 15 level. These are not nationally eligible and cannot be included in an FCERM-GiA application. See Section 5.1 for description of GVA calculations and treatment of NRD '999' classified properties. For planning, investment and funding decisions it is recommended that the GVA values excluding the '999' properties are used as a guide.

**Table 8-37: Local economic wider damages for ODU 15**

Local benefit category	Appraisal period	PV Do Nothing Damage (£k)	Commentary
GVA – stay and do nothing scenario, <b>excluding</b> 999 classified properties	10 years	0	Do Nothing damages would not be avoided by the National Economic Leading Option.
GVA – stay and do nothing scenario, <b>excluding</b> 999 classified properties	100 years*	0	
Visitor economy (assuming 20% reduction in visitor numbers)	100 years	5,918	
Car park income	100 years	0	
Beach hut income	100 years	0	
Coastal recreation (assuming 20% reduction in recreation users)	100 years	930	
Health and wellbeing	100 years	771	

\*as outlined in Section 5.1, calculating GVA values over a 100 year appraisal period is highly uncertain and a 10 year appraisal period is more accurate.

\*\*the visitor economy values are based on tourism economy values for visits to Christchurch as a whole, obtained from Visit Britain (2019) and is not separated into site specific details. Each of the ODUs along the Strategy frontage has features and characteristics that attract tourists to the area and therefore the Do Nothing value for the visitor economy for the Strategy frontage has been divided equally across each of the 18 ODUs.

## 8.16 ODU 16 – Cliff Road

ODU 16 spans over 700m between the Hordle beach huts and the west end of the defences at Rook Cliff. There are a range of short list options for ODU 16, including Do Nothing, Do Minimum, Maintain, Improve and a variety of Managed Realignment options.

### 8.16.1 Benefit cost comparison

Table 8-38 below presents the economic costs, damages and benefits of each option and the average benefit cost ratios. All costs and benefits are presented in discounted present value (PV) terms. The options on ODU 16 cannot be ordered based on AEP because they are focussed on managing the erosion risk and have therefore been ordered according to the NPV. The Managed Realignment C option has the highest NPV and is therefore selected as the provisional National Economic Leading Option.

It is noticeable that Managed Realignment A and B also have an ABCR greater than unity. These options follow the same approach as Managed Realignment C but with the initial capital interventions occurring sooner, in either the first part of epoch 1 (Managed Realignment) or the start of epoch 2 (Managed Realignment B) rather than the mid-point of epoch 2.

**Table 8-38: ODU 16 economic appraisal**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV (£k)	Leading Economic Option
Managed Realignment C	4,405	15	7,400	1.68	2,995	X
Managed Realignment B	5,069	15	7,400	1.46	2,331	
Managed Realignment A	5,612	15	7,400	1.32	1,788	
Maintain	1,791	4,398	3,017	1.68	1,226	
Do Nothing	-	7,415	-	-	-	
Do Minimum	469	7,415	0	-	-469	
Improve	7,954	0	7,415	0.93	-539	

### 8.16.2 Testing uncertainty

The main uncertainties with the options in this location relate to option cost, and changes to the estimated costs could influence the choice and viability of different options. Given the large role of beach nourishment in the Managed Realignment options, the specific cost of this intervention is likely to have a significant influence on the viability of these options as a whole and the selection process.

A range of sensitivity tests have been undertaken to address these uncertainties. Sensitivity tests for this area include generic cost uplift of 10% or 25% and also amended costs for the beach nourishment element of the options. The sensitivity tests are shown in Table 12-27 to Table 12-29 in Appendix A.

The cost increase sensitivity tests of 10% and 25% have been applied to just the Managed Realignment C option to determine how the cost increase would alter the choice of leading options. The sensitivity tests show that with a 10% increase in costs, Managed Realignment C is the option that has the highest NPV and would therefore remain the provisional National Leading Economic Option. With a 25% increase in cost, the National Leading Economic Option would switch to Managed Realignment B. However, it is likely that scenarios where the cost of Managed Realignment C increased, the cost for Managed Realignment B would also increase.

The original beach nourishment cost applied in the cost estimates was £33.3 per m<sup>3</sup> of material which is considered to be a reasonable, mid-level estimate of nourishment costs at the Strategy level. However there could be potential to reduce this cost if local sources of material were to be used or with optimisations to the dredging / placement approach. In addition, smaller quantities of material or material with different characteristics (e.g. coarser material) could also be used to achieve a similar FCERM function.

The sensitivity test on beach nourishment costs undertaken assumes a 50% cost reduction in the beach nourishment interventions. This has been applied to all options that include beach nourishment. As can be seen in Appendix A, the choice of the provisional National Economic Leading Option in this scenario would remain unchanged, however, the economic case of each of the Managed Realignment options would improve and the cost required to deliver options with an intervention sooner (e.g. Managed realignment A or B) would reduce.

### 8.16.3 National Economic Leading Option

The economic appraisal provisionally identified Managed Realignment C option as being the National Economic Leading Option.

The SEA has not identified any major negative impacts for this option and there are expected to be positive environmental impacts, including the potential for improvements to the condition of the SSSI in the future.

The primary defence measure as part of this option is beach nourishment and the social appraisal indicates that this measure had a high level of support during the previous engagement phase. The Managed Realignment C option would involve erosion of the cliff line in the future and the potential impact that this may have on the beach huts currently located along the foot of the cliff could impact local community support for this option. The alternative options on the short list would all also have impacts on the beach huts and therefore it is not considered to be a determining factor for the selection of options. However if Managed Realignment C is taken forward, it is recommended that an adaptation plan for the beach huts is put in place to help manage any potential impacts.

Based on the above points the Managed Realignment C option is confirmed as the National Economic Leading Option. Managed Realignment C is in line with the SMP policy for the area and is largely based on its recommendations (e.g. using a strong point to help manage rates of erosion). From a strategic perspective, the placement of beach material in ODU 16 is also likely to have a beneficial impact on beach levels downdrift, in ODUs 17-18.

### 8.16.4 Local Aspirational / Backup Options

As outlined in the Leading Options Report (AECOM, 2024), the Managed Realignment A / Managed Realignment B options have been identified as Local Aspirational Options for ODU 16. These are the same as Managed Realignment C, except they include an earlier intervention (epoch 1 for Managed Realignment A and epoch 2 for Managed Realignment B). The estimated PV cost for these options is between £5-5.6million.

As a backup option, the Maintain Option has been identified. This would involve refurbishing existing defences and undertaking small scale beach nourishment over time on a regular basis. The Maintain option would not deliver the same level of benefits as the Managed Realignment options and would result in extensive loss of property in the future. However, relative to Do Nothing, it would help delay the onset of erosion to properties and provide time for an adaptation plan to be implemented.

### 8.16.5 Local Economic Wider Benefits

Table 8-39 below outlines the potential local economic damages in ODU 16 for the Do Nothing scenario.

It is likely that some of these damages would be avoided by the National Economic and Local Aspirational Options (Managed Realignment A-C), creating an economic benefit. For these options the majority of the GVA damages would be avoided and the visitor economy, coastal recreation and health and wellbeing damages would be expected to be fully avoided (i.e. full value converted to an economic benefit). However, these options are expected to eventually lead to the loss of the Hordle Cliff (West) car park in the future and therefore car park income damages would occur. There is uncertainty as to how much of the beach hut income could be retained with the National and Local Aspirational Options. It is likely that many of the beach huts will need to be moved over time as the cliff line erodes and the viability of this is uncertain. However, compared to the Do Nothing scenario there would be expected to be some damages avoided / economic benefit associated with beach hut income.

The Backup option (Maintain) would likely still lead to significant erosion risk over the appraisal period and therefore would only be expected to lead to minor damages avoided, with the majority of the Do Nothing damages still expected to occur.

The values shown in Table 8-39 are based on the damage calculations presented in Section 5 of this report, broken down to the ODU 16 level. These are not nationally eligible and cannot be included in an FCERM-GiA application. See Section 5.1 for description of GVA calculations and treatment of NRD '999' classified properties. For planning, investment and funding decisions it is recommended that the GVA values excluding the '999' properties are used as a guide.

**Table 8-39: Local economic wider damages for ODU 16**

Local benefit category	Appraisal period	PV Do Nothing Damage (£k)	Commentary
GVA – stay and do nothing scenario, <b>excluding</b> 999 classified properties	10 years	0	Do Nothing damages will be partially avoided (creating economic benefits) with the National Economic and Local Aspirational Options (Managed Realignment A-C). Uncertainty around extent of damage avoided in car park and beach hut income.  Backup option (Maintain) not expected to lead to significant damages being avoided.
GVA – stay and do nothing scenario, <b>excluding</b> 999 classified properties	100 years*	9,054	
Visitor economy (assuming 20% reduction in visitor numbers)	100 years	5,918	
Car park income	100 years	1,310	
Beach hut income	100 years	4,042	
Coastal recreation (assuming 20% reduction in recreation users)	100 years	4,141	
Health and wellbeing	100 years	1,763	

\*as outlined in Section 5.1, calculating GVA values over a 100 year appraisal period is highly uncertain and a 10 year appraisal period is more accurate.

\*\*the visitor economy values are based on tourism economy values for visits to Christchurch as a whole, obtained from Visit Britain (2019) and is not separated into site specific details. Each of the ODUs along the Strategy frontage has features and characteristics that attract tourists to the area and therefore the Do Nothing value for the visitor economy for the Strategy frontage has been divided equally across each of the 18 ODUs.

## 8.17 ODU 17 – Rook Cliff

ODU 17 is located between the start of the Rook Cliff defences and the Hurst Road West car park (just to the east of the White House). There are a range of short list options for ODU 17, including Do Nothing, Do Minimum, Maintain, Improve and Managed Realignment options.

### 8.17.1 Benefit cost comparison

Table 8-40 below presents the economic costs of each option, the economic damages and benefits of each option and the average benefit cost ratios. All costs and benefits are presented in discounted present value (PV) terms. The options on ODU 17 cannot be ordered based on AEP because they are focussed on managing the erosion risk and have therefore been ordered according to the NPV. The Improve C option has the highest NPV and is therefore selected as the provisional National Economic Leading Option.

**Table 8-40: ODU 17 economic appraisal**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV (£k)	Leading Economic Option
Improve C	9,055	0	11,516	1.27	2,461	X
Improve B	9,376	0	11,516	1.23	2,140	
Maintain	4,110	7,294	4,222	1.03	112	
Improve A	11,471	0	11,516	1.00	45	
Do Nothing	-	11,516	-			
Do Minimum	241	11,516	0	-	-241	
Managed Realignment A	14,021	1,424	10,092	0.72	-3,929	
Managed Realignment B	17,269	0	11,516	0.67	-5,753	

### 8.17.2 Testing uncertainty

The main uncertainties with the options in this location relate to option cost, and changes to the estimated costs could influence the choice and viability of different options. A sensitivity test has been undertaken to test the choice of options with a cost uplift of 10% and 25% for Improve C (the provisional National Economic Leading Option). The sensitivity tests are shown in Table 12-30 and Table 12-31 in Appendix A.

The sensitivity tests show that with a 10% and 25% increase in costs, the choice of option would change to Improve B. However, given that each option has broadly the same interventions (just at different times in the appraisal period), in a situation where the cost of Improve C increased, there would also likely be similar increases in cost for Improve B. In the event that costs for both options increases by the same percentage, Improve C would be retained as the National Economic Leading Option. The choice of the Improve C as the provisional National Economic Leading Option has therefore not been changed as a result of the sensitivity tests.

### 8.17.3 National Economic Leading Option

The economic appraisal above provisionally identified Improve C option as being the National Economic Leading Option.

The SEA has not identified any major negative impacts for this option. The primary defence measure as part of this option is a rock revetment and the social appraisal indicates that these measures had a high level of support during

the previous engagement phase. Based on the above points the Improve C option is confirmed as the National Economic Leading Option.

### 8.17.4 Local Aspirational / Backup Options

As outlined in the Leading Options Report (AECOM, 2024), the Improve A / Improve B options have been identified as Local Aspirational Options for ODU 17. These are the same as Improve C, except they include an earlier intervention (epoch 1 for Improve A and epoch 2 for Improve B). The estimated PV cost for these options is between £9.4-11.5million.

As a backup option, the Maintain Option has been identified. This would involve refurbishing existing defences. The Maintain option would not deliver the same level of benefits as the Managed Realignment options and would result in extensive loss of property in the future. However, relative to Do Nothing, it would help delay the onset of erosion to properties and provide time for an adaptation plan to be implemented.

### 8.17.5 Local Economic Wider Benefits

Table 8-41 below outlines the potential local economic damages in ODU 17 for the Do Nothing scenario.

It is likely that these damages would be avoided by the National Economic and Local Aspirational Options (Improve A-C), creating an economic benefit. The Backup option (Maintain) would not lead to as many benefits as the Improve Options because there could still be significant erosion risk over the appraisal period with the majority of the Do Nothing damages still expected to occur.

The values shown in Table 8-41 are based on the damage calculations presented in Section 5 of this report, broken down to the ODU 17 level. These are not nationally eligible and cannot be included in an FCERM-GiA application. See Section 5.1 for description of GVA calculations and treatment of NRD '999' classified properties. For planning, investment and funding decisions it is recommended that the GVA values excluding the '999' properties are used as a guide.

**Table 8-41: Local economic wider damages for ODU 17**

Local benefit category	Appraisal period	PV Do Nothing Damage (£k)	Commentary
GVA – stay and do nothing scenario, <b>excluding</b> 999 classified properties	10 years	0	Do Nothing damages will be avoided (creating economic benefits) with the National Economic and Local Aspirational Options (Improve A-C).  Backup option (Maintain) not expected to lead to significant damages being avoided.
GVA – stay and do nothing scenario, <b>excluding</b> 999 classified properties	100 years*	1,639	
Visitor economy (assuming 20% reduction in visitor numbers)	100 years	5,918	
Car park income	100 years	377	
Beach hut income	100 years	0	
Coastal recreation (assuming 20% reduction in recreation users)	100 years	4,141	
Health and wellbeing	100 years	1,763	

\*as outlined in Section 5.1, calculating GVA values over a 100 year appraisal period is highly uncertain and a 10 year appraisal period is more accurate.

\*\*the visitor economy values are based on tourism economy values for visits to Christchurch as a whole, obtained from Visit Britain (2019) and is not separated into site specific details. Each of the ODUs along the Strategy frontage has features and characteristics that attract tourists to the area and therefore the Do Nothing value for the visitor economy for the Strategy frontage has been divided equally across each of the 18 ODUs.

## 8.18 ODU 18 – Milford on Sea Frontage

ODU 18 covers the area between Hurst Road West car park and the eastern end of Hurst Road, at the start of the rock revetment at the west end of Hurst Spit. There are a range of short list options for ODU 18, including Do Nothing, Do Minimum, Maintain, Improve and Managed Realignment options.

### 8.18.1 Benefit cost comparison

Table 8-42 below presents the economic costs of each option, the economic damages and benefits of each option and the average benefit cost ratios. All costs and benefits are presented in discounted present value (PV) terms. The options on ODU 18 cannot be ordered based on AEP because they are primarily focussed on managing the erosion risk; the flood risk management component of the overall cost is considerably smaller than the erosion risk management component. The options have therefore been ordered according to the NPV. The NPV of Improve B and Improve A are very similar and therefore both options have been taken through for further consideration as provisional leading economic options.

**Table 8-42: ODU 18 economic appraisal**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV (£k)	Leading Economic Option
Improve B	11,035	330	11,155	1.01	120	X
Improve A	11,060	330	11,155	1.01	95	X
Maintain	8,872	2,552	8,933	1.01	61	
Do Nothing	-	11,485	-	-	-	
Do Minimum	963	11,402	83	0.09	-880	
Managed Realignment B	12,269	330	11,155	0.91	-1,114	
Managed Realignment A	11,999	3,867	7,618	0.63	-4,381	

### 8.18.2 Testing uncertainty

The main uncertainties with the options in this location relate to option cost, and changes to the estimated costs could influence the choice and viability of different options. Given the large role of beach nourishment in the Improve and Managed Realignment options, the specific cost of this intervention is likely to have a significant influence on the viability of these options as a whole and the selection process.

A range of sensitivity tests have been undertaken to address these uncertainties. Sensitivity tests for this area include generic cost uplift of 10% or 25% and also amended costs for the beach nourishment element of the options. The sensitivity tests are shown in Table 12-32 to Table 12-34 in Appendix A.

The cost increase sensitivity tests of 10% and 25% have been applied to both the Improve A and Improve B options to determine how the cost increase would alter the choice of leading options. The sensitivity tests show that with a 10% and 25% increase in costs, the choice of option would change to Maintain. However, whilst this may be the case, in a scenario whereby the cost of the Improve B option were to increase, given the similarities in the approach with the Maintain option it is likely that the Maintain option would also have similar cost increases.

The original beach nourishment cost applied in the cost estimates was £33.3 per m<sup>3</sup> of material which is a reasonable, mid-level estimate of nourishment costs at the Strategy level. However there could be potential to reduce this cost if local sources of material were to be used or with optimisations to the dredging / placement approach. In addition, smaller quantities of material or material with different characteristics (e.g. coarser material) could also be used to achieve a similar FCERM function.

The sensitivity test on beach nourishment costs undertaken assumes a 50% cost reduction in the beach nourishment interventions. This has been applied to all options that include beach nourishment. As can be seen in Appendix A, the choice of the provisional National Economic Leading Option in this scenario would be Improve A.

### 8.18.3 National Economic Leading Option

The economic appraisal above provisionally identified the Improve A and B options as being the Leading Economic Option. Both of these options have a similar benefit cost ratio and net present values. As per stage 3 of the FCERM-AG decision rules, when two options have a similar economic case then wider factors and uncertainty should be considered to help identify the National Economic Leading Option.

Both Improve A and Improve B involve the same capital interventions but the key difference between the options is the timing of when the first major capital scheme would occur. For Improve A it has been assumed that this would occur in the first part of epoch 1 whereas for Improve B it has been assumed to occur at the start of epoch 2. Major defence refurbishments would be required in the interim with Improve B to prevent defence failure.

Currently the defences in ODU 18 are in a poor condition and threatened by lowering beach levels. NFDC need to frequently top up beach levels to ensure there is enough material to protect the defence toe and reduce the risk of failure. As such, with the earlier capital scheme, Improve A provides significantly more certainty to the success of the option. By shortening the time until the capital scheme is undertaken, the existing assets will not need to be relied upon for as long leading to a reduced risk of defence failure before the scheme is implemented. Furthermore, should beach nourishment costs reduce (see sensitivity test), the economic case of Improve A improves relative to Improve B. Based on these factors, Improve A is identified as the National Economic Leading Option.

The SEA has not identified any major negative impacts for this option. There could be a minor negative impact associated with the biodiversity / geodiversity impact of construction in proximity to environmental designations. The primary defence measure as part of this option is a seawall with beach nourishment and groynes and the social appraisal indicates that these measures had a high level of support during the previous engagement phase.

### 8.18.4 Local Aspirational / Backup Options

As outlined in the Leading Options Report (AECOM, 2024), two Backup options have been identified for ODU 18. Improve B is the first backup option and would be selected as an adaptive pathway should funding for Improve A in the first part of epoch 1 not be secured. By delaying the capital scheme until the start of epoch 2, this would provide more time to secure non-GiA funding to deliver the option.

The second Backup option is Maintain. This would involve refurbishing existing defences and undertaking small scale beach nourishment for as long as is feasible but would come with an increased risk of defence failure over time. There is long term uncertainty as to how long this option may be effective in reducing risks. However, relative to Do Nothing, it would help delay the onset of erosion to properties and provide time for an adaptation plan to be implemented.

### 8.18.5 Local Economic Wider Benefits

Table 8-43 below outlines the potential local economic damages in ODU 18 for the Do Nothing scenario.

It is likely that these damages would be avoided by the Improve A and B options (National Economic and first Backup Option), creating an economic benefit. However the Maintain option (second Backup) would likely still lead to significant erosion risk over the appraisal period and therefore would only be expected to lead to minor damages avoided, with the majority of the Do Nothing damages still expected to occur.

The values shown in Table 8-43 are based on the damage calculations presented in Section 5 of this report, broken down to the ODU 17 level. These are not nationally eligible and cannot be included in an FCERM-GiA application. See Section 5.1 for description of GVA calculations and treatment of NRD '999' classified properties. For planning, investment and funding decisions it is recommended that the GVA values excluding the '999' properties are used as a guide.

**Table 8-43: Local economic wider damages for ODU 18**

Local benefit category	Appraisal period	PV Do Nothing Damage (£k)	Commentary
GVA – stay and do nothing scenario, <b>excluding</b> 999 classified properties	10 years	19	Do Nothing damages will be avoided (creating economic benefits) with the Improve A and B options (National Economic and first Backup option).  The Maintain option (second Backup option) not expected to lead to significant damages being avoided.
GVA – stay and do nothing scenario, <b>excluding</b> 999 classified properties	100 years*	6,316	
Visitor economy (assuming 20% reduction in visitor numbers)	100 years	5,918	
Car park income	100 years	3,083	
Beach hut income	100 years	1,636	
Coastal recreation (assuming 20% reduction in recreation users)	100 years	4,141	
Health and wellbeing	100 years	1,763	

\*as outlined in Section 5.1, calculating GVA values over a 100 year appraisal period is highly uncertain and a 10 year appraisal period is more accurate.

\*\*the visitor economy values are based on tourism economy values for visits to Christchurch as a whole, obtained from Visit Britain (2019) and is not separated into site specific details. Each of the ODUs along the Strategy frontage has features and characteristics that attract tourists to the area and therefore the Do Nothing value for the visitor economy for the Strategy frontage has been divided equally across each of the 18 ODUs.

## 9. Summary of Option Appraisal

Section 8 of this report outlines how the National Economic Leading Options were identified for each ODU. In some ODUs, Local Aspirational and/or Backup options were also identified by considering wider objectives, local preferences and potential funding availability. The Leading Options Report (AECOM, 2023) provides details of the selection process for the Local and Backup options. Table 9-1 below provides a summary of the leading options in each ODU.

