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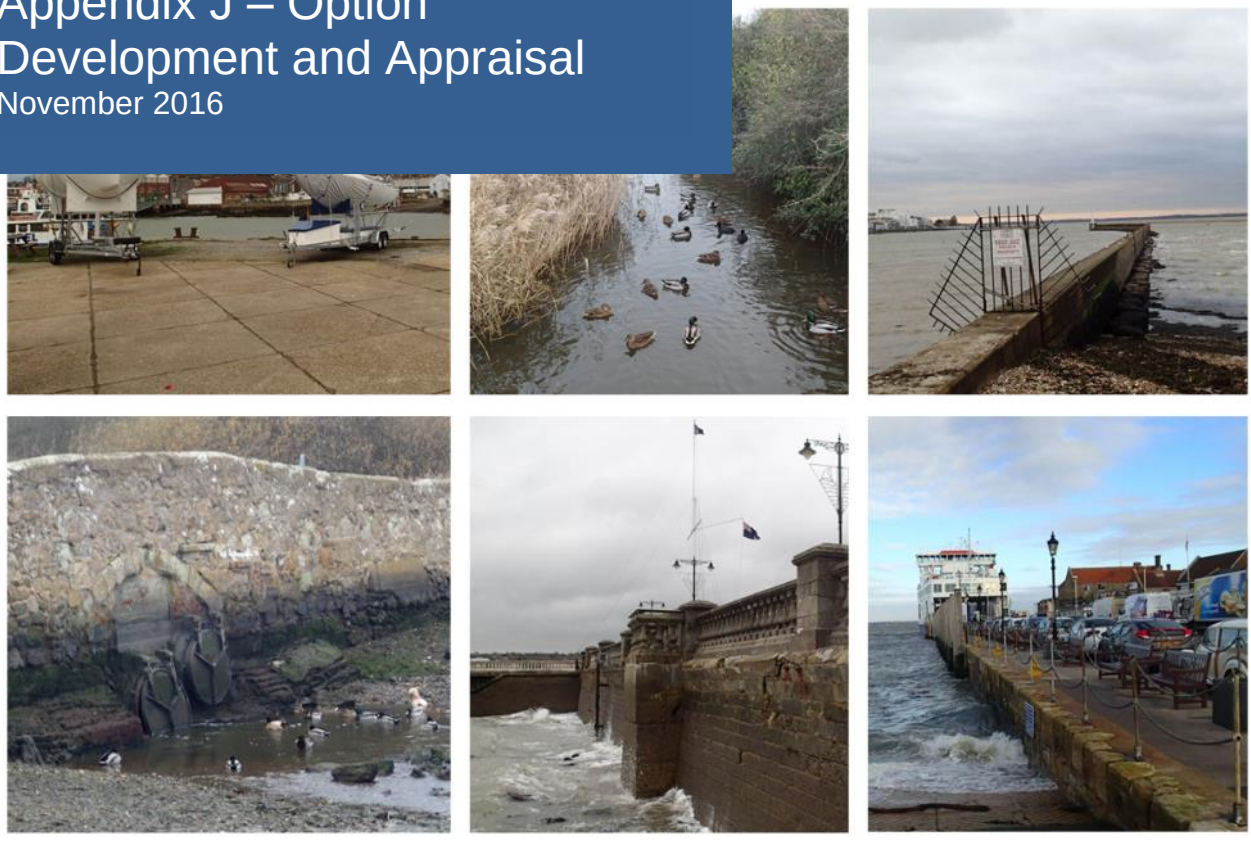
Water and Environment Management Framework
Lot 3 – Engineering and Related Services

West Wight Coastal Flood and Erosion Risk Management Strategy

Appendix J – Option Development and Appraisal

November 2016



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Document overview

Capita | AECOM was commissioned by the Isle of Wight Council in October 2014 to undertake a Coastal Flood and Erosion Risk Management Strategy. As part of this commission, a contaminated land review is required in order to determine the potential contamination issues that need to be considered as part of the strategy.

Document history

Version	Status	Issue date	Prepared by	Reviewed by	Approved by
1	Draft for comment	September 2015	Ben Taylor - Graduate Coastal Engineer	Jon Short - Senior Coastal Specialist	David Dales – Director (Water)
2	Draft following client comments	December 2015	Ben Taylor - Graduate Coastal Engineer	Jon Short - Senior Coastal Specialist	David Dales – Director (Water)
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Midpoint
Alencon Link,
Basingstoke,
Hampshire,
RG21 7PP.

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The methodology adopted and the sources of information used by Capita | AECOM in providing its services are outlined in this Report. The work described in this Report was undertaken between December 2014 and September 2015 and is based on the conditions encountered and the information available during the said period of time. The scope of this Report and the services are accordingly factually limited by these circumstances.

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1. Introduction

1.1 Project Background

Capita | AECOM has been appointed by the Isle of Wight Council (IWC) to develop a coastal flood and erosion risk management strategy ('the Strategy') for West Wight, between Freshwater Bay westward along the coast to East Cowes.

This document outlines the process of the Strategy option development and appraisal for the 84km coastline between Freshwater Bay and East Cowes. The aim of this document is to demonstrate the Strategy has undergone a robust option development process and to confirm selection of preferred options for managing coastal flood and erosion risk along the Strategy's frontage over the next 100 years.

1.2 Shoreline Management Plan Hierarchy

The management of coastal flooding and erosion follows a hierarchy of plans. At the top of the hierarchy is the Shoreline Management Plan (SMP). A SMP is a high-level non statutory planning document which provides a broad assessment of the risk associated with coastal processes and presents a long-term policy framework to reduce these risks to people and the developed, historic and natural environment in a sustainable manner. This frontage is covered by the approved Isle of Wight SMP (2011).

A number of management policies can be assigned within the SMP, these include:

- Hold the Line
- Managed Realignment
- Advance the Line
- No Active Intervention

The Coastal Strategy sits at the second tier in the hierarchy and it is the role of strategies to identify the appropriate scheme or flood risk mitigation option for implementing the SMP policies. A strategy considers how flood and erosion risk is likely to change in the future in response to climate change and develops sustainable and robust options to manage the risks associated with coastal flooding and erosion. It provides a coordinated plan for a stretch of coastline and identifies priority schemes.

At the third tier in the management plan hierarchy are the local projects. Typically this can be in the form of a Scheme (e.g. build new defences) to reduce coastal flood and erosion risk. During the scheme development, further elements of work are carried out to design the scheme and deliver the business case for funding. In other areas, where there is limited risk, the future action may instead include maintenance or even 'Do Nothing' if appropriate. There may also be action such as monitoring, planning and further studies in order to gain evidence to help make robust management decisions in the future.

Figure 1-1 outlines how the Coastal Strategy fits into the management hierarchy of flood and erosion risk.

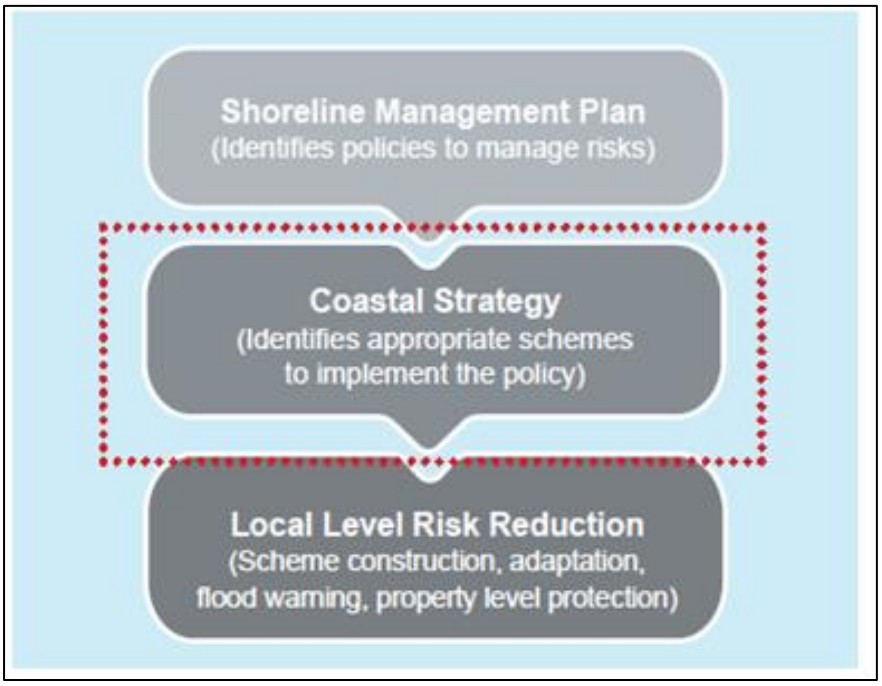


Figure 1-1: The coastal management hierarchy

Descriptions of the management policies used in an SMP are provided below.

Hold the Line

An approach with the overarching intent to build or maintain coastal defences to ensure that the shoreline remains in its current position.

No Active Intervention

A policy whereby no action is taken whatsoever. Where there are existing defences, this approach assumes that no further maintenance or repair work is undertaken.

Advance the Line

A policy whereby new defences are constructed on the seaward side of the existing shoreline.

Managed Realignment

A policy whereby the shoreline is allowed to move naturally, but the process is managed to direct it in certain areas. The approach can be misunderstood so a detailed description of managed realignment that is provided by the ICE (2016) (available at www.ice.org.uk) is provided below.

Managed realignment *"involves altering the location of the line of defence, working to provide a more sustainable position from which the manage flood and erosion risks. It can involve advancement (moving forward), set back, or breach of the existing defence line. Most commonly, it involves establishing a new set back line of defence on the coast or within an estuary.*

The need for managed realignment is driven by a number of factors, including historic and proposed development, climate change and increasing costs of maintaining fixed, linear coastal defences in the dynamic coastal environment. In the UK, much of the coastline is internationally

designated for its conservation value. However, as coastlines naturally evolve and as sea levels rise through climate change impacts, coastal habitat is being lost where there is a sea defence in place – a process known as coastal squeeze. This creates a driver for managed realignment to provide replacement coastal habitat to compensate losses elsewhere.

Typically, managed realignment involves breaching or removing the existing coastal defence. New defences are often constructed behind the original line to continue to protect key assets. In some cases it is possible to make use of existing high ground as the new line of defence. The land behind the new and old defence is then opened up to the sea helping to create new habitat such as saltmarsh. The result is an effective, sustainable solution to flood and erosion risk at the coast.

1.3 Option Development and Appraisal – an overview

This Strategy is publicly funded and therefore the option development has followed the Environment Agency's Flood and Coastal Erosion Risk Management appraisal guidelines (FCERMAG, 2010).

By necessity, option development was partly an iterative process which comprised; identifying a range of strategic options; identifying, costing, evaluating and selecting local level measures; and finally a detailed appraisal of strategic options to select the optimum solution.

Given the change in flood and erosion risk over time, a key aspect of developing robust strategic approaches relates to identifying the required phasing of works over time and the standards of protection to be delivered. Therefore, where applicable, a range of options providing various phasing and standards of protection were developed and appraised to identify the optimal implementation of measures.

Each step undertaken in the option development process is summarised in a separate chapter in this report. The following chapters are included:

Chapter 2 – The Project Objectives

Before developing and appraising options it is necessary to define objectives so that they can be incorporated into the appraisal process. The objectives were developed and agreed by the Steering Group early in the project and are presented in this chapter.

Chapter 3 – Developing a Strategic Approach (Strategy Management Zones and Option Development Units)

Flood and erosion risk management options were considered and developed on two interlinked levels; the wider strategic level options and the local level measures required to implement these options. To facilitate this approach, the Strategy frontage was split into six Strategy Management Zones (SMZs) and then broken down further into 32 local level Option Development Units (ODUs). This chapter outlines this process.

Chapter 4 – Developing Strategic Options

At the Strategic level a number of options were developed in line with the FCERM-AG. This chapter outlines the long-listing and short-listing of the Strategic options in each Strategy Management Zone (SMZ).

Chapter 5 – Accounting for Local Requirements

To facilitate the development of relevant and robust strategic options, it was necessary to account for local issues, spatial and temporal changes in flood and erosion risk. This chapter outlines the process by which appropriate local level measures were established for each option development unit.

Chapter 6 – Option Appraisal

This chapter summarises the economic, social, technical and environmental appraisal process which was used to select the preferred management options.

Chapter 7 – The Preferred Options

This chapter provides the preferred management options for each SMZ along with a summary of the ODU level measures that comprise them.

Option Appraisal Period

The Strategy options were appraised over 3 time periods (often referred to as epochs); the short term, the medium term and the long term.

The approved Isle of Wight SMP2 (2011) set policies for the epochs 2005 – 2025, 2025 – 2055 and 2055 – 2105. Ideally the short, medium and long term time periods of the Strategy should align with these SMP epochs so that management policy changes can be supported by strategic options. However, if the Strategy was to align exactly with the SMP epochs it would mean that the Strategy appraisal period would only be 90 years (10 years short of the typical FCERM appraisal period of 100 years). Therefore, as a compromise between the FCERM guidance and aligning with the SMP policies, the Strategy option appraisal period were selected and agreed with the Environment Agency and Steering Group as:

- Short term (2015 – 2025)
- Medium term (2025 – 2055)
- Long term (2055 – 2115)

The Strategy sets preferred options over a 100 year appraisal period from the present day (2015) to 2115. The first Strategy epoch has been shortened from the typical 20 year guidance period to 10 years so that the timing is more closely aligned with the SMP epochs. The medium term runs for 30 years and the last epoch runs for 60 years to deliver a 100 year Strategy appraisal period. This means the Strategy period runs for 10 years beyond the SMP life, but this is deemed acceptable given the level of future uncertainty and the likelihood that many of the SMP policies would remain consistent beyond 2105.

Stakeholder Engagement

Throughout the option development and appraisal process, stakeholder engagement and feedback provided vital information. Frequent and effective communication and engagement with key stakeholders provided a range of views from land use and development to protection of the strategy frontage. Stakeholder engagement was used to define strategy objectives, steer option development and achieve consensus on the preferred management options. Ultimately the Strategy must be accepted by a wide range of stakeholders in order to benefit the wider community as well as managing coastal flood and erosion risk.

In February 2015 a bus tour of the Strategy frontage was undertaken with key stakeholders. Among the stakeholders in attendance were the Environment Agency, Natural England and the Estuaries Partnership. The tour was carried out early on in the option development phase of the Strategy and provided an opportunity to introduce the Stakeholders to the key issues and

opportunities along the frontage and also to gain valuable feedback and identify management aspirations.

Immediately following the bus tour two public key stakeholder workshops were held in Cowes and Yarmouth. During the workshop feedback and input was provided, helping to map key features, issues and opportunities for the Strategy to consider. The workshops received positive feedback from the Stakeholders who demonstrated support for the strategy and its objectives. These workshops were open to the public and attracted a good attendance, helping to raise public awareness of the Strategy and explain the new system of partnership funding.

In addition to the stakeholder workshop, additional discussions were held with key organisations or potential beneficiaries of schemes to explore partnership funding potential and help build links, open dialogue channels and discuss future management opportunities and joint working.

2. Project Objectives

The primary strategy objectives as agreed by the Project Steering Group are:

- To build on the work of the Isle of Wight Shoreline Management Plan 2, 2011;
- To identify the consequences of implementing the preferred Policies from the IW SMP2, and to seek and select the most appropriate and achievable methods to do so;
- To determine the optimum economic level of coastal flood and erosion protection for the West Wight through assessment of options;
- To provide a co-ordinated approach between the authorities and organisations managing the coastline;
- To refine the understanding of coastal flooding and erosion risks to people and the developed, historic and natural environments using the latest information;
- To balance the needs of people and the environment, in a dynamic coastal environment with flood, erosion and landslide risks;
- To identify any required Schemes, including their location, timing, feasibility, costs, benefits and associated Partnership Funding scores and Outcome Measures;
- To consult with the community to seek acceptable and achievable methods to implement the IW SMP2 Policies;
- To identify the operating authority or landowners responsible for new and existing infrastructure and begin work with them to develop proposals;
- To identify the requirements and opportunities for financial contributions for any proposed schemes, in line with Partnership Funding requirements;
- To comply with environmental legislation and identify opportunities for environmental enhancement, allowing where possible the natural process and evolution of the shoreline;
- To consider opportunities for broader outcomes linked to initiatives such as regeneration, development, tourism, recreation and amenity; and
- To define and prioritise an implementation plan of technically, economically and environmentally sound and sustainable proposals for managing coastal flood and erosion risks over the 100 year appraisal period.

The secondary strategy objectives are:

- To assess the existing standard of protection provided by the existing coastal infrastructure;
- To utilise existing information for the area where possible;
- To understand and consider multiple natural risks;
- To assist communities to reduce flood and erosion risks, where appropriate;
- To encourage awareness and adaptation;
- To seek coordinated solutions in areas of complex ownership;
- To identify existing environmental and socio-economic constraints that will have a bearing on the outcome of the Strategy;
- To consider opportunities for coastal access;
- To identify funding gaps;
- To understand the implications and opportunities of the Partnership Funding system for the risk management authorities, for decision-makers and for individuals;
- To enable access to seek future FDGiA (Flood Defence Grant in Aid);
- To contribute information for local communities and private landowners to understand and act on local flood and erosion risks, through considering their options;

- The outcome of the Strategy can inform Coastal Change Management Area boundaries and policies, including understanding residual risks, to inform the Local Planning Authority;
- To inform future land use and coastal development to take account of natural risks, timescales of impacts, and a realistic assessment of potential schemes; and
- To comply with all legal requirements.

These objectives, stakeholder feedback, baseline data, risk mapping and appreciation of the key features and issues for the coastline set the context for the identification and appraisal of options as described in the following chapters.

3. Developing a Strategic Approach

Flood and erosion risk management options have been considered on two interlinked levels; the strategic level options and the local level measures required to implement these options.

To facilitate this approach, the Strategy frontage was split into six Strategy Management Zones (SMZs) and then broken down further into 32 local level Option Development Units (ODUs). At the Strategic level, a range of potential options for each SMZ were developed with each option relating to the high level SMP approach (if applicable). Appropriate local level measures were then explored and identified to support the delivery of these strategic options.

3.1 Strategy Management Zones

Strategy Management Zones (SMZs) have been developed to provide the suitable mechanism to facilitate appraisal of strategy options. This strategic approach was required to prevent disjointed and inconsistent decision making across the Strategy frontage. The approach also helped to ensure that future actions provide holistic, sustainable and cost effective solutions for the Strategy coastline.

In total, six SMZs were established for the Strategy frontage (Figure 3-1). These are defined below:

SMZ 1. **Needles Headland** - Fort Redoubt to southern limit of Totland Bay

SMZ 2. **Totland and Colwell Bays** – Southern limit of Totland Bay to Fort Victoria

SMZ 3. **Yarmouth and the Western Yar** – Yarmouth coast (Fort Victoria to Port la Salle) and the Western Yar valley (including Freshwater Bay).

SMZ 4. **Newtown Coast** – Bouldnor Cliff to Thorness Bay (including Newtown Estuary)

SMZ 5. **Gurnard and Cowes Headland** – Gurnard Luck to Cowes Parade

SMZ 6. **Cowes, East Cowes and the Medina** – Cowes Parade to Old Castle Point, East Cowes

Strategy Management Zones 3, 5 and 6 were broken down further into sub zones to facilitate a more robust option appraisal process in these areas. These sub-zones are defined below:

SMZ 3a. Yarmouth coast (Yarmouth town and Fort Victoria to Port la Salle)

SMZ 3b. Western Yar Estuary (Yar Estuary shoreline including Thorley Brook and Barnfields Stream)

SMZ 3c. Freshwater (Freshwater bay, Freshwater village and the Causeway)

SMZ 5a. Gurnard Luck and Gurnard cliff (Gurnard Luck / Gurnard marsh area)

SMZ 5b. Gurnard to Cowes Parade (Cowes headland, from Gurnard Bay to Cowes Parade)

SMZ 6a. Cowes and East Cowes (Cowes: Cowes Parade to Medina Wharf. East Cowes: Shrape Breakwater to Kingston Road Power Station)

SMZ 6b. Medina Estuary and East Cowes Outer Esplanade (Medina Wharf and Kingston Road Power Station south to Newport Harbour and Shrape Breakwater to Old Castle Point)

SMZ 6c. Newport Harbour (Newport Harbour and quayside)

A summary of the Strategy Management Zones themes and characteristics is presented in Table 3-1 (towards the end of section 3.2).