Table 9-1: Summary of Leading Options

ODU		National Economic Leading Option	Local Aspirational Leading Option	Backup Option
1 – Hengistbury Head East	Option	Do Minimum	Managed Realignment	-
	Details	Small scale repairs to existing defences (i.e. patch-repairs)	Maintain toe defences and undertake beach recycling from epoch 1. Erosion of cliff would be controlled but not stopped entirely	-
	Option cost (PV £k)	340	2,823	-
	Option benefits (PV £k)	0	0	-
	ABCR	-	-	-
2 – Mudeford Sandbank	Option	Do Minimum	Maintain with Adaptation	-
	Details	Small scale repairs to existing defences (i.e. patch-repairs)	Sustain the FCERM service of the Sandbank by holding its form over time and aiming to keep it broadly in its current position. Achieved through beach nourishment and defence maintenance. Property level protection to permanent properties on the Sandbank.	-
	Option cost (PV £k)	680	5,456	-
	Option benefits (PV £k)	0	89	-
	ABCR	-	0.02	-
3 – Christchurch Harbour South	Option	Adaptation / Resilience A	Adaptation / Resilience C	-
	Details	Property level protection to properties at risk	As per Adaptation / Resilience A, but with localised erosion defences to the access road to Hengistbury Head and around Wick historic landfill site	-
	Option cost (PV £k)	118	776	-
	Option benefits (PV £k)	669	811	-
	ABCR	5.67	1.05	-

ODU		National Economic Leading Option	Local Aspirational Leading Option	Backup Option
4 - Wick	Option	Sustain C	Sustain B	-
	Details	Raise and lengthen existing setback embankment defence from epoch 1, and then progressively over time to keep pace with sea level rise	As per Sustain C, however, repeat maintenance / refurbishments would also be undertaken on the frontline quay wall to prevent erosion of historic landfill	-
	Option cost (PV £k)	1,490	3,499	-
	Option benefits (PV £k)	3,898	3,638	-
	ABCR	2.62	1.04	-
5 – Willow Drive and the Quomps	Option	Improve D-F (alignment to be decided)	Improve A-C (alignment to be decided)	Adaptation / Resilience
	Details	Raise height of defences to improve SoP from epoch 2. Maintain / replace frontline defence adjacent to historic landfill site at the Quomps	As per Improve D-F, except defence height would be raised in epoch 1 rather than epoch 2	Maintain frontline defences and undertake property level protection to properties at risk of flooding
	Option cost (PV £k)	11,397 – 14,702	13,660 – 22,507	11,927
	Option benefits (PV £k)	35,206 – 37,306	34,439 – 36,532	16,526
	ABCR	2.54 – 3.09	1.62 – 2.52	1.39
6 – River Avon West Bank	Option	Adaptation / Resilience	-	-
	Details	Maintain frontline defences and undertake property level protection to properties at risk of flooding	-	-
	Option cost (PV £k)	2,802	-	-
	Option benefits (PV £k)	2,877	-	-
	ABCR	1.03	-	-
7 – Rossiters Quay	Option	Improve A	-	Adaptation / Resilience
	Details	Raise existing / construct new flood defences in epoch 2	-	Maintain / refurbish existing defences and undertake property level protection to properties at risk of flooding
	Option cost (PV £k)	4,118	-	2,630
	Option benefits (PV £k)	5,329	-	3,253
	ABCR	1.29	-	1.24

ODU		National Economic Leading Option	Local Aspirational Leading Option	Backup Option
<b>8 -River Avon East Bank</b>	Options to be appraised separately by Environment Agency			
<b>9 - Stanpit</b>	<b>Option</b>	Sustain A	-	Adaptation / Resilience
	<b>Details</b>	Raise existing / construct new flood defences from epoch 2 and then raise over time to keep pace with sea level rise. Defences would defend Stanpit historic landfill site	-	Maintain / refurbish existing defences and undertake property level protection to properties at risk of flooding
	<b>Option cost (PV £k)</b>	10,960	-	8,271
	<b>Option benefits (PV £k)</b>	37,809	-	12,554
	<b>ABCR</b>	3.45	-	1.52
<b>10 - Mudeford</b>	<b>Option</b>	Improve A	-	Adaptation / Resilience
	<b>Details</b>	Property level protection to properties at risk in epochs 1 and 2. Construct new flood defences in epoch 3 to increase the SoP against flooding	-	Maintain / refurbish existing quay walls and undertake property level protection to properties at risk of flooding
	<b>Option cost (PV £k)</b>	8,373	-	5,473
	<b>Option benefits (PV £k)</b>	11,124	-	2,777
	<b>ABCR</b>	1.33	-	0.51
<b>11 – Mudeford Quay</b>	<b>Option</b>	Do Minimum	Adaptation / Resilience	-
	<b>Details</b>	Small scale repairs to existing defences (i.e. patch-repairs)	Property level protection to properties at risk. Maintain existing quay walls.	-
	<b>Option cost (PV £k)</b>	340	9,530	-
	<b>Option benefits (PV £k)</b>	0	680	-
	<b>ABCR</b>	-	0.07	-

ODU		National Economic Leading Option	Local Aspirational Leading Option	Backup Option
12 Avon Beach and Friars Cliff	Option	Improve A	Improve C	'Scaled back' Improve A
	Details	Maintain / refurbish existing defences from epoch 1. Undertake beach nourishment from epoch 2 as well as new rock groynes and raising Avon Beach seawall. Localised property level protection in epoch 3 to manage flood risk.	As per Improve A but undertake broader public realm enhancements (such as promenade raising)	Reduce beach nourishment volume / scale of defence improvements to reduce cost and improve affordability
	Option cost (PV £k)	8,443	14,030	-
	Option benefits (PV £k)	8,978	8,978	-
	ABCR	1.06	0.64	-
13 - Highcliffe	Option	Improve C	Improve A	'Scaled back' Improve C
	Details	In epoch 1 construct rock armour defence at east end of unit to reduce outflanking risk. In epoch 1 and 2 maintain existing defences and undertake beach recycling. From epoch 3 undertake beach nourishment, construct new rock groynes and refurbish defences	As per Improve C, except the beach nourishment in epoch 3 would be brought forward to be undertaken from epoch 2. New rock groynes from epoch 3	Reduce beach nourishment volume / scale of defence improvements to reduce cost and improve affordability
	Option cost (PV £k)	5,431	6,689	-
	Option benefits (PV £k)	6,946	6,946	-
	ABCR	1.28	1.04	-
14 – Naish Cliff and Barton on Sea	Option	Managed Realignment A	-	Managed Realignment B; or Managed Realignment D; or Maintain
	Details	Improved toe defences and cliff stabilisation / drainage in the area between Marine Drive West and the eastern end of Barton on Sea during the first part of epoch 1. This would help to slow rates of cliff top recession but not stop it entirely.	-	Managed Realignment B: As per Managed Realignment A, except defence improvements would be undertaken during epoch 2.  Managed Realignment D: As per Managed Realignment B, except no new cliff drainage and toe protection at Marine Drive West.

ODU		National Economic Leading Option	Local Aspirational Leading Option	Backup Option
				Maintain: Maintain existing defences and functioning drainage but no new defences constructed.
	Option cost (PV £k)	22,211	-	Managed Realignment B: 19,718 Managed Realignment D: 14,218 Maintain: 5,927
	Option benefits (PV £k)	23,489	-	Managed Realignment B: 20,077 Managed Realignment D: 14,391 Maintain: 5,959
	ABCR	1.06	-	Managed Realignment B: 1.02 Managed Realignment D: 1.01 Maintain: 1.01
15 – Barton on Sea to Hordle Cliff	Option	Do Nothing	-	-
	Details	No defence maintenance or beach management undertaken. Undertake health and safety activities following cliff erosion events to make safe public spaces.	-	-
	Option cost (PV £k)	-	-	-
	Option benefits (PV £k)	-	-	-
	ABCR	-	-	-
16 – Cliff Road	Option	Managed Realignment C	Managed Realignment A or B	Maintain
	Details	From second half of epoch 2 undertake beach nourishment and construct local strong point to control rate of cliff erosion. Cliff top recession would still occur but intent would be to prevent it reaching Cliff Road.	As per Managed Realignment C, except beach nourishment and strong point would be constructed much sooner, in either epoch 1 (Managed Realignment A) or start of epoch 2 (Managed Realignment B)	Maintain existing defences and undertake beach recycling to control beach levels. In the long term this is likely to lead to more erosion than the Managed Realignment options.
	Option cost (PV £k)	4,405	5,069 – 5,612	1,791
	Option benefits (PV £k)	7,400	7,400	3,017
	ABCR	1.68	1.32 – 1.46	1.68
	Option	Improve C	Improve A or B	Maintain:

ODU		National Economic Leading Option	Local Aspirational Leading Option	Backup Option
17 – Rook Cliff	<b>Details</b>	Refurbish existing cliff toe defences in epoch 1. From second half of epoch 2 upgrade defences at cliff toe.	As per Improve C, except toe defence improvements would be constructed much sooner, in either epoch 1 (Managed Realignment A) or start of epoch 2 (Managed Realignment B)	Maintain existing defences at the toe of the cliff. Long term sustainability of this approach is uncertain given lowering beach levels in this location and this option is therefore likely to lead to more erosion than the Improve options.
	<b>Option cost (PV £k)</b>	9,055	9,376 – 11,471	4,110
	<b>Option benefits (PV £k)</b>	11,516	11,516	4,222
	<b>ABCR</b>	1.27	1.00 – 1.23	1.03
18 – Milford on Sea	<b>Option</b>	Improve A	-	Improve B; or Maintain
	<b>Details</b>	Upgrade seawall, construct new groynes and undertake major beach nourishment from epoch 1. Construct setback tidal flood defences at eastern end of Milford on Sea to reduce risk of flooding from Sturt Pond direction in epoch 2.	-	Improve B: As per Improve A, except upgrade coastal defences and beach nourishment in epoch 2. Refurbish existing defences in epoch 1 to extend service life until upgrade.  Maintain: Maintain existing defences and undertake beach recycling. Long term effectiveness is uncertain.
	<b>Option cost (PV £k)</b>	11,060	-	Improve B: 11,035 Maintain: 8,872
	<b>Option benefits (PV £k)</b>	11,155	-	Improve B: 11,155 Maintain: 8,933
	<b>ABCR</b>	1.01	-	Improve B: 1.01 Maintain: 1.01

## 10. Partnership Funding

FCERM schemes in England are typically jointly funded from central government funding known as FCERM-Grant in Aid (FCERM-GiA) and other funding sources, such as private contributions, local levy, council funds and others. This arrangement is known as Partnership Funding.

The amount of FCERM-GiA that a scheme is eligible for is based on a series of DEFRA Outcome Measure (OM) targets. There are four OMs under which projects can attract FCERM-GiA:

- **OM1:** All benefits arising as a result of the investment, less than those valued under the other outcome measures;
- **OM2:** Households moved from one category of flood risk to a lower category;
- **OM3:** Households better protected against coastal erosion; and,
- **OM4:** Statutory environmental obligations met through flood and erosion risk management.

The Environment Agency has prepared a standard spreadsheet Partnership Funding calculator (2020 version) to calculate the level of FCERM-GiA available to a scheme based on a series of input parameters. These include whole life option costs, benefits (OM1) and the number of properties moving from one flood risk band to another (OM2s). The Partnership Funding calculator provides a GiA contribution (£) and an initial 'Raw' OM score which can be used to assess the likelihood of a scheme attracting Partnership Funding. The GiA contribution represents a theoretical maximum funding value that could be available based upon the outcomes delivered by the scheme.

A key output of the Partnership Funding calculator is the Partnership Funding score (%). Broadly this percentage shows the amount of the option cost that is eligible to be covered by GiA. The remaining % of the cost would need to be covered by non-GiA sources, such as private or other public sector contributions. In order to be eligible for the GiA contribution, any shortfall in funding needs to be secured, so that the adjusted Partnership Funding score reaches 100%.

For more details and definitions of each term used in the Partnership Funding calculator please refer to the Partnership Funding guidance documents (2021).

### 10.1 Partnership Funding Assessment

Although not typically required or undertaken at this strategic stage, an indicative Partnership Funding assessment has been undertaken to understand potential affordability challenges for the National Economic Leading Options and Local Aspirational Leading Options for the Strategy. Being strategic in nature, each of the leading options involves a series of defence interventions over time and it is therefore not appropriate to apply the Partnership Funding calculator to the option as a whole (the calculator is typically used for scheme level funding).

Therefore, the Partnership Funding calculator has been used to estimate the amount of GiA funding that could be available for **the major capital scheme within each option**.

For the majority of the National Economic and Local Aspirational Leading Options, the major capital scheme does not occur in year 0 (i.e. present day), but typically occurs later on in the appraisal period (e.g. in epoch 2 or 3). In these situations, in order to establish an indicative Partnership Funding score for the major capital scheme, it has been necessary to 'jump forward' in time in the appraisal period, making a number of assumptions to do this:

- The base date for the calculation has been shifted so that it starts at the time of the major scheme. For example, for a major capital scheme at the start of epoch 3, the base date for the calculation was shifted to year 50.
- For capital schemes that rely on other parts of the option being implemented before the scheme, for example, maintenance of existing defences, refurbishment of existing defences or defence lengthening, it has been assumed that the costs and benefits of these earlier interventions have already occurred. These costs have not been included as costs in the Partnership Funding calculators but would still occur in practice and would need to be funded prior to the major capital schemes (likely through non-GiA sources).

- For schemes that reduce flood risk and lead to OM2 benefits, the base date for the calculation of OM2s at risk before the scheme was taken to be the properties at risk at the base date for the scheme (i.e. typically not present day).
- Many schemes in the Strategy reduce erosion risk either by stabilising the position of the coastline / cliff top or by reducing the rate of erosion. To calculate the erosion benefits of a scheme from a different base date, it was first necessary to work out the erosion damages in an undefended scenario if the scheme didn't take place. This is straightforward if the scheme is planned in year 0 as the baseline Do Nothing erosion zones could be used from today's base date. However, if the scheme was not planned until epoch 2 or 3, an assumption had to be made on the coastline position at that point in time. In these situations, the damages / benefits from the original baseline erosion zones were assumed to apply. For example, if an erosion scheme was planned in epoch 3, the Do Nothing damages in epoch 3 were assumed to apply to calculate the benefits, despite uncertainty as to where the cliff line may be at the start of epoch 3 (it could be seaward or landward of the projected line depending on the management interventions prior to this point in time). This is a reasonable assumption, as in a situation where prior management slowed the rate of cliff erosion and the baseline cliff position at the start of epoch 3 was seaward of the baseline erosion zone position, without a new scheme in place catch-up erosion would likely occur resulting in a similar progression of erosion relative to the Do Nothing scenario.
- Crucially, the calculations assume that the GiA funding rules between now and the time of the initial intervention would be unchanged. This is considered unlikely as the funding rules change frequently and are related to central government funding arrangements for FCERM schemes, that can change subject to political changes / objectives / economic climate.

Based on these assumptions, there is a large amount of uncertainty in using the Partnership Funding calculator in this way and therefore the calculations are for illustration purposes only to indicate approximate / hypothetical funding availability and the possible scale of contributions required to implement the major schemes as part of the options. These funding amounts are not precise and should not be used to inform long term investment decisions, but rather act as a guide to the likely level of contributions that will need to be secured in the coming years to enable the recommended FCERM investment to occur in line with the leading options identified in this Strategy. A range of factors could change between the time of writing this report and when schemes may be implemented.

## 10.2 Indicative Partnership Funding Scores

The indicative Partnership Funding scores for the National Economic and Local Aspirational options are presented in Table 10-1. The table includes details of which schemes within the options the calculation has been undertaken for. In some ODUs it was not possible to calculate a partnership funding score and the reasons for this are also outlined in the table.

In summary, the indicative partnership funding scores range between 9% and 46% and therefore significant non-GiA funding contributions will be required to deliver the Strategy capital schemes and leading options. Potential funding sources could include private contributions, local levy, council funds, the flood and coastal resilience innovation fund and other sources. The FCERM teams in BCP and NFDC will explore the different funding sources available and work with the Councils to develop funding strategies to ensure there is confidence in the leading options being delivered. The work undertaken in Section 5 of this report can be used as an evidence base to demonstrate the wider implications of not implementing the Strategy on the broader economy. In line with the adaptive pathway principles, if funding cannot be found, the Strategy leading options have been selected so that there is flexibility to move between options as required (such as to the Backup options).

Where the cost of the Local Aspirational option exceeds that of the National Economic Leading Option, the amount of GiA available for the Local Aspirational option would be capped at the amount eligible for the National Economic Leading Option. In Table 10-1, an asterisk denotes where this could occur.

Further work on the Partnership funding scores for ODU 14 has been undertaken to explore how the funding may change with different scheme timing. This work is presented in Appendix C.

For the Local Option in ODU 18 the Partnership Funding score has been estimated for the open coast part of the scheme in epoch 1 (seawall upgrade, beach nourishment and rock groyne). The objective for this part of the option is primarily to control erosion risk and therefore the calculation of benefits are based on the erosion risk from the open coast only. All properties at risk of erosion have been included in the benefit calculation. For those properties in ODU 18 that are at risk from both erosion and flood risk, further discussion with the Environment Agency will be needed during business case development to agree on an approach to split the benefits between the two parts of

the option (i.e. the erosion and flood risk elements). The funding score provides NFDC with an approximate estimate of funding availability for the open coast part of the option which they would lead on. However, there is potential for the OM1 benefits to be reduced (and therefore the funding score) if some of the flood risk benefits to the properties at risk from erosion are assigned to the business case for the flood risk element of the option (i.e. the flood risk from Sturt Pond direction).

Table 10-1: Indicative Partnership Funding scores

ODU	Option	Capital scheme calculated	Estimated capital cost (£k)	PV maintenance cost following scheme (£k)	PV total cost (£k)	PV benefit (£k)	Assumed benefit period (yrs)	Indicative PF score	Maximum eligible GiA (£k) for upfront costs (in cash terms at time of scheme)	Minimum contribution / saving required (£k) for upfront cost (in cash terms at time of scheme)
1	National: Do Minimum	PF score not calculated – no capital scheme in option								
1	Local: Managed Realignment	PF score not calculated – GiA capped at National option								
2	National: Do Minimum	PF score not calculated – no capital scheme in option								
2	Local: Maintain with Adaptation	PF score not calculated – GiA capped at National option								
3	National: Adaptation / Resilience A	PF score not calculated – few properties at risk. Alternative grants likely available for property level resilience / protection measures								
3	Local: Adaptation / Resilience C	PF score not calculated – GiA capped at National option								
4	National: Sustain C	Epoch 3	1,860	168	2,028	11,536	50	40%	735	1,125
4	Local: Sustain B	Epoch 3	3,787	168	3,955	11,665	50	20%	775*	3,013
5	National: Improve E	Epoch 2	20,125	989	21,114	57,958	80	21%	4,327	15,798
5	Local: Improve B	Epoch 1	20,125	996	21,121	37,417	100	13%	2,536	17,589
6	National: Adaptation / Resilience	PF score not calculated – no capital scheme in option								
7	National: Improve A	Epoch 2	7,991	130	8,121	8,535	80	8%	630	7,360
9	National: Sustain A	Epoch 2	18,876	2,488	21,365	45,966	80	16%	2,985	15,892
10	National: Improve A	Epoch 3	25,487	112	25,598	28,074	50	8%	2,093	23,394
11	National: Do Minimum	PF score not calculated – no capital scheme in option								
11	Local: Adaptation / Resilience	PF score not calculated – GiA capped at National option								
12	National: Improve A	Epoch 2	9,689	1,747	11,436	15,332	80	15%	1,454	8,235
12	Local: Improve C	PF score not calculated – GiA capped at National option								
13	National: Improve C	Epoch 3	7,578	957	8,535	25,596	50	30%	2,268	5,309

ODU	Option	Capital scheme calculated	Estimated capital cost (£k)	PV maintenance cost following scheme (£k)	PV total cost (£k)	PV benefit (£k)	Assumed benefit period (yrs)	Indicative PF score	Maximum eligible GiA (£k) for upfront costs (in cash terms at time of scheme)	Minimum contribution / saving required (£k) for upfront cost (in cash terms at time of scheme)
13	Local: Improve A	Epoch 2	8,972	1,315	10,287	11,785	80	17%	1,537	7,435
14	National: Managed Realignment A	Epoch 1	26,100	4,424	30,525	30,710	90	12%	3,215	22,886
15	National: Do Nothing	PF score not calculated – no capital scheme in option								
16	National: Managed Realignment C	Epoch 2 mid	10,220	1,780	12,000	17,552	65	19%	1,932	8,288
16	Local: Managed Realignment B	Epoch 2	7,371	1,981	9,352	11,690	80	21%	1,564	5,807
16	Local: Managed Realignment A	Epoch 1 mid	4,523	2,010	6,533	8,957	90	29%	1,301	3,221
17	National: Improve C	Epoch 2 mid	17,471	809	18,280	30,711	65	20%	3,457	14,014
17	Local: Improve B	Epoch 2	17,471	823	18,294	19,757	80	15%	2,676	14,795
17	Local: Improve A	Epoch 1 mid	13,625	832	14,458	14,826	90	18%	2,400	11,225
18	National: Improve A (erosion benefits only)	Epoch 1 mid	10,907	1,513	12,420	13,999	90	12%	1,355	9,552

\*denotes where amount of GiA for the Local Option is likely to be capped at the amount available for the National Option within an ODU

# 11. Summary

As part of the development of the Strategy AECOM has undertaken a baseline economic damages assessment and economic appraisal of short list options. The results of the baseline assessment provide an estimate of the economic damages associated with the baseline 'Do Nothing' scenario for the next 100 years. The appraisal of options indicates which of the short list options are the National Economic Leading Options based on the steps outlined in FCERM Appraisal Guidance.

## 11.1 Baseline Damages Assessment

The assessment has included an assessment of national damages (eligible for inclusion in the central government partnership funding process for the Strategy options) and local / regional damages.

The assessment of national damages are those eligible to be included as part of an FCERM-AG (2022) compliant assessment. These economic damages are associated with national losses and comprise physical damages to property and infrastructure and a range of wider economic impacts that are outlined in the Multi-coloured Manual. The damages established in this part of the assessment will form the basis of the cost benefit assessment that will be undertaken on options in the next stages of the Strategy development.

In addition to the assessment of national damages, an assessment of economic damages on the regional/local level has also been undertaken, including impacts to Gross Value Added, the visitor economy, local council income, coastal recreation, health and wellbeing, natural capital and ecosystem services. The impacts considered as part of this regional / local assessment are not eligible to be included as part of an FCERM-AG compliant assessment as they represent local/regional level financial impacts that can theoretically be displaced to other parts of the country when considered on a national level.

In summary, at a national level:

- The flood and erosion risk to the Strategy area over the next 100 years is estimated to lead to Do Nothing damages of £1.21 billion in undiscounted cash terms, and £186.2 million in present value discounted terms. These damages include direct flood and erosion damages to residential and non-residential properties and indirect damages including intangible damages, damages to vehicles, evacuation/temporary accommodation costs, traffic disruption, road damages, education service closure damages, loss of life damages and mental health damages.