3.2 Option Development Units

To ensure that the management solutions proposed by the Strategy are robust and sustainable at the local level it was necessary to split the SMZ frontages into smaller Option Development Units (ODUs). This step helps accommodate the local scale variations in present day land use, future land use (redevelopment), land ownership, coastal defence asset types and coastal flood and erosion risk management that exist within each SMZ. In essence, the creation of the ODUs provides the flexibility to refine strategic options that are both appropriate on a local scale and also fit within the FCERM-AG criteria.

Option Development Units are defined as manageable areas with consistent themes that help to facilitate and rationalise option identification and appraisal. The following information was used to define the ODU boundaries:

- Wight Shoreline Management Plan 2 (2011) boundaries and policies;
- Current coastal risk management assets and standards of protection;
- Coastal processes;
- Flood zones and mapping;
- SMP erosion bands;
- Land use and ownership;
- Opportunities and constraints; and
- Historical and current issues or concerns.

In total 32 ODUs were created along the Strategy frontage. Figure 3-1 and Figure 3-2 present the location of the SMZs and ODUs along the frontage.

The key drivers behind the ODU boundary definitions are summarised in Table 3-1, which also includes details of the residual defence life without maintenance, the local SMP policy, the coastal process and key land uses. A detailed breakdown of the ODU characteristics is provided in Appendix 1.

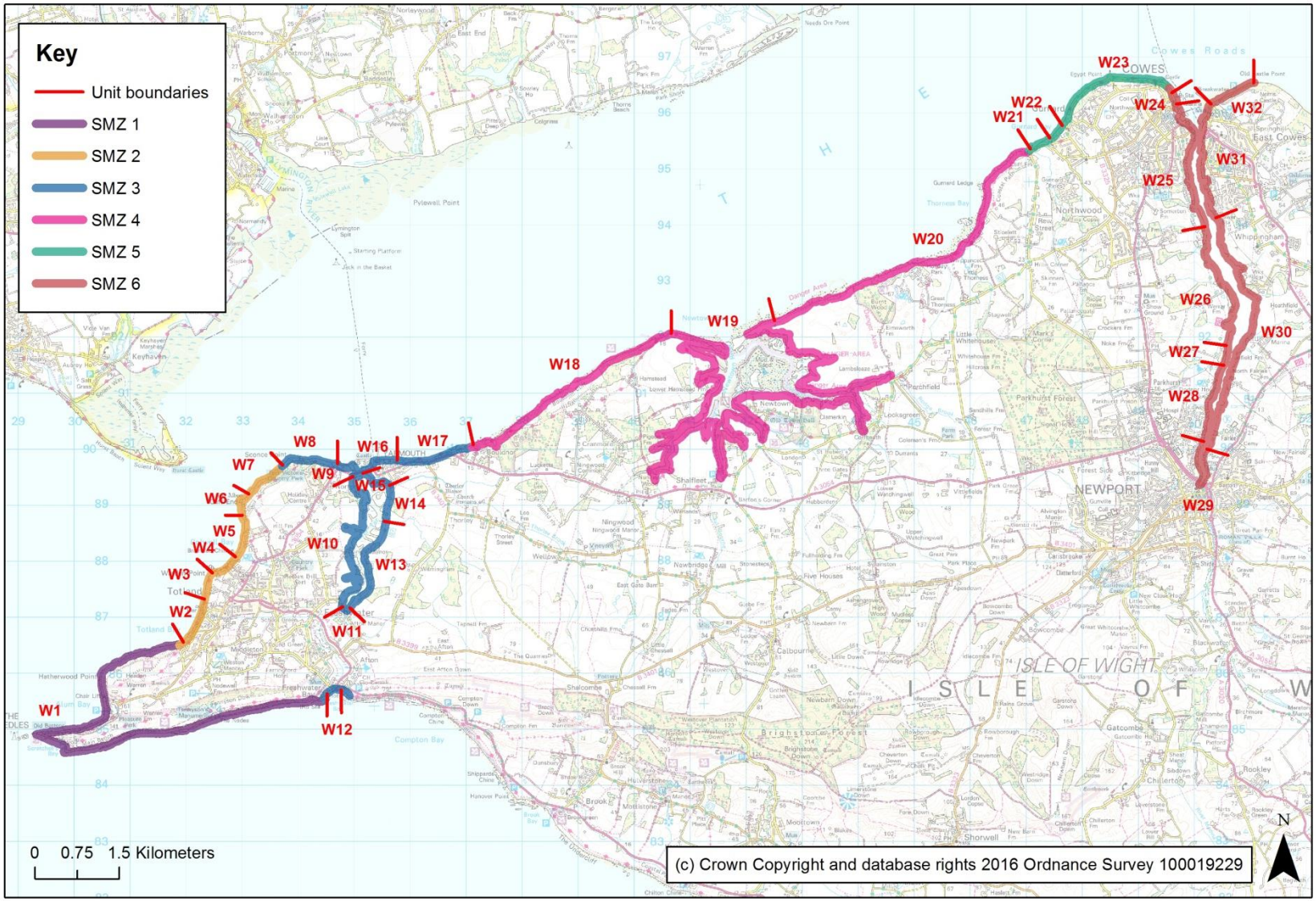


Figure 3-1. SMZ and ODU locations and boundaries

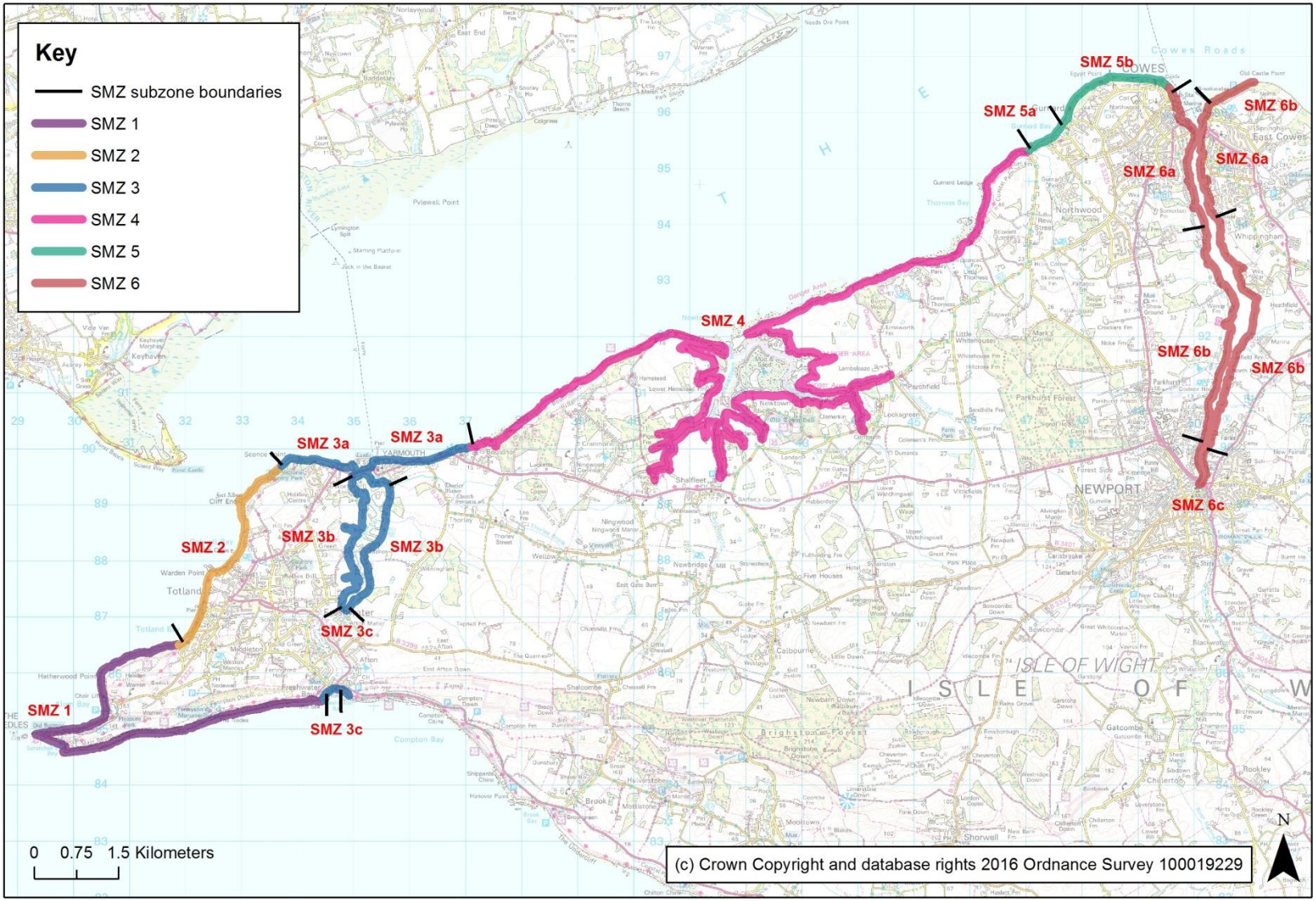


Figure 3-2. SMZ and SMZ sub-zone locations and boundaries

Table 3-1. Overview of the Strategy Management Zone themes and characteristics

Management Zone Summary					
Zone	**Name**	**Geographic Extent**	**Policy Units**	**SMP Policy (2011)**	**Zone Characteristics (common themes / issues)**
1	Needles headland	Fort Redoubt to southern limit of Totland Bay	W1	No Active Intervention	• Undefended, cliffed coastline • Exposed to relatively large waves – high rates of erosion • Small number of assets at risk from erosion at the clifftop • No flood risk • Leisure / recreational use
2	Totland and Colwell bays	Southern limit of Totland Bay to Fort Victoria	W2 to W7	Mixed (Hold the Line in the south. Transferring from Hold the Line to No Active Intervention in the north)	• Cliffs subject to landsliding • Significant number of residential and some commercial properties at risk of erosion • Popular recreational area • No flood risk
3a	Yarmouth Coast	Yarmouth town and Fort Victoria to Port la Salle	W8 to W9 and W15 to W17	Mixed (Hold the Line around Yarmouth and to the east. Transferring from Hold the Line to No Active Intervention in the west)	• Yarmouth is a key residential and town centre • Significant flood and erosion risks • Roads that provide access to other parts of the Island are at risk from flooding and erosion • Ferry terminal provides link to mainland
3b	Western Yar Estuary	Western Yar Estuary shoreline including Thorley Brook and Barnfields Stream	W10, W13 and W14	No Active Intervention, with Managed Realignment at Thorley Brook	• Recreation area and farmland • Cyclepath situated on the eastern side of the estuary • Predominantly undefended • Small and localised flood and erosion risks • Mostly sheltered and estuarine

Management Zone Summary					
Zone	**Name**	**Geographic Extent**	**Policy Units**	**SMP Policy (2011)**	**Zone Characteristics (common themes / issues)**
3c	Freshwater	Freshwater Bay, Freshwater Village and the Causeway	W11 and W12	Hold The Line	• Large number of residential and commercial properties at risk from flooding • Low lying area at flood risk between the Causeway and Freshwater Bay • Freshwater Bay exposed to large swell waves that can result in overtopping of the defences • Small risk of erosion at Freshwater Bay • A3055 at risk of flooding
4	Newtown Coast	Bouldnor cliff to Thorness Bay, including Newtown Estuary	W18 to W20	No Active Intervention	• Open space • Undefended • Environmentally important area • Small localised risk of erosion • No flood risk
5a	Gurnard Luck and Gurnard cliff	Gurnard Luck / Gurnard marsh area	W21 to W22	Mixed (Hold the Line changing to No Active Intervention at Gurnard Luck. No Active Intervention to the east)	• Significant risk of flooding at Gurnard Luck • Erosion risk because of the close proximately of properties to the coastline • Existing private defences have relatively low crest levels
5b	Gurnard to Cowes Parade	Cowes headland, from Gurnard Bay to Cowes Parade	W23	Hold The Line	• The developed coastal slopes have potential for landslide reactivation • Erosion is more of a significant risk than flooding • There are existing sea wall defences, overtopped at low points at high tide events
6a	Cowes and East Cowes	Cowes: Cowes Parade to Medina Wharf. East Cowes: Shrape breakwater to Kingston Road Power Station	W24 to W25 and W31	Hold The Line	• Cowes and East Cowes are key urban centres • Significant amount of residential and commercial properties are at risk from both flooding and erosion • Waterfront access is important • Two ferry terminals provide links to the mainland

Management Zone Summary					
Zone	**Name**	**Geographic Extent**	**Policy Units**	**SMP Policy (2011)**	**Zone Characteristics (common themes / issues)**
6b	Medina Estuary (and East Cowes Outer Esplanade)	Medina Wharf and Kingston Road Power Station south to Newport Harbour and Shrape Breakwater to Old Castle Point	W26 to W28, W30, W32	Mixed (mainly No Active Intervention, plus Hold the Line at West Medina Mills and Hold the Line transferring to No Active Intervention at East Cowes outer esplanade)	• Land is predominantly farmland and recreational land • Small landslides have blocked access near Old Castle Point • Small amount of properties at risk from flooding and erosion
6c	Newport Harbour	Newport Harbour and quayside	W29	Hold The Line	• Waterfront access is important • Commercial and industrial properties are close to the waterfront and at risk of flooding • If the harbour walls failed a number of properties are at risk of damage

Table 3-2 Overview table of Option Development Units W1 – W17

KEY

SMP Policy: HTL = Hold the Line; NAI = No Active Intervention; MR = Managed Realignment

Erosion & Flood risk: Indicative risk to people or assets under a 'Do Nothing' Scenario

Low | Moderate | High

Overview table of option development units

ODU	Unit Name	SMP PU	SMP Policy			Defence Residual Life (years)	Frontage Maintainer	Indicative Erosion Risk			Indicative Flood Risk			Coastal Processes	Landuse
			to 2025	to 2055	to 2105			0-10	10-40	40-100	0-10	10-40	40-100		
W1	Tennyson Down, Alum Bay and Headon Warren	PU6A.2	NAI	NAI	NAI	Undefended	National Trust + Private							High wave energy, exposed cliff line	Open space, attractions (Needles Park), farmland, coastal footpath
W2	Southern and Central Totland Bay	PU6B.1	HTL	HTL	HTL	<10-20+	IWC + Private							High wave energy	Recreation, residential
W3	Northern Totland Bay	PU6B.1	HTL	HTL	HTL	<10-20+	IWC + Private							High wave energy	Recreation, residential
W4	Southern Colwell Bay	PU6B.1	HTL	HTL	HTL	10-20+	IWC + Private							High wave energy	Recreation, residential
W5	Central Colwell Bay	PU6B.2	NAI	NAI	NAI	Undefended	IWC + Private							High wave energy, net sediment movement is from southwest to northeast	Recreation, holiday parks, residential (holiday homes), open space
W6	Fort Albert	PU6B.3	HTL	HTL	NAI	10-20+	IWC + Private							High wave energy	Residential (holiday Homes), open space
W7	Fort Victoria Country Park	PU6B.4	NAI	NAI	NAI	Undefended	IWC + Private							Relatively high wave energy	Open space (woodland)
W8	Fort Victoria and Norton	PU6B.5	HTL	NAI	NAI	<10-20+	IWC + Private							Low wave energy (fetch limited)	Residential, recreation (resort leisure club)
W9	Norton Spit	PU6C.1	HTL	HTL	HTL	10-20+	Private							Low wave energy (fetch limited)	Recreation, harbour
W10	Western Yar Estuary - western shore	PU6C.2	NAI	NAI	NAI	Undefended	Private							Estuarine, sheltered	Recreation (boat yard), farmland
W11	The Causeway	PU6C.3	HTL	HTL	HTL	10-20+	Environment Agency							Estuarine, sheltered	Residential, open space
W12	Freshwater Bay	PU6A.1	HTL	HTL	HTL	10-20+	IWC + Private							Bay receives sediment from the west. Accretion in middle, erosion at flanks. High wave energy	Recreation, residential (apartments)
W13	Western Yar Estuary - eastern shore	PU6C.4	NAI	NAI	NAI	Undefended	IWC							Estuarine, sheltered	Farmland, cyclepath
W14	Thorley Brook and Barnfields Stream	PU6C.5	HTL	MR	NAI	15-20+	Environment Agency, IWC + Private							Estuarine, sheltered	Open space (nature conservation)
W15	Thorley Brook to Yar Bridge	PU6C.6	HTL	HTL	HTL	15-20+	IWC + Private							Estuarine, sheltered	Residential, recreation, school
W16	Yar Bridge to Yarmouth Common	PU6C.6	HTL	HTL	HTL	15-20+	Private							Low wave energy (fetch limited)	Harbour including ferry terminal, behind the harbour are commercial and residential properties
W17	Yarmouth Common to Port la Salle	PU6C.6	HTL	HTL	HTL	<10-20+	IWC + Private							Low wave energy (fetch limited)	Recreation, residential

Table 3-3 Overview table of Option Development Units W18 - W32

KEY

SMP Policy: HTL = Hold the Line; NAI = No Active Intervention; MR = Managed Realignment

Erosion & Flood risk: Indicative risk to people or assets under a 'Do Nothing' Scenario

Low | Moderate | High

W18	Bouldnor Copse and Hamstead	PU7.1	NAI	NAI	NAI	Undefended	Private							Low wave energy (fetch limited)	Open space (woodland), limited residential properties
W19	Newtown Estuary	PU7.2	NAI	NAI	NAI	Undefended	National Trust + SERFCA + Private							Mostly estuarine, locally littoral drift is from both sides towards the inlet / spits	Nature reserve, farmland, some small residential areas
W20	Thorness Bay and southern Gurnard Bay	PU7.3	NAI	NAI	NAI	Undefended	Private							Low wave energy (fetch limited)	Recreation (holiday park), farmland, woodland, some small residential areas
W21	Gurnard Luck	PU1A.1	HTL	NAI	NAI	<10-20+	Private + Environment Agency							Low wave energy (fetch limited)	Residential, harbour
W22	Gurnard Cliff	PU1A.2	NAI	NAI	NAI	Undefended	Private							Low wave energy (fetch limited)	Woodland, residential area on top of the cliff
W23	Gurnard to Cowes Parade	PU1A.3	HTL	HTL	HTL	Mainly 15-20+	IWC + Private							Low wave energy (fetch limited), weak net eastwards littoral drift, landslide reactivation potential	Residential, recreation (beach huts), commerical
W24	Cowes Town Centre to Fountain Yard	PU1A.4	HTL	HTL	HTL	15-20+	Private							Low wave energy (fetch limited)	Residential, commerical (large High Street)
W25	Cowes (Fountain Yard to Medina Wharf)	PU1A.4	HTL	HTL	HTL	15-20+	Private							Mostly estuarine, sheltered	Industrial properties with residential streets landward, commercial buildings, harbour, wharfs and a ferry terminal
W26	Central Medina - northwest shore	PU1B.1	NAI	NAI	NAI	Undefended	IWC + Private							Estuarine, sheltered	Farmland, cyclepath
W27	West Medina Mills	PU1B.2	HTL	HTL	HTL	10-20+	Private							Estuarine, sheltered	Small industrial area, with private defences
W28	Central Medina - southwest shore	PU1B.3	NAI	NAI	NAI	Undefended	IWC + Private							Estuarine, sheltered	Farmland, small residential areas, industrial area to the south is setback from the frontage, cyclepath
W29	Newport Harbour	PU1B.4	HTL	HTL	HTL	10-20+	IWC + Private							Estuarine, sheltered	Industrial areas, harbour, commercial, residential
W30	Central Medina - eastern shore	PU1B.5	NAI	NAI	NAI	Mainly Undefended	IWC + Private							Estuarine, sheltered	Farmland, waste water pumping station, recreation (harbour and holiday park), disused industrial facility
W31	East Cowes (Kingston Road Power Station to Shrape Breakwater)	PU1A.5	HTL	HTL	HTL	15-20+	Private							Low wave energy (fetch limited)	Industrial facilities (including fuel depot and power station), residential, commericial buildings and wharfs, harbour, ferry terminal
W32	East Cowes outer Esplanade (Shrape Breakwater to Old Castle Point)	PU1A.6	HTL	NAI	NAI	15-20+	IWC							Low wave energy (fetch limited)	Recreation area with residential properties landward, woodland

3.3 Establishing the baseline

In order to compare the relative advantages and disadvantages of future management approaches it was necessary to first establish the baseline economic, environmental and social damages that would be expected over the next 100 years under the 'Do Nothing' approach.

The baseline damages expected under the 'Do Nothing' approach for each SMZ were established with use of TuFLOW flood mapping, SMP erosion predictions and National Receptor Database (NRD) property data. For details of how the flood mapping and erosion predictions were produced please refer to the Flood modelling / Coastal Processes report (Strategy Appendices C and D).

In a GIS system the NRD property data was interrogated against the flood mapping and erosion predictions to identify the properties at risk over the next 100 years under the 'Do Nothing' approach.

Table 3-4 to Table 3-12 present the number of residential and commercial properties at risk of flooding from a 1:200 year flood event within each SMZ under the 'Do Nothing' scenario. The number of properties expected to be at risk from erosion is also presented in these tables. It should be noted that the numbers of properties considered to be at risk have changed slightly compared to the previously published SMP (2011). This is mainly the result of updates to the numerical flood modelling run during the Strategy.

In keeping with sea level rise predictions, generally the number of properties at risk increases over time. The exception to this trend is in SMZ 3b and 6c where the number of properties at risk of flooding is shown to reduce over time; however this is a result of erosion loss (i.e. from defences failure under a Do Nothing scenario) which leads to a number of properties previously at risk of flooding being eroded and written off in the future and therefore cease to count to the flood risk property numbers.

Once the properties at risk had been identified, the baseline property damages (in monetary terms) were then estimated. In addition, indirect economic, environmental and social damages (e.g. health, loss of visitors, traffic disruption, habitat losses etc.) associated with the 'Do Nothing' approach were also estimated (in monetary terms). Table 3-15 outlines the baseline damages (present value) expected to residential, commercial and environmental assets over the next 100 years in each SMZ.

Table 3-4.SMZ 1 residential and commercial properties at risk under 'Do Nothing'

Year	No. residential properties at risk of flooding (1:200 year event)	No. commercial properties at risk of flooding (1:200 year event)	Total no. of properties at risk of flooding (1:200 year event)	No. residential properties at risk of erosion	No. commercial properties at risk of erosion	Total no. properties at risk of erosion
2015	0	0	0	0	0	0
2025	0	0	0	1	0	1
2055	0	0	0	5	2	7
2115	0	0	0	27	8	35

Table 3-5. SMZ 2 residential and commercial properties at risk under 'Do Nothing'

Year	No. residential properties at risk of flooding (1:200 year event)	No. commercial properties at risk of flooding (1:200 year event)	Total no. of properties at risk of flooding (1:200 year event)	No. residential properties at risk of erosion	No. commercial properties at risk of erosion	Total no. properties at risk of erosion
2015	0	0	0	0	0	0
2025	0	0	0	4	0	4
2055	0	0	0	62	24	86
2115	0	0	0	284	110	394

Table 3-6. SMZ 3a residential and commercial properties at risk under 'Do Nothing'

Year	No. residential properties at risk of flooding (1:200 year event)	No. commercial properties at risk of flooding (1:200 year event)	Total no. of properties at risk of flooding (1:200 year event)	No. residential properties at risk of erosion	No. commercial properties at risk of erosion	Total no. properties at risk of erosion
2015	13	28	41	0	0	0
2025	15	33	48	0	0	0
2055	18	29	47	15	30	45
2115	41	36	77	130	64	194

Table 3-7. SMZ 3b residential and commercial properties at risk under 'Do Nothing'

Year	No. residential properties at risk of flooding (1:200 year event)	No. commercial properties at risk of flooding (1:200 year event)	Total no. of properties at risk of flooding (1:200 year event)	No. residential properties at risk of erosion	No. commercial properties at risk of erosion	Total no. properties at risk of erosion
2015	4	12	16	0	0	0
2025	4	13	17	0	0	0
2055	3	13	16	1	0	1
2115	4	15	19	2	0	2

Table 3-8. SMZ 3c residential and commercial properties at risk under 'Do Nothing'

Year	No. residential properties at risk of flooding (1:200 year event)	No. commercial properties at risk of flooding (1:200 year event)	Total no. of properties at risk of flooding (1:200 year event)	No. residential properties at risk of erosion	No. commercial properties at risk of erosion	Total no. properties at risk of erosion
2015	12	16	28	0	0	0
2025	17	18	35	0	0	0
2055	28	19	47	0	2	2
2115	53	24	77	11	5	16

Table 3-9. SMZ 4 residential and commercial properties at risk under 'Do Nothing'

Year	No. residential properties at risk of flooding (1:200 year event)	No. commercial properties at risk of flooding (1:200 year event)	Total no. of properties at risk of flooding (1:200 year event)	No. residential properties at risk of erosion	No. commercial properties at risk of erosion	Total no. properties at risk of erosion
2015	0	0	0	0	0	0
2025	0	0	0	0	1	1
2055	0	0	0	7	5	12
2115	0	0	0	32	27	59

Table 3-10. SMZ 5a residential and commercial properties at risk under 'Do Nothing'

Year	No. residential properties at risk of flooding (1:200 year event)	No. commercial properties at risk of flooding (1:200 year event)	Total no. of properties at risk of flooding (1:200 year event)	No. residential properties at risk of erosion	No. commercial properties at risk of erosion	Total no. properties at risk of erosion
2015	38	5	43	0	0	0
2025	38	5	43	0	0	0
2055	32	4	36	18	1	19
2115	4	4	8	52	2	54

Table 3-11. SMZ 5b residential and commercial properties at risk under 'Do Nothing'

Year	No. residential properties at risk of flooding (1:200 year	No. commercial properties at risk of flooding (1:200 year	Total no. of properties at risk of flooding (1:200 year event)	No. residential properties at risk of erosion	No. commercial properties at risk of erosion	Total no. properties at risk of erosion

	event)	event)				
2015	2	2	4	0	0	0
2025	3	3	6	0	0	0
2055	7	1	8	33	11	44
2115	0	0	0	228	41	269

Table 3-12. SMZ 6a residential and commercial properties at risk under 'Do Nothing'

Year	No. residential properties at risk of flooding (1:200 year event)	No. commercial properties at risk of flooding (1:200 year event)	Total no. of properties at risk of flooding (1:200 year event)	No. residential properties at risk of erosion	No. commercial properties at risk of erosion	Total no. properties at risk of erosion
2015	122	195	317	0	0	0
2025	131	214	345	0	0	0
2055	137	235	372	45	53	98
2115	195	228	423	180	153	333

Table 3-13. SMZ 6b residential and commercial properties at risk under 'Do Nothing'

Year	No. residential properties at risk of flooding (1:200 year event)	No. commercial properties at risk of flooding (1:200 year event)	Total no. of properties at risk of flooding (1:200 year event)	No. residential properties at risk of erosion	No. commercial properties at risk of erosion	Total no. properties at risk of erosion
2015	4	9	13	0	0	0
2025	6	9	15	0	0	0
2055	16	12	28	0	4	4
2115	43	18	61	0	9	9

Table 3-14. SMZ 6c residential and commercial properties at risk under 'Do Nothing'

Year	No. residential properties at risk of flooding (1:200 year event)	No. commercial properties at risk of flooding (1:200 year event)	Total no. of properties at risk of flooding (1:200 year event)	No. residential properties at risk of erosion	No. commercial properties at risk of erosion	Total no. properties at risk of erosion
2015	7	9	16	0	0	0
2025	11	11	22	0	0	0
2055	3	3	6	14	15	29
2115	19	11	30	24	15	39

Table 3-15. Baseline present value damages expected between 2015 and 2115 under 'Do Nothing'

SMZ	PV Flooding (£k)	PV Erosion (£k)	PV Indirect (£k)	PV Total (£k)
1	£0	£1,699	£0	£1,699
2	£0	£11,877	£1,310	£13,187
3a	£3,569	£7,307	£25,120	£35,996
3b	£1,993	£217	£1,139	£3,349
3c	£6,834	£1,592	£1,928	£10,354
4	£0	£2,069	£0	£2,069
5a	£2,076	£2,334	£1,930	£6,340
5b	£141	£23,144	£595	£23,879
6a	£55,657	£12,894	£24,094	£92,645
6b	£1,840	£77	£650	£2,568
6c	£2,114	£2,961	£573	£5,648
All	£74,223	£66,169	£57,339	£197,732

4. Option Development

Once the baseline had been established for each SMZ, a range of strategic options to manage the coastline were developed in line with FCERM-AG.

In order to develop a robust Strategy and to ensure that no potential strategic options were overlooked, the strategic option development process initially involved creating a long list of all potential options available to manage the flood and erosion risk and to satisfy wider Strategy objectives. From this long list, a short list of potentially suitable options was then selected and defined for appraisal in each SMZ (typically four or five of the most appropriate options were identified for each SMZ).

4.1 Long list of strategic level options

The scope of the generic strategic level options available to each SMZ included:

- Do Nothing – no active intervention
- Do Minimum – e.g. maintain health and safety obligations, minor reactive maintenance / repairs
- Maintain – proactively maintain defences (i.e. continue to protect against erosion, or maintain the current defence crest height of flood defences accepting standard of protection will fall over time)
- Sustain – sustain a standard of protection by adapting defences over time to keep pace with sea level rise
- Improve Standard of Protection – raise existing defence levels, allowing for future sea level rise
- Environmental Enhancement / Improvement – including managed realignment

In addition, variations of the above options were also considered.

4.2 Options short-listed for appraisal

From the long list of strategic options, a short list of potentially suitable options was selected and defined for appraisal in each SMZ (typically four or five of the most appropriate options were identified for each SMZ). This allowed a robust comparison to be made between the available management choices and helped in the justification for a preferred strategic option.

The selection of the most appropriate strategic options in each SMZ was largely guided by the distribution of the baseline ‘Do Nothing’ damages and the Strategy teams understanding of the wider risks, issues and opportunities in each SMZ. The Project Steering Group provided valuable feedback during this stage of the option development process and agreed the options for appraisal.

In line with FCERM-AG, the short list options selected for appraisal in each SMZ included the ‘Do Nothing’ and ‘Do Minimum’ options. These options provide a baseline against which the other ‘Do Something’ options can be compared.

Table 4-1 below outlines the short list of options that were appraised for each SMZ.

Table 4-1. Strategic options identified at each SMZ

SMZ / ODUs	Area	Option	Description
SMZ 1 W1	Needles Headland	Do Nothing	No active intervention. Baseline scenario
SMZ 2 W2 – W7	Totland and Colwell Bays	Do Nothing	No active intervention. Baseline scenario
		Do Minimum	Maintain H&S and access as long as possible and develop coastal change management area plan (W2-W6).
		Maintain then Improve from 2025	Phased seawall improvement and cliff stabilisation. Maintain defences (W2-W4) until end of design life then implement phased cliff drainage and sea wall stabilisation works (for example a mass rock revetment). Do minimum elsewhere.
		Improve (now)	Seawall stabilisation works (for example a mass rock revetment) and cliff stabilisation and cliff drainage now (W2-W4). Do minimum elsewhere.
SMZ 3a W8 – W9 W15 – W17	Yarmouth coast (Fort Victoria to Port La Salle)	Do Nothing	No active intervention. Baseline scenario
		Do Minimum	H&S and access. Flood warning and emergency response plan.
		Maintain (and Temporary Flood Barriers) then Improve from 2055	Use Temporary Flood Barriers to manage and reduce flooding to areas at significant risk by sustaining a 1 in 75 year (1.33% AEP) standard of protection. Prevent erosion to critical infrastructure serving the town and the West Wight. From 2055, if funding can be secured, raise / implement new defences (bunds and floodwalls) to manage long term increase in flood and erosion risk posed by sea level rise.
		Maintain (and PLP) then Improve from 2055	Use Property Level Protection to manage and reduce flooding to residential properties at very significant risk. Prevent erosion to critical infrastructure serving the town and the West Wight. From 2055, if funding can be secured, raise / implement new defences (bunds and floodwalls) to manage long term increase in flood and erosion risk posed by sea level rise.
		Improve (now)	Raise / implement new defences (bunds and floodwalls) now manage longer term increase in flood and erosion risk posed by sea level rise.
SMZ 3b W10 W13 – W14	Western Yar estuary	Do Nothing	No active intervention. Baseline scenario
		Do Minimum	H&S and access (minor repairs to cyclepath i.e. debris removal).
		Do Minimum with Managed Realignment between 2025 and 2055	Maintain existing structures, H&S and cycle and footpath access. If funding can be secured, managed realignment at Thorley Brook between 2025 and 2055 to provide environmental mitigation and create intertidal habitat.
		Maintain	Maintenance of existing structures (including cycle path repairs) and refurbishment at end of design life.
SMZ 3c W11 - W12	Freshwater (The Causeway and Freshwater	Do Nothing	No active intervention. Baseline scenario
		Do Minimum	H&S and access. Flood warning and emergency response plan.
		Adaption and Resilience	Recommend Property Level Protection and flood warning / emergency response plan for residential properties at very

SMZ / ODUs	Area	Option	Description
	Bay)	(and PLP) / Do Minimum	significant risk.
		Maintain (and PLP) then Improve (2055)	Maintenance of existing structures and recommend Property Level Protection to the residential properties at significant flood risk. Refurbishment of existing defences at Freshwater Bay at end of design life to prevent erosion risk and implement new defences at Freshwater Village in the long term to mitigate flood risk and improve the standard of protection
		Maintain and Improve (now)	Maintain existing defences at Freshwater Bay, improve standard of protection at Freshwater Village. Refurbishment and Improve existing defences at end of design life at Freshwater Bay to mitigate erosion risk and implement new defences at Freshwater Village to improve the standard of flood protection.
SMZ 4 W18 – W20	Newtown Coast	Do Nothing	No active intervention. Baseline scenario
SMZ 5a W21 – W22	Gurnard Luck and Gurnard Cliff	Do Nothing	No active intervention. Baseline scenario
		Do Minimum, with community led adaption	Privately funded community and property level flood resilience and adaptation at Gurnard Luck (up to 2055). Private maintenance of existing assets permitted (subject to obtaining the required consents). In the longer term accept that flood risk will increase due to sea level rise but provide a Coastal Change Management Area Plan to support the No Active Intervention policy. Do Minimum (maintain health and safety) at Gurnard cliff.
		Improve (now) and then adapt	Improve to 1 in 75 year (1.33%) standard of protection through privately funded scheme involving parapet raising and setback walls and private maintenance of existing assets. In the longer term accept that flood risk will increase due to sea level rise but provide a Coastal Change Management Area Plan to support the No Active Intervention policy. Do Minimum (maintain health and safety) at Gurnard cliff.
		Maintain	Maintenance of existing structures and refurbishment at end of design life (and flood warning and emergency response plan). Accept flood risk will increase over time due to sea level rise. Do Minimum (maintain health and safety) at Gurnard cliff where there are no existing defences.
SMZ 5b W23	Gurnard to Cowes Parade	Do Nothing	No active intervention. Baseline scenario
		Do Minimum	Maintain H&S and access and also provide coastal change management area plan.
		Maintain	Maintenance of existing structures and refurbishment or replacement at end of their residual life to reduce risks of erosion and landslide reactivation. Flood risk will increase due to sea level rise.
		Improve (now)	Implement seawall stabilisation works along Cowes – Gurnard to reduce erosion risk and increase standard of flood protection
SMZ 6a W24 – W25 W31	Cowes and East Cowes	Do Nothing	No active intervention. Baseline scenario
		Do Minimum	Maintain H&S and access. Provide flood warning and emergency response plan.
		Do Minimum (and PLP) then Adapt	Recommend Property Level Protection for residential properties at very significant risk and maintain H&S and access. Adapt and provide flood warning / emergency response plan.

SMZ / ODUs	Area	Option	Description
		Maintain	Maintenance of existing structures and refurbishment at end of design life. Accept standard of protection will fall over time.
		Sustain (with Temporary Flood Barriers and PLP) then Improve from 2055	In the short and medium term maintain the existing defences and use Temporary Flood Barriers and Property Level Protection to sustain a 1 in 75 year (1.33% AEP) standard of protection in the areas at significant flood risk. Use redevelopment opportunities to facilitate the raising / implementation of new strategic defences. In the long term (from 2055), if the funding can be secured, implement new defences such as seawalls or setback floodwalls to manage the increase in flood and erosion risk posed by sea level rise.
		Sustain (with PLP) then Improve from 2055	In the short and medium term maintain the existing defences and use Property Level Protection and a flood warning / emergency response plan (no Temporary Flood Barriers) to manage and reduce flooding to residential properties at significant risk. Use redevelopment opportunities to facilitate the raising / implementation of new strategic defences. In the long term (from 2055), if the funding can be secured, implement new defences such as seawalls or setback floodwalls to manage the increase in flood and erosion risk posed by sea level rise.
		Improve (now)	Replace and raise defences to provide a 1in 200 year (0.5% AEP) standard of protection.
SMZ 6b W26 – W28 W30 W32	Medina Estuary (and East Cowes Outer Esplanade)	Do Nothing	No active intervention. Baseline scenario
		Do Minimum	Maintain H&S and access.
		Maintain	Maintenance of existing structures and refurbishment at end of design life. Accept standard of protection against flooding will fall over time due to sea level rise.
SMZ 6c W29	Newport Harbour	Do Nothing	No active intervention. Baseline scenario
		Do Minimum	Maintain H&S and access. Provide flood warning and emergency response plan.
		Maintain (and PLP) then Improve from 2055 (through redevelopment)	In the short term recommend Property Level Protection to manage and reduce flooding to the few residential properties at very significant risk. Maintain then refurbish existing defences once they reach the end of their service life. In the long term use redevelopment opportunities to facilitate the raising / implementation of new strategic defences to improve the standard of flood protection.
		Maintain (and PLP) then Improve from 2055 (through a frontline scheme)	In the short term recommend Property Level Protection to manage and reduce flooding to the few residential properties at very significant risk. Maintain then refurbish existing defences once they reach the end of their service life. A new frontline scheme from 2055 to improve the standard of flood protection.
		Improve (now)	Raise / implement new frontline defences to manage longer term increase in flood risk posed by sea level rise.

5. Accounting for Local Requirements

To ensure that each of the strategic options developed are robust and relevant to local issues and spatial and temporal changes in risk, it was necessary to establish an appropriate 'package of measures' for each ODU within the SMZ.

Each 'package' comprised different types of coastal defence structure or management option (including maintenance), and the required timing of works necessary to deliver the strategic option. The 'package of measures' and type of coastal defence structure selected was informed by the following:

- Supporting data and assessments – a review of a wide range of relevant data and completion on baseline studies provided the understanding of the frontage and the issues, constraints and opportunities. This information provided the facts from which to screen out non-viable measures and to identify potentially viable measures that could meet the higher level SMZ strategic options and the overarching Strategy objectives.