In summary, at the regional / local level:

- An assessment to calculate the gross value added (GVA) damages due to flooding and erosion in the Strategy area indicates that with a Do Nothing scenario, over the next 10 years the total negative GVA impact due to flooding and erosion is estimated to be between £3.3million to 8.7million in PV terms and between £4million to £10.5million in undiscounted cash terms. Over 50 years this increases to between £66.1million and £167.3million in PV terms and between £201million and £511million in undiscounted cash terms. Over 100 years this increases to between £120million and £419million in PV terms and between £775million and £3.5billion in undiscounted cash terms. It should be noted that GVA impacts calculated over timespans greater than 10 years are highly uncertain. **For planning, investment and funding decisions it is recommended that the lower range estimates of the GVA values are used.**
- Should businesses respond as expected to the risk of flooding and erosion, the total GVA damages are less than the Do Nothing response for all businesses. Over the next 10 years the negative GVA impact is estimated to be between approximately £2.5million and £6.6million in PV terms or between £3.0million and £7.9million in undiscounted cash terms. Over the next 50 years the impact would be expected to be between approximately £59million and £148million in PV terms and between £181million and £489million in cash terms. Over 100 years this increases to between £109million to £384million in PV terms and between £717million and £3.2billion in cash terms. **For planning, investment and funding decisions it is recommended that the lower range estimates of the GVA values are used as a guide.**
- The Do Nothing scenario is likely to impact the visitor economy of the area, although the magnitude of this impact depends on the reduction in visitor numbers due to coastal erosion and flood risk. Should visitor

numbers reduce by 20% then the impact over 100 years is estimated to be £106million in present value terms and £462million in undiscounted cash terms.

- Multiple car parks within the Strategy area have been identified as being at risk of coastal erosion over the 100-year appraisal period. The total Do Nothing PV damages associated with a loss of car park income are estimated to be approximately £3.2million for 20 years with an equivalent value in undiscounted cash terms of £5.4million. Over the next 50 years, this is predicted to increase to £11.3million PV and £35.9million undiscounted cash damages, increasing to £19.6million PV and £118million undiscounted cash damages over the next 100 years.
- Under the Do Nothing scenario, the beach huts along the frontage are at risk of coastal erosion. Loss of these huts would reduce the income to the council and could also result in beach hut owners visiting other coastal areas instead outside of the Strategy area, thus impacting the visitor economy. Significant private investment may also be lost. The total Do Nothing PV damages are estimated to be approximately £4.3million for 20 years and the equivalent value in undiscounted cash terms is £7.3million. Over the next 50 years, this is predicted to increase to £10.4million PV and £27.4million undiscounted cash damages, increasing to £13.8million PV and £60.0million undiscounted cash damages over the next 100 years.
- The ORVal tool has been interrogated to determine the key greenspace and recreation locations in Christchurch Bay and Harbour and their annual value to the local economy. Given that the majority of the sites are located on the coast the sites are at risk from either flooding or erosion. Flooding of the sites is likely to lead to disruption and cause a short term reduction in visitor numbers and whilst the site is cleared and repaired. Erosion of the sites could lead to a permanent loss of the site and a permanent reduction in visitors and recreation in the area. Should recreation visitor numbers decrease by 20% then the associated Do Nothing damage due to loss of recreation activity is estimated to be £60.2million in present value terms over the next 100 years and £261.4million in undiscounted cash terms over the next 100 years.
- With the Do Nothing scenario, erosion or flooding of the coastal footpaths and cycle routes has the potential to lead to a reduction in the physical activity of the local population and visitors to the area, impacting physical health of the population and mortality rates. The WHO HEAT tool has been used to estimate the impact of this in monetary terms. In summary, over a 20-year period, in present value terms the damages caused by a loss of coastal footpaths is estimated to be £7.5million. In undiscounted cash terms, this equates to approximately £12.7million. Over a 50-year period, in present value terms the damages equate to approximately £18million and in undiscounted cash terms to £47million, and over a 100-year period the present value damages equate to approximately £23.8million and in undiscounted cash terms £103.6million.
- Under the Do Nothing scenario, the existing coastal defences are left to fail over time and no new defences are constructed. This scenario is expected to lead to increased coastal flood and erosion risk and would have an overall negative impact on the delivery of ecosystem services, affecting the ecosystem services which are currently protected.

## 11.2 Appraisal of Short List Options

Economic costs and benefits have been estimated for the short list options and have informed an economic appraisal of the options in line with the FCERM appraisal guidance. The economic costs that have been developed are suitably high level for a Strategic project of this nature and could be subject to change when further, more detailed site specific assessments are undertaken.

In each ODU a National Economic Leading Option has been identified in the economic appraisal. This is the option that has the most robust economic case according to the appraisal guidance, as informed by the benefit cost ratios / net present value. The identification of the National Economic Leading Option has also considered uncertainty and has taken into account the results of key sensitivity tests such as changes to option cost.

The results of the economic appraisal have been used as a key input to the wider option development and appraisal. The Leading Options Report (AECOM, 2024) outlines how the rest of the option appraisal has been undertaken, considering wider factors and local aspirations and objectives. In some ODUs, more than one leading option has been selected in addition to the National Economic Leading Option. Local Aspirational Options and Backup options have also been identified, however, the process by which these have been identified is not covered in this report (see the Leading Options Report for details on this).

FCERM schemes in England are typically jointly funded from central government funding known as FCERM-Grant in Aid (FCERM-GiA) and other funding sources, such as private contributions, local levy, council funds and others. This arrangement is known as Partnership Funding. An indicative Partnership Funding assessment has been undertaken to provide an indication of the potential amount of FCERM-GiA that could be available to help fund the major schemes as part of the leading options. In summary, the indicative partnership funding scores range between 8% and 40% and therefore significant non-GiA funding contributions will be required to deliver the Strategy capital schemes and leading options.

# 12. Appendices

## 12.1 Appendix A: Option Appraisal Sensitivity Tests

### 12.1.1 ODU 3

Table 12-1: ODU 3 economic appraisal sensitivity test +10% cost increase for Adaptation / Resilience A

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Adaptation / Resilience A	130	331	669	5.15	539	X
Adaptation / Resilience B	253	331	669	2.64	416	
Adaptation / Resilience C	776	189	811	1.05	35	
Do Nothing	-	1,000	0	-	-	
Do Minimum	44	1,000	0	-	-44	
Maintain A	204	1,000	0	-	-204	
Maintain B	727	857	143	0.20	-584	

Table 12-2: ODU 3 economic appraisal sensitivity test +25% cost increase for Adaptation / Resilience A

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Adaptation / Resilience A	148	331	669	4.54	522	X
Adaptation / Resilience B	253	331	669	2.64	416	
Adaptation / Resilience C	776	189	811	1.05	35	
Do Nothing	-	1,000	0	-	-	
Do Minimum	44	1,000	0	-	-44	
Maintain A	204	1,000	0	-	-204	
Maintain B	727	857	143	0.20	-584	

## 12.1.2 ODU 4

**Table 12-3: ODU 4 economic appraisal sensitivity test +10% cost increase for Sustain C**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Sustain C (75yr SoP)	1,615	598	3,586	2.22	1,971	X
Improve C (75yr SoP – end of appraisal period)	2,889	334	3,850	1.33	961	
Sustain B (75yr SoP)	3,499	546	3,638	1.04	139	
Do Nothing	-	4,184	0	-	-	
Do Minimum	340	4,176	8	0.02	-332	
Improve B (75yr SoP – end of appraisal period)	4,919	282	3,902	0.79	-1,017	
Maintain	2,684	4,145	39	0.01	-2,645	
Sustain A (75yr SoP)	6,301	546	3,638	0.58	-2,663	
Improve A (75yr SoP – end of appraisal period)	10,818	282	3,902	0.36	-6,916	

**Table 12-4: ODU 4 economic appraisal sensitivity test +25% cost increase for Sustain C**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Sustain C (75yr SoP)	1,762	598	3,586	2.04	1,824	X
Improve C (75yr SoP – end of appraisal period)	2,889	334	3,850	1.33	961	
Sustain B (75yr SoP)	3,499	546	3,638	1.04	139	
Do Nothing	-	4,184	0	-	-	
Do Minimum	340	4,176	8	0.02	-332	
Improve B (75yr SoP – end of appraisal period)	4,919	282	3,902	0.79	-1,017	
Maintain	2,684	4,145	39	0.01	-2,645	
Sustain A (75yr SoP)	6,301	546	3,638	0.58	-2,663	
Improve A (75yr SoP – end of appraisal period)	10,818	282	3,902	0.36	-6,916	

**Table 12-5: ODU 4 economic appraisal sensitivity test +0.9m crest height cost increase for Sustain and Improve Options**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Sustain C (75yr SoP)	2,948	598	3,586	1.22	638	X
Do Nothing	-	4,184	0	-	-	
Do Minimum	340	4,176	8	0.02	-332	
Sustain B (75yr SoP)	4,979	546	3,638	0.73	-1,341	
Maintain	2,684	4,145	39	0.01	-2,645	
Improve C (75yr SoP – end of appraisal period)	5,307	334	3,850	0.73	-1,457	
Improve B (75yr SoP – end of appraisal period)	7,337	282	3,902	0.53	-3,435	
Sustain A (75yr SoP)	8,005	546	3,638	0.45	-4,367	
Improve A (75yr SoP – end of appraisal period)	13,006	282	3,902	0.30	-9,104	

## 12.1.3 ODU 5

**Table 12-6: ODU 5 economic appraisal sensitivity test +10% cost increase for Improve D, E, F**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Improve F (75yr SoP – end of appraisal period)	12,521	3,532	34,424	2.75	21,903	X
Improve E (75yr SoP – end of appraisal period)	15,348	1,532	36,424	2.37	21,076	X
Improve C (75yr SoP – end of appraisal period)	13,660	3,517	34,439	2.52	20,779	X
Sustain F (75yr SoP)	11,059	6,204	31,752	2.87	20,693	X
Improve D (75yr SoP – end of appraisal period)	16,008	1,532	36,424	2.28	20,416	X
Sustain E (75yr SoP)	13,943	4,507	33,449	2.40	19,506	
Sustain D (75yr SoP)	16,547	4,507	33,449	2.02	16,902	
Sustain C (75yr SoP)	15,398	6,187	31,769	2.06	16,371	
Improve B (75yr SoP – end of appraisal period)	20,908	1,424	36,532	1.75	15,624	
Improve A (75yr SoP – end of appraisal period)	22,507	1,424	36,532	1.62	14,025	
Sustain B (75yr SoP)	21,130	4,475	33,481	1.58	12,351	
Sustain A (75yr SoP)	24,435	4,475	33,481	1.37	9,046	
Adaptation / Resilience	11,927	21,430	16,526	1.39	4,599	
Do Minimum	340	37,136	820	2.41	480	
Do Nothing	-	37,956	0	-	-	
Maintain	9,079	30,280	7,676	0.85	-1,403	

**Table 12-7: ODU 5 economic appraisal sensitivity test +25% cost increase for Improve D, E, F**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Improve C (75yr SoP – end of appraisal period)	13,660	3,517	34,439	2.52	20,779	X
Sustain F (75yr SoP)	11,059	6,204	31,752	2.87	20,693	X
Improve F (75yr SoP – end of appraisal period)	14,229	3,532	34,424	2.42	20,195	X
Sustain E (75yr SoP)	13,943	4,507	33,449	2.40	19,506	X
Improve E (75yr SoP – end of appraisal period)	17,441	1,532	36,424	2.09	18,983	X
Improve D (75yr SoP – end of appraisal period)	18,191	1,532	36,424	2.00	18,233	X
Sustain D (75yr SoP)	16,547	4,507	33,449	2.02	16,902	
Sustain C (75yr SoP)	15,398	6,187	31,769	2.06	16,371	
Improve B (75yr SoP – end of appraisal period)	20,908	1,424	36,532	1.75	15,624	
Improve A (75yr SoP – end of appraisal period)	22,507	1,424	36,532	1.62	14,025	
Sustain B (75yr SoP)	21,130	4,475	33,481	1.58	12,351	
Sustain A (75yr SoP)	24,435	4,475	33,481	1.37	9,046	
Adaptation / Resilience	11,927	21,430	16,526	1.39	4,599	
Do Minimum	340	37,136	820	2.41	480	
Do Nothing	-	37,956	0	-	-	
Maintain	9,079	30,280	7,676	0.85	-1,403	

**Table 12-8: ODU 5 economic appraisal sensitivity test +0.9m crest height cost increase for Sustain and Improve Options**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Improve E (75yr SoP – end of appraisal period)	14,912	1,532	36,424	2.44	21,512	X
Improve F (75yr SoP – end of appraisal period)	13,192	3,532	34,424	2.61	21,232	X
Improve D (75yr SoP – end of appraisal period)	16,847	1,532	36,424	2.16	19,577	X
Sustain F (75yr SoP)	13,756	6,204	31,752	2.31	17,996	
Sustain E (75yr SoP)	15,481	4,507	33,449	2.16	17,968	
Improve C (75yr SoP – end of appraisal period)	17,137	3,517	34,439	2.01	17,302	
Improve B (75yr SoP – end of appraisal period)	22,817	1,424	36,532	1.60	13,715	
Sustain D (75yr SoP)	20,048	4,507	33,449	1.67	13,401	
Sustain C (75yr SoP)	19,029	6,187	31,769	1.67	12,740	
Improve A (75yr SoP – end of appraisal period)	27,070	1,424	36,532	1.35	9,462	
Sustain B (75yr SoP)	24,602	4,475	33,481	1.36	8,879	
Adaptation / Resilience	11,927	21,430	16,526	1.39	4,599	
Sustain A (75yr SoP)	30,143	4,475	33,481	1.11	3,338	
Do Minimum	340	37,136	820	2.41	480	
Do Nothing	-	37,956	0	-	-	
Maintain	9,079	30,280	7,676	0.85	-1,403	

## 12.1.4 ODU 6

**Table 12-9: ODU 6 sensitivity test on Sustain B**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV
Sustain B (200yr SoP) – full option	3,303	3,516	3,921	1.19	618
Sustain B (200yr SoP) – north part of unit only (no PLP costs or benefits in south part of unit included)	2,352	6,381	1,056	0.45	-1,296

## 12.1.5 ODU 7

**Table 12-10: ODU 7 economic appraisal sensitivity test +10% cost increase for Improve A (200yr SoP)**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Do Nothing	-	5,388	0	-	-	
Do Minimum	340	5,075	313	0.92	-27	
Maintain	1,975	3,716	1,672	0.85	-303	
Adaptation / Resilience	2,630	2,135	3,253	1.24	632	
Sustain A (75yr SoP)	4,031	645	4,743	1.18	712	
Sustain A (200yr SoP)	4,090	210	5,178	1.27	1,088	
Improve A (75yr SoP – end of appraisal period)	4,060	144	5,244	1.29	1,184	X
Improve A (200yr SoP – end of appraisal period)	4,530	59	5,329	1.18	799	

**Table 12-11: ODU 7 economic appraisal sensitivity test +25% cost increase for Improve A (200yr SoP)**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Do Nothing	-	5,388	0	-	-	
Do Minimum	340	5,075	313	0.92	-27	
Maintain	1,975	3,716	1,672	0.85	-303	
Adaptation / Resilience	2,630	2,135	3,253	1.24	632	
Sustain A (75yr SoP)	4,031	645	4,743	1.18	712	
Sustain A (200yr SoP)	4,090	210	5,178	1.27	1,088	
Improve A (75yr SoP – end of appraisal period)	4,060	144	5,244	1.29	1,184	X
Improve A (200yr SoP – end of appraisal period)	5,148	59	5,329	1.04	182	

**Table 12-12: ODU 7 economic appraisal sensitivity test +0.9m crest height cost increase for Sustain and Improve Options**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Do Nothing	-	5,388	0	-	-	
Do Minimum	340	5,075	313	0.92	-27	
Maintain	1,975	3,716	1,672	0.85	-303	
Adaptation / Resilience	2,630	2,135	3,253	1.24	632	
Sustain A (75yr SoP)	4,843	645	4,743	0.98	-100	
Sustain A (200yr SoP)	4,902	210	5,178	1.06	276	
Improve A (75yr SoP – end of appraisal period)	4,589	144	5,244	1.14	655	
Improve A (200yr SoP – end of appraisal period)	4,648	59	5,329	1.15	681	X

## 12.1.6 ODU 9

**Table 12-13: ODU 9 economic appraisal sensitivity test +10% cost increase for Sustain A (200yr SoP)**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Do Nothing	-	39,803	0	-	-	
Do Minimum	510	38,510	1,293	2.54	783	
Maintain	7,087	33,103	6,700	0.95	-387	
Adaptation / Resilience	8,271	27,249	12,554	1.52	4,283	
Sustain A (75yr SoP)	10,859	5,519	34,284	3.16	23,425	
Sustain A (200yr SoP)	12,056	1,994	37,809	3.14	25,753	
Improve A (75yr SoP – end of appraisal period)	11,760	2,171	37,632	3.20	25,872	
Improve A (200yr SoP – end of appraisal period)	12,082	796	39,007	3.23	26,925	X

**Table 12-14: ODU 9 economic appraisal sensitivity test +25% cost increase for Sustain A (200yr SoP)**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Do Nothing	-	39,803	0	-	-	
Do Minimum	510	38,510	1,293	2.54	783	
Maintain	7,087	33,103	6,700	0.95	-387	
Adaptation / Resilience	8,271	27,249	12,554	1.52	4,283	
Sustain A (75yr SoP)	10,859	5,519	34,284	3.16	23,425	
Sustain A (200yr SoP)	13,700	1,994	37,809	2.76	24,109	
Improve A (75yr SoP – end of appraisal period)	11,760	2,171	37,632	3.20	25,872	
Improve A (200yr SoP – end of appraisal period)	12,082	796	39,007	3.23	26,925	X

**Table 12-15: ODU 9 economic appraisal sensitivity test +0.9m crest height cost increase for Sustain and Improve Options**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Do Nothing	-	39,803	0	-	-	
Do Minimum	510	38,510	1,293	2.54	783	
Maintain	7,087	33,103	6,700	0.95	-387	
Adaptation / Resilience	8,271	27,249	12,554	1.52	4,283	
Sustain A (75yr SoP)	17,292	5,519	34,284	1.98	16,992	
Sustain A (200yr SoP)	17,350	1,994	37,809	2.18	20,459	
Improve A (75yr SoP – end of appraisal period)	16,663	2,171	37,632	2.26	20,969	
Improve A (200yr SoP – end of appraisal period)	16,663	796	39,007	2.34	22,344	X

## 12.1.7 ODU 10

**Table 12-16: ODU 10 economic appraisal sensitivity test +10% cost increase for Improve A (200yr SoP)**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Do Nothing	-	12,747	0	-	-	
Do Minimum	340	12,747	0	-	-340	
Maintain	3,526	12,747	0	-	-3,526	
Adaptation / Resilience	5,473	9,970	2,777	0.51	-2,696	
Improve A (75yr SoP from epoch 3)	8,319	2,254	10,493	1.26	2,174	X
Improve B (75yr SoP from epoch 3)	9,003	2,254	10,493	1.17	1,490	
Improve A (200yr SoP from epoch 3)	9,210	1,623	11,124	1.21	1,914	
Improve B (200yr SoP from epoch 3)	9,071	1,623	11,124	1.23	2,053	

**Table 12-17: ODU 10 economic appraisal sensitivity test +25% cost increase for Improve A (200yr SoP)**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Do Nothing	-	12,747	0	-	-	
Do Minimum	340	12,747	0	-	-340	
Maintain	3,526	12,747	0	-	-3,526	
Adaptation / Resilience	5,473	9,970	2,777	0.51	-2,696	
Improve A (75yr SoP from epoch 3)	8,319	2,254	10,493	1.26	2,174	X
Improve B (75yr SoP from epoch 3)	9,003	2,254	10,493	1.17	1,490	
Improve A (200yr SoP from epoch 3)	10,466	1,623	11,124	1.06	658	
Improve B (200yr SoP from epoch 3)	9,071	1,623	11,124	1.23	2,053	

**Table 12-18: ODU 10 economic appraisal sensitivity test +0.9m crest height cost increase for all Improve Options**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Do Nothing	-	12,747	0	-	-	
Do Minimum	340	12,747	0	-	-340	
Maintain	3,526	12,747	0	-	-3,526	
Adaptation / Resilience	5,473	9,970	2,777	0.51	-2,696	
Improve A (75yr SoP from epoch 3)	8,805	2,254	10,493	1.19	1,688	
Improve B (75yr SoP from epoch 3)	9,622	2,254	10,493	1.09	871	
Improve A (200yr SoP from epoch 3)	8,859	1,623	11,124	1.26	2,265	X
Improve B (200yr SoP from epoch 3)	9,691	1,623	11,124	1.15	1,433	

## 12.1.8 ODU 12

**Table 12-19: ODU 12 economic appraisal sensitivity test +10% cost increase for Improve A**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Do Nothing	-	8,989	-	-	-	
Improve A	9,287	11	8,978	0.97	-309	
Do Minimum	510	8,827	162	0.32	-348	
Improve B	11,398	11	8,978	0.79	-2,420	
Improve C	14,030	11	8,978	0.64	-5,052	
Maintain	9,412	5,535	3,454	0.37	-5,958	

**Table 12-20: ODU 12 economic appraisal sensitivity test +25% cost increase for Improve A**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Do Nothing	-	8,989	-	-	-	
Do Minimum	510	8,827	162	0.32	-348	
Improve A	10,554	11	8,978	0.85	-1,576	
Improve B	11,398	11	8,978	0.79	-2,420	
Improve C	14,030	11	8,978	0.64	-5,052	
Maintain	9,412	5,535	3,454	0.37	-5,958	

**Table 12-21: ODU 12 economic appraisal sensitivity test 50% reduction in beach nourishment costs**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Improve A	7,009	11	8,978	1.28	1,969	X
Do Nothing	-	8,989	-	-	-	
Do Minimum	510	8,827	162	0.32	-348	
Improve B	11,398	11	8,978	0.79	-2,420	
Improve C	12,172	11	8,978	0.74	-3,194	
Maintain	9,412	5,535	3,454	0.37	-5,958	