- Visual site inspections – a site walkover aided the teams' understanding and appreciation of the issues, constraints and opportunities for the different strategic defence options along the Strategy frontage.

- Key stakeholder engagement – engagement and liaison with key stakeholders formed a fundamental part of the screening process. Dedicated meetings to inform this stage of the appraisal process were carried out with the key stakeholders and the project steering group.

More detail on the identification of suitable measures in each ODU is found in Appendix 2.

An example summary table showing the ODU level interventions required to implement the option 'Maintain and Temporary Flood Barriers then Improve' is presented in Table 5-1 for SMZ 3a.

Table 5-1. Example table outlining the 'package of measures' required at each ODU within SMZ 3a to deliver the 'Maintain and Temporary Flood Barriers then Improve' strategic option.

	W8	W9	W15	W16	W17
2015 – 2025	Maintain access and H&S*	Maintain and upgrade / refurbish	Temporary flood barriers	Temporary flood barriers	Maintenance
2025 – 2055	Maintain access and H&S*	Maintain and upgrade / refurbish	Temporary flood barriers	Temporary flood barriers	Upgrade**
2055 - 2115	Maintain access and H&S*	Upgrade / new defences**	Upgrade / new defences**	Upgrade / new defences**	Maintenance

*Maintain health and safety requirements of the structure in line with health and safety legislation standards

**'Upgrade' involves the raising / refurbishment of existing defences. 'New defences' involves constructing a new defence (i.e. a setback flood wall)

6. Option appraisal

6.1 Decision making process

The selection of the preferred strategic option for each SMZ followed the FCERM-AG decision rules. However, this process is necessarily (at least in part) an iterative process, taking into consideration technical feasibility and effectiveness, economic appraisal and environmental and social assessment.

Flow charts describing the option appraisal process used to select the preferred option for each SMZ are provided in Figure 6-1 and Figure 6-2.
Figure **6-3** and Figure 6-4 provide a worked example of the decision making process for SMZs 2 and 3a respectively.

The stages of the decision making processes are outlined below:

Stage 1 – Establish the whole life costs and benefits. Ensure the benefit cost ratio >1 for all options.

Stage 2 – Organise the options. Following the FCERM-AG decision process, for each SMZ the options were organised into a list according to their Average Benefit Cost Ratio (ABCR). From this list, depending on the factors driving the option selection (i.e. erosion risk / flood risk), either the Average Benefit Cost Ratio or Incremental Benefit Cost Ratio (IBCR) was used to identify the leading economic option.

In instances when the erosion risk was the key driver behind the selection process the option with the highest ABCR was identified as the leading economic option.

However, when flood risk was the key driver behind the selection process it was necessary to consider the relative merits of the options with a lower ABCR. For instance, options providing a higher standard of protection yielding higher economic benefits are typically more expensive and may not necessarily have the highest ABCR. To indicate the cost effectiveness of the additional investment of these options the IBCR was considered. If the additional investment was considered value for money (i.e. the additional cost was outweighed by the additional benefits) then the leading economic option was identified on this basis.

Please refer to chapter 8 in the Economic Appraisal Report (Strategy Appendix F) for details on the selection of the leading economic option.

Stage 3 – Accounting for contributions. Include any contributions and evaluate whether the average and incremental benefit:cost ratio of options changes the choice of the leading economic option.

Stage 4 – Testing uncertainty. A number of sensitivity tests were carried out to determine whether uncertainty would influence the choice of the leading option. These tests included altering the level of optimism bias and levels of indirect benefit associated with specific options.

Stage 5 – Consider wider objectives. The choice of the leading economic option was then considered against the wider objectives of the Strategy, such as stakeholder and community aspirations and environmental benefits. The choice of the leading option was reconsidered if an alternative option demonstrated a significantly stronger case in terms of meeting the wider objectives and non-monetary benefits (e.g. through providing greater environmental benefits).

The process of option testing and decision making was supported by a multi-criteria appraisal and the strategic environmental assessment. A summary of this analysis is provided in section 6.3.

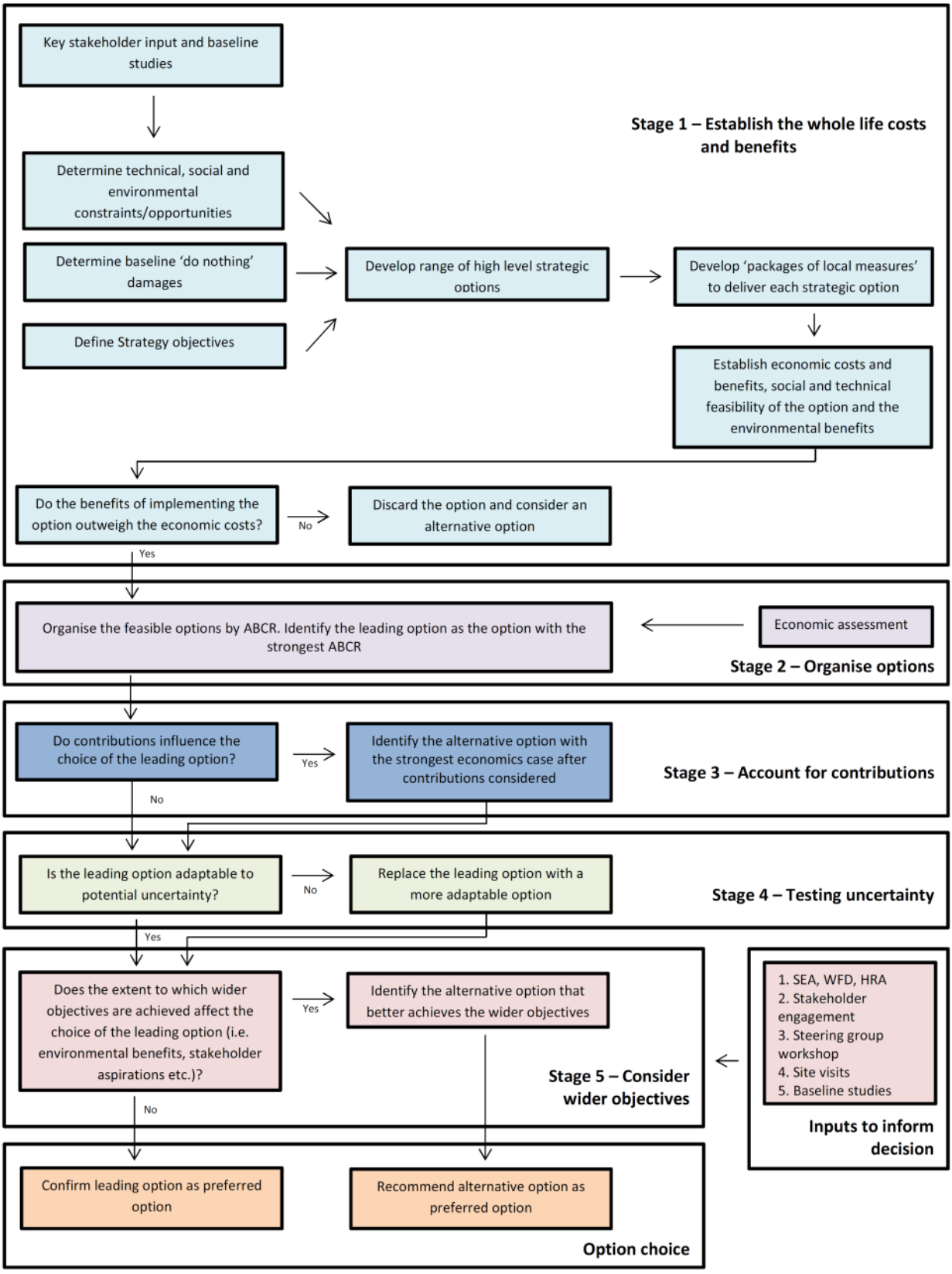


Figure 6-1. Overview of the option appraisal and decision making process to select the preferred options when Erosion risk is the key risk being addressed.

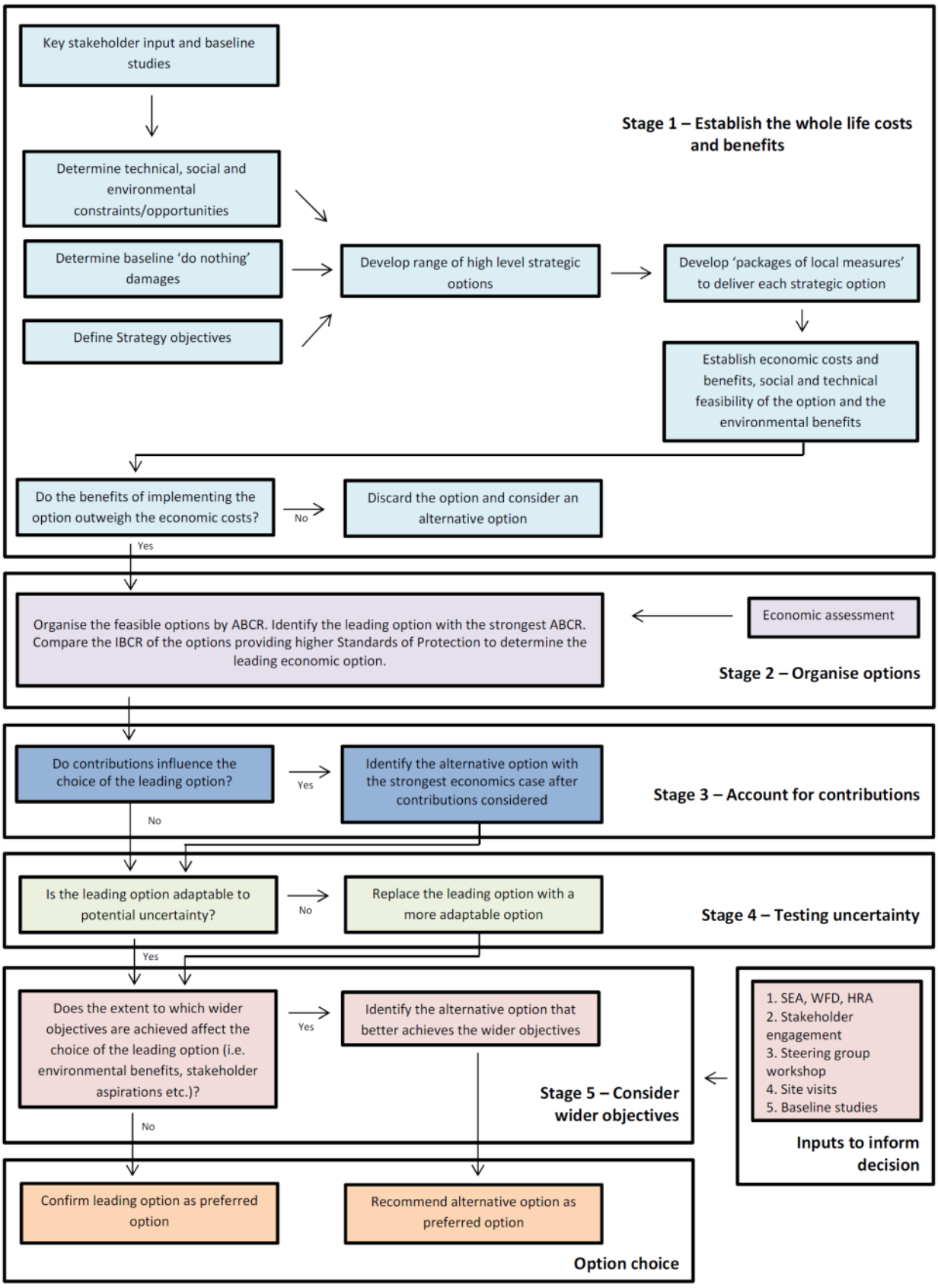


Figure 6-2. Overview of the option appraisal and decision making process to select the preferred options when Flooding is the key risk being addressed.

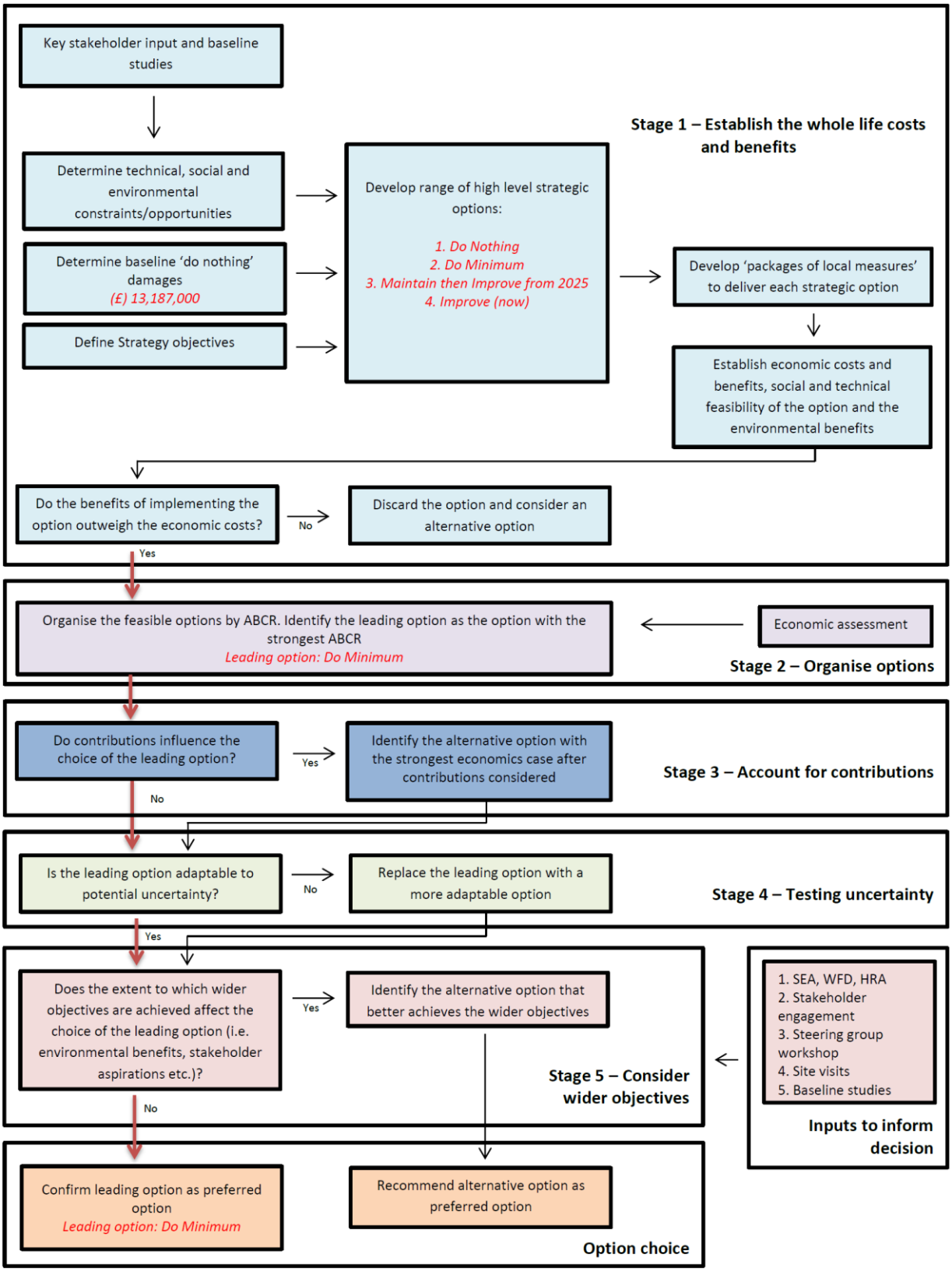


Figure 6-3. Flowchart representation of the options appraisal and decision making process to select the preferred option at SMZ 2 (where erosion risk is the key driver)

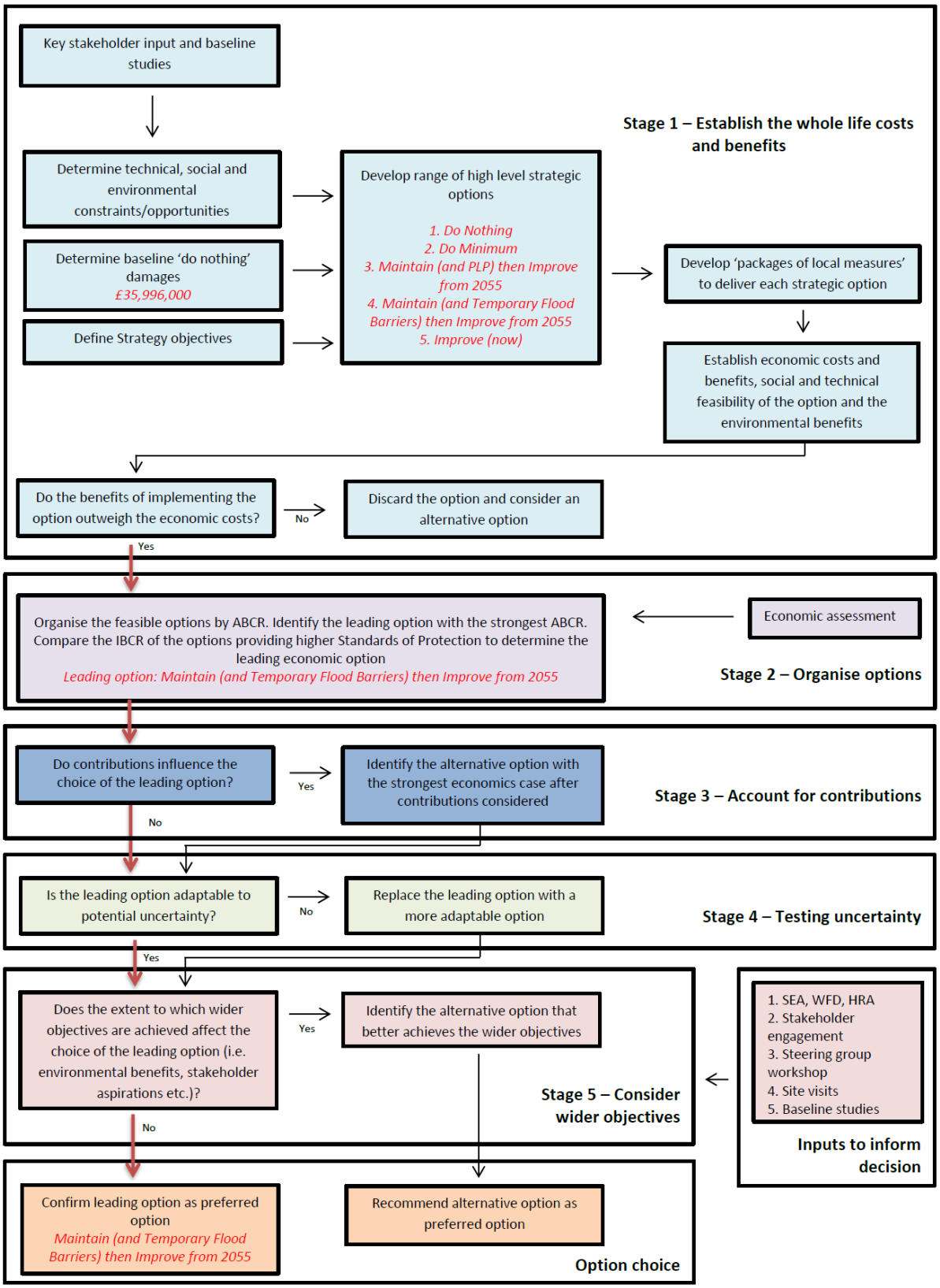


Figure 6-4. Flowchart representation of the options appraisal and decision making process to select the preferred option at SMZ 3a (where flood risk is a key issue)

6.2 Multi-criteria analysis

In order to test each strategic option against the wider strategic objectives (**Stage 5** of the FCERM-AG decision making process), and to confirm the selection of the preferred option a multi-criteria analysis was undertaken. The multi-criteria analysis scored each Strategic option against the following categories; economic, technical, environmental and social impacts. The scoring of the options was based upon the findings of relevant economic, technical, environmental and social assessments that were carried out during the development of the Strategy. An overview of the technical, environmental and social assessments carried out is provided below.

6.2.1 Technical assessment

The consideration of local and strategic scale technical issues formed a key component of the appraisal of options. These included aspects such as construction and buildability, maintenance requirements, adaptability and impacts on wider coastal processes. When appraising the options, each of these technical aspects was considered in the context of the SMZ / ODU location and condition. This has ensured that local level detail has been incorporated into the strategic options, and in doing so means that options put forward are buildable and realistic to implement.

The detailed flood modelling used by the Strategy and the mapping of future erosion under a 'Do Nothing' case helped underpin a sound understanding of the progression of flood and erosion risk. It also helped to identify thresholds, or 'triggers', for when future works are required. This formed an important part in determining the required phasing of future works across the frontage for each strategic option.

6.2.2 Environmental assessment

The presence of environmentally significant sites of National and European importance surrounding much of the frontage meant that environmental considerations formed an integral part of the option appraisal process.

In accordance with the Environment Agency and Defra policy and best practice a Strategic Environmental Assessment (SEA) was carried out as part of the option appraisal process. Through this assessment each strategic option was appraised in relation to its impact on the environmental objectives of the key categories defined in the environmental assessments; biodiversity, climate, cultural heritage, human health, landscape, material assets, soil, water and the interrelationship between these factors.

The Strategic Environmental Assessment (SEA) was undertaken in parallel with the technical, economic and social appraisals of options and, along with a Water Framework Directive assessment (WFDa) and Habitats Regulations Assessment (HRA), was integral in the confirmation of the preferred options. The SEA determined the environmental implications and highlighted potential benefits and detrimental effects whilst also ensuring that environmental enhancement opportunities were captured and incorporated within the option appraisal process.

6.2.3 Social and community assessment

Understanding the social background and aspirations of local communities is important to ensure that the Strategy develops acceptable options which will be supported by current and future generations.

The social impact of the strategic options was informed from detailed stakeholder engagement throughout the Strategy development process. Stakeholder feedback and input was gained at an early stage through a key stakeholder bus tour and workshop which involved mapping key features, issues and opportunities for the Strategy to consider. Further social and community based feedback and on-going guidance was provided throughout the option appraisal process via the Steering Group and through meetings and discussions with potential beneficiaries. Although there are always conflicting interests along the coastline, good consensus of some common themes was gained from the engagement activities.

A detailed understanding of what the local community wants from their coastline has allowed the strategic option appraisal to assess options against these aspirations as well as the wider Strategy objectives. This has insured options have considered the delivery of broader outcomes e.g. improving coastal access, environmental enhancement etc. which opens up further potential avenues for future contributions.

6.3 Multi-criteria analysis tables

For each category (economic, technical, environmental and social) each option was given an indicative score between +2 and -2 to summarise the findings of the more detailed assessments made under each category.

A score of +2 indicates strong positive impacts whilst a score of -2 indicates strong negative impacts. A score of 0 is indicative of no change or neutral impact.

An unweighted average score across all four categories was then calculated to identify whether an option helps achieve wider strategy objectives and to inform the selection of the preferred option.

For each strategic option the relative scoring of option impacts was decided and informed by each discipline specialist and was ratified by the wider project team. This helped to avoid any individual subjectivity in the scoring system and ensured the process was as transparent as possible.

Strategy Management Zone 1

Table 6-1. Multi-criteria appraisal of strategic options for SMZ 1

Strategic Option	Technical	Economic	Environmental	Social	Unweighted Average	Notes
Do Nothing	0	0	+2	+2	+1	Risk of flooding is negligible and whilst erosion is an issue, only a very small number of assets are at risk. Allowing natural processes to continue could create positive environmental and social impacts. Sustaining the unspoilt environment and naturally eroding cliffs is likely to attract wildlife and tourists to the area.

Strategy Management Zone 2

Table 6-2. Multi-criteria appraisal of strategic options for SMZ 2

Strategic Option	Technical	Economic	Environmental	Social	Unweighted Average	Notes
Do Nothing	0	-2	+1	-2	-0.75	Negative economic and social impacts due to erosion to assets in the future. Allowing natural processes to continue will enhance natural environment which may improve local biodiversity.
Do Minimum	0	+1	0	-1	0	Technically least challenging option (except for Do Nothing). Whilst residual damages will occur this option presents the best value for money. Negative social impacts due to residual risk of erosion but slightly better than Do Nothing given sustaining H&S, access and coastal change management plan.
Maintain then Improve from 2025	-1	-1	-1	+2	-0.25	Technically challenging. Economic benefits but at a significant cost which is not justifiable. Intrusive cliff stabilisation could have negative environmental impact. Positive social impacts due to reduced erosion risk to properties.
Improve (now)	-1	-2	-1	+2	-0.25	Technically challenging. Economic benefits but at a significant immediate cost which is not justifiable. Intrusive cliff stabilisation could have negative environmental impact. Positive social impacts due to reduced erosion risk to properties.

Strategy Management Zone 3a

Table 6-3. Multi-criteria appraisal of strategic options for SMZ 3a

Strategic Option	Technical	Economic	Environmental	Social	Unweighted Average	Notes
Do Nothing	0	-2	+1	-2	-0.75	Negative economic and social impacts due to flooding and erosion of assets in the future. Allowing natural processes to continue will enhance natural environment which may improve local biodiversity.
Do Minimum	+1	+1	0	-1	+0.25	Significant residual damages but improvements will be at a low cost. Social benefits arising from H&S and access but future erosion risk could to lead to negative social impacts.
Maintain (and Temporary Flood Barriers) then Improve from 2055	+1	+2	-1	+2	+0.75	Option represents best benefit: cost. Significant benefits at a moderate cost. Potential for minor negative environmental impacts in the future associated with frontline upgrades (i.e. increased defence footprint). Positive social impacts due to reduced erosion and flood risk to people and property.
Maintain (and PLP) then Improve from 2055	0	+1	-1	+1	+0.25	Some benefit but larger residual damage than temporary barriers. Potential for negative environmental impacts in the future associated with frontline upgrades (i.e. increased defence footprint). Positive social impacts due to reduced erosion and flood risk to people and property.
Improve (now)	-1	+1	-1	+2	+0.25	Technically challenging due to lack of space for defences in some areas. Option provides the greatest value of benefits but at a very high cost. Potential for negative environmental impacts associated with frontline upgrades (i.e. increased defence footprint). Positive social impacts due to reduced erosion and flood risk to people and property.

Strategy Management Zone 3b

Table 6-4. Multi-criteria appraisal of strategic options for SMZ 3b

Strategic Option	Technical	Economic	Environmental	Social	Unweighted Average	Notes
Do Nothing	0	-1	-2	-1	-1	Minor negative social and economic impacts due to flooding of assets in the future. Loss of Thorley Brook grazing marsh likely to lead to significant negative environmental impacts.
Do Minimum	0	-1	-2	+1	-0.5	Significant residual damages but improvements will be at a low cost. Social benefits arising from H&S and access. Loss of Thorley Brook grazing marsh likely to lead to significant negative environmental impacts.
Do Minimum with Managed Realignment between 2025 and 2055	0	-2	+2	+1	+0.25	Large cost but environmental benefits would be gained from MR at Thorley Brook. Also positive social impacts associated with management of local flood risk, landscape and cycle path repairs.
Maintain	0	+1	0	+1	+0.5	Positive economic and social impacts arising from flood protection and repair of cycle path.

Strategy Management Zone 3c

Table 6-5. Multi-criteria appraisal of strategic options for SMZ 3c

Strategic Option	Technical	Economic	Environmental	Social	Unweighted Average	Notes
Do Nothing	0	-2	-1	-2	-1.25	Negative social and economic impacts due to flooding and erosion of assets in the future. Allowing natural processes to continue will enhance natural environment which may improve local biodiversity.
Do Minimum	0	+1	-1	0	+0	Significant residual damages but some benefit at a low cost. Social benefits arising from H&S and access.
Adaption and Resilience (and PLP) / Do Minimum	0	+1	0	+1	+0.5	Positive economic and social impacts arising from flood protection.
Maintain (and PLP) then Improve (2055)	0	+2	0	+1	+0.5	Positive economic and social impacts arising from flood and erosion protection.
Maintain and Improve (now)	0	+2	0	+2	+1.25	Positive social and economic impacts arising from flood and erosion protection. Potential environmental benefits if managed realignment at the Causeway / Freshwater.

Strategy Management Zone 4

Table 6-6. Multi-criteria appraisal of strategic options for SMZ 4

Strategic Option	Technical	Economic	Environmental	Social	Unweighted Average	Notes
Do Nothing	0	0	+1	+1	+0.5	Risk of flooding and erosion is negligible. Allowing natural processes to continue could create positive environmental and social impacts. Sustaining the unspoilt environment is likely to sustain wildlife and attract visitors to the area.

Strategy Management Zone 5a

Table 6-7. Multi-criteria appraisal of strategic options for SMZ 5a

Strategic Option	Technical	Economic	Environmental	Social	Unweighted Average	Notes
Do Nothing	0	-2	+1	-2	-0.75	Negative social and economic impacts due to flooding and erosion of assets in the future. Allowing natural processes to continue may enhance local biodiversity.
Do Minimum, with community led adaption	+1	+1	0	+1	+0.75	Positive economic and social impacts arising from risk reduction and adaptation to change.
Improve (now) and then adapt	0	0	-1	+2	+0.25	Positive economic and social impacts arising from flood and erosion protection.
Maintain	0	+1	0	+1	+0.5	Positive economic and social impacts arising from maintaining existing defences

Strategy Management Zone 5b

Table 6-8. Multi-criteria appraisal of strategic options for SMZ 5b

Strategic Option	Technical	Economic	Environmental	Social	Unweighted Average	Notes
Do Nothing	0	-2	+1	-2	-0.75	Negative social and economic impacts due to flooding and erosion of assets in the future and reactivation of landsliding. Allowing natural processes to continue will enhance natural environment which may improve local biodiversity.
Do Minimum	0	+1	0	+1	+0.5	Significant residual damages but improvements will be at a low cost. Social benefits arising from H&S and access.
Maintain	0	+1	0	+2	+0.75	Positive economic and social impacts arising from erosion protection.
Improve (now)	0	0	-1	+2	+0.25	Positive economic and social impacts arising from flood and erosion protection. However, cost of option is significantly higher than the other options in this zone. Potential negative environmental impacts associated with frontline wall improvements (increase in defence footprint).

Strategy Management Zone 6a

Table 6-9. Multi-criteria appraisal of strategic options for SMZ 6a

Strategic Option	Technical	Economic	Environmental	Social	Unweighted Average	Notes
Do Nothing	0	-2	-1	-2	-1.25	Negative social and economic impacts due to flooding and erosion of assets in the future.
Do Minimum	0	+1	0	-1	0	Significant residual damages but improvements will be at a low cost. Social impacts due to increased flood risk.
Do Minimum (and PLP) then Adapt	0	+1	0	+1	+0.5	Positive economic and social impacts arising from flood protection. Relatively low option cost.
Maintain	0	+1	0	+1	+0.5	Positive economic and social impacts arising from erosion protection. Flood risk increases though.
Sustain (with Temporary Flood Barriers and PLP) then Improve from 2055	0	+1	0	+2	+0.75	Positive economic and social impacts arising from flood protection. Increased cost compared to Adaption and Resilience option (above) but significantly more economic benefits.
Sustain (with PLP) then Improve from 2055	-1	+1	-1	+2	+0.25	Positive economic and social impacts arising from flood and erosion protection. Potential for negative environmental impacts associated with improvements to frontline structures (potential increase in defence footprint).
Improve (now)	-2	+2	-2	+2	+0.5	Technically challenging due to lack of space for defences. Positive economic and social impacts arising from flood and erosion protection. Despite significant economic benefits the cost of the option is very high. Potential for negative environmental impacts associated with improvements to

						frontline structure (potential increase in defence footprint).

Strategy Management Zone 6b

Table 6-10. Multi-criteria appraisal of strategic options for SMZ 6b

Strategic Option	Technical	Economic	Environmental	Social	Unweighted Average	Notes
Do Nothing	0	0	+1	+1	+0.5	Risk of flooding and erosion is low with only a very small number of assets are at risk. Allowing natural processes to continue could create positive environmental and social impacts. Sustaining the unspoilt environment is likely to attract wildlife and tourists to the area.
Do Minimum	0	0	+1	+1	+0.5	Residual damages may occur through flooding and erosion, but they are expected to be low. Social benefits arising from H&S and access provision. Small cost of option.
Maintain	0	+1	0	+1	+0.5	Residual damages may occur through flooding, but they are expected to be low. Social benefits arising from H&S and access provision.

Strategy Management Zone 6c

Table 6-11. Multi-criteria appraisal of strategic options for SMZ 6c

Strategic Option	Technical	Economic	Environmental	Social	Unweighted Average	Notes
Do Nothing	0	-2	+1	-2	-0.75	Negative social and economic impacts due to flooding and erosion of assets in the future. Allowing natural processes to continue will enhance natural environment which may improve local biodiversity.
Do Minimum	0	+1	0	+1	+0.5	Significant residual damages but improvements will be at a low cost. Social benefits arising from H&S and access.
Maintain (and PLP) then Improve from 2055 (through redevelopment)	0	+2	0	+1	+0.5	Residual damages may occur through flooding, but they are expected to be lower with adaption and resilience measures in place. Seeking funding through redevelopment is likely to improve affordability of the option.
Maintain (and PLP) then Improve from 2055 (through frontline scheme)	0	+1	-1	+1	+0.25	Residual damages may occur through flooding, but they are expected to be low. High option cost but likely to provide significant flooding benefits. Social and economic benefits arising from flood and erosion protection. Potential for negative environmental impacts due to improvement of frontline structure (potential for increased defence footprint).
Improve (now)	0	+2	-1	+1	+0.5	Much higher option cost associated with this option although economic and social benefits will be gained. Potential for negative environmental impacts due to improvement of

						frontline structures (potential for increased defence footprint).

7. Preferred Options

The strategy option appraisal process identified a preferred strategic option for each SMZ. The following sections provide further details of the preferred management options.

In the appraisal process the economic costs and benefits are key measures of option feasibility. In the following section these are presented in Present Value (PV) terms whereby the costs and benefits have been discounted across the appraisal period to provide the current worth of future sums of money. The appraisal period spans the duration of the scheme lifespan and therefore the costs and benefits are referred to in 'Whole Life Present Value' terms. The undiscounted cash costs of the options will exceed the PV values presented.

7.1 Strategy Management Zone 1 (Needles Headland)

Strategy management zone 1 (Needles Headland) spans from Fort Redoubt to the southern limit of Totland Bay (W1). In this zone there is negligible flood risk and only localised erosion risk to properties. It is also undefended and is valued for its natural beauty and environmental importance.

The strategic management options considered in SMZ 1 are presented in Table 7-1.

The preferred option for this zone is to ***Do Nothing.*** This will involve allowing natural processes to continue, with privately funded maintenance of existing assets permitted (subject to normal consents). The Isle of Wight Council will not repair or maintain existing defences, and no new defences will be permitted where they are not already present.

It recognised that local erosion risks to businesses, people and coastal footpaths may need to be mitigated or adapted to on an asset by asset basis. Therefore, privately funded maintenance of the limited existing coastal structures will be permitted subject to gaining the necessary consents. In addition, the Old Needles Battery site is a key heritage feature within this zone and there is a recognition that this asset may be at threat of erosion in the longer term and localised adaption or mitigation may be required.

The preferred option will work with nature as much as possible to maintain or enhance the natural environment. It will ensure that the natural landscape of the Heritage Coast, which draws in many visitors, is allowed to evolve in a largely unspoilt manner. The ongoing erosion of the chalky and sandy cliffs will also provide an additional benefit through the continued supply of sediment which is important for nourishing the beaches of the adjacent Totland and Colwell Bays.

Table 7-1. The whole life present value costs and benefits of the strategic management options developed for SMZ 1

Strategic Option	WL Cost (PV £k)	WL Benefits (PV £k)	Residual Damage (PV £k)	B:C
Do Nothing	**£0**	**£0**	**£1,699**	**-**

Table 7-2 below outlines the measures in each ODU that are required to implement the preferred management option in SMZ 1; ***Do Nothing***.

Table 7-2. The measures required in each ODU to implement the preferred strategic option at SMZ 1

		W1
2015 - 2025	Measure	Do Nothing
	Notes	-
2025 – 2055	Measure	Do Nothing
	Notes	-
2055 - 2115	Measure	Do Nothing
	Notes	-

Option Development Unit W1 (Tennyson Down, Alum Bay and Headon Warren): Option Development Unit W1 encompasses the entire SMZ 1 frontage. The flood risk is negligible and there is only a small localised erosion risk to properties. The management approach for this Option Development Unit is therefore to Do Nothing and to allow natural processes to continue. However, as part of this approach privately funded maintenance of existing assets will be permitted, but no new defences will be constructed in currently undefended areas.

7.2 Strategy Management Zone 2 (Totland and Colwell Bays)

Strategy Management Zone 2 (Totland and Colwell Bays) spans from the southern limit of Totland Bay to Fort Victoria. Due to the steep topography within the zone the flood risk is negligible (2 residential and 4 commercial properties at risk from a 1:200 year present day flood event). However, the frontage is characterised by a cliffed coastline which is subject to erosion and landsliding which leads to significant erosion risk, with large future erosion predictions over the next 100 years.

The strategic management options considered in SMZ 2 are presented in Table 7-3.

Given that there is an erosion risk to a significant number of properties, especially in the longer term, there is a strong aspiration to replace the seawalls and continue to protect these assets, as well as preserving the popular amenity use of the area. As a result, options to maintain, upgrade or improve the seawall have been explored in the appraisal process. However, there is no certainty that undertaking these works would prevent the erosion risk because a key failure mechanism for landslips in this area relates to groundwater pressure and drainage, and is not necessarily due to coastal processes alone. As a result it is likely that a slope stabilisation scheme would be required as well as strengthening of the seawalls. A range of methods of improving the defences in the area (see Appendix 2) were considered and costed to develop the options.

The economic assessment has demonstrated that the case for undertaking a slope stabilisation scheme coupled with new coastal defences is not economically viable as the costs significantly exceed the economic benefits at the present time. In addition, only a small number of properties are at risk over the next 50 years, with the majority of properties becoming at risk after this point

in time (i.e. in the long term). Therefore there is very little likelihood of any significant government Grant in Aid funding being available to pay for such an option, under the current national funding system, or of a very large contribution from other sources being forthcoming. Installing a mass rock revetment (the most viable solution) and slope stabilisation in Totland and Colwell Bays (units W2, W3, W4) would cost approximately £25 million in PV terms, and the money to pay for this is not currently available nationally, locally or from the community.

The choice of the preferred option for this zone is therefore constrained by affordability and the lack of available funding for implementing the more costly options. As a result, the preferred option for this zone is to ***Do Minimum.*** This will involve maintaining coastal access as long as possible and ensure health and safety compliance (i.e. by maintaining structural requirements in line with health and safety legislation or by limiting public access to areas considered at risk of failure). A Coastal Change Management Area Plan will also be developed and adaptation will be supported by the planning process. Privately funded maintenance of existing private defences will be permitted (subject to gaining the necessary consents).

The preferred option recognises the importance to the community of the seawall and associated coastal access which was highlighted by the large landslip which occurred in December 2012 to the north of the old pier at Totland. Restoration work to the footpath over the recent landslip was completed in 2015 but it is likely that further slips will occur in the future and similar restoration works to re-instate access will be required. Small scale maintenance along the seawalls in the area will also continue, and will help to extend the life of the current defences. However at some point in the future a larger magnitude event causing extensive damage is likely to occur and at this point it may no longer be affordable to maintain or replace the defences.