## 12.1.9 ODU 13

**Table 12-22: ODU 13 economic appraisal sensitivity test +10% cost increase for Improve C**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Improve C	5,974	0	6,946	1.16	972	X
Improve A	6,689	0	6,946	1.04	257	
Do Nothing	-	6,946	0			
Do Minimum	177	6,946	0	-	-177	
Improve B	7,918	0	6,946	0.88	-972	
Managed Realignment A	7,562	369	6,577	0.87	-985	
Maintain	5,310	4,401	2,545	0.48	-2,765	
Managed Realignment B	11,474	369	6,577	0.57	-4,897	

**Table 12-23: ODU 13 economic appraisal sensitivity test +25% cost increase for Improve C**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Improve A	6,689	0	6,946	1.04	257	X
Improve C	6,789	0	6,946	1.02	157	X
Do Nothing	-	6,946	0			
Do Minimum	177	6,946	0	-	-177	
Improve B	7,918	0	6,946	0.88	-972	
Managed Realignment A	7,562	369	6,577	0.87	-985	
Maintain	5,310	4,401	2,545	0.48	-2,765	
Managed Realignment B	11,474	369	6,577	0.57	-4,897	

**Table 12-24: ODU 13 economic appraisal sensitivity test 50% reduction in beach nourishment costs**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Improve C	5,051	0	6,946	1.38	1,895	X
Improve A	5,680	0	6,946	1.22	1,266	
Managed Realignment A	6,553	369	6,577	1.00	24	
Do Nothing	-	6,946	0			
Do Minimum	177	6,946	0	-	-177	
Improve B	7,918	0	6,946	0.88	-972	
Maintain	5,310	4,401	2,545	0.48	-2,765	
Managed Realignment B	10,618	369	6,577	0.62	-4,041	

## 12.1.10 ODU 14

Table 12-25: ODU 14 economic appraisal sensitivity test +10% cost increase for Managed Realignment A

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Managed Realignment B	19,718	8,287	20,077	1.02	359	X
Managed Realignment D	14,218	13,973	14,391	1.01	173	
Maintain	5,927	22,405	5,959	1.01	32	
Do Nothing	-	28,364	-	-	-	
Managed Realignment C	15,317	13,973	14,391	0.94	-926	
Do Minimum	1,228	28,078	286	0.23	-942	
Managed Realignment A	24,432	4,875	23,489	0.96	-943	
Managed Realignment F	11,750	19,150	9,214	0.78	-2,536	
Managed Realignment E	11,836	19,150	9,214	0.78	-2,622	
Improve B	46,061	1,089	27,275	0.59	-18,786	
Improve A	55,527	1,089	27,275	0.49	-28,252	

**Table 12-26: ODU 14 economic appraisal sensitivity test +25% cost increase for Managed Realignment A**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Managed Realignment B	19,718	8,287	20,077	1.02	359	X
Managed Realignment D	14,218	13,973	14,391	1.01	173	
Maintain	5,927	22,405	5,959	1.01	32	
Do Nothing	-	28,364	-	-	-	
Managed Realignment C	15,317	13,973	14,391	0.94	-926	
Do Minimum	1,228	28,078	286	0.23	-942	
Managed Realignment F	11,750	19,150	9,214	0.78	-2,536	
Managed Realignment E	11,836	19,150	9,214	0.78	-2,622	
Managed Realignment A	27,764	4,875	23,489	0.85	-4,275	
Improve B	46,061	1,089	27,275	0.59	-18,786	
Improve A	55,527	1,089	27,275	0.49	-28,252	

## 12.1.11 ODU 16

**Table 12-27: ODU 16 economic appraisal sensitivity test +10% cost increase for Managed Realignment C**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Managed Realignment C	4,846	15	7,400	1.53	2,555	X
Managed Realignment B	5,069	15	7,400	1.46	2,331	
Managed Realignment A	5,612	15	7,400	1.32	1,788	
Maintain	1,791	4,398	3,017	1.68	1,226	
Do Nothing	-	7,415	-	-	-	
Do Minimum	469	7,415	0	-	-469	
Improve	7,954	0	7,415	0.93	-539	

**Table 12-28: ODU 16 economic appraisal sensitivity test +25% cost increase for Managed Realignment C**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Managed Realignment B	5,069	15	7,400	1.46	2,331	X
Managed Realignment C	5,506	15	7,400	1.34	1,894	
Managed Realignment A	5,612	15	7,400	1.32	1,788	
Maintain	1,791	4,398	3,017	1.68	1,226	
Do Nothing	-	7,415	-	-	-	
Do Minimum	469	7,415	0	-	-469	
Improve	7,954	0	7,415	0.93	-539	

**Table 12-29: ODU 16 economic appraisal sensitivity test 50% reduction in beach nourishment costs**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Managed Realignment C	3,071	15	7,400	2.41	4,329	X
Managed Realignment B	3,476	15	7,400	2.13	3,924	
Managed Realignment A	3,692	15	7,400	2.00	3,708	
Maintain	1,472	4,398	3,017	2.05	1,545	
Do Nothing	-	7,415	-	-	-	
Do Minimum	469	7,415	0	-	-469	
Improve	7,954	0	7,415	0.93	-539	

## 12.1.12 ODU 17

**Table 12-30: ODU 17 economic appraisal sensitivity test +10% cost increase for Improve C**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Improve B	9,376	0	11,516	1.23	2,140	X
Improve C	9,961	0	11,516	1.16	1,556	
Maintain	4,110	7,294	4,222	1.03	112	
Improve A	11,471	0	11,516	1.00	45	
Do Nothing	-	11,516	-			
Do Minimum	241	11,516	0	-	-241	
Managed Realignment A	14,021	1,424	10,092	0.72	-3,929	
Managed Realignment B	17,269	0	11,516	0.67	-5,753	

**Table 12-31: ODU 17 economic appraisal sensitivity test +25% cost increase for Improve C**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Improve B	9,376	0	11,516	1.23	2,140	X
Improve C	11,319	0	11,516	1.02	197	
Maintain	4,110	7,294	4,222	1.03	112	
Improve A	11,471	0	11,516	1.00	45	
Do Nothing	-	11,516	-			
Do Minimum	241	11,516	0	-	-241	
Managed Realignment A	14,021	1,424	10,092	0.72	-3,929	
Managed Realignment B	17,269	0	11,516	0.67	-5,753	

## 12.1.13 ODU 18

**Table 12-32: ODU 18 economic appraisal sensitivity test +10% cost increase for Improve A and B**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV (£k)	Leading Economic Option
Maintain	8,872	2,552	8,933	1.01	61	X
Do Nothing	-	11,485	-	-	-	
Do Minimum	963	11,402	83	0.09	-880	
Improve B	12,139	330	11,155	0.92	-984	
Improve A	12,166	330	11,155	0.92	-1,011	
Managed Realignment B	12,269	330	11,155	0.91	-1,114	
Managed Realignment A	11,999	3,867	7,618	0.63	-4,381	

**Table 12-33: ODU 18 economic appraisal sensitivity test +25% cost increase for Improve A and B**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV (£k)	Leading Economic Option
Maintain	8,872	2,552	8,933	1.01	61	X
Do Nothing	-	11,485	-	-	-	
Do Minimum	963	11,402	83	0.09	-880	
Managed Realignment B	12,269	330	11,155	0.91	-1,114	
Improve B	12,139	330	11,155	0.81	-2,639	
Improve A	12,166	330	11,155	0.81	-2,670	
Managed Realignment A	11,999	3,867	7,618	0.63	-4,381	

**Table 12-34: ODU 18 economic appraisal sensitivity test 50% reduction in beach nourishment costs**

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV (£k)	Leading Economic Option
Improve A	9,731	330	11,155	1.15	1,424	X
Improve B	10,257	330	11,155	1.09	898	X
Maintain	8,872	2,552	8,933	1.01	61	
Do Nothing	-	11,485	-	-	-	
Managed Realignment B	11,812	330	11,155	0.94	-657	
Do Minimum	963	11,402	83	0.09	-880	
Managed Realignment A	10,913	3,867	7,618	0.70	-3,295	

## 12.2 Appendix B: Leading Option Cost and Funding Overview

This appendix provides details of the estimated costs for the leading options and indicative FCERM-GiA funding amounts. It also includes details of the key costing assumptions for each of the leading options. All costs shown in the cost breakdowns in Appendix B have been rounded up to the nearest £k.

The FCERM-GiA funding amounts shown should be interpreted with the following points:

- Indicative amounts of FCERM-GiA funding have been calculated for the major capital scheme recommended by the options (if the option has a capital scheme(s)).
- If an option has more than one capital scheme over its duration, funding has only been calculated for the latest scheme in the option (by cost). More GiA funding could potentially be available for the whole option.
- Several limitations / assumptions were made in estimating the indicative GiA funding amounts, such as assuming a jump forward in time to reset the base year, no change in GiA funding rules over time etc. Refer to Section 10 for more details on these assumptions.
- Note that in ODU 14 no GiA-funding is shown for the Local Aspirational option given that the option cost benefit ratio is less than unity
- The option costs shown in this Appendix have been rounded up to the nearest £1k. Therefore the total option cost values may not exactly match those shown earlier in the report which have not been rounded.

The cost and funding breakdown for each ODU uses the following terminology to indicate what type of intervention is included in the option at a particular point in time:

<u>Key</u>	
Main	Patch and repair / small scale maintenance
Refurb	Refurbishment
Beach	Beach management (recycling / nourishment)
PLP	Property level protection / resilience
Scheme	Capital scheme to upgrade defences

## 12.2.1 ODU 1

Leading Option	Description	Assumed interventions and timing for costing														
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)				
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99
National	Do Minimum: small scale repairs to existing defences	Main	Main	Main	Main	Main	Main	Main								
Local	Managed Realignment: maintain toe defences and undertake beach recycling from epoch 1. Erosion of cliff would be controlled but not stopped entirely	Main, Beach	Main, Beach	Refurb, Main, Beach	Main, Beach	Main, Beach	Main, Beach	Main, Beach	Refurb, Main, Beach	Main, Beach	Main, Beach	Main, Beach	Refurb, Main, Beach	Main, Beach	Refurb, Main, Beach	Main, Beach

Leading Option	Description	Indicative option cost (£k) - cash															Total
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)					
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Do Minimum: small scale repairs to existing defences	23.0	46.0	91.0	91.0	183.0	183.0	37.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	654.0
Local	Managed Realignment: maintain toe defences and undertake beach recycling from epoch 1. Erosion of cliff would be controlled but not stopped entirely	40.0	54.0	2,098.0	54.0	40.0	54.0	40.0	2,112.0	40.0	54.0	94.0	2,152.0	94.0	2,152.0	94.0	9,172.0

Leading Option	Description	Indicative option cost (£k) - PV															Total
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)					
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Do Minimum: small scale repairs to existing defences	21.0	36.0	61.0	51.0	86.0	72.0	13.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	340.0
Local	Managed Realignment: maintain toe defences and undertake beach recycling from epoch 1. Erosion of cliff would be controlled but not stopped entirely	37.0	43.0	1,485.0	30.0	19.0	21.0	13.0	648.0	10.0	12.0	16.0	314.0	9.0	158.0	5.0	2,820.0

Leading Option	Description	Indicative GiA funding for major capital scheme (£k) - cash*															Total
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)					
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Do Minimum: small scale repairs to existing defences	Not calculated - no major capital scheme															0
Local	Managed Realignment: maintain toe defences and undertake beach recycling from epoch 1. Erosion of cliff would be controlled but not stopped entirely	Not calculated - GiA to be capped at National option															0

### **ODU 1 costing assumptions – National Option (Do Minimum)**

- Do Minimum involves small scale patch-repair works to existing defences.
- The patch-repair rate from Table 7-2 applied to the existing defence length on annual basis.
- Increased the rate over time to account for deterioration of defences, by doubling the rate in year 5, 10, and 20.
- Assumed unviable to continue with small scale patch-repair maintenance from year 35.

### **ODU 1 costing assumptions – Local Aspirational Option (Managed Realignment)**

- Option involves a series of defence refurbishments to existing defences, assumed to occur every 25 years on average, from year 10-14, with ongoing beach management activities.
- The refurbishments to the existing defences include costs for refurbishing the rock revetment (330m), the rock groynes (250m) and gabions (100m).
- The costs for refurbishment will vary depending on the condition of the existing structures and how this may change over time (which is uncertain). A typical refurbishment for rock structures could involve reprofiling the rock structure, replacing damaged rock and any geotextile / fill materials. A typical refurbishment for a gabion could involve replacing some of the rock fill, repairing the wire mesh and reprofiling / realigning the structure.
- For the rock revetment refurbishment, given the uncertainty in the future condition of the structure and in how much of structure would require refurbishment work, an indicative cost was estimated based on a unit rate of 50% of the unit rate cost of a new small rock revetment (e.g. 1-2m high). This rate was multiplied by the existing defence length.
- For the rock groyne refurbishment, given the uncertainty in the future condition of the structures and in how much of the structures would require refurbishment work, an indicative cost was estimated based on a unit rate of 50% of the unit rate cost of a new rock groyne, approximately 2m high. This rate was multiplied by the existing defence length.
- For the gabion refurbishment, given the uncertainty in the future condition of the structure and in how much of structure would require refurbishment work, an indicative cost was estimated based on a unit rate of 50% of the unit rate cost of a new small rock revetment (e.g. 1-2m high). This rate was multiplied by the existing defence length.
- Beach management assumed to be beach recycling of approximately 2,500m<sup>3</sup> every 2 years.
- Small scale patch-repair assumed to occur annually between defence refurbishments.

## 12.2.2 ODU 2

Leading Option	Description	Assumed interventions and timing for costing														
		Epoch 1 (years)				Epoch 2 (years)					Epoch 3 (years)					
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99
National	Do Minimum: small scale repairs to existing defences	Main	Main	Main	Main	Main	Main	Main								
Local	Maintain with Adaptation: sustain the FCERM service of the Sandbank by holding its form over time and aiming to keep it broadly in its current position. Achieved through beach nourishment and defence maintenance. Property level protection to permanent properties on the Sandbank	Main, Beach	Main, Beach	Refurb, PLP, Main, Beach	Main, Beach	Main, Beach	Main, Beach	Refurb, PLP, Main, Beach	Main, Beach	Main, Beach	Main, Beach	Main, Beach	Refurb, PLP, Main, Beach	Main, Beach	PLP, Main, Beach	Main, Beach

Leading Option	Description	Indicative option cost (£k) - cash															Total
		Epoch 1 (years)				Epoch 2 (years)					Epoch 3 (years)						
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Do Minimum: small scale repairs to existing defences	46.0	91.0	183.0	183.0	365.0	365.0	73.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,306.0
Local	Maintain with Adaptation: sustain the FCERM service of the Sandbank by holding its form over time and aiming to keep it broadly in its current position. Achieved through beach nourishment and defence maintenance. Property level protection to permanent properties on the Sandbank	23.0	37.0	3,688.0	37.0	37.0	37.0	3,688.0	37.0	37.0	3,057.0	3,725.0	1,566.0	3,725.0	74.0	19,805.0	

Leading Option	Description	Indicative option cost (£k) - PV															Total
		Epoch 1 (years)				Epoch 2 (years)					Epoch 3 (years)						
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Do Minimum: small scale repairs to existing defences	43.0	72.0	121.0	102.0	172.0	144.0	26.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	680.0	
Local	Maintain with Adaptation: sustain the FCERM service of the Sandbank by holding its form over time and aiming to keep it broadly in its current position. Achieved through beach nourishment and defence maintenance. Property level protection to permanent properties on the Sandbank	21.0	30.0	2,613.0	21.0	18.0	15.0	13.0	1,133.0	10.0	8.0	602.0	546.0	148.0	274.0	4.0	5,456.0

Leading Option	Description	Indicative GiA funding for major capital scheme (£k) - cash*															Total
		Epoch 1 (years)				Epoch 2 (years)					Epoch 3 (years)						
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Do Minimum: small scale repairs to existing defences	Not calculated - no major capital scheme															0
Local	Maintain with Adaptation: sustain the FCERM service of the Sandbank by holding its form over time and aiming to keep it broadly in its current position. Achieved through beach nourishment and defence maintenance. Property level protection to permanent properties on the Sandbank	Not calculated - GiA to be capped at National option															0

### **ODU 2 costing assumptions – National Option (Do Minimum)**

- Do Minimum involves small scale patch-repair works to existing defences.
- The patch-repair rate from Table 7-2 applied to the existing defence length on annual basis.
- Increased the rate over time to account for deterioration of defences, by doubling the rate in year 5, 10, and 20.
- Assumed unviable to continue with small scale patch-repair maintenance from year 35.

### **ODU 2 costing assumptions – Local Aspirational Option (Maintain with Adaptation)**

- Option involves a series of defence refurbishments to existing defences, assumed to occur every 25 years on average, from year 10-14, with ongoing beach management activities.
- Option also includes beach nourishment scheme(s) in epoch 3.
- The refurbishments to the existing defences include costs for refurbishing the rock revetment (380m), the rock groynes (600m) and seawall (260m).
- The costs for refurbishment will vary depending on the condition of the existing structures and how this may change over time (which is uncertain). A typical refurbishment for rock structures could involve reprofiling the rock structure, replacing damaged rock and any geotextile / fill materials. A typical refurbishment for a seawall could involve repairing toe protection, resurfacing the concrete (e.g. concrete spray), replacing sections of the wall with significant cracks and/or filling cracks.
- For the rock revetment refurbishment, given the uncertainty in the future condition of the structure and in how much of structure would require refurbishment work, an indicative cost was estimated based on a unit rate of 50% of the unit rate cost of a new small rock revetment (e.g. 1-2m high). This rate was multiplied by the existing defence length.
- For the rock groyne refurbishment, given the uncertainty in the future condition of the structures and in how much of the structures would require refurbishment work, an indicative cost was estimated based on a unit rate of 50% of the unit rate cost of a new rock groyne, approximately 2m high. This rate was multiplied by the existing defence length.
- For the seawall refurbishment, given the uncertainty in the future condition of the structure and in how much of structure would require refurbishment work, an indicative cost was estimated based on a unit rate of 50% of the unit rate cost of a new small concrete seawall (e.g. 1m high). This rate was multiplied by the existing defence length.
- Small scale beach management assumed to be beach recycling of approximately 2,500m<sup>3</sup> every 5 years.
- Large scale beach nourishment scheme towards the start of epoch 3 assumed to require approximately 90,000m<sup>3</sup> of material. This volume is uncertain given that this is an intervention in approximately 50-100 years and the beach / Sandbank will evolve in the interim period.
- A top-up beach nourishment of 45,000<sup>3</sup> was assumed to be required during the mid-point of epoch 3 (50% of the original volume).
- Property level protection / resilience measures assumed as £10k per property.
- Small scale patch-repair assumed to occur annually between defence refurbishments.

### 12.2.3 ODU 3

Leading Option	Description	Assumed interventions and timing for costing														
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)				
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99
National	Adaptation / Resilience A: Property level protection	Main	Main	PLP, Main	Main	Main	Main	Main	PLP, Main	Main	Main	Main	PLP, Main	Main	PLP, Main	Main
Local	Adaptation / Resilience C: As per Adaptation / Resilience A, but with localised erosion defences to the access road to Hengistbury Head and around Wick historic landfill site	Main	Main	Scheme, PLP, Main	Main	Main	Main	Main	Scheme, PLP, Main	Main	Main	Main	Scheme, PLP, Main	Main	Scheme, PLP, Main	Main

Leading Option	Description	Indicative option cost (£k) - cash															
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)					Total
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Adaptation / Resilience A: Property level protection	11.0	11.0	51.0	11.0	11.0	11.0	11.0	51.0	11.0	11.0	23.0	63.0	23.0	63.0	23.0	385.0
Local	Adaptation / Resilience C: As per Adaptation / Resilience A, but with localised erosion defences to the access road to Hengistbury Head and around Wick historic landfill site	11.0	11.0	557.0	23.0	23.0	23.0	23.0	557.0	23.0	23.0	46.0	579.0	46.0	579.0	46.0	2,570.0

Leading Option	Description	Indicative option cost (£k) - PV															
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)					Total
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Adaptation / Resilience A: Property level protection	11.0	9.0	36.0	6.0	5.0	5.0	4.0	16.0	3.0	2.0	4.0	9.0	2.0	5.0	1.0	118.0
Local	Adaptation / Resilience C: As per Adaptation / Resilience A, but with localised erosion defences to the access road to Hengistbury Head and around Wick historic landfill site	11.0	9.0	393.0	13.0	11.0	9.0	8.0	171.0	6.0	5.0	8.0	84.0	4.0	43.0	3.0	778.0

Leading Option	Description	Indicative GiA funding for major capital scheme (£k) - cash*															
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)					Total
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Adaptation / Resilience A: Property level protection	Very few properties at risk and funding for PLP/PLR likely to come from different sources															0
Local	Adaptation / Resilience C: As per Adaptation / Resilience A, but with localised erosion defences to the access road to Hengistbury Head and around Wick historic landfill site	Funding for historic landfill / access unlikely to be from GiA. GiA capped at national option															0

### **ODU 3 costing assumptions – National Option (Adaptation / Resilience A)**

- Option involves repeat interventions of property level protection / resilience measures applied to properties at risk.
- Property level protection / resilience measures assumed as £10k per property.
- Option also involves annual small scale patch-repair works to existing defences, based on patch-repair rate from table 7-2. There are relatively few formal defences in this unit and it is sheltered.

### **ODU 3 costing assumptions – Local Aspirational Option (Adaptation / Resilience C)**

- Option involves schemes to provide small scale verge armouring / shoreline stabilisation. The area is sheltered therefore it has been assumed that large new coastal defences would not be required to stabilise the shoreline and prevent it eroding.
- Therefore in the costing the unit rate for the small scale verge armouring / shoreline stabilisation in Table 7-1 has been applied. This rate has been multiplied by a defence length of 1.6km to estimate the scheme cost and has been applied every 25 years to reflect the typically lower service life of this defence type.
- Given the sheltered location of this unit, it is unlikely that the verge armouring / shoreline stabilisation would be required along the full 1.6km of shoreline (around the historic landfill sites and access road) because it is unlikely that the full length of shoreline would be actively eroding. It is more likely that only small lengths of defence would be required and should be targeted as needed, informed by ongoing monitoring and further design work.
- The option also includes property level protection / resilience measures, assumed as £10k per property.
- Option also involves annual small scale patch-repair works to existing defences, based on patch-repair rate from table 7-2. There are relatively few formal defences in this unit and it is sheltered.