The Coastal Change Management Area Plan will ensure that future inappropriate development is not permitted within the potential erosion and landslip risk zones and will also provide support to help communities adapt or relocate if an alternative solution is not found. There may also be opportunities for more appropriate or time-limited land uses in such areas.

The Present Value (PV) cost of the preferred strategic option in SMZ 2 is approximately £0.31million (approximately £0.92million in cash terms). The Isle of Wight council will continue to explore potential funding options and if sufficient contributions can be sourced, alternative options to better reduce the risks posed by erosion and landsliding could be implemented.

Table 7-3. The whole life present value costs and benefits of the strategic management options developed for SMZ 2:

Strategic Option	WL Cost (PV £k)	WL Benefits (PV £k)	Residual Damage (PV £k)	B:C
Do Nothing	£0	£0	£13,187	-
Do Minimum	**£308**	**£931**	**£12,256**	**3.0**
Maintain then Improve from 2025	£17,063	£8,167	£5,020	0.5
Improve (now)	£25,498	£8,167	£5,020	0.3

Table 7-4 below outlines the measures in each ODU that are required to implement the preferred management option in SMZ 2; *Do Minimum.*

Table 7-4. The measures required in each ODU to implement the preferred strategic option in SMZ 2

		W2	W3	W4	W5	W6	W7
2015 - 2025	Measure	Maintain access and H&S	Maintain access and H&S	Maintain access and H&S	Maintain access and H&S	Maintain access and H&S	Do Nothing
	Notes	-	-	-	-	-	-
2025 – 2055	Measure	Maintain access and H&S and produce / implement CCMAP	Maintain access and H&S and produce / implement CCMAP	Maintain access and H&S and produce / implement CCMAP	Maintain access and H&S and produce / implement CCMAP	Maintain access and H&S and produce / implement CCMAP	Do Nothing
	Notes	-	-	-	-	-	-
2055 - 2115	Measure	Implement CCMAP and adaptation	Implement CCMAP and adaptation	Implement CCMAP and adaptation	Implement CCMAP and adaptation	Implement CCMAP and adaptation	Do Nothing
	Notes	-	-	-	-	-	-

Option Development Units W2 (Southern and Central Totland Bay), W3 (Northern Totland Bay), W4 (Southern Colwell Bay), W5 (Central Colwell Bay), W6 (Fort Albert) and W7 (Fort Victoria Country Park):

The management approach in each of the Option Development Units in SMZ 2 is as follows to implement the preferred strategic option.

In W2 (southern Totland Bay), W3 (northern Totland Bay) and W4 (southern Colwell Bay) during the first time epoch existing coastal access, footpath routes and seawalls will be maintained where possible, as explained above. This is likely to require a significant maintenance effort given that landslips could be numerous. Small scale maintenance will continue (within the limited funding available) and will help to extend the life of the current structures. However notable damage to the seawalls will be assessed on a case-by-case basis until the point at which significant damage becomes unaffordable to repair and replace. At the end of the seawall life it is not currently affordable to replace the structures so the area is expected to undergo change in the future. Privately funded maintenance of existing defences will also be permitted (subject to gaining the necessary consents).

In W5 (Central Colwell Bay) erosion of the undefended cliffs will continue, with only minor health and safety work on the remnant groynes.

In W6 (Fort Albert) privately funded maintenance of existing defences will be permitted (subject to gaining the necessary consents). There are no plans to improve or replace defences.

In W7 (Fort Victoria Country Park) the management approach is to do nothing and to allow natural processes to continue.

From epoch two of the Strategy a Coastal Change Management Area Plan (CCMAP) will be produced and implemented for SMZ2. This will prevent further developments in the areas at risk from erosion and landslip and also provide support to communities which may have to adapt or relocate due to the erosion risk. There may also be opportunities for more appropriate or time-limited land uses in such areas.

7.3 Strategy Management Zone 3a (Yarmouth coast)

Strategy Management Zone 3a includes Yarmouth town, and stretches along the open coast from Fort Victoria to Port La Salle. It includes Norton Spit and Yarmouth to as far south as (but not including) Thorley Brook.

The strategic management options considered in SMZ 3a are presented in Table 7-5.

The SMZ is situated in a relatively sheltered location but is still subject to a significant tidal flood risk. The risk to commercial and residential properties is significant along the western side of Yarmouth, the Wight link Ferry Terminal and around the Harbour. In the future this flood risk is expected to increase in severity and extent due to climate change and sea level rise, which will also increase the risk of erosion along the frontage if the current coastal structures are allowed to deteriorate and fail.

Even though Yarmouth has experienced a number of tidal flood events in recent years, the work of the Strategy has determined that under the current funding system, the national government Grant in Aid monies available for a scheme at Yarmouth are modest. In addition, the significant contributions that would be required to implement ambitious flood protection schemes are not currently forthcoming. A key reason that the case for a nationally funded flood and erosion relief scheme is not strong is that a large number of the properties at risk are commercial properties; shops and businesses, which don't attract the same level of Grant in Aid as residential properties.

The preferred option for Yarmouth town is therefore to ***Maintain (and Temporary Flood Barriers) then Improve from 2055.*** This option will involve providing approximately 400 metres of temporary flood barriers to manage and to reduce flooding to the area at significant risk by sustaining a 1 in 75 year (1.33% AEP) standard of protection. From 2055, if funding can be secured, it is the aspiration to improve the protection by implementing new defences. This would involve an approximately 270 metre front line defence to the north of Yarmouth and additionally a combination of approximately 570 metres of setback defences (bunds and floodwalls) extending from the Harbour to the south, protecting the primary school and the properties south of the school along Mill Road to manage the long term increase in flood and erosion risk posed by sea level rise.

The Present Value (PV) cost of the preferred option at SMZ 3a is approximately £6.5 million (approximately £22.8million in cash terms). In the short to medium term it is likely that a minor proportion of the cost for temporary barriers will be funded through Grant in Aid as it would reduce tidal flood risk to the areas of Yarmouth at greatest risk, however, a public or private contribution will also be required to secure the scheme. The Isle of Wight Council will seek funding for this scheme. The community may also be able offer support in the storage and deployment of such a system. A potential alignment for the temporary barrier is shown on Figure 7-1. It should be noted that there will be residual flood risk to properties outside the areas protected by the temporary barriers, as they cannot provide protection in all areas. The advantage of temporary barriers over the alternative 'property level protection' measures is that the temporary barriers also provide protection to commercial properties in the area as well as the residential properties at risk.

There are a range of industry approved commercially available temporary flood barriers which could be utilised. Typically these systems comprise of interlocking units which can be stored locally on the Island then manually deployed prior to an event by trained personnel. The units require no permanent fixing to the ground but would require ongoing maintenance and upkeep. To ensure the barriers are effective, their deployment will need to be linked to a flood warning system.

In addition, the Yarmouth Harbour Commission wishes to continue to maintain and/or improve the existing breakwater fronting the Harbour, thus providing a contribution to reducing the tidal flood risk (as without the breakwater the tidal flood ingress would be exacerbated through increased wave action and overtopping).

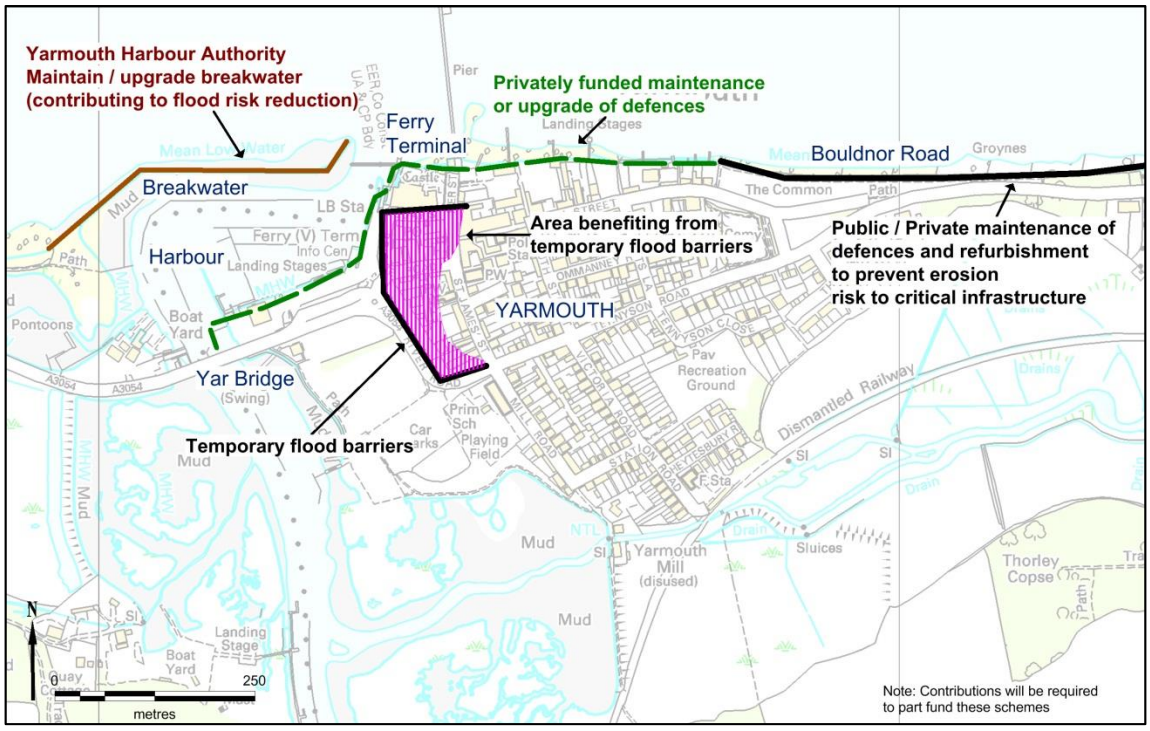


Figure 7-1 Strategy preferred options for Yarmouth (2015-2055)

Private ongoing maintenance and improvement of the defences fronting private properties, particularly along the seafront, will be encouraged, to reduce the risks of erosion and flooding, and to contribute towards a future more strategic solution

Another important issue in this area is the ongoing maintenance and refurbishment of coastal defences which protect critical infrastructure for the town and links to the West Wight communities beyond.

It is important to prevent erosion of the A3054 just east of Yarmouth which is considered a critical highway link for the whole of the West Wight population. Additionally, under the A3054 is a key services corridor (i.e. water supply etc.) which serves the town and hence protection of this link is critical. Island Roads recently completed a multi-million pound scheme of piling and reconstruction to reinstate the road surface along part of this 1km length, under the Isle of Wight's current Highways PFI contract. However, in the medium term, the seawall itself at the base of the coastal slope (protecting nearby properties and the road) will also require refurbishment. Therefore, the preferred option includes short term maintenance followed by refurbishment of the sea defences in the area fronting the road. This refurbishment of the 810m

of seawall has been costed based on strengthening through a sprayed concrete technique from 15 years time onwards that would have a minimum of 20 years lifespan and keep the seawall at its current height. Further details of this scheme are outlined in Appendix 3 of this document. The condition and role of the groynes in the area should be considered during future detailed Scheme Design. Based upon the current funding system in place, the PF score for the refurbishment scheme is 75%. This scheme is therefore likely to be eligible for a proportion of Grant in Aid funding, although part of the cost will need to be funded through other partners or authorities, with approximately £290k of funding required to achieve a PF score of 100%. In line with the partnership funding approach, contributions will be sought from a range of public and private sources, including landowners and those benefitting from the improved defences.

In the longer term as the risk at Yarmouth becomes greater, the preferred option is to improve protection through raising or replacing existing quay walls and coastal defences, coupled with setback bunds, floodwalls and flood gates (see Figure 7-2 for potential defence alignment locations and Appendix 3 for a detailed breakdown of the scheme). Significant non Grant in Aid funding contributions will be required to secure this approach; chapter 11 of the main Strategy report provides more guidance on potential funding sources. The length of time available (40 years) until this defence improvement is proposed provides sufficient time to develop a range of potential funding sources, including those linked to development, contributions and the planning system, as well as initiatives led by the communities in the area and the west Wight. The local community has been pro-active in exploring flood risk and climate change impacts on Yarmouth in recent years and is well-placed to start thinking about innovative opportunities to start collecting contributions towards the cost of future defences for the town.

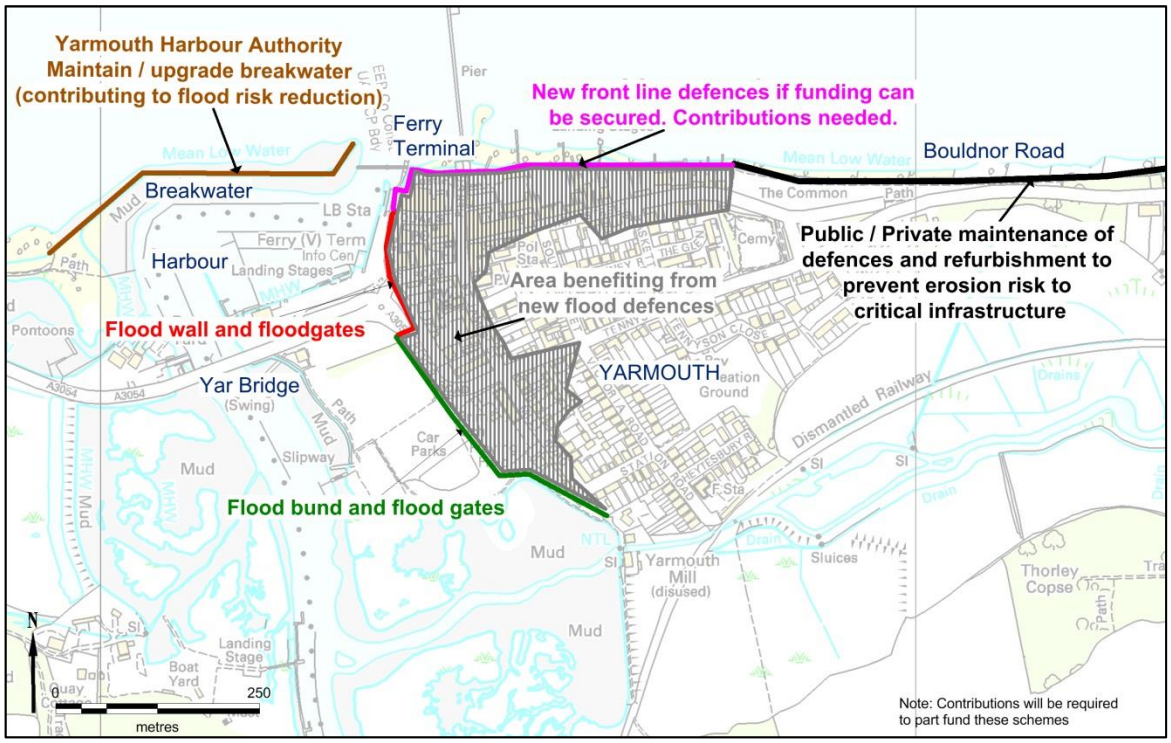


Figure 7-2 Strategy preferred options for Yarmouth (2055-2115)

In summary the Strategy has updated and examined all the evidence in accordance with the current guidance and recognises that a major permanent flood relief scheme in Yarmouth is not currently affordable. It seeks more affordable smaller-scale work for the areas at greatest risk

in the short to medium term, and highlights that the town would benefit from significant defence improvements from 2055 onwards as risk levels increase.

Elsewhere within the SMZ, the A3054 west of the Yar Bridge is another key link from Yarmouth to the west of the Island. The preferred option in this location is to maintain the existing defences including the timber planking running parallel with the coastline, adjacent to the breakwater, that supports the small beach and shelters the Norton Spit Site of Special Scientific Interest behind. Maintenance in this area coupled with the maintenance/improvement of the breakwater will provide protection for this section of coastline including the road in the short to medium term. In the longer term with increasing sea levels, the preferred option is to improve the road defences by primarily preventing erosion and also potentially improving the flood standard of protection through earth bunds or new walls. During scheme design it should be considered whether new defences should be provided adjacent to the road or whether the existing defences in front of the Norton Spit can be improved taking into account the environmental designated land behind.

Also west of the Yar Bridge, the coastline from Fort Victoria to Norton has a piecemeal mixture of defences and structures of differing residual lives and only a limited number of properties at risk. There are no defence improvements proposed for this area. Privately funded maintenance of existing defences will be permitted (subject to gaining the necessary consents).

Table 7-5 The whole life present value costs and benefits of the strategic management options developed for SMZ 3a

Strategic Option	WL Cost (PV £k)	WL Benefits (PV £k)	Residual Damage (PV £k)	B:C
Do Nothing	£0	£0	£35,996	-
Do Minimum	£360	£233	£35,763	0.6
Maintain (and PLP) then Improve from 2055	£6,366	£31,259	£4,736	4.9
Maintain (and Temporary Flood Barriers) then Improve from 2055	**£6,560**	**£31,854**	**£4,142**	**4.9**
Improve (now)	£25,263	£32,810	£3,186	1.3

Table 7-6 outlines the measures in each ODU that are required to implement the preferred management option in SMZ 3a; *Maintain and sustain 1.33% AEP SoP with temporary flood barriers then improve from 2055*.

Table 7-6. The measures required in each ODU to implement the preferred strategic option in SMZ 3a

		W8	W9	W15	W16	W17
2015 - 2025	Measure	Maintain access and H&S	Maintain and upgrade / refurbish in corner	Setback temporary flood barriers. Maintenance elsewhere.	Setback temporary flood barriers. Maintenance elsewhere.	Maintenance
	Notes	-	Yarmouth Harbour Authority to maintain / upgrade breakwater if funding is available	-	-	-
2025 – 2055	Measure	Maintain access and H&S, where appropriate	Maintain and upgrade / refurbish in corner	Setback temporary flood barriers. Maintenance elsewhere	Setback temporary flood barriers. Maintenance elsewhere	Maintenance
	Notes	-	Yarmouth Harbour Authority to maintain / upgrade breakwater if funding is available	Replace temporary barrier when required (after approx. 20 years). Maintenance elsewhere. Developer, frontager and community contributions.	Replace temporary barrier when required (after approx. 20 years). Maintenance elsewhere. Developer, frontager and community contributions	Refurbish defences at Bouldnor Road and Yarmouth utilities corridor Developer, frontager and community contributions
2055 - 2115	Measure	Health & Safety works as required	Maintain and upgrade	Upgrade / new defences	Upgrade / new defences	Maintenance
	Notes	-	Yarmouth Harbour Authority to maintain / upgrade breakwater if funding is available Improve road protection.	Replace / raise frontline and setback defences Developer, frontager and community contributions.	Replace / raise frontline and setback defences Developer, frontager and community contributions.	- Continue refurbishment of defences Developer, frontager and community contributions.

Option Development Unit W8 (Fort Victoria and Norton):
Option Development Unit W8 extends from Fort Victoria to Norton. Few properties are at risk of flooding within this unit. To implement the preferred strategic option will involve maintaining access where possible and any health and safety requirements for the frontage. No defence improvements are proposed.

Option Development Unit W9 (Norton Spit):
Option Development Unit W9 encompasses Norton Spit. The preferred strategic option in this location is to continue maintaining the existing defences in the short term (including potentially requiring a defence refurbishment or upgrade of the timber planking in the corner of the unit to protect the road). Over time the breakwater will approach the end of its design life and require replacement. Yarmouth Harbour Commissioners wish to maintain this structure (which will need to be privately funded) and are actively pursuing this work in the short to medium term. In the longer term, from 2055, the importance of protecting the A3054 west of the Yar Bridge is recognised and the Strategy recommends improving defences to achieve this.