## 12.2.4 ODU 4

Leading Option	Description	Assumed interventions and timing for costing														
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)				
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99
National	Sustain C: Raise and lengthen existing setback embankment defence from epoch 1, and then progressively over time to keep pace with sea level rise	Main	Scheme, Main	Main	Main	Scheme, Main	Main	Main	Main	Main	Main	Scheme, Main	Main	Main	Main	Main
Local	Sustain B: As Sustain C, however, repeat maintenance / refurbishments would also be undertaken on the frontline quay wall to prevent erosion of historic landfill	Main	Scheme, Main	Main	Refurb, Main	Scheme, Main	Main	Main	Main	Refurb, Main	Main	Scheme, Main	Refurb, Main	Main	Main	Refurb, Main

Leading Option	Description	Indicative option cost (£k) - cash															
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)					Total
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Sustain C: Raise and lengthen existing setback embankment defence from epoch 1, and then progressively over time to keep pace with sea level rise	34.0	606.0	34.0	34.0	905.0	34.0	34.0	34.0	34.0	34.0	1,929.0	68.0	68.0	68.0	68.0	3,984.0
Local	Sustain B: As Sustain C, however, repeat maintenance / refurbishments would also be undertaken on the frontline quay wall to prevent erosion of historic landfill	34.0	606.0	34.0	1,962.0	870.0	34.0	34.0	34.0	1,962.0	34.0	1,905.0	1,996.0	68.0	68.0	1,996.0	11,637.0

Leading Option	Description	Indicative option cost (£k) - PV															
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)					Total
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Sustain C: Raise and lengthen existing setback embankment defence from epoch 1, and then progressively over time to keep pace with sea level rise	32.0	509.0	23.0	19.0	454.0	14.0	12.0	10.0	9.0	7.0	379.0	9.0	7.0	5.0	4.0	1,493.0
Local	Sustain B: As Sustain C, however, repeat maintenance / refurbishments would also be undertaken on the frontline quay wall to prevent erosion of historic landfill	32.0	509.0	23.0	1,169.0	436.0	14.0	12.0	10.0	519.0	7.0	374.0	253.0	7.0	5.0	129.0	3,499.0

Leading Option	Description	Indicative GiA funding for major capital scheme (£k) - cash*															
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)					Total
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Sustain C: Raise and lengthen existing setback embankment defence from epoch 1, and then progressively over time to keep pace with sea level rise											735.0					735.0
Local	Sustain B: As Sustain C, however, repeat maintenance / refurbishments would also be undertaken on the frontline quay wall to prevent erosion of historic landfill											809.0					809.0

#### **ODU 4 costing assumptions – National Option (Sustain C)**

- Option involves raising and lengthening the setback embankment defence in a series of increments over time, to keep pace with sea level rise.
- The embankment unit rate in table 7-1 was used and was multiplied by the length required to provide the desired standard of protection. The initial embankment raising / lengthening scheme was assumed to occur between years 5-9, the second embankment scheme between years 20-24, and the final embankment scheme between years 50-59.
- The initial scheme in years 5-9 was based on a new defence length of approximately 400m with a <0.5m embankment height. The second scheme in years 20-24 was based on 170m embankment lengthening of approximately 0.5m high, and approximately 400m raising <0.5m. The third scheme in years 50-59 was based on approximately 100m embankment lengthening of >1.3m high, and approximately 1km of embankment raising of >0.5m.
- Option also involves annual small scale patch-repair works to embankment defence, based on patch-repair rate from table 7-2.

#### **ODU 4 costing assumptions – Local Aspirational Option (Sustain B)**

- Option involves the same embankment modifications and assumptions as outlined for the National option above.
- In addition, this option also involves repeat refurbishments of the frontline sheet pile quay wall in years 15-19, 40-44, 60-69 and 90-99.
- The costs for refurbishment of the sheet pile quay wall will vary depending on the condition of the existing structure and how this may change over time (which is uncertain). A typical refurbishment for a quay wall could involve welding of steel patches, cathodic protection, application of corrosion resistant repair/support panels, or replacing sections of wall in a poor condition.
- For the sheet pile quay wall refurbishment, given the uncertainty in the future condition of the structure and in how much of structure would require refurbishment work, an indicative cost was estimated based on a unit rate of 50% of the unit rate cost of a new small sheet pile wall (e.g. 1-2m high). This rate was multiplied by the existing defence length.
- Option also involves annual small scale patch-repair works to embankment defence and sheet pile wall, based on patch-repair rate from Table 7-2.

## 12.2.5 ODU 5

Leading Option	Description	Assumed interventions and timing for costing														
		Epoch 1 (years)				Epoch 2 (years)					Epoch 3 (years)					
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99
National	Improve D-F: Raise height of defences to improve SoP from epoch 2. Maintain / replace frontline defence adjacent to historic landfill site at the Quomps (Improve D shown)	Refurb, PLP, Main	Main	Main	Main	Scheme, Main	Main	Main	Main	Refurb, Main	Main	Main	Refurb, Main	Refurb, Main	Main	Refurb, Main
Local	Improve A-C: As per Improve D-F, except defence height would be raised in epoch 1 rather than epoch 2 (Improve B shown)	Scheme/ Refurb, Main	Main	Main	Main	Main	Main	Main	Main	Refurb, Main	Main	Main	Main	Main	Main	Main
Backup	Adaptation / Resilience: Maintain frontline defences and undertake property level protection to properties at risk of flooding	PLP, Refurb, Main	Main	Main	PLP, Refurb, Main	Main	Main	Main	Main	Refurb, Main	PLP, Main	Main	Refurb, Main	PLP, Main	Main	Refurb, Main

Leading Option	Description	Indicative option cost (£k) - cash															Total
		Epoch 1 (years)				Epoch 2 (years)					Epoch 3 (years)						
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Improve D-F: Raise height of defences to improve SoP from epoch 2. Maintain / replace frontline defence adjacent to historic landfill site at the Quomps (Improve D shown)	3,356.0	23.0	23.0	23.0	19,439.0	23.0	23.0	23.0	2,590.0	23.0	46.0	2,613.0	2,806.0	46.0	2,613.0	33,670.0
Local	Improve A-C: As per Improve D-F, except defence height would be raised in epoch 1 rather than epoch 2 (Improve B shown)	19,936.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	4,401.0	46.0	46.0	46.0	46.0	24,728.0
Backup	Adaptation / Resilience: Maintain frontline defences and undertake property level protection to properties at risk of flooding	2,826.0	23.0	23.0	8,321.0	23.0	23.0	23.0	23.0	6,201.0	3,583.0	46.0	6,224.0	5,666.0	46.0	6,224.0	39,275.0

Leading Option	Description	Indicative option cost (£k) - PV															Total
		Epoch 1 (years)				Epoch 2 (years)					Epoch 3 (years)						
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Improve D-F: Raise height of defences to improve SoP from epoch 2. Maintain / replace frontline defence adjacent to historic landfill site at the Quomps (Improve D shown)	3,355.0	18.0	15.0	13.0	9,768.0	9.0	8.0	7.0	686.0	5.0	8.0	331.0	306.0	3.0	170.0	14,702.0
Local	Improve A-C: As per Improve D-F, except defence height would be raised in epoch 1 rather than epoch 2 (Improve B shown)	19,935.0	18.0	15.0	13.0	11.0	9.0	8.0	7.0	6.0	5.0	867.0	6.0	4.0	3.0	3.0	20,910.0
Backup	Adaptation / Resilience: Maintain frontline defences and undertake property level protection to properties at risk of flooding	2,825.0	18.0	15.0	4,882.0	11.0	9.0	8.0	7.0	1,644.0	772.0	8.0	788.0	534.0	3.0	405.0	11,929.0

Leading Option	Description	Indicative GIA funding for major capital scheme (£k) - cash*															Total
		Epoch 1 (years)				Epoch 2 (years)					Epoch 3 (years)						
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Improve D-F: Raise height of defences to improve SoP from epoch 2. Maintain / replace frontline defence adjacent to historic landfill site at the Quomps (Funding for Improve E shown**)					4,327.0											4,327.0
Local	Improve A-C: As per Improve D-F, except defence height would be raised in epoch 1 rather than epoch 2 (Funding for Improve B shown)	2,536.0															2,536.0

### **ODU 5 costing assumptions – National Option (Improve D-F)**

- Option costing assumptions vary, depending on the defence alignment. For the purpose of this description, the option costings assumptions for Improve D are summarised. This is the highest cost National option and is the option shown in the cost breakdown above.
- Improve D involves a refurbishment of the existing masonry quay wall in the east part of the unit between years 0-5 (due to the existing poor condition of this wall), a scheme to improve the standard of the defences in years 20-24, followed by repeat refurbishments of some of the existing defences in years 40-44, 60-79 and 90-99. The option also involves property level protection / resilience measures in years 0-5 to those properties initially at risk of flooding.
- Given the existing condition of the masonry wall in the east part of the unit, it is likely that more extensive refurbishment works will be required. Refurbishment could involve repointing, resealing, replacement of fill material or complete rebuild of some sections of the wall. Without undertaking structural investigations it is unclear how much of the wall would need to be refurbished, or the extent of any refurbishments. The cost for refurbishment is therefore uncertain, but it has been estimated based on the unit rate of a new small seawall (i.e. approximately 3k per metre length) from Table 7-1, multiplied by the length of the structure. In addition, the risk allowance for this cost has been increased given that the existing structure is masonry and not concrete.
- Repeat refurbishments of the masonry wall in the east part of the unit were assumed to occur in years 20-24, 40-45, 60-69 and 90-99.
- The scheme in years 20-24 as part of this option involves a number of interventions, including a new sheet pile frontline wall in the west part of the unit, raising the existing setback floodwall in the east part of the unit, extending the existing setback floodwall in the east part of the unit, and a repeat refurbishment of the existing masonry wall in the east part of the unit. The rates provided in table 7-1 for the sheet pile wall and floodwall were used for the sheet pile replacement / floodwall modification costs. The refurbishment cost outlined above for the masonry wall was used again for this element of the work.
- The estimated length of the new sheet pile wall in the west part of the unit was approximately 1km. The existing setback floodwall was assumed to be raised by approximately 0.6m and lengthened by approximately 100m with a 1.6m height. It was assumed that the existing setback wall could be used as part of the structure and wouldn't need to be fully replaced (a full replacement would increase the cost). However, further structural investigations would be needed during outline design to confirm this.
- This option also involves annual small scale patch-repair works to defences, based on the patch-repair rate from table 7-2.
- This option also involves property level protection / resilience in the west part of the unit during epoch 1, based on a rate of £10k per property.

### **ODU 5 costing assumptions – Local Aspirational Option (Improve A-C)**

- Option costing assumptions vary, depending on the defence alignment. For the purpose of this description, the option costings assumptions for Improve A are summarised. This is the highest cost Local option and is the option shown in the cost breakdown above.
- The option involves broadly the same interventions as Improve D (outlined above) and the costing assumptions for each intervention are the same. However, the timing of the interventions is different and Improve A does not include a cost for property level protection / resilience in the west part of the unit.

### **ODU 5 costing assumption – Backup Option (Adaptation / Resilience)**

- Option involves a series of defence refurbishments to existing defences and property level protection to properties at risk from flooding.
- Initial defence refurbishment to the existing masonry wall in the east part of the unit assumed to occur in years 0-4. Given the existing condition of the masonry wall in the east part of the unit, it is likely that more extensive refurbishment works will be required. Refurbishment could involve repointing, resealing, replacement of fill material or complete rebuild of some sections of the wall. Without undertaking structural investigations it is unclear how much of the wall would need to be refurbished, or the extent of any refurbishments. The cost for

refurbishment is therefore uncertain, but it has been estimated based on the unit rate of a new small seawall (i.e. approximately 3k per metre length) from Table 7-1, multiplied by the length of the structure. In addition, the risk allowance for this cost has been increased given that the existing structure is masonry and not concrete.

- In years 15-19 a refurbishment of all the defences in the unit has been assumed in the costing. This refurbishment cost is repeated in years 40-45, 60-69 and 90-99.
- Refurbishment costs for the masonry quay wall applied as outlined in the paragraph above.
- For the sheet pile quay wall refurbishment, given the uncertainty in the future condition of the structure and in how much of structure would require refurbishment work, an indicative cost was estimated based on a unit rate of 50% of the unit rate cost of a new small sheet pile wall (e.g. 1-2m high). This rate was multiplied by the existing defence length.
- For the setback floodwall refurbishment, given the uncertainty in the future condition of the structure and in how much of structure would require refurbishment work, an indicative cost was estimated based on a unit rate of 50% of the unit rate cost of a new small floodwall (e.g. 1m high). This rate was multiplied by the existing defence length.
- Property level protection / resilience measures assumed as £10k per property.
- Small scale patch-repair assumed to occur annually between defence refurbishments.

## 12.2.6 ODU 6

Leading Option	Description	Assumed interventions and timing for costing														
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)				
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99
National	Adaption / Resilience: Maintain frontline defences and undertake property level protection to properties at risk of flooding	PLP, Main	Main	Main	Refurb, Main	PLP, Main	Main	Main	Main	Main	Refurb, Main	PLP, Main	Main	Refurb, PLP, Main	Main	Main

Leading Option	Description	Indicative option cost (£k) - cash															
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)					Total
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Adaption / Resilience: Maintain frontline defences and undertake property level protection to properties at risk of flooding	641.0	11.0	11.0	1,589.0	701.0	11.0	11.0	11.0	11.0	1,589.0	953.0	23.0	2,900.0	23.0	23.0	8,508.0

Leading Option	Description	Indicative option cost (£k) - PV															
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)					Total
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Adaption / Resilience: Maintain frontline defences and undertake property level protection to properties at risk of flooding	641.0	9.0	8.0	948.0	352.0	5.0	4.0	3.0	3.0	363.0	187.0	3.0	273.0	2.0	1.0	2,802.0

Leading Option	Description	Indicative GiA funding for major capital scheme (£k) - cash*															
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)					Total
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Adaption / Resilience: Maintain frontline defences and undertake property level protection to properties at risk of flooding	Funding for PLP / PLR likely to be from alternative sources															0

**ODU 6 costing assumptions – National Option (Adaptation / Resilience)**

- Option involves repeat interventions of property level protection / resilience measures applied to properties at risk.
- Property level protection / resilience measures assumed as £10k per property.
- Option also includes refurbishment of the quay walls (masonry wall / sheet pile wall) that provide an FCERM function in years 15-19, 45-59 and 70-79.
- For the masonry wall, given the uncertainty in the future condition of the structure and in how much of structure would require refurbishment work, an indicative cost was estimated based on a unit rate of 50% of the unit rate cost of a new small concrete seawall (e.g. 1m high). This rate was multiplied by the existing defence length.
- For the sheet pile quay wall refurbishment, given the uncertainty in the future condition of the structure and in how much of structure would require refurbishment work, an indicative cost was estimated based on a unit rate of 50% of the unit rate cost of a new small sheet pile wall (e.g. 1-2m high). This rate was multiplied by the existing defence length.
- This option also involves annual small scale patch-repair works to defences, based on the patch-repair rate from table 7-2.

## 12.2.7 ODU 7

Leading Option	Description	Assumed interventions and timing for costing														
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)				
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99
National	Improve A: Raise existing / construct new flood defences in epoch 2	Main	Main	Main	Main	Scheme, Main	Main	Main	Main	Main	Main	Main	Main	Main	Main	Main
Backup	Adaptation / Resilience: Maintain / refurbish existing defences and undertake property level protection to properties at risk of flooding	PLP, Main	Main	Main	Refurb, Main	PLP, Main	Main	Main	Main	Refurb, Main	PLP, Main	Main	Refurb, Main	PLP, Main	Main	Refurb, Main

Leading Option	Description	Indicative option cost (£k) - cash															
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)					Total
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Improve A: Raise existing / construct new flood defences in epoch 2	11.0	11.0	11.0	11.0	8,014.0	23.0	23.0	23.0	23.0	23.0	46.0	46.0	46.0	46.0	46.0	8,403.0
Backup	Adaptation / Resilience: Maintain / refurbish existing defences and undertake property level protection to properties at risk of flooding	41.0	11.0	11.0	1,821.0	746.0	11.0	11.0	11.0	1,821.0	821.0	23.0	1,833.0	878.0	23.0	1,833.0	9,895.0

Leading Option	Description	Indicative option cost (£k) - PV															
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)					Total
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Improve A: Raise existing / construct new flood defences in epoch 2	11.0	9.0	8.0	6.0	4,027.0	9.0	8.0	7.0	6.0	5.0	8.0	6.0	4.0	3.0	3.0	4,120.0
Backup	Adaptation / Resilience: Maintain / refurbish existing defences and undertake property level protection to properties at risk of flooding	41.0	9.0	8.0	1,087.0	375.0	5.0	4.0	3.0	483.0	177.0	4.0	232.0	83.0	2.0	119.0	2,632.0

Leading Option	Description	Indicative GiA funding for major capital scheme (£k) - cash*															
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)					Total
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Improve A: Raise existing / construct new flood defences in epoch 2					630.0											630.0
Backup	Adaptation / Resilience: Maintain / refurbish existing defences and undertake property level protection to properties at risk of flooding	Funding for PLP / PLR likely to be from alternative sources															0

### **ODU 7 costing assumptions – National Option (Improve A)**

- Option involves a scheme in years 20-24 to increase the standard of protection of the existing defences. It has been assumed that the existing defences would be raised and would be used as part of the new structure. A full replacement of the existing defences would likely increase the cost of the scheme.
- The scheme costs have been estimated using the unit rates for a sheet pile wall and a setback concrete floodwall from Table 7-1. The total length of sheet pile wall assumed was approximately 570m, and the total length of concrete floodwall was approximately 190m, at approximately 1.5m height. The scheme alignment will need further thought / consideration during outline design which could alter the option cost.
- For the frontline parts of the assumed scheme alignment, the risk allowance for the costs was increased to account for the complexity associated with the location, such as structures close to the water's edge, potential for construction from the river etc, and any complexities associated with the mechanical assets at Brigands Creek.
- Further consideration on the construction approach, and also the design solution around Brigands Creek would be required during outline design. This has the potential to increase costs of the scheme. In addition, whilst the sheet pile wall cost has been used for a large part of the scheme length, this may not be the defence measure that is used after outline design, so costs could change as a result.
- This option also involves annual small scale patch-repair works to defences, based on the patch-repair rate from Table 7-2.

### **ODU 7 costing assumptions – Backup Option (Adaptation / Resilience)**

- Option involves repeat interventions of property level protection / resilience measures applied to properties at risk.
- Property level protection / resilience measures assumed as £10k per property.
- The option also involves repeat refurbishments to the existing defences around ODU 7. The costs for refurbishment will vary depending on the condition of the existing structures and how this may change over time (which is uncertain). The existing defences are typically comprised of masonry walls, sheet pile walls and embankments.
- A typical refurbishment for the masonry wall structures could involve repointing, replacing any damaged sections and refilling behind the structure. A typical refurbishment for a quay wall could involve welding of steel patches, cathodic protection, application of corrosion resistant repair/support panels, or replacing sections of wall in a poor condition. A typical refurbishment for an embankment section could involve reprofiling, infilling any voids and replacing the impermeable core material.
- For the frontline structures, given the uncertainty in the future condition of the structures and in how much of structures would require refurbishment work, an indicative cost was estimated based on a unit rate of 50% of the unit rate cost of a new small concrete seawall (e.g. 1m high). This rate was multiplied by the existing frontline defence length. For the frontline refurbishment costs, the risk allowance was also increased to account for the uncertainties associate with working in the river bank / space constraints.
- For the setback structures, given the uncertainty in the future condition of the structures and in how much of structures would require refurbishment work, an indicative cost was estimated based on a unit rate of 50% of the unit rate cost of a new small concrete floodwall (e.g. 1m high). This rate was multiplied by the existing setback defence length.
- This option also involves annual small scale patch-repair works to defences, based on the patch-repair rate from Table 7-2.

## 12.2.8 ODU 9

Leading Option	Description	Assumed interventions and timing for costing														
		Epoch 1 (years)				Epoch 2 (years)					Epoch 3 (years)					
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99
National	Sustain A: Raise existing / construct new flood defences from epoch 2 and then raise over time to keep pace with sea level rise. Defences would defend Stanpit historic landfill site	Main	Main	Main	Main	Scheme, Main	Main	Main	Main	Main	Main	Scheme, Main	Main	Main	Main	Main
Backup	Adaptation / Resilience: Maintain / refurbish existing defences and undertake property level protection to properties at risk of flooding	PLP, Main	Main	Main	Refurb, Main	Scheme / refurb**, PLP, Main	Main	Main	Main	Refurb, Main	Main	PLP, Main	Refurb, Main	PLP, Main	Main	Refurb, Main

Leading Option	Description	Indicative option cost (£k) - cash															
		Epoch 1 (years)				Epoch 2 (years)					Epoch 3 (years)						Total
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Sustain A: Raise existing / construct new flood defences from epoch 2 and then raise over time to keep pace with sea level rise. Defences would defend Stanpit historic landfill site	34.0	34.0	34.0	34.0	18,910.0	34.0	34.0	34.0	34.0	34.0	6,504.0	68.0	68.0	68.0	68.0	25,992.0
Backup	Adaptation / Resilience: Maintain / refurbish existing defences and undertake property level protection to properties at risk of flooding	54.0	34.0	34.0	1,811.0	8,945.0	34.0	34.0	34.0	1,811.0	34.0	4,528.0	1,845.0	8,738.0	68.0	1,845.0	29,849.0

Leading Option	Description	Indicative option cost (£k) - PV															
		Epoch 1 (years)				Epoch 2 (years)					Epoch 3 (years)						Total
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Sustain A: Raise existing / construct new flood defences from epoch 2 and then raise over time to keep pace with sea level rise. Defences would defend Stanpit historic landfill site	32.0	27.0	23.0	19.0	9,503.0	14.0	12.0	10.0	9.0	7.0	1,281.0	9.0	7.0	5.0	4.0	10,962.0
Backup	Adaptation / Resilience: Maintain / refurbish existing defences and undertake property level protection to properties at risk of flooding	52.0	27.0	23.0	1,079.0	4,494.0	14.0	12.0	10.0	480.0	7.0	892.0	234.0	823.0	5.0	120.0	8,272.0

Leading Option	Description	Indicative GIA funding for major capital scheme (£k) - cash*															
		Epoch 1 (years)				Epoch 2 (years)					Epoch 3 (years)						Total
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Sustain A: Raise existing / construct new flood defences from epoch 2 and then raise over time to keep pace with sea level rise. Defences would defend Stanpit historic landfill site					2,985.0											2,985.0
Backup	Adaptation / Resilience: Maintain / refurbish existing defences and undertake property level protection to properties at risk of flooding	Funding for PLP / PLR likely to be from alternative sources															0

### **ODU 9 costing assumptions – National Option (Sustain A)**

- Option involves a scheme in years 20-24 and in years 50-59 to increase the standard of protection of the existing defences over time. Where there are existing defences, it has been assumed that they would be raised and be used as part of the new structure. A full replacement of the existing defences would likely increase the cost of the scheme.
- The scheme costs in years 20-24 have been estimated using the unit rates for a floodwall and an armoured embankment from Table 7-1. The floodwall cost has been applied to the length of the defence adjacent to the River Avon and the armoured embankment cost has been applied to the defences around Stanpit recreation ground.
- For the parts of the scheme alignment around Stanpit recreation ground, the risk allowance for the costs was increased to account for potential cost increases associated with working close to potentially contaminated land.
- The scheme costs in years 50-59 involves raising the defence structure built in years 20-24. The costs been estimated using the same unit rates for a floodwall and armoured embankment.
- This option also involves annual small scale patch-repair works to defences, based on the patch-repair rate from Table 7-2.

### **ODU 9 costing assumptions – Backup Option (Adaptation / Resilience)**

- Option involves repeat interventions of property level protection / resilience measures applied to properties at risk.
- Property level protection / resilience measures assumed as £10k per property.
- The option also involves repeat refurbishments to the existing defences around ODU 9. The costs for refurbishment will vary depending on the condition of the existing structures and how this may change over time (which is uncertain). The existing defences are typically comprised of floodwalls and quay walls.
- For the quay wall refurbishments, given the uncertainty in the future condition of the structure and in how much of structure would require refurbishment work, an indicative cost was estimated based on a unit rate of 50% of the unit rate cost of a new small sheet pile wall (e.g. 1-2m high). This rate was multiplied by the existing defence length.
- For the floodwalls, given the uncertainty in the future condition of the structures and in how much of structures would require refurbishment work, an indicative cost was estimated based on a unit rate of 50% of the unit rate cost of a new small concrete floodwall (e.g. 1m high). This rate was multiplied by the existing setback defence length.
- Currently there is a natural verge / embankment around the Stanpit recreation ground. It was assumed in the costing for this option that this would need to be strengthened in the future to prevent erosion in years 20-24. The same approach to costing this intervention as used in the National Option was applied (see above).
- This option also involves annual small scale patch-repair works to defences, based on the patch-repair rate from Table 7-2.

## 12.2.9 ODU 10

Leading Option	Description	Assumed interventions and timing for costing														
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)				
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99
National	Improve A: Property level protection to properties at risk in epochs 1 and 2. Construct new flood defences in epoch 3 to increase SoP against flooding	PLP, Main	Main	Main	Refurb, Main	PLP, Main	Main	Main	Main	Main	Main	Scheme, Main	Main	Main	Main	Main
Backup	Adaptation / Resilience: Maintain / refurbish existing defences and undertake property level protection to properties at risk of flooding	PLP, Main	Main	Main	Refurb, Main	PLP, Main	Main	Main	Main	Refurb, Main	Main	PLP, Main	Refurb, Main	PLP, Main	Main	Refurb, Main

Leading Option	Description	Indicative option cost (£k) - cash															
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)					Total
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Improve A: Property level protection to properties at risk in epochs 1 and 2. Construct new flood defences in epoch 3 to increase SoP against flooding	763.0	23.0	23.0	3,056.0	1,333.0	23.0	23.0	23.0	23.0	23.0	25,533.0	46.0	46.0	46.0	46.0	31,030.0
Backup	Adaptation / Resilience: Maintain / refurbish existing defences and undertake property level protection to properties at risk of flooding	761.0	23.0	23.0	3,056.0	1,333.0	23.0	23.0	23.0	3,056.0	23.0	1,856.0	3,079.0	4,136.0	46.0	3,079.0	20,540.0

Leading Option	Description	Indicative option cost (£k) - PV															
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)					Total
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Improve A: Property level protection to properties at risk in epochs 1 and 2. Construct new flood defences in epoch 3 to increase SoP against flooding	761.0	18.0	15.0	1,823.0	669.0	9.0	8.0	7.0	6.0	5.0	5,036.0	6.0	4.0	3.0	3.0	8,373.0
Backup	Adaptation / Resilience: Maintain / refurbish existing defences and undertake property level protection to properties at risk of flooding	761.0	18.0	15.0	1,823.0	669.0	9.0	8.0	7.0	810.0	5.0	365.0	390.0	390.0	3.0	200.0	5,473.0

Leading Option	Description	Indicative GIa funding for major capital scheme (£k) - cash*															
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)					Total
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Improve A: Property level protection to properties at risk in epochs 1 and 2. Construct new flood defences in epoch 3 to increase SoP against flooding											2,093.0					2,093.0
Backup	Adaptation / Resilience: Maintain / refurbish existing defences and undertake property level protection to properties at risk of flooding	Funding for PLP / PLR likely to be from alternative sources															0

### **ODU 10 costing assumptions – National Option (Improve A)**

- Option involves a scheme in years 50-59 to increase the standard of protection of the existing defences. Prior to this property level protection / resilience would be used to manage the flood risk and the existing quay walls would be refurbished.
- Property level protection / resilience measures assumed as £10k per property.
- The costs for refurbishment of the existing quay walls will vary depending on the condition of the existing structures and how this may change over time (which is uncertain). The existing defences are typically comprised of masonry / concrete form.
- A typical refurbishment for the masonry wall structures could involve repointing, replacing any damaged sections and refilling behind the structure. A typical refurbishment for the concrete wall structures could involve repairing toe protection, resurfacing the concrete (e.g. concrete spray), replacing sections of the wall with significant cracks and/or filling cracks.
- For the quay wall structures, given the uncertainty in the future condition of the structures and in how much of structures would require refurbishment work, an indicative cost was estimated based on a unit rate of 50% of the unit rate cost of a new small concrete seawall (e.g. 1m high).
- The scheme costs in years 50-59 have been estimated using the unit rates for a sheet pile wall from Table 7-1. The sheet pile cost has been applied to the length of the defence alignment, approximately 3km. During design the form and finish of the wall would need to be determined and it is possible that a sheet pile construction would not be preferred which could change the option costs.
- This option also involves annual small scale patch-repair works to defences, based on the patch-repair rate from Table 7-2.

### **ODU 10 costing assumptions – Backup Option (Adaptation / Resilience)**

- Option involves repeat refurbishments of the existing frontline quay walls and property level protection / resilience measures to manage the increase in flood risk.
- Property level protection / resilience measures assumed as £10k per property.
- The costing for the refurbishments of the quay walls follows the same approach as outlined above for the National option, with the refurbishments repeated in years 15-19, 40-44, 60-69 and 90-99.
- This option also involves annual small scale patch-repair works to defences, based on the patch-repair rate from Table 7-2.

## 12.2.10 ODU 11

Leading Option	Description	Assumed interventions and timing for costing														
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)				
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99
National	Do Minimum: small scale repairs to existing defences	Main	Main	Main	Main	Main	Main	Main								
Local	Adaptation / Resilience: Property level protection to properties at risk. Maintain existing quay walls	PLP, Main	Main	Refurb, Main	Main	PLP, Main	Main	Main	Refurb, Main	Main	Main	PLP, Main	Refurb, Main	Main	Refurb, Main	Main

Leading Option	Description	Indicative option cost (£k) - cash															
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)					Total
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Do Minimum: small scale repairs to existing defences	23.0	46.0	91.0	91.0	183.0	183.0	37.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	654.0
Local	Adaptation / Resilience: Property level protection to properties at risk. Maintain existing quay walls	101.0	11.0	7,517.0	11.0	121.0	11.0	11.0	7,517.0	11.0	11.0	143.0	7,529.0	143.0	7,529.0	23.0	30,689.0

Leading Option	Description	Indicative option cost (£k) - PV															
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)					Total
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Do Minimum: small scale repairs to existing defences	21.0	36.0	61.0	51.0	86.0	72.0	13.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	340.0
Local	Adaptation / Resilience: Property level protection to properties at risk. Maintain existing quay walls	101.0	9.0	5,329.0	6.0	61.0	5.0	4.0	2,310.0	3.0	2.0	28.0	1,105.0	14.0	554.0	1.0	9,532.0

Leading Option	Description	Indicative GiA funding for major capital scheme (£k) - cash*															
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)					Total
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Do Minimum: small scale repairs to existing defences	Not calculated - no major capital scheme															0
Local	Adaptation / Resilience: Property level protection to properties at risk. Maintain existing quay walls	Not calculated - GiA to be capped at National option															0

### **ODU 11 costing assumptions – National Option (Do Minimum)**

- Do Minimum involves small scale patch-repair works to existing defences.
- The patch-repair rate from Table 7-2 applied to the existing defence length on annual basis.
- Increased the rate over time to account for deterioration of defences, by doubling the rate in year 5, 10, and 20.
- Assumed unviable to continue with small scale patch-repair maintenance from year 35.

### **ODU 11 costing assumptions – Local Option (Adaptation / Resilience)**

- Option involves repeat refurbishments of the existing frontline quay walls and property level protection / resilience measures to manage the increase in flood risk.
- Property level protection / resilience measures assumed as £10k per property.
- The costs for refurbishment will vary depending on the condition of the existing structures and how this may change over time (which is uncertain). The existing structures in this unit are primarily sheet pile quay walls. A typical refurbishment for a sheet pile quay wall could involve welding of steel patches, cathodic protection, application of corrosion resistant repair/support panels, or replacing sections of wall in a poor condition.
- For the sheet pile quay wall refurbishment, given the uncertainty in the future condition of the structure and in how much of the structure would require refurbishment work, an indicative cost was estimated based on the unit rate cost of a new small sheet pile wall (e.g. 1-2m high) from Table 7-1. The full unit rate was applied here given the large size of the sheet pile quay wall, particularly at Mudeford Quay. This rate was multiplied by the existing defence length. The risk allowance was also increased to account for the uncertainties associate with potential working close the Run navigation channel / fast flowing water.
- Refurbishments were assumed to occur in years 10-14, 35-39, 60-69 and 80-89.
- This option also involves annual small scale patch-repair works to defences, based on the patch-repair rate from Table 7-2.

## 12.2.11 ODU 12

Leading Option	Description	Assumed interventions and timing for costing														
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)				
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99
National	Improve A: Maintain / refurbish existing defences from epoch 1. Undertake beach nourishment from epoch 2 as well as new groynes and raising Avon beach seawall. Localised property level protection in epoch 3 to manage flood risk	Main, Beach	Main, Beach	Refurb, Main, Beach	Main, Beach	Scheme, Main, Beach	Main, Beach	Main, Beach	Main, Beach	Main, Beach	Main, Beach	Main, Beach, PLP	Main, Beach	Main, Beach	Main, Beach	
Local	Improve C: As per Improve A, but also undertake broader public realm enhancements and intervene sooner	Main, Beach	Main, Beach	Scheme, Main, Beach	Main, Beach	Main, Beach	Main, Beach	Main, Beach	Main, Beach	Main, Beach	Main, Beach	Main, Beach, PLP	Main, beach	Main, Beach	Main, Beach	
Backup	Scaled back Improve: Reduce beach nourishment volume / scale of defence improvements to reduce cost and improve affordability	As per National / Local, subject to timing followed														

Leading Option	Description	Indicative option cost (£k) - cash															Total	
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)						
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99		
National	Improve A: Maintain / refurbish existing defences from epoch 1. Undertake beach nourishment from epoch 2 as well as new groynes and raising Avon beach seawall. Localised property level protection in epoch 3 to manage flood risk	49.0	49.0	3,499.0	49.0	9,737.0	49.0	49.0	49.0	49.0	49.0	2,097.0	213.0	97.0	2,145.0	97.0	2,145.0	20,373.0
Local	Improve C: As per Improve A, but also undertake broader public realm enhancements and intervene sooner	49.0	49.0	18,216.0	49.0	49.0	49.0	49.0	49.0	49.0	2,097.0	256.0	140.0	2,188.0	140.0	2,188.0	25,617.0	

Leading Option	Description	Indicative option cost (£k) - PV															Total
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)					
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Improve A: Maintain / refurbish existing defences from epoch 1. Undertake beach nourishment from epoch 2 as well as new groynes and raising Avon beach seawall. Localised property level protection in epoch 3 to manage flood risk	46.0	39.0	2,479.0	28.0	4,892.0	20.0	17.0	14.0	12.0	479.0	40.0	13.0	233.0	7.0	124.0	8,443.0
Local	Improve C: As per Improve A, but also undertake broader public realm enhancements and intervene sooner	46.0	39.0	12,912.0	28.0	23.0	20.0	17.0	14.0	12.0	479.0	47.0	18.0	237.0	11.0	126.0	14,029.0

Leading Option	Description	Indicative GIA funding for major capital scheme (£k) - cash*															Total
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)					
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Improve A: Maintain / refurbish existing defences from epoch 1. Undertake beach nourishment from epoch 2 as well as new groynes and raising Avon beach seawall. Localised property level protection in epoch 3 to manage flood risk					1,454.0											1,454.0
Local	Improve C: As per Improve A, but also undertake broader public realm enhancements and intervene sooner	Capped at National option amount															0

### **ODU 12 costing assumptions – National Option (Improve A)**

- Option involves a scheme in years 20-24 to upgrade the coastal defences. It also includes a refurbishment of the existing defences in years 10-14, as well as ongoing beach management works. An area of property level protection / resilience is also outlined in years 50-59.
- The refurbishments to the existing defences in years 10-14 include costs for refurbishing the seawall (1.7km) and the rock revetment (170m).
- The costs for refurbishment will vary depending on the condition of the existing structures and how this may change over time (which is uncertain). A typical refurbishment for rock structures could involve reprofiling the rock structure, replacing damaged rock and any geotextile / fill materials. A typical refurbishment for a seawall could involve repairing toe protection, resurfacing the concrete (e.g. concrete spray), replacing sections of the wall with significant cracks and/or filling cracks.
- For the rock revetment refurbishment, given the uncertainty in the future condition of the structure and in how much of structure would require refurbishment work, an indicative cost was estimated based on a unit rate of 50% of the unit rate cost of a new small rock revetment (e.g. 1-2m high). This rate was multiplied by the existing defence length.
- For the seawall refurbishment, given the uncertainty in the future condition of the structure and in how much of structure would require refurbishment work, an indicative cost was estimated based on a unit rate of 50% of the unit rate cost of a new small concrete seawall (e.g. 1m high). This rate was multiplied by the existing defence length.
- The scheme in year 20-24 includes costs for crest raising of the existing Avon Beach seawall, new rock groynes / rock groyne upgrades and a beach nourishment scheme.
- Costs for crest raising of the Avon Beach seawall were based of the crest raising unit cost in Table 7-1 over a length of approximately 980m. This unit rate assumes the existing seawall structure can accommodate the additional loadings from the crest raising and is structurally sound. However, if a new structure is required to support the crest raising, then the cost of this option could increase.
- The cost of the rock groyne upgrades were based on the rock groyne cost from Table 7-1. It is beyond the remit of the Strategy to design a rock groyne field and therefore it was necessary to assume a layout / geometry for the structures. Rock groynes of 50m length, with 150m spacing between structures were assumed (similar to the structures to the east at Highcliffe).
- The cost of beach nourishment was estimated based on a volume of 120,000m<sup>3</sup> of material. This volume is uncertain give that this is an intervention in the future and the beach will evolve in the interim period.
- A top-up beach nourishment of 60,000<sup>3</sup> was assumed to be required in years 45-49, 70-79 and 90-99 (50% of the original volume). In addition, beach recycling of approximately 2,500m<sup>3</sup> also assumed every 5 years.
- Property level protection / resilience measures assumed as £10k per property.
- Small scale patch-repair assumed to occur annually between defence refurbishments.

### **ODU 12 costing assumptions – Local Option (Improve C)**

- Option involves undertaking the scheme earlier in years 10-14 to upgrade the coastal defences / undertake beach nourishment. This would be undertaken alongside the refurbishment to the seawall and rock revetment. An area of property level protection / resilience is also outlined in years 50-59.
- The same costing assumptions for the refurbishment and defence upgrades / beach nourishment as outlined in the National option have been applied.
- The defence upgrades also include a cost for broader public realm enhancements / promenade raising. This cost has been based on a cost for land raising from Table 7-1, assuming 4,300m<sup>3</sup> of raising in total along the promenade. It is likely that this cost will vary considerably based on the design of any public realm enhancements.
- The top up beach nourishment was also applied in this option, as well as the property level protection and small scale patch-repair, following the same assumptions as for the National option.

## 12.2.12 ODU 13

Leading Option	Description	Assumed interventions and timing for costing														
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)				
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99
National	Improve C: In epoch 1 construct rock armour defence at east end of unit to reduce outflanking risk. In epoch 1 and 2 maintain existing defences and undertake beach recycling. From epoch 3 undertake beach nourishment, construct new rock groynes and refurbish defences	Main, Beach	Main, Beach	Scheme, Main, Beach	Main, Beach	Refurb, Main, Beach	Main, Beach	Main, Beach	Main, Beach	Main, Beach	Main, Beach	Scheme, Main, Beach	Main, Beach	Main, Beach	Main, Beach	Main, Beach
Local	Improve A: As per Improve C, except the beach nourishment in epoch 3 would be brought forward to be undertaken from epoch 2. New rock groynes from epoch 3	Main, Beach	Main, Beach	Scheme, Main, Beach	Main, Beach	Refurb, Main, Beach	Main, Beach	Main, Beach	Main, Beach	Main, Beach	Main, Beach	Scheme, Main, Beach	Main, Beach	Main, Beach	Main, Beach	Main, Beach
Backup	Scaled back Improve: Reduce beach nourishment volume / scale of defence improvements to reduce cost and improve affordability	As per National / Local, subject to timing followed														

Leading Option	Description	Indicative option cost (£k) - cash															Total	
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)						
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99		
National	Improve C: In epoch 1 construct rock armour defence at east end of unit to reduce outflanking risk. In epoch 1 and 2 maintain existing defences and undertake beach recycling. From epoch 3 undertake beach nourishment, construct new rock groynes and refurbish defences	60.0	60.0	740.0	60.0	5,919.0	60.0	60.0	60.0	60.0	60.0	60.0	7,698.0	120.0	1,676.0	120.0	120.0	16,873.0
Local	Improve A: As per Improve C, except the beach nourishment in epoch 3 would be brought forward to be undertaken from epoch 2. New rock groynes from epoch 3	60.0	60.0	740.0	60.0	9,032.0	60.0	60.0	60.0	60.0	60.0	6,142.0	120.0	1,676.0	120.0	120.0	18,430.0	

Leading Option	Description	Indicative option cost (£k) - PV															Total
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)					
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Improve C: In epoch 1 construct rock armour defence at east end of unit to reduce outflanking risk. In epoch 1 and 2 maintain existing defences and undertake beach recycling. From epoch 3 undertake beach nourishment, construct new rock groynes and refurbish defences	57.0	48.0	522.0	34.0	2,973.0	24.0	20.0	18.0	15.0	13.0	1,516.0	16.0	158.0	9.0	7.0	5,430.0
Local	Improve A: As per Improve C, except the beach nourishment in epoch 3 would be brought forward to be undertaken from epoch 2. New rock groynes from epoch 3	57.0	48.0	522.0	34.0	4,538.0	24.0	20.0	18.0	15.0	13.0	1,209.0	16.0	158.0	9.0	7.0	6,688.0

Leading Option	Description	Indicative GIA funding for major capital scheme (£k) - cash*															Total
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)					
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Improve C: In epoch 1 construct rock armour defence at east end of unit to reduce outflanking risk. In epoch 1 and 2 maintain existing defences and undertake beach recycling. From epoch 3 undertake beach nourishment, construct new rock groynes and refurbish defences											2,268.0					2,268.0
Local	Improve A: As per Improve C, except the beach nourishment in epoch 3 would be brought forward to be undertaken from epoch 2. New rock groynes from epoch 3					1,537.0											1,537.0

### **ODU 13 costing assumptions – National Option (Improve C)**

- Option involves a scheme in years 10-14 to construct a defence at the eastern end of the unit to reduce the outflanking risk. At the start of epoch 2 the option includes a refurbishment of the existing defences to extend their service life and then between years 50-59 a scheme to upgrade the rock groynes and undertake beach nourishment.
- There is uncertainty as to the design of the outflanking defence at the eastern end of the unit. For the purposes of costing it was assumed that the defence would consist of a rock structure, such as rock revetment or breakwater. The cost of this was based on the rock revetment costs in Table 7-1, assuming a geometry of approximately 80m long.
- The costs for refurbishment of the existing defences at the start of epoch 2 will vary depending on the condition of the existing structures and how this may change over time (which is uncertain). A typical refurbishment for rock structures could involve reprofiling the rock structure, replacing damaged rock and any geotextile / fill materials.
- For the rock revetment refurbishment, given the uncertainty in the future condition of the structure and in how much of structure would require refurbishment work, an indicative cost was estimated based on a unit rate of 50% of the unit rate cost of a new small rock revetment (e.g. 1-2m high). This rate was multiplied by the existing defence length.
- For the rock groyne refurbishment, given the uncertainty in the future condition of the structures and in how much of the structures would require refurbishment work, an indicative cost was estimated based on a unit rate of 50% of the unit rate cost of a new rock groyne, approximately 2m high. This rate was multiplied by the existing defence length.
- In years 50-59 the cost of the rock groyne upgrades were based on the rock groyne cost from Table 7-1. It is beyond the remit of the Strategy to design a rock groyne field and therefore it was necessary to assume a layout / geometry for the structures. Rock groynes of the same length and spacing as the existing groynes were assumed given that the existing layout is successful in retaining material, but the spacing could change subject to future design.
- The cost of beach nourishment was estimated based on a volume of 90,000m<sup>3</sup> of material. This volume is uncertain given that this is an intervention in the future and the beach will evolve in the interim period.
- A top-up beach nourishment of 45,000<sup>3</sup> was assumed to be required in years 70-79 (50% of the original volume). In addition, beach recycling of approximately 2,500m<sup>3</sup> also assumed every 5 years throughout the appraisal period.
- Small scale patch-repair assumed to occur annually between defence upgrades and refurbishments based on costs presented in Table 7-2.

### **ODU 13 costing assumptions – Local Option (Improve A)**

- Option is the same as the National Option except that it involves undertaking the beach nourishment scheme earlier in years 20-24. This would be undertaken alongside the refurbishment to the existing rock structures.
- The same costing assumptions for the refurbishment and defence upgrades / beach nourishment as outlined in the National option have been applied.
- An additional beach nourishment top-up applied later in the appraisal period due to the earlier initial beach nourishment intervention. Beach nourishment top-ups therefore applied in years 50-59 and 70-79.