Option Development Units for Yarmouth town, W15 (Thorley Brook to Yar Bridge) and W16 (Yar Bridge to Yarmouth Common):
Option Development Units W15 and W16 encompass Yarmouth town waterfronts to the west and north, from (but not including) Thorley Brook to the beginning of Yarmouth Common. In these locations the flood risk is significant and in the short term and medium term (epochs 1 and 2) temporary flood barriers have been identified by the Strategy as the most appropriate option to mitigate this flood risk to those at most risk, where achievable alignments can be identified. Some residual flood risk will remain for other areas. Further information on the funding required for this scheme can be found in Appendix F, section 11. As flood risk develops further over time and more properties are subject to flood risk the economic case for undertaking a capital scheme improves. The Strategy therefore recommends undertaking a capital replacement and raising of the frontline and setback defences from year 2055 onwards. Significant non Grant in Aid contributions will need to be secured in this area.

Option Development Unit 17 (Yarmouth Common to Port la Salle):
For Option Development Unit 17, spanning Yarmouth Common to Port la Salle, to implement the preferred option the Strategy has identified that (as outlined above), following a period of ongoing maintenance, a capital defence refurbishment of approximately 810m is required during epoch 2 (2025-2055), supported by further work in the long term (epoch 3). This is necessary to prevent erosion of the A3054 road and also the key services corridor (i.e. water etc.) that exists beneath. The upgraded defences will require maintenance for the remainder of the Strategy duration through to 2115. This will require a combination of public and private funding, as although this scheme is likely to be eligible for some government Grant in Aid, a proportion of the cost (approximately £290k) will need to be funded through other partners and contributions. The condition and role of the groynes in the area should be considered during detailed Scheme Design.

7.4 Strategy Management Zone 3b (Western Yar Estuary)

Strategy Management Zone 3b (Yar Estuary) covers the Yar estuary to as far south as, but not including, the Causeway. There is a localised and very small erosion risk in the Thorley Brook area of the zone and also a flood risk to a small number of properties, although it is much less significant and more localised compared to other Strategy Management Zones.

The Strategic options considered in SMZ 3b are presented in Table 7-7.

Given the largely rural and unspoilt nature of the environmentally designated estuarine area, with few assets at risk of flooding and erosion, the preferred option is to ***Do Minimum with Managed Realignment between 2025 and 2055***. This option involves maintaining coastal access (such as the cycle path and footpath access) for as long as sustainably possible and also ensuring health and safety compliance. On the whole this approach will ensure that the Western Yar Valley continues to evolve under natural processes, thus helping preserve the environmentally important habitats both for the Isle of Wight and the greater Solent.

At Thorley Brook the preferred option is to undertake Managed Realignment in the medium term (between 2025-2055). Managed Realignment will involve removing or breaching the existing coastal defence. New defences will be constructed behind the original defence line to ensure the continued protection of key assets. The land between the new and existing defences will then be opened up to the sea which will help to create new intertidal habitat. The creation of coastal habitat will benefit local ecology, compensate losses of habitat elsewhere along the coastline, and also help to absorb wave energy as it approaches the new line of defence. The result is an effective, sustainable solution to flood and erosion risk in the area. A managed realignment scheme would include seeking land, design and capital works, creation of intertidal area, operation and maintenance.

The delivery of this scheme is subject to the Environment Agency securing the required funding and the delivery of compensatory grazing marsh through the Regional Habitat Creation Programme. The site is currently well used by birds for both feeding and roosting and therefore prior to realignment there will also be a need to better understand how the site is used by these birds. Mitigation will be required, including where feasible the creation of compensatory feeding and roosting sites.

Prior to managed realignment in 2025, it will be necessary to maintain the existing defences. If the managed realignment scheme is not delivered, maintenance of the existing defences fronting Thorley Brook will continue into epoch 2. To help facilitate the managed realignment scheme from 2025 onwards, work to plan the scheme could begin during epoch 1.

Table 7-7. The whole life present value costs and benefits of the strategic management options developed for SMZ 3b

Strategic Option	WL Cost (PV £k)	WL Benefits (PV £k)	Residual Damage (PV £k)	B:C
Do Nothing	£0	£0	£3,349	-
Do Minimum	£88	£564	£2,784	6.4
Maintain	£284	£781	£2,567	2.8
Do Minimum with Managed Realignment between 2025 and 2055	**£3,824**	**£1,271**	**£2,077**	**0.3**

Table 7-8 outlines the measures in each ODU that are required to implement the preferred management option in SMZ 3b; *Do Minimum with Thorley Brook Managed Realignment (from 2025)*.

Table 7-8. The measures required in each ODU to implement the strategic option in SMZ 3b

		W10	W13	W14
2015 - 2025	Measure	Maintain access and H&S	Maintain access and H&S	Maintenance
	Notes	-	-	Maintenance of existing defences and also undertake planning for future managed realignment scheme
2025 – 2055	Measure	Maintain access and H&S	Maintain access and H&S	Environmental mitigation / habitat creation
	Notes	-	-	Managed realignment / habitat creation at Thorley Brook. New setback flood defence to reduce flood risk as part of the scheme
2055 - 2115	Measure	Maintain access and H&S	Maintain access and H&S	Do Nothing and maintenance
	Notes	-	-	-

Option Development Unit W10 (Western Yar estuary – western shore) and W13 (Western Yar estuary – eastern shore):
For both ODUs W10 and W13 the management approach to implement the preferred strategic option is the same and involves maintaining access and health and safety requirements for the frontage. With few assets at risk along these frontages this approach will look to preserve the unspoilt nature of the local environment and allow natural processes to continue.

Option Development Unit W14 (Thorley Brook and Barnfields Stream):
At this location the preferred option seeks environmental enhancement opportunities from 2025 onwards, in accordance with the plan outlined in the Isle of Wight Shoreline Management Plan (2011). Prior to this maintenance of the existing defences is required. It will also be necessary to start to plan the environmental enhancement and attain the required consents and funding prior to starting work between 2025-2055. Managed realignment and habitat creation at this location will look to deliver necessary environmental mitigation and compensatory habitat for losses that may occur elsewhere. For the successful delivery of the scheme compensatory grazing marsh and high tide roost sites will need to be secured via the Regional Habitat Creation Programme to offset any losses in these habitats that may occur at the site following managed realignment. As part of this scheme new setback flood defences would be delivered to a small number of properties on the margin of the new tidal floodplain. The delivery of this scheme is subject to the Environment Agency securing the required funding and compensatory habitat requirements (as the Regional Habitat Creation Programme progresses and prioritises works). If the realignment scheme is not delivered, maintenance at the mouth of the creek will continue.

7.5 Strategy Management Zone 3c (Freshwater)

Strategy Management Zone 3c includes Freshwater Bay, the edge of Freshwater village and the Causeway, and the Freshwater / Afton Marsh area in between these locations.

The majority of the flood risk in this zone is found at Freshwater village where flood risk is thought to come predominantly from the Causeway to the north. The A3055 main road is also at risk from erosion and flooding behind the seawall at Freshwater Bay.

The Strategic options considered in SMZ 3c are presented in Table 7-9.

The preferred option for SMZ 3c is to ***Maintain (and PLP) then Improve (2055).***

At Freshwater Bay, this option will involve maintaining the strategically important defences (seawall) at Freshwater Bay to prevent erosion to key road links and also to prevent a tidal breach to the western Yar Valley. Future refurbishment works to the seawall will be required at the end of the structure's residual life to ensure the continued function of the defence. In the longer term further maintenance and refurbishment works will be required to the defences to prevent erosion and reduce flood risk.

Under the preferred option there will be a continued flood risk from wave overtopping to a number properties as well as the A3055. This risk is expected to increase over time due to sea level rise and no active increases in defences crest height.

In the Western Yar Estuary, between the Causeway to the edge of Freshwater village, the preferred option involves maintaining existing defences and recommending privately funded property level protection in the short term to address the localised flood risk within this zone. The Causeway and flapped culverts will continue to be maintained to ensure its function is reducing flood risk to Freshwater.

In the medium and long term, it will be necessary to refurbish the existing defences (Causeway) and it is recommended to implement new defences (at Freshwater village) to prevent tidal flooding to commercial and residential properties near to the A3055 at the intersection with Stroud Road (subject to available funding). Here there are a number of residential and commercial properties at significant potential flood risk, mainly under extreme tidal conditions coming from the north (the Western Yar Valley at the Causeway).

The Present Value (PV) cost of the preferred option in SMZ 3c is approximately £1.5million (approximately £4.0million in cash terms). There will be limited Grant in Aid (GiA) funding available for these works. It is intended that the Isle of Wight Council (IWC) will continue work to explore potential future funding options and opportunities, possibly through delivering in partnership with other services on the Island, to maintain the strategically important defences.

Regarding the use of groynes in Freshwater Bay, the Strategy does not propose lengthening groynes as the environment is international designated, as well as the cost constraints outlined above. Similarly, it does not propose raising the height of the groynes, as this would potentially raise rather than lower the height of storage of beach materials at the back of the beach, and therefore not assist in reducing amount of the beach materials that can be pushed up onto the defences during storm events. The beach also provides a degree of natural protection to the ageing seawall, which will be difficult to replace at the end of its life as funding is limited, although there is the aspiration to do so, as stated above. The Strategy highlights the importance of refurbishing the seawall in the medium term, at the end of its residual life, to prevent a breach. The maintenance of the existing groynes in area in the short term is an issue for consideration in the prioritisation of local level maintenance funding by the asset owner. When the time comes for more comprehensive refurbishment of the seawall in the medium

term, the condition and role of the groynes in the area should be considered during the detailed scheme design. Further information on coastal monitoring and beach profiles in the area is provided in Appendix C of the Strategy on coastal processes.

In the future if there is a legal requirement to provide compensatory habitat to offset habitat losses that may arise from defending the coastline, as well as the proposed realignment at Thorley Brook (see section 7.4), another area which may be suitable has been identified near Freshwater, from the Causeway westwards along the valley towards the village (near the cycletrack). If feasible, habitat creation at this area could also be incorporated into a wider flood risk works for Freshwater which would deliver multiple outcomes and potentially unlock partnership funding streams. This opportunity will need to be investigated in more detail in subsequent appraisals.

Table 7-9. The whole life present value costs and benefits of the strategic management options developed for SMZ 3c

Strategic Option	WL Cost (PV £k)	WL Benefits (PV £k)	Residual Damage (PV £k)	B:C
Do Nothing	£0	£0	£10,354	-
Do Minimum	£56	£269	£10,085	4.8
Adaption and Resilience (and PLP) / Do Minimum	£199	£1,538	£8,816	7.7
Maintain (and PLP) then Improve (2055)	**£1,450**	**£5,514**	**£4,839**	**3.8**
Maintain and Improve (now)	£1,708	£6,614	£3,739	3.9

Table 7-10 outlines the measures in each ODU that are required to implement the preferred management option in SMZ 3c; *Maintain and Improve (now)*.

Table 7-10. The measures required in each ODU to implement the preferred strategic option in SMZ 3c

		W11	W12
2015 - 2025	Measure	Maintain Causeway and PLP	Maintain seawall
	Notes	Privately funded PLP recommended to a small number of properties in Freshwater Village to address localised flood risk within this zone	Programme of maintenance for existing seawall.
2025 – 2055	Measure	Refurbish and PLP	Upgrade / refurbish and maintain
	Notes	Refurbish existing defences at the Causeway. Privately funded PLP recommended for a small number of properties in Freshwater village.	Capital refurbishment of existing seawall. Limited Grant in Aid likely to be available and therefore funding needs to be sourced.
2055 - 2115	Measure	Implement new defences at Freshwater village to prevent tidal flooding to residential and commercial properties near the A3055	Continued refurbishment and maintain
	Notes	Continued refurbishment of defences at the Causeway and maintain new defences at Freshwater village	Continued refurbishment and maintenance of defences at Freshwater Bay

Option Development Units W11 (The Causeway):
At ODU W11, the Causeway, the preferred option outlines maintenance of the existing defences for the first time epoch of the Strategy alongside recommending privately funded PLP to properties (8 properties) in Freshwater village to address the localised flood risk within this zone. In the medium to long term, the existing defences at the Causeway should be refurbished and it is recommended that new defences (e.g. floodwalls) are installed at Freshwater Village to prevent tidal flooding to properties near the A3055, subject to available funding. Ongoing refurbishment of the defences at the Causeway will need to continue into the longer term, whilst maintenance of the new defences at Freshwater village will also be required. In future appraisals, a potential managed realignment area from the Causeway westwards should be investigated in more detail to establish the feasibility of creating habitat in this area and also the viability of linking this into a wider flood risk reduction scheme in the area. Planning and further investigations for this work could be undertaken from epoch 2 onwards. Further discussions with the Environment Agency and other stakeholders are required to help facilitate this.

Option Development Units W12 (Freshwater Bay):
At Freshwater Bay in the short term the preferred option recommends ongoing maintenance of the existing seawall in front of the A3055. After this, in the medium and long term, it is likely that ongoing capital refurbishment will be required for this structure (primarily for erosion protection, to prevent a breach). There is likely to be limited government Grant in Aid funding available for these works so contributions will be required to fund this scheme. During future scheme design for refurbishment of the wall the condition and role of the groynes in the area should be considered.

7.6 Strategy Management Zone 4 (Newtown Coast)

Strategy Management Zone 4 is located between Bouldnor and the southern limit of Gurnard Bay.

The strategic management options considered in SMZ 4 are presented in Table 7-11.

Given that this zone has very low flood risk and localised erosion risk to individual properties, is undefended, and is valued for its natural beauty and environmental importance, the preferred strategic approach is ***Do Nothing.*** This option will involve working with nature as much as possible to maintain and enhance the landscape and environment, both along the coast and inside the Estuary. The Isle of Wight Council will not repair or maintain existing defences, and no new defences will be permitted where they are not already present.

However, it is recognised that local erosion risks to businesses, people and coastal footpaths will need to be mitigated or adapted to, and therefore privately funded maintenance of existing assets will be permitted (subject to gaining the necessary consents).

The preferred option will ensure that the natural landscape of the Heritage Coast is allowed to evolve in a largely unspoilt manner. The preferred option will ensure that coastal process will continue in an unhindered manner thus maintaining sediment transport pathways which is important for nourishing the beaches of the adjacent frontages.

Table 7-11. The whole life present value costs and benefits of the strategic management options developed for SMZ 4

Strategic Option	WL Cost (PV £k)	WL Benefits (PV £k)	Residual Damage (PV £k)	B:C
Do Nothing	**£0**	**£0**	**£2,069**	**-**

Table 7-12 outlines the measures in each ODU that are required to implement the preferred management option in SMZ 4; *Do Nothing*.

Table 7-12. The measures required in each ODU to implement the preferred strategic option in SMZ 4

		W18	W19	W20
2015 - 2025	Measure	Do Nothing	Do Nothing	Do Nothing
	Notes	-	-	-
2025 – 2055	Measure	Do Nothing	Do Nothing	Do Nothing
	Notes	-	-	-
2055 - 2115	Measure	Do Nothing	Do Nothing	Do Nothing
	Notes	-	-	-

Option Development Units W18 (Bouldnor Copse and Hampstead), W19 (Newtown Estuary) and W20 (Thorness Bay and southern Gurnard Bay):
The management approach in each of the Option Development Units in SMZ 4 is the same to implement the preferred strategic option. The flood risk is negligible and there is a small localised erosion risk to properties that develops in the future. The management approach for this Unit is therefore to Do Nothing and to allow natural processes to continue. However, as part of this approach privately funded maintenance of existing assets will be permitted, but no new defences will be constructed in currently undefended areas.

7.7 Strategy Management Zone 5a (Gurnard Luck and Gurnard cliff)

Strategy Management Zone 5a includes the low-lying Gurnard Luck / Gurnard Marsh area and Gurnard cliff to the north-west. The community at Gurnard Luck is at risk of both tidal and fluvial flooding, and also wave overtopping. There is also erosion risk along the frontage as demonstrated by the recent localised wall failure in front of the Beach Chalets; which has since been repaired through a community led scheme, with repair and renewal grant and private funding.

The strategic management options considered in SMZ 5a are presented in Table 7-13.

In the future, as the multiple risks from tidal flooding, fluvial flooding and erosion increase, the community will need to continue to adapt. Some properties in Gurnard Luck have already taken action to adapt to flood risk by raising the level of their properties, and these measures should continue to be implemented as appropriate (subject to planning consent). A long term built solution to reduce the risks over the next 100 years is not achievable as the level of investment required to provide substantial defences right around the settlement is not justified due to the limited number of properties.

The preferred strategic option for this zone is to ***Do Minimum and Resilience then Adapt***. This involves privately-funded community and property level flood resilience and adaptation at Gurnard Luck. Where possible, self-help measures to reduce potential flood ingress and damage should be implemented. Some properties in the area may be more suitable for flood 'resilience' measures (i.e. accepting that flood water will enter the property and plan for that, e.g. raise the height of electrical installations) then 'resistance' measures (which are designed to prevent water entering the individual property, where this can be achieved). Privately funded maintenance of existing coastal defences will also be permitted (subject to gaining the necessary consents). The Isle of Wight Council (IWC) will work with the community to develop and implement a Coastal Change Management Area plan, supported by the IWC planning process, which will clearly set out the strategy to respond and adapt to the risks, and to avoid inappropriate development in areas at risk. Environment Agency (EA) operation of control structures at the mouth of Gurnard Luck stream is expected to continue whilst feasible. Sound flood response plans linked to the EA flood warning systems should continue to be developed and adopted by the community to reduce risk.

The Strategy recognises that there is a strong community aspiration to improve the Standard of Protection against flooding at Gurnard Luck. Following consultation feedback, further more detailed appraisal of scheme options was carried out to explore the technical and economic case for implementing new raised defences. The outcome of these studies confirmed the need for the adaptation approach outlined above, but also examined the potential for a smaller scale scheme to reduce risks in the short to medium term. Such a scheme could utilise existing defence elements, and supplement them with additional raised set-back defences around the harbour and along sections of the waterfront, with the aim of achieving a more limited standard

of protection (to a current 1:75 year standard) to reduce *tidal flood* risks to existing properties. The assessment has determined that such a scheme has some economic merit but would require significant local funding contributions to proceed. Further more detailed technical assessment would also be required before seeking to progress a scheme to ensure that other sources of potential flood risk (e.g. tide locking of fluvial flows) are adequately considered, mitigated and not exacerbated by new defences. The assessments undertaken have also confirmed that in the longer term it will become increasingly challenging and unsustainable to mitigate flood and erosion risk if climate change occurs as projected. Due to the increasing long-term risks, the IWC will not be prioritising investment in flood defences or maintenance in this area. A significant funding shortfall would need to be met by the local community –of approximately 200k) in order to supplement potential national Grant in Aid funding (of a similar amount) for a small scheme.

Therefore, in the absence of available contributions to progress a scheme delivering new tidal flood defences the Strategy recommends community and property level resilience and management of flood risk, with adaptation to the increasing risks. This is the primary approach which the Strategy will deliver, however, if the required contributions for a small scheme could be raised and it can be demonstrated that a scheme is technically sound (in respect to other sources of flooding) and fully supported by those affected, the delivery of required interventions to more robustly reduce flood risk in the short to medium term is recommended. It should be noted that in the event of a small scheme being undertaken, adaptation and flood resilience will still be required within the community. Although such a scheme could provide an improved a modest level of protection, it would be of relatively short term nature. The standard of protection will fall over time (with predicted sea level rise) and there would be the risk of a large magnitude event exceeding the height of the defences. In the longer term adaptation will still be needed in this low-lying area in the face of increasing risks.

Please see Appendix 4 of this report (provided below) for full information on the additional technical studies undertaken for the Gurnard Marsh area and testing the minor scheme idea.

Along the cliffs between Gurnard Luck and Gurnard Bay there is very limited risk to properties (as they are set back from the cliff top, although the cliff top is expected to retreat back closer to the properties over time). The preferred option is to allow natural processes to continue (but ensure health and safety compliance (e.g. by limiting public access to areas considered at risk of failure).