## 12.2.13 ODU 14

Leading Option	Description	Assumed interventions and timing for costing														
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)				
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99
National	Managed Realignment A: Improved toe defences and cliff stabilisation / drainage in the area between Marine Drive West and the eastern end of Barton on Sea from epoch 1	Main	Main	Scheme, Main	Main	Main	Main	Main	Main	Main	Main	Main	Refurb, Main	Main	Main	Main
Backup	Managed Realignment B: As per Managed Realignment A, except defence improvements would be undertaken during epoch 2 (rather than epoch 1) and beach nourishment at Naish Cliff	Main	Main	Main	Main	Scheme, Main, Beach	Main	Main	Main	Main	Main, Beach	Main	Main	Refurb, Main, Beach	Main	Main, Beach
Backup	Managed Realignment D: As per Managed Realignment B, except defences would not be constructed at Marine Drive West	Main	Main	Main	Main	Scheme, Main, Beach	Main	Main	Main	Main	Main, Beach	Main	Main	Refurb, Main, Beach	Main	Main, Beach
Backup	Maintain: maintain existing defences and functioning drainage but no new defences constructed.	Main	Main	Main	Refurb, Main	Main	Main	Main	Main	Refurb, Main	Main	Main	Refurb, Main	Main	Main	Refurb, Main

Leading Option	Description	Indicative option cost (£k) - cash															
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)					Total
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Managed Realignment A: Improved toe defences and cliff stabilisation / drainage in the area between Marine Drive West and the eastern end of Barton on Sea from epoch 1	255.0	270.0	26,370.0	270.0	383.0	383.0	383.0	383.0	383.0	383.0	653.0	12,936.0	765.0	765.0	765.0	45,347.0
Backup	Managed Realignment B: As per Managed Realignment A, except defence improvements would be undertaken during epoch 2 (rather than epoch 1) and beach nourishment at Naish Cliff	255.0	255.0	255.0	255.0	32,011.0	284.0	284.0	374.0	397.0	1,564.0	794.0	794.0	15,778.0	681.0	1,960.0	55,941.0
Backup	Managed Realignment D: As per Managed Realignment B, except defences would not be constructed at Marine Drive West	255.0	255.0	255.0	255.0	21,639.0	284.0	284.0	374.0	397.0	1,564.0	794.0	794.0	13,142.0	681.0	1,960.0	42,933.0
Backup	Maintain: maintain existing defences and functioning drainage but no new defences constructed.	255.0	255.0	255.0	5,361.0	180.0	180.0	240.0	255.0	2,770.0	180.0	420.0	5,616.0	360.0	495.0	2,950.0	19,772.0

Leading Option	Description	Indicative option cost (£k) - PV															
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)					Total
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Managed Realignment A: Improved toe defences and cliff stabilisation / drainage in the area between Marine Drive West and the eastern end of Barton on Sea from epoch 1	238.0	212.0	18,682.0	151.0	180.0	151.0	129.0	111.0	96.0	83.0	115.0	1,889.0	74.0	57.0	45.0	22,213.0
Backup	Managed Realignment B: As per Managed Realignment A, except defence improvements would be undertaken during epoch 2 (rather than epoch 1) and beach nourishment at Naish Cliff	238.0	201.0	169.0	142.0	16,079.0	113.0	96.0	108.0	99.0	353.0	138.0	103.0	1,716.0	50.0	113.0	19,718.0
Backup	Managed Realignment D: As per Managed Realignment B, except defences would not be constructed at Marine Drive West	238.0	201.0	169.0	142.0	10,866.0	113.0	96.0	108.0	99.0	353.0	138.0	103.0	1,428.0	50.0	113.0	14,217.0
Backup	Maintain: maintain existing defences and functioning drainage but no new defences constructed.	238.0	201.0	169.0	3,193.0	85.0	71.0	80.0	74.0	732.0	39.0	72.0	713.0	35.0	37.0	190.0	5,929.0

Leading Option	Description	Indicative GIA funding for major capital scheme (£k) - cash*															
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)					Total
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Managed Realignment A: Improved toe defences and cliff stabilisation / drainage in the area between Marine Drive West and the eastern end of Barton on Sea from epoch 1			3,215.0													3,215.0

### **ODU 14 costing assumptions – National Option (Managed Realignment A)**

- Option involves a scheme in years 10 to upgrade the defences to reduce the erosion risk (but not stop it entirely). This scheme would involve extending the rock revetment and reinstating cliff drainage. The defences would then be refurbished between years 60-69.
- The scheme in year 10 involves upgrading the existing rock revetment and also extending it to the west. The rock revetment costs in Table 7-1 have been used to estimate the costs for these defence works. For the existing structure upgrade, the unit rates for a 2m high revetment have been used and multiplied by the existing 1.3km defended section of the frontage. For the extension to the west, the unit rates for a 3.5m high revetment for 500m have been used. No wave run-up, overtopping or rock sizing calculations have been undertaken at the Strategy level to inform the costing and therefore the revetment sizes are uncertain. For the existing structure upgrade, it has been assumed that the existing rock material could be re-used which is the reason why the unit rate for a smaller rock revetment was adopted. Costs for the rock revetment will need to be refined during outlined design and are likely to depend upon the source of rock material and transport costs, as well as the design geometry of the structure.
- The scheme also includes cliff drainage. The Barton on Sea cliff drainage unit rate per m length of defence from Table 7-1 was used as the basis for the calculations. A rate of approximately £10k per m frontage length was applied to a cliff length of 1.2km. The costs are likely to be subject to change depending on the cliff drainage system that is designed here but provide an estimate at the strategic level.
- The scheme also includes a refurbishment of the existing rock groynes. Given the uncertainty in the future condition of the structures and in how much of the structures would require refurbishment work, an indicative cost was estimated based on a unit rate of 50% of the unit rate cost of a new rock groyne, approximately 2m high. This rate was multiplied by the existing defence length.
- The costs for refurbishment of the defences in years 60-69 will vary depending on the condition of the structures and how this may change over time (which is uncertain). A typical refurbishment for rock structures could involve reprofiling the rock structure, replacing damaged rock and any geotextile / fill materials. A typical refurbishment for cliff drainage could involve reinstating any failed sections and adding more drainage further inland.
- For the rock revetment, given the uncertainty in the future condition of the structure and in how much of structure would require refurbishment work, an indicative cost was estimated based on a unit rate of 50% of the unit rate cost of a new small rock revetment (e.g. 1-2m high). This rate was multiplied by the existing defence length.
- For the rock groyne refurbishment, given the uncertainty in the future condition of the structures and in how much of the structures would require refurbishment work, an indicative cost was estimated based on a unit rate of 50% of the unit rate cost of a new rock groyne, approximately 2m high. This rate was multiplied by the existing defence length.
- For the cliff drainage, the rate provided in Table 7-1 was adopted for the refurbishment costs in years 60-69 and applied to 50% of the defence length.
- In addition to the scheme and refurbishment costs in ODU 14, annual patch-repair maintenance costs were also applied. These were based on maintenance budget information provided by NFDC in August 2023 which indicate a typical annual expenditure of approximately £51k. This rate was used to with the following assumptions / modifications:
  - Years 0-10: £51k per annum as indicated by NFDC maintenance budgets
  - Years 10-20 and 60-69: £54k per annum calculated by removing rock maintenance costs (directly after rock scheme / refurbishment so assumed not required) and then uplifting by 50% to account for additional drainage length.
  - Years 20-59 and 70-99: £76k per annum calculated by uplifting £51k rate by 50% to account for additional defence length relative to existing. This includes rock patch-repair costs.

#### **ODU 14 costing assumptions – Backup Option (Managed Realignment B)**

- Option is the same as the National Option except that it involves undertaking the defence upgrade scheme later in years 20-25. The same costing assumptions for the refurbishment and defence upgrades as outlined in the National option have been applied.
- The scheme also includes beach nourishment at Naish Cliff. The cost of beach nourishment was estimated based on a volume of 70,000m<sup>3</sup> of material. This volume is uncertain given that this is an intervention in the future and the beach will evolve in the interim period.
- Beach nourishment top-ups at Naish Cliff were included in the costs in years 45-49, 70-79 and 90-99. The volume assumed was 35,000m<sup>3</sup>, 50% of the original nourishment scheme. In addition, beach recycling of approximately 2,500m<sup>3</sup> also assumed every 5 years throughout the appraisal period.

#### **ODU 14 costing assumptions – Backup Option (Managed Realignment D)**

- Option is the same as Managed Realignment B, except that it involves a shorter length of cliff drainage and defences at the cliff toe in years 20-25, with no protection provided to Marine Drive West.

#### **ODU 14 costing assumptions – Backup Option (Maintain)**

- Option involves a series of defence refurbishments to existing toe defences, assumed to occur approximately every 25 years on average, from year 15-19 and then in years 40-44, 60-69 and 90-99. This option does not involve refurbishment of the cliff drainage system or reinstatement of the failed sections of drainage, although small scale maintenance would be undertaken to extend the life of the existing intact drainage as far as reasonably possible.
- The costs for refurbishment of the existing toe defences will vary depending on the condition of the existing structures and how this may change over time (which is uncertain). A typical refurbishment for rock structures could involve reprofiling the rock structure, replacing damaged rock and any geotextile / fill materials.
- For the first and third rock revetment refurbishments, given the uncertainty in the future condition of the structure and in how much of structure would require refurbishment work, an indicative cost was estimated based on a unit rate of 50% of the unit rate cost of a new small rock revetment (e.g. 1-2m high). This rate was multiplied by 100% of existing defence length.
- For the second and fourth rock revetment refurbishments an indicative cost was estimated based on multiplying the refurbishment unit rate above by 50% of the existing defence length. The second and fourth refurbishments are therefore half the cost of the first and third.
- No rock groyne refurbishment have been assumed to occur.
- In addition to the refurbishment costs in ODU 14, annual patch-repair maintenance costs were also applied. These were based on maintenance budget information provided by NFDC in August 2023 which indicate a typical annual expenditure of approximately £51k. This rate was used to with the following assumptions / modifications:
  - Years 0-14, 31-39, 56-64 and 81-89: £51k per annum as indicated by NFDC maintenance budgets
  - Years 15-30, 40-55, 65-80 and 90-99: £36k per annum calculated by removing rock maintenance costs (directly after rock refurbishment so assumed not required).

## 12.2.14 ODU 15

Leading Option	Description	Assumed interventions and timing for costing														
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)				
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99
National	Do Nothing	Do Nothing	Do Nothing	Do Nothing	Do Nothing	Do Nothing	Do Nothing	Do Nothing	Do Nothing	Do Nothing	Do Nothing	Do Nothing	Do Nothing	Do Nothing	Do Nothing	Do Nothing

Leading Option	Description	Indicative option cost (£k) - cash															
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)					Total
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Do Nothing	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Leading Option	Description	Indicative option cost (£k) - PV															
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)					Total
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Do Nothing	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Leading Option	Description	Indicative GiA funding for major capital scheme (£k) - cash*															
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)					Total
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Do Nothing	No GiA available															0

**ODU 15 costing assumptions – National Option (Do Nothing)**

- Option does not include any costs towards FCERM

## 12.2.15 ODU 16

Leading Option	Description	Assumed interventions and timing for costing														
		Epoch 1 (years)				Epoch 2 (years)					Epoch 3 (years)					
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99
National	Managed Realignment C: From second half of epoch 2 undertake beach nourishment and construct local strong point to control rate of cliff erosion. Intent to stop cliff erosion reaching Cliff Road	Main	Main	Main	Main	Main, Beach	Main, Beach	Main, Beach	Scheme, Main, Beach	Main, Beach	Main, Beach	Main, Beach	Main, Beach	Main, Beach	Main, Beach	Main, Beach
Local	Managed Realignment A or B (A shown here): As per Managed Realignment C, except beach nourishment and strong point would be constructed much sooner; in epoch 1	Main	Scheme, Main, Beach	Main, Beach	Main, Beach	Main, Beach	Main, Beach	Main, Beach	Main, Beach	Main, Beach	Main, Beach	Main, Beach	Main, Beach	Main, Beach	Main, Beach	Main, Beach
Backup	Maintain: Maintain existing defences and undertake beach recycling to control beach levels. Likely leading to more long term erosion	Main	Refurb, Main	Main	Main	Main, Beach	Main, Beach	Refurb, Main, Beach	Main, Beach	Main, Beach	Main, Beach	Refurb, Main, Beach	Main, Beach	Main, Beach	Refurb, Main, Beach	Main, Beach

Leading Option	Description	Indicative option cost (£k) - cash															Total
		Epoch 1 (years)				Epoch 2 (years)					Epoch 3 (years)						
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Managed Realignment C: From second half of epoch 2 undertake beach nourishment and construct local strong point to control rate of cliff erosion. Intent to stop cliff erosion reaching Cliff Road	98.0	98.0	98.0	98.0	348.0	264.0	264.0	10,357.0	137.0	137.0	274.0	1,948.0	274.0	1,948.0	271.0	16,614.0
Local	Managed Realignment A or B (A shown here): As per Managed Realignment C, except beach nourishment and strong point would be constructed much sooner; in epoch 1	98.0	4,660.0	137.0	137.0	137.0	137.0	1,811.0	137.0	137.0	137.0	1,948.0	274.0	274.0	1,948.0	274.0	12,246.0
Backup	Maintain: Maintain existing defences and undertake beach recycling to control beach levels. Likely leading to more long term erosion	98.0	491.0	98.0	98.0	348.0	264.0	741.0	264.0	348.0	264.0	1,005.0	612.0	612.0	1,005.0	612.0	6,860.0

Leading Option	Description	Indicative option cost (£k) - PV															Total
		Epoch 1 (years)				Epoch 2 (years)					Epoch 3 (years)						
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Managed Realignment C: From second half of epoch 2 undertake beach nourishment and construct local strong point to control rate of cliff erosion. Intent to stop cliff erosion reaching Cliff Road	91.0	77.0	65.0	54.0	163.0	104.0	90.0	3,181.0	34.0	30.0	48.0	281.0	27.0	144.0	16.0	4,405.0
Local	Managed Realignment A or B (A shown here): As per Managed Realignment C, except beach nourishment and strong point would be constructed much sooner; in epoch 1	91.0	3,916.0	91.0	77.0	65.0	54.0	643.0	40.0	34.0	30.0	333.0	36.0	27.0	160.0	16.0	5,613.0
Backup	Maintain: Maintain existing defences and undertake beach recycling to control beach levels. Likely leading to more long term erosion	91.0	408.0	65.0	54.0	163.0	104.0	257.0	77.0	87.0	57.0	174.0	80.0	60.0	79.0	36.0	1,792.0

Leading Option	Description	Indicative GiA funding for major capital scheme (£k) - cash*															Total
		Epoch 1 (years)				Epoch 2 (years)					Epoch 3 (years)						
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Managed Realignment C: From second half of epoch 2 undertake beach nourishment and construct local strong point to control rate of cliff erosion. Intent to stop cliff erosion reaching Cliff Road								1,932.0								1,932.0
Local	Managed Realignment A or B (A shown here): As per Managed Realignment C, except beach nourishment and strong point would be constructed much sooner; in epoch 1		1,301.0														1,301.0

### **ODU 16 costing assumptions – National Option (Managed Realignment C)**

- Option includes a scheme at the mid-point of epoch 2 to construct a local strong point and undertake beach nourishment of the area.
- The design for the local strong point is uncertain, but at the Strategy stage it has been assumed to be a rock structure. The rock revetment unit costs from Table 7-1 have been used and a structure size of 4m high by 300m long have been assumed for costing purposes. The costs for the rock revetment will need to be refined during outlined design and are likely to depend upon the source of rock material and transport costs, as well as the design geometry of the structure. No wave run-up, overtopping or rock sizing calculations have been undertaken at the Strategy level.
- For the beach nourishment part of the scheme, a volume of approximately 200,000m<sup>3</sup> has been assumed. This is based on a beach cross sectional area approximately twice that of the beach at Highcliffe (ODU 12 / 13) multiplied by a beach length of 700m. This could be an overestimate of the required beach volume, but it is uncertain how far the cliffs will erode in the period between now and the scheme in the mid-point of epoch 2 and therefore a conservative beach volume has been assumed.
- Beach nourishment top-ups at ODU 16 were included in the costs in years 60-69 and 80-89. The volume assumed was 50,000m<sup>3</sup>, 25% of the original nourishment scheme. In addition, beach recycling of approximately 2,500m<sup>3</sup> also assumed every 5 years after the initial scheme in epoch 2.
- In the period between the start of epoch 2 and the mid-point of epoch 2 (before the major beach nourishment scheme is scheduled), costs for repeat smaller scale beach nourishment of 2,500m<sup>3</sup> every 2 years have been included in the costs.
- In addition to the scheme costs in ODU 16, annual patch-repair maintenance costs were also applied. These were based on maintenance budget information provided by NFDC in August 2023 which indicate a typical annual expenditure of approximately £20k in this location. This rate was used to with the following assumptions / modifications:
  - Years 0-35: £20k per annum as indicated by NFDC maintenance budgets
  - Years 35-99: £25k per annum calculated by adding in rock maintenance costs (prorated from ODU 14 NFDC rock maintenance costs) to the NFDC maintenance budget.

### **ODU 16 costing assumptions – Local Option (Managed Realignment A or B)**

- The Local Option involves undertaking the local strong point and beach nourishment scheme earlier. For Managed Realignment A (shown in the table above), the scheme would be delivered between years 5-9. Given that the scheme is occurring sooner there would be an increased buffer area on top of the cliff in which erosion could occur before assets are threatened. Therefore a smaller strong point structure has been included in the costs, as well as a smaller volume of beach nourishment relative to the National Option.
- The rock revetment unit costs in Table 7-1 have been used and a structure size of 4m high by 100m long have been assumed for costing purposes. The costs for the rock revetment will need to be refined during outlined design and are likely to depend upon the source of rock material and transport costs, as well as the design geometry of the structure. No wave run-up, overtopping or rock sizing calculations have been undertaken at the Strategy level.
- For the beach nourishment part of the scheme, a volume of approximately 100,000m<sup>3</sup> has been assumed. This is based on a beach cross sectional area approximately equal to that of the beach at Highcliffe (ODU 12 / 13) multiplied by a beach length of 700m.
- Beach nourishment top-ups at ODU 16 were included in the costs in years 30-34, 50-59 and 80-89. The volume assumed was 50,000m<sup>3</sup>, 50% of the original nourishment scheme. In addition, beach recycling of approximately 2,500m<sup>3</sup> also assumed every 5 years after the initial scheme in years 5-9.
- In addition to the scheme costs in ODU 16, annual patch-repair maintenance costs were also applied. These were based on maintenance budget information provided by NFDC in August 2023 which indicate a typical annual expenditure of approximately £20k in this location. This rate was used to with the following assumptions / modifications:
  - Years 0-4: £20k per annum as indicated by NFDC maintenance budgets

- Years 5-99: £25k per annum calculated by adding in rock maintenance costs (prorated from ODU 14 NFDC rock maintenance costs) to the NFDC maintenance budget.

#### **ODU 16 costing assumptions – Backup Option (Maintain)**

- Option involves a series of defence refurbishments to existing seawall defence in the eastern part of the unit, assumed to occur approximately every 25 years on average, from year 5-9 and then in years 30-34, 50-59 and 80-89.
- The costs for refurbishment of the existing seawall defences will vary depending on the condition of the existing structure and how this may change over time (which is uncertain). A typical refurbishment for a seawall could involve repairing toe protection, resurfacing the concrete (e.g. concrete spray), replacing sections of the wall with significant cracks and/or filling cracks.
- For the seawall refurbishment, given the uncertainty in the future condition of the structure and in how much of the structure would require refurbishment work, an indicative cost was estimated based on a unit rate of 50% of the unit rate cost of a new small concrete seawall (e.g. 1m high). This rate was multiplied by the existing defence length.
- In addition to the refurbishment costs in ODU 16, annual patch-repair maintenance costs were also applied. These were based on maintenance budget information provided by NFDC in August 2023 which indicate a typical annual expenditure of approximately £20k in this location.
- A cost for repeat small scale beach nourishment of 2,500m<sup>3</sup> every 2 years was also applied in the costs from the start of epoch 2 to help control the rate of erosion in the currently undefended part of this unit.

## 12.2.16 ODU 17

Leading Option	Description	Assumed interventions and timing for costing														
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)				
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99
National	Improve C: Refurbish existing cliff toe defences in epoch 1. From second half of epoch 2 upgrade the defences at the cliff toe	Main	Refurb, Main	Main	Main	Main	Main	Main	Scheme, Main	Main	Main	Main	Main	Main	Main	Main
Local	Improve A or B (A shown here): As per Improve C, except toe defence improvements undertaken in epoch 1	Main	Scheme, Main	Main	Main	Main	Main	Main	Main	Main	Main	Refurb, Main	Main	Main	Main	Main
Backup	Maintain: Maintain existing defences at the toe of the cliff. Long term sustainability of this approach is uncertain	Main	Refurb, Main	Main	Refurb, Main	Main	Main	Refurb, Main	Main	Main	Main	Refurb, Main	Refurb, Main	Main	Refurb, Main	Main

Leading Option	Description	Indicative option cost (£k) - cash															Total
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)					
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Improve C: Refurbish existing cliff toe defences in epoch 1. From second half of epoch 2 upgrade the defences at the cliff toe	50.0	3,836.0	50.0	50.0	50.0	50.0	50.0	17,521.0	50.0	50.0	100.0	100.0	100.0	2,828.0	100.0	24,985.0
Local	Improve A or B (A shown here): As per Improve C, except toe defence improvements undertaken in epoch 1	50.0	13,675.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	2,828.0	100.0	100.0	100.0	100.0	17,353.0
Backup	Maintain: Maintain existing defences at the toe of the cliff. Long term sustainability of this approach is uncertain	50.0	2,778.0	50.0	1,107.0	50.0	50.0	1,414.0	50.0	50.0	50.0	2,828.0	1,157.0	100.0	1,464.0	100.0	11,298.0

Leading Option	Description	Indicative option cost (£k) - PV															Total
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)					
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Improve C: Refurbish existing cliff toe defences in epoch 1. From second half of epoch 2 upgrade the defences at the cliff toe	47.0	3,227.0	33.0	28.0	23.0	20.0	17.0	5,384.0	13.0	11.0	17.0	13.0	10.0	208.0	6.0	9,057.0
Local	Improve A or B (A shown here): As per Improve C, except toe defence improvements undertaken in epoch 1	47.0	10,749.0	33.0	28.0	23.0	20.0	17.0	14.0	13.0	11.0	482.0	13.0	10.0	7.0	6.0	11,473.0
Backup	Maintain: Maintain existing defences at the toe of the cliff. Long term sustainability of this approach is uncertain	47.0	2,111.0	33.0	659.0	23.0	20.0	462.0	14.0	13.0	11.0	442.0	147.0	10.0	113.0	6.0	4,111.0

Leading Option	Description	Indicative GIa funding for major capital scheme (£k) - cash*															Total
		Epoch 1 (years)				Epoch 2 (years)						Epoch 3 (years)					
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Improve C: Refurbish existing cliff toe defences in epoch 1. From second half of epoch 2 upgrade the defences at the cliff toe								3,457.0								3,457.0
Local	Improve A or B (A shown here): As per Improve C, except toe defence improvements undertaken in epoch 1		2,400.0														2,400.0

### **ODU 17 costing assumptions – National Option (Improve C)**

- Option includes a scheme at the mid-point of epoch 2 to upgrade the defences at the cliff toe. Prior to this the existing defences would be refurbished to extend their service life between years 5-9.
- The cost for the initial refurbishment of the defences is uncertain as it will be reliant on the condition of the existing structures and how this may change over time (which is uncertain). A typical refurbishment for rock structures could involve reprofiling the rock structure, replacing damaged rock and any geotextile / fill materials. The refurbishment costs do not include any maintenance to the existing seawall landward of the rock revetment.
- For the rock revetment refurbishment, given the uncertainty in the future condition of the structure and in how much of structure would require refurbishment work, an indicative cost was estimated based on a unit rate of 50% of the unit rate cost of a new small rock revetment (e.g. 1-2m high). This rate was multiplied by the existing defence length.
- For the rock groyne refurbishment, given the uncertainty in the future condition of the structures and in how much of the structures would require refurbishment work, an indicative cost was estimated based on a unit rate of 50% of the unit rate cost of a new rock groyne, approximately 2m high. This rate was multiplied by the existing defence length.
- The cost to upgrade the defences in the mid-point of epoch 2 includes costs for upgraded rock groynes and an upgraded rock revetment. No costs have been included for the seawall behind the rock revetment as it has been assumed that the rock revetment will provide the required defence standard.
- For the rock groynes the cost of the upgrades were based on the rock groyne cost from Table 7-1. It is beyond the remit of the Strategy to design a rock groyne field and therefore it was necessary to assume a layout / geometry for the structures. Rock groynes 70m long with 80m spacing were assumed for the purpose of costing as this similar to other rock groyne structures within Christchurch Bay, but this will need to be revisited during further design work.
- For the rock revetment upgrade, the rock revetment units rates in Table 7-1 were used as a basis for the cost estimate. The rate for a 3.5m high revetment for 760m defence length was used. An additional risk uplift of 50% was applied to this cost to account for the condition of the existing defences here and the potential need to remove / repair these in addition to the rock revetment cost. The defence length does not include the 200m section of existing rock revetment that has recently been repaired. The costs for the rock revetment will need to be refined during outlined design and are likely to depend upon the source of rock material and transport costs, as well as the design geometry of the structure. No wave run-up, overtopping or rock sizing calculations have been undertaken at the Strategy level.
- An cost for refurbishing the upgraded rock revetment was included in years 80-89 . This was based on the same costing approach as the refurbishment during epoch 1.
- In addition to the refurbishment and scheme costs in ODU 17, annual patch-repair maintenance costs of £10,000 were also applied. NFDC did not provide any annual maintenance costs for this location, so the annual amount was estimated based on the rock maintenance costs provided by NFDC for ODU 14, accounting for the shorter defence length in ODU 17.

### **ODU 17 costing assumptions – Local Option (assumptions for Improve A shown)**

- Option involves undertaking the scheme earlier in years 5-10 to upgrade the coastal defences.
- Generally same costing assumptions for the defence upgrades as outlined in the National option have been applied, just at different timings in the appraisal period.
- The exception is that the 50% risk uplift on the rock revetment structure upgrade that was applied in the National Option (Improve C) was not applied here due to the earlier intervention and reduced likelihood of further defence deterioration.

### **ODU 17 costing assumptions – Backup Option (Maintain)**

- Option involves a series of defence refurbishments to existing rock groynes and rock revetment structures. Refurbishments to the rock revetment were assumed to occur approximately every 25 years on average from

year 5-9. Refurbishments to the rock groyne were assumed to occur in years 15-19 and 60-69. No costs for refurbishing the seawall landward of the rock revetment have been included.

- The costs for refurbishment of the existing rock defences will vary depending on the condition of the existing structure and how this may change over time (which is uncertain). A typical refurbishment for rock structures could involve reprofiling the rock structure, replacing damaged rock and any geotextile / fill materials.
- For the first and third rock revetment refurbishments, given the uncertainty in the future condition of the structure and in how much of structure would require refurbishment work, an indicative cost was estimated based on a unit rate of 50% of the unit rate cost of a new small rock revetment (e.g. 1-2m high). This rate was multiplied by 100% of existing defence length.
- For the second and fourth rock revetment refurbishments an indicative cost was estimated based on multiplying the refurbishment unit rate above by 50% of the existing defence length. The second and fourth refurbishments are therefore half the cost of the first and third.
- For the rock groyne refurbishment, given the uncertainty in the future condition of the structures and in how much of the structures would require refurbishment work, an indicative cost was estimated based on a unit rate of 50% of the unit rate cost of a new rock groyne, approximately 2m high. This rate was multiplied by the existing defence length.
- In addition to the refurbishment and scheme costs in ODU 17, annual patch-repair maintenance costs of £10,000 were also applied. NFDC did not provide any annual maintenance costs for this location, so the annual amount was estimated based on the rock maintenance costs provided by NFDC for ODU 14, accounting for the shorter defence length in ODU 17.

## 12.2.17 ODU 18

Leading Option	Description	Assumed interventions and timing for costing														
		Epoch 1 (years)				Epoch 2 (years)					Epoch 3 (years)					
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99
National	Improve A: Upgrade seawall, construct new groynes and undertake major beach nourishment from epoch 1. Construct setback tidal defences at eastern end of Milford on Sea to reduce risk of flooding from Sturt Pond direction in epoch 2.	Main, Beach	Scheme, Main, Beach	Main, Scheme, Beach	Main, Beach	Main, Beach	Main, Beach	Scheme, PLP, Main, Beach	Main, Beach	Main, Beach	Main, Beach	PLP, Main, Beach	Main, Beach	Main, Beach	Main, Beach	
Backup	Improve B: Refurbish existing defences in epoch 1 and undertake small scale repeat beach nourishment. Upgrade seawall, construct new groynes and undertake major beach nourishment from epoch 2. Construct setback tidal defences at eastern end of Milford on Sea to reduce risk of flooding from Sturt Pond direction in epoch 2.	Main, Beach	Refurb, Main, Beach	Main, Beach	Main, Beach	Scheme, Main, Beach	Main, Beach	Main, Beach, PLP	Main, Beach	Main, Beach	Main, Beach	PLP, Main, Beach	Main, Beach	Main, Beach	Main, Beach	
Backup	Maintain existing defences and undertake repeated small scale beach nourishment. Long term sustainability of this approach is uncertain given lowering beach levels.	Main, Beach	Refurb, Main, Beach	Main, Beach	Main, Beach	Main, Beach	Main, Beach	Refurb, Main, Beach	Main, Beach	Main, Beach	Main, Beach	Refurb, Main, Beach	Refurb, Main, Beach	Main, Beach	Refurb, Main, Beach	

Leading Option	Description	Indicative option cost (£k) - cash															Total
		Epoch 1 (years)				Epoch 2 (years)					Epoch 3 (years)						
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Improve A: Upgrade seawall, construct new groynes and undertake major beach nourishment from epoch 1. Construct setback tidal defences at eastern end of Milford on Sea to reduce risk of flooding from Sturt Pond direction in epoch 2.	803.0	4,331.0	6,741.0	89.0	89.0	89.0	3,796.0	89.0	89.0	89.0	2,557.0	429.0	429.0	1,652.0	414.0	21,686.0
Backup	Improve B: Refurbish existing defences in epoch 1 and undertake small scale repeat beach nourishment. Upgrade seawall, construct new groynes and undertake major beach nourishment from epoch 2. Construct setback tidal defences at eastern end of Milford on Sea to reduce risk of flooding from Sturt Pond direction in epoch 2.	803.0	3,998.0	250.0	250.0	10,982.0	89.0	2,572.0	89.0	89.0	1,312.0	1,259.0	179.0	1,602.0	429.0	429.0	24,332.0
Backup	Maintain existing defences and undertake repeated small scale beach nourishment. Long term sustainability of this approach is uncertain given lowering beach levels.	1,328.0	4,672.0	376.0	376.0	376.0	376.0	4,497.0	376.0	376.0	376.0	4,873.0	752.0	752.0	4,873.0	451.0	24,830.0

Leading Option	Description	Indicative option cost (£k) - PV															Total
		Epoch 1 (years)				Epoch 2 (years)					Epoch 3 (years)						
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Improve A: Upgrade seawall, construct new groynes and undertake major beach nourishment from epoch 1. Construct setback tidal defences at eastern end of Milford on Sea to reduce risk of flooding from Sturt Pond direction in epoch 2.	750.0	3,404.0	4,774.0	50.0	42.0	35.0	1,275.0	26.0	22.0	19.0	412.0	55.0	41.0	129.0	24.0	11,058.0
Backup	Improve B: Refurbish existing defences in epoch 1 and undertake small scale repeat beach nourishment. Upgrade seawall, construct new groynes and undertake major beach nourishment from epoch 2. Construct setback tidal defences at eastern end of Milford on Sea to reduce risk of flooding from Sturt Pond direction in epoch 2.	750.0	3,152.0	166.0	139.0	5,152.0	35.0	864.0	26.0	22.0	283.0	204.0	23.0	162.0	32.0	24.0	11,034.0
Backup	Maintain existing defences and undertake repeated small scale beach nourishment. Long term sustainability of this approach is uncertain given lowering beach levels.	1,241.0	3,682.0	249.0	210.0	176.0	149.0	1,510.0	109.0	94.0	81.0	791.0	97.0	72.0	383.0	27.0	8,871.0

Leading Option	Description	Indicative GIA funding for major capital scheme (£k) - cash*															Total
		Epoch 1 (years)				Epoch 2 (years)					Epoch 3 (years)						
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	90-99	
National	Improve A: Upgrade seawall, construct new groynes and undertake major beach nourishment from epoch 1. Construct setback tidal defences at eastern end of Milford on Sea to reduce risk of flooding from Sturt Pond direction in epoch 2. GIA funding shown for coastal erosion works only (seawall, groynes and beach nourishment)		1,355.0														1,355.0

### **ODU 18 costing assumptions – National Option (Improve A)**

- Option includes a scheme between years 7-10 to upgrade the defences and undertake a major beach nourishment scheme.
- In year 7, for the beach nourishment part of the scheme, a volume of approximately 75,000m<sup>3</sup> has been assumed. This is based on providing a beach cross sectional area approximately equal to that of the beach at Highcliffe (ODU 12 / 13), multiplied by a beach length of 600m.
- In year 7, for the new rock groynes as part of the scheme, the rock groyne unit rate provided in Table 7-1 was used. A rock groyne length of 60m and a spacing of 150m was assumed, similar to other areas in Christchurch Bay. It is beyond the scope of the Strategy to design the groyne layout / geometry so this could change subject to further design work during outline design.
- In year 10, the costs for the new seawall were based on the seawall unit rates provided in Table 7-1. A 2.5m wall was assumed for a length of approximately 650m. The costs for the seawall will need to be refined during outline design and will be influenced by the design geometry of the structure. This will change when wave overtopping calculations are undertaken to determine the design crest level of the structure.
- Between years 30-34 a setback flood defence scheme would be constructed. For the new setback floodwall as part of the scheme, the rates provided in Table 7-1 were used. A wall length of 680m of 1m high was used in the estimate based on the flood cell and potential alignment identified in GIS. Property level protection / resilience measures assumed as £10k per property.
- Beach nourishment top-ups were included in the costs in years 30-34, 50-59 and 80-89. The volume assumed was 37,500m<sup>3</sup>, 50% of the original nourishment scheme. In addition, beach recycling of approximately 2,500m<sup>3</sup> also assumed every 5 years from after the scheme in epoch 1.
- In addition to the scheme and refurbishment costs in ODU 18, annual maintenance costs were also applied. These were based on maintenance budget information provided by NFDC in August 2023 which indicate a typical annual expenditure of approximately £316k in this location. If this rate was applied annually as currently undertaken, none of the Strategic options would have a viable benefit cost ratio. With the defence refurbishments and upgrades as part of this option it is assumed that the amount of annual maintenance in this location would be reduced. Therefore this rate was used with the following assumptions / modifications:
  - Years 0-4: prior to the first scheme, it was assumed that the full £316k maintenance cost would occur every 2 years. This includes patch-repair maintenance to the structures and small scale beach nourishment every 2 years. This is a reduction in the rate of expenditure as currently the £316k expenditure typically occurs annually. However, with the defences being upgraded from year 7 9, it was assumed that the overall amount of expenditure would reduce prior to this. For example, the £100k annual expenditure on timber groyne maintenance may not be needed ahead of a larger scale defence upgrades.
  - Years 7-57: expenditure of £15k per annum given the condition of the defences will have been significantly improved by the capital schemes. The frequency of small scale beach nourishment also assumed to be reduced to on average once every 5 years during this period, with larger beach top-ups occurring every 25 years.
  - Years 57-99: assumed expenditure of £40k per annum as defences age and more annual maintenance may be required.
- Note that the maintenance costing assumptions above should not be used to inform the frequency of interventions. Interventions and their frequency should be guided by monitoring of beach levels and the condition of defences, which are uncertain and difficult to predict ahead of time.

### **ODU 18 costing assumptions – Backup Option (Improve B)**

- Option includes a scheme at the start of epoch 2 to upgrade the defences and undertake a major beach nourishment scheme. Prior to this the existing defences would be refurbished to extend their service life between years 5-9.
- The cost for the initial refurbishment of the defences is uncertain as it will be reliant on the condition of the existing structures and how this may change over time. A typical refurbishment for a seawall could involve repairing toe protection, resurfacing the concrete (e.g. concrete spray), replacing sections of the wall with

significant cracks and/or filling cracks. For timber groynes a typical refurbishment could involve replacing timber piles, beams and joints that are damaged / in need of replacement.

- For the seawall refurbishment, there is uncertainty in the future condition of the structure and in how much of the structure would require refurbishment work. For the Strategy level cost estimate, an indicative cost for refurbishment was estimated using the unit rate of a new small concrete seawall (e.g. 1m high) from Table 7-1. There is uncertainty as to how much of the structure would need to be refurbished but this unit rate was multiplied by the 75% existing defence length to estimate the refurbishment cost.
- For the timber groyne refurbishment there is also uncertainty as to how much of the structures would need to be refurbished and by what method. To provide a high level estimate for the Strategy costs, the unit rate costs for new rock groynes from Table 7-1 were used to estimate the refurbishment costs of the structures. This rate was multiplied by 75% of the length of the existing groynes at the site.
- For the scheme in epoch 2 the costs included a number of different aspects; costs for a new seawall, a beach nourishment, new rock groynes, a setback floodwall to reduce the tidal flood risk from Sturt Pond direction, and property level protection to the properties outside of the scheme benefit area. The same costing assumptions for these elements of construction as the Improve A (National Option) were assumed.
- Beach nourishment top-ups were included in the costs in years 45-49 and 70-79. The volume assumed was 37,500m<sup>3</sup>, 50% of the original nourishment scheme. In addition, beach recycling of approximately 2,500m<sup>3</sup> also assumed every 5 years from after the scheme at the start of epoch 2.
- In addition to the scheme and refurbishment costs in ODU 18, annual maintenance costs were also applied. These were based on maintenance budget information provided by NFDC in August 2023 which indicate a typical annual expenditure of approximately £316k in this location. If this rate was applied annually as currently undertaken, none of the Strategic options would have a viable benefit cost ratio. With the defence refurbishments and upgrades as part of this option it is assumed that the amount of annual maintenance in this location would be reduced. Therefore this rate was used with the following assumptions / modifications:
  - Years 0-4: prior to the defence refurbishment in years 5-9, it was assumed that the full £316k maintenance cost would occur every 2 years. This includes patch-repair maintenance to the structures and small scale beach nourishment every 2 years. This is a reduction in the rate of expenditure as currently the £316k expenditure typically occurs annually. However, with the refurbishment of defences scheduled to occur in years 5-9, it was assumed that the overall amount of expenditure would reduce prior to this. For example, the £100k annual expenditure on timber groyne maintenance may not be needed ahead of a larger scale refurbishment of these structures in years 5-9.
  - Years 5-19: expenditure of £15k per annum given the condition of the defences will have been significantly improved by the refurbishment works. The frequency of small scale beach nourishment also assumed to be reduced to on average once every 5 years during this period, prior to the large scale nourishment scheme at the start of epoch 2.
  - Years 20-69: assumed expenditure of £15k per annum following new defence construction and large scale nourishment (and continued recycling) at the start of epoch 2.
  - Years 70-99: assumed expenditure of £40k per annum as defences age and more annual maintenance may be required.
- Note that the maintenance costing assumptions above should not be used to inform the frequency of interventions. Interventions and their frequency should be guided by monitoring of beach levels and the condition of defences, which are uncertain and difficult to predict ahead of time.

#### **ODU 18 costing assumptions – Backup Option (Maintain)**

- Option involves a series of defence refurbishments to existing coastal defence structures, assumed to occur approximately every 25 years on average, from year 5-9 and then in years 30-34, 50-59 and 80-89.
- The cost for the refurbishments of the defences is uncertain as it will be reliant on the condition of the existing structures and how this may change over time. A typical refurbishment for a seawall could involve repairing toe protection, resurfacing the concrete (e.g. concrete spray), replacing sections of the wall with significant cracks and/or filling cracks. For timber groynes a typical refurbishment could involve replacing timber piles, beams and joints that are damaged / in need of replacement.

- For the seawall refurbishment, there is uncertainty in the future condition of the structure and in how much of the structure would require refurbishment work. For the Strategy level cost estimate, an indicative cost for refurbishment was estimated based on a unit rate of a new small concrete seawall (e.g. 1m high) from Table 7-1. There is uncertainty as to how much of the structure would need to be refurbished but this unit rate was multiplied by the 75% existing defence length to estimate the refurbishment cost.
- For the timber groyne refurbishment there is also uncertainty as to how much of the structures would need to be refurbished and by what method. To provide a high level estimate for the Strategy costs, the unit rate costs for new rock groynes from Table 7-1 were used to estimate the refurbishment costs of the structures. This rate was multiplied by 75% of the length of the existing groynes at the site.
- The assumptions for the annual maintenance for this option are similar to the National / Local options and are based on the annual maintenance budgets provided by NFDC. It is not feasible to continue with an annual expenditure of £316k with the benefits the Maintain option provides and it is assumed that the defence refurbishments would reduce the annual expenditure compared to current levels. Therefore the following assumptions / modifications were made in the option costing:
  - Years 0-4: prior to the defence refurbishment in years 5-9, it was assumed that the full £316k maintenance cost would occur every 2 years. This includes patch-repair maintenance to the structures and small scale beach nourishment every 2 years. This is a reduction in the rate of expenditure as currently the £316k expenditure typically occurs annually. However, with the refurbishment of defences scheduled to occur in years 5-9, it was assumed that the overall amount of expenditure would reduce prior to this. For example, the £100k annual expenditure on timber groyne maintenance may not be needed ahead of a larger scale refurbishment of these structures in years 5-9.
  - Years 5-99: assumed expenditure of £15k per annum, then £316k every 5 years. This assumes a small scale beach nourishment and groyne repair on average every 5 years.
- Note that the maintenance costing assumptions above should not be used to inform the frequency of interventions. Interventions and their frequency should be guided by monitoring of beach levels and the condition of defences, which are uncertain and difficult to predict ahead of time.

## 12.3 Appendix C: Barton on Sea Partnership Funding Sensitivity Test

A sensitivity test has been undertaken to estimate the Partnership Funding score for the Managed Realignment option A in ODU 14 when the initial scheme is delayed, until year 50 and year 75 in the appraisal period. There are several assumptions with the Partnership funding calculation, as outlined in Section 10.1. These assumptions also apply to this sensitivity test.

In addition, in the economic appraisal, the economic damages and benefits during epoch 3 due to coastal erosion have been assumed to occur at the mid-point of the epoch, in year 75. Therefore in the test where the scheme is undertaken in year 50, there is 25 years of discounting applied for the option benefits. In the test where the scheme is undertaken in year 75, there is no discounting on the option benefits.

All economic damages prior to the scheme in the first 50 or 75 years of the appraisal period have been assumed to have occurred and have not impacted the viability of the scheme. The scheme capital costs have not been amended.

Table 12-35 below shows the results of the test. The test indicates that if the scheme is delayed, the funding score increases. This is because less discounting is applied to the option benefits which increases their value relative to the capital scheme cost, improving the benefit cost ratio and the OM1 benefits of the scheme. The scheme that is delayed until year 75 has the greatest score, however, the score remains below 100% and a significant amount of non-GiA funding would still be required. If the scheme is undertaken in the first part of epoch 1 (as per the Leading Option), then an estimated £23million of non-GiA funding will be needed. If the scheme is delayed until year 50 then this amount is still estimated to be £21million. This falls to approximately £15million if the scheme is delayed until year 75 which remains a significant amount.

Table 12-35: ODU 14 Managed Realignment funding sensitivity test

ODU	Option	Capital scheme calculated	Estimated capital cost (£k)	PV maintenance cost following scheme (£k)	PV total cost (£k)	PV benefits (£k)	Assumed benefit period (yrs)	Indicative PF score	PV maximum eligible GiA (£k) for upfront costs	Minimum contribution / saving required (£k)
14	Managed Realignment A – year 10 (Leading Option recommendation)	Year 10	26,100	4,424	30,525	30,710	90	12%	3,215	22,886
14	Managed Realignment A – year 50	Year 50	26,100	1,656	27,756	57,795	50	18%	4,780	21,320
14	Managed Realignment A – year 75	Year 75	26,100	1,656	27,756	133,844	50	44%	11,423	14,677