Table 7-13. The whole life present value costs and benefits of the strategic management options developed for SMZ 5a

Strategic Option	WL Cost (PV £k)	WL Benefits (PV £k)	Residual Damage (PV £k)	B:C
Do Nothing	£0	£0	£6,340	-
Do Minimum, with community led adaption	**£79**	**£354**	**£5,985**	**4.5**
Improve (now) and then adapt	£358	£1,873	£4,467	5.2

Maintain	£759	£2,392	£3,947	3.2

Table 7-14 outlines the measures in each ODU that are required to implement the preferred management option in SMZ 5a; *Do Minimum and Resilience then Adapt (with community led adaption).*

Table 7-14. The measures required in each ODU to implement the preferred strategic option in SMZ 5a

		W21	W22
2015 - 2025	Measure	Maintain access and H&S, flood warning / emergency response plan	Maintain access and H&S
	Notes	Community led flood resilience and adaption, privately funded maintenance	-
2025 – 2055	Measure	Maintain access and H&S, flood warning / emergency response plan	Maintain access and H&S
	Notes	Continue community funded flood measures. But, prepare to adapt to sea level rise with development and implementation of a Coastal Change Management Area Plan	-
2055 - 2115	Measure	Adaptation	Maintain access and H&S
	Notes	Implement the Coastal Change Management Area Plan	-

Option Development Unit W21 (Gurnard Luck):
At Gurnard Luck the preferred approach for the first two time epochs of the Strategy is to Do Minimum, with community and property level resilience and adaption. This approach is line with the SMP2 proposals which involve increasing adaptation for the community. In the short to medium term (up to 2055), this option involves continued community led property level protection and resilience at Gurnard Luck to reduce the flood risk to a small number of properties at very significant risk. The IoW council will not be prioritising any publically funded investment in coastal defences or maintenance in this area, however, privately funded maintenance of existing assets will be permitted (subject to the normal consents).
The flood risk increases in the future due to sea level rise, and the IoW council will work with communities to develop and implement a Coastal Change Management Area plan to set out the strategy to respond and adapt to the risk posed by sea level rise.

Option Development Unit W22 (Gurnard Cliff):
Along Gurnard Cliff, the preferred approach is to Do Minimum for the duration of the Strategy. This approach is feasible as the coastline is currently undefended and the clifftop properties are set back from the cliff edge. Natural processes will be allowed to continue but health and safety compliance in the area will be ensured (e.g. by limiting public access to areas considered to be at risk of failure).

7.8 Strategy Management Zone 5b (Gurnard to Cowes Parade)

Strategy Management Zone 5b is located from Gurnard Bay around the headland to Cowes Parade (where there is currently a continuous coastal esplanade).

Due to the topography of the area the flood risk to properties in this zone is small. Whilst the seafront road is notably at risk of periodic tidal flooding and disruption, only a small number of isolated properties are vulnerable within this zone; the most concentrated area of properties at risk of flooding is behind The Parade car park.

Erosion is a more significant risk in this zone with properties behind Prince's Esplanade/Egypt Esplanade/Queen's Road being at risk over the next 100 years. Additionally, there is risk of landslide reactivation caused by erosion at the toe of the coastal slopes triggering failures within the developed coastal slopes (as it is a potential landslide reactivation zone). The scale and location of initial failures and such events are uncertain; but the risk zone contains approximately 500 properties (including those directly in the erosion zone). This headland is also an area where essential utility links cross from the UK mainland to the Isle of Wight, (including water supply). It is expected that if this area continues to be defended from erosion, as it is currently, the risk of a large landslide event will be minimised.

The strategic management options considered in SMZ 5b are presented in Table 7-15.

The preferred strategic option at SMZ 5b is to ***Maintain.*** This option requires a programme of maintenance and capital refurbishments of the sea wall defences to prevent erosion and re-activation of relict landslips. The defences are an integral aspect helping to maintain the stability of the coastal slopes in this area as they prevent wave action and coastal processes from eroding the base of the slopes.

Given the variable condition of the seawall, it is likely that sections of the wall will require an initial capital refurbishment or replacement scheme in 15 years, with further period interventions thereafter. At this stage it is too early to establish the refurbishment requirements of the scheme (i.e. refurbishment length and design) but an estimated cost for the works has been determined based upon the assumptions provided in Appendix 3. The cost of refurbishment of the 2.5km of 2.7m high seawall (average height) has been estimated based on strengthening through a sprayed concrete technique in 2030 that would have a minimum of 20 years lifespan and keep the seawall at its current height. Whilst the seawall varies in height, predicted residual life and structure type, and therefore this type of refurbishment technique might not always be appropriate, it is reasoned that this approach combined with application of an optimism bias is robust enough at Strategy level to give an approximation of the cost. There will be limited Grant in Aid (GiA) funding available for these works, so although this may form part of the funding required to implement the preferred option (~50%), other public and private contributions will be required. The Isle of Wight Council is committed to exploring potential future funding options and opportunities, possibly through delivering in partnership with other services on the Island, as well as through the planning framework and development opportunities. Further information on the funding required for this scheme can be found in Appendix F, section 11.

It should be noted that under the preferred option (maintaining the seawall at its current height to mitigate the erosion risk) the localised flood risk will not be mitigated (as it would be significantly more costly to raise the wall to do so). Therefore, flood risk, mainly disruption to the local road and promenade areas (from wave overtopping in storm events), is expected to increase over time, as crest heights will not be actively raised given the minimal flood risk to properties.

Table 7-15. The whole life present value costs and benefits of the strategic management options developed for SMZ 5b

Strategic Option	WL Cost (PV £k)	WL Benefits (PV £k)	Residual Damage (PV £k)	B:C
Do Nothing	£0	£0	£23,879	-
Do Minimum	£259	£175	£23,704	0.7
Maintain	**£3,641**	**£23,551**	**£328**	**6.5**
Improve (now)	£16,408	£23,768	£111	1.4

Table 7-16 Table 7-12 outlines the measures in each ODU that are required to implement the preferred management option in SMZ 5b; *Maintain*.

Table 7-16 The measures required in each ODU to implement the preferred strategic option in SMZ 5b

		W23
2015 - 2025	Measure	Maintain Developer and frontager contributions.
	Notes	-
2025 – 2055	Measure	Maintain and refurbishment / upgrade. Developer and frontager contributions.
	Notes	-
2055 - 2115	Measure	Maintain and refurbishment / upgrade. Developer and frontager contributions.
	Notes	-

Option Development Unit W23 (Gurnard to Cowes Parade):
Option Development Unit W23 encompasses the entire SMZ 5b frontage. Within this unit the preferred option is to continue maintenance of the existing defences, before undertaking capital refurbishment and replacement in the medium and long term of approximately 2.5km, to prevent erosion risk. Contributions will be required. Flood risk to the esplanade road is expected to continue to increase.

7.9 Strategy Management Zone 6a (Cowes and East Cowes)

Strategy Management Zone 6a includes the towns of Cowes and East Cowes, with residential and commercial properties lining the mouth of the Medina Estuary. There is significant tidal flood risk affecting commercial and residential properties in parts of East and West Cowes. In the future this flood risk is expected to increase in severity and extent due to climate change and sea level rise, which will also increase the risk of erosion along the coastal frontage if coastal structures and defences are allowed to deteriorate and fail.

The strategic management options considered in SMZ 6a are presented in Table 7-17.

The preferred option recognises the need to reduce flood risk, but currently the Grant in Aid monies available for a new frontline / setback flood protection scheme at Cowes are modest. This is because the properties at risk are spread across a long coastal frontage and therefore the length (and cost) of defence required to protect these properties is unevenly high. In addition, improving the defences in this area is also likely to be very technically challenging due to multiple and varied property ownership, frequent waterfront access and a general lack of space along the waterfront. Despite experiencing several flood events the contributions that would be required to implement such a scheme are currently unavailable.

The preferred option is therefore to ***Sustain (with Temporary Flood Barriers and PLP) then Improve from 2055.*** This will involve, in the short and medium term (up to 2055) using a combination of Temporary Flood Barriers and Property Level Protection to reduce the impacts of tidal flooding to the properties at most risk by sustaining a 1 in 75 year (1.33% AEP) standard of protection. Private ongoing maintenance and improvement of defence assets, particularly along the seafront, is also required and encouraged. Waterfront property owners and Developers should not only mitigate flood risk, but actively take steps to raise their defences or land raise, to remove their properties from flood risk, to reduce risks to properties behind, and to contribute towards the potential for a wider strategic defence in the long term.

Areas that could benefit from the Temporary Flood Barriers and Property Level Protection are shown on
Figure 7-3. It should be noted that there will be residual flood risk to properties in other areas. An advantage of temporary barriers (where alignments are achievable) is that they also provide protection to the commercial properties as well as the residential properties at risk. PLP measures will be targeted towards ground floor *residential* properties.

There are a range of industry approved commercially available temporary flood barriers which could be utilised in the short and medium term. Typically these systems comprise of interlocking units which can be stored locally (on the Island) then manually deployed prior to an event by trained personnel. The community may also be able offer support in the storage and deployment of such a system. The units require no permanent fixing to the ground but would require ongoing maintenance and upkeep. To ensure the barriers are effective, deployment will need to be linked to a tide event flood warning system and they would only be provided at times of need.

The Present Value (PV) cost of the preferred option at SMZ 6a is approximately £19.4 million (approximately £63.5 million in cash terms). In the short to medium term there is a high likelihood of securing a high proportion of government Grant in Aid funding for the temporary barriers and property level protection for residential properties at very significant risk; however, some contributions will still be required. The Isle of Wight Council will seek funding for this scheme.

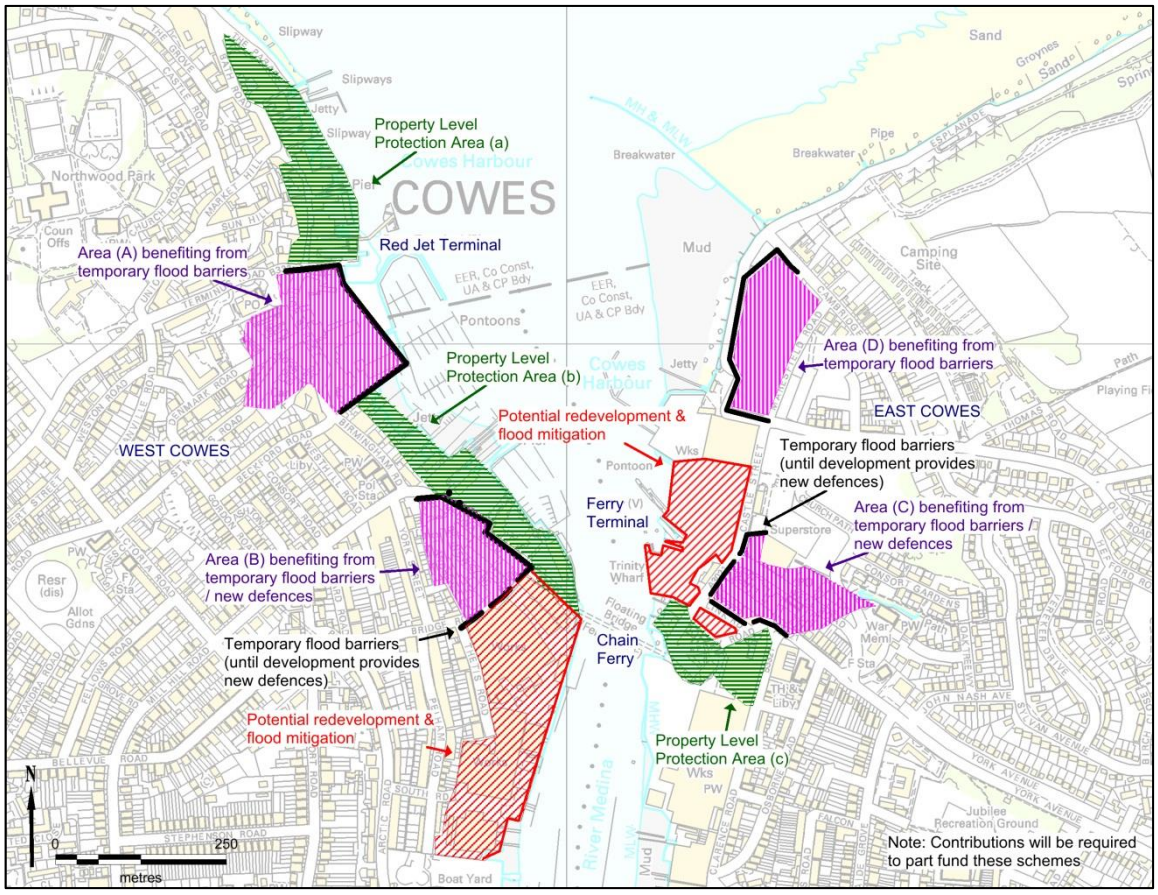


Figure 7-3 Strategy preferred options for Cowes (2015 – 2055)

In the longer term (2055-2115) as the flood risk becomes greater the preferred option is to improve protection through raising or replacing existing frontline quay walls and constructing new frontline or setback flood defences.

Figure 7-4 below highlights the need for these defences.

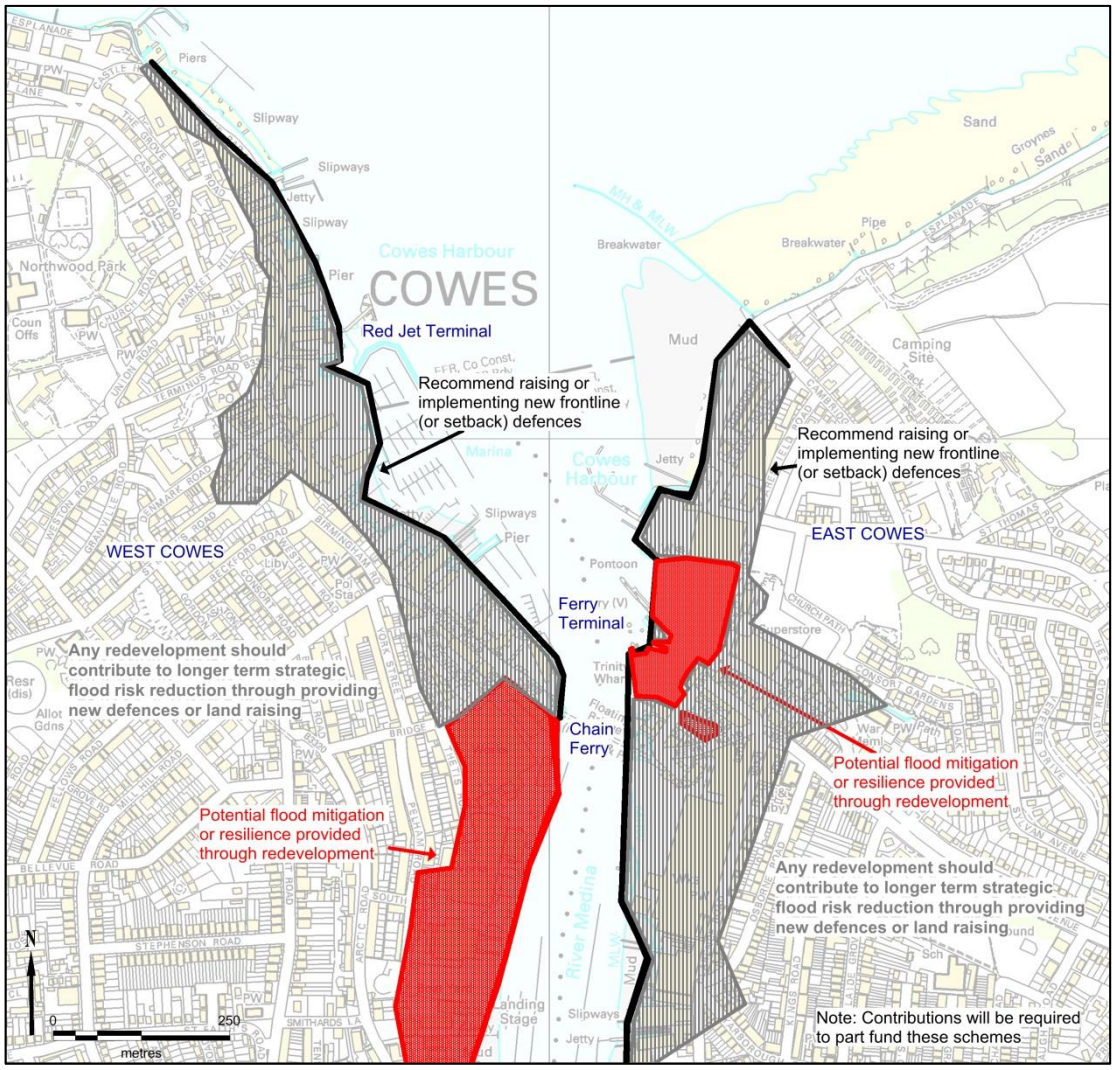


Figure 7-4 Strategy preferred options for Cowes (2055-2115)

The long term approach (2055-2155) is more costly and therefore a significant amount of non Grant in Aid funding will need to be secured. The national 'partnership funding' system for flood and coastal defence advocates those benefitting from new flood and coastal defences to contribute to their cost. The time available (40 years) until the third epoch where this defence improvement is proposed provides time to develop a range of potential funding sources. A key source of contributions is likely to come through redevelopment opportunities. Through the planning process development within the flood zone or along the coastal edge should contribute not only to reducing site flood risk, but also towards the longer term strategic management of flood risk, though providing or improving defences, or raising ground levels. Other potential sources of funding could come from initiatives led by the communities and businesses in the area. Chapter 11 of the main Strategy report provides more guidance on potential funding sources.

Table 7-17. The whole life present value costs and benefits of the strategic management options developed for SMZ 6a

Strategic Option	WL Cost (PV £k)	WL Benefits (PV £k)	Residual Damage (PV £k)	B:C
Do Nothing	£0	£0	£92,645	-
Do Minimum	£673	£2,080	£90,565	3.1
Do Minimum (and PLP) then Adapt	£1,704	£10,296	£82,348	6.0
Maintain	£8,621	£24,760	£67,885	2.9
Sustain (with PLP) then Improve from 2055	£18,802	£49,231	£43,413	2.6
Sustain (with Temporary Flood Barriers and PLP) then improve from 2055	**£19,356**	**£57,006**	**£35,639**	**2.9**
Improve (now)	£87,601	£92,203	£442	1.1

Table 7-18 outlines the measures in each ODU that are required to implement the preferred management option in SMZ 6a; *Sustain 1.33% AEP SoP with Temporary Flood Barriers and PLP (to 2055) then improve*.

Table 7-18. The measures required in each ODU to implement the preferred strategic option in SMZ 6a

		W24	W25	W31
2015 - 2025	Measure	PLP for residential properties at most risk and redevelopment.	Temporary flood barriers and PLP for areas at most risk and redevelopment	Temporary flood barriers and PLP for areas at most risk and redevelopment
	Notes	Reduce tidal flood risk through PLP and community flood warning scheme. Developers (and private frontagers) provide defences and contributions.	Reduce tidal flood risk through PLP and temporary flood barriers. Link approaches to a community flood warning scheme. Developers (and private frontagers) provide defences and contributions.	Reduce tidal flood risk through PLP and temporary flood barriers. Link approaches to a community flood warning scheme. Developers (and private frontagers) provide defences and contributions.
2025 – 2055	Measure	PLP for residential properties at most risk and redevelopment	Temporary flood barriers and PLP for areas at most risk and redevelopment	Temporary flood barriers and PLP for areas at most risk and redevelopment
	Notes	Reduce tidal flood risk through PLP and community flood warning scheme.	Reduce tidal flood risk through PLP and temporary flood barriers. Link approaches to a	Reduce tidal flood risk through PLP and temporary flood barriers. Link approaches to a

		Developers (and private frontagers) provide defences and contributions.	community flood warning scheme. Developers (and private frontagers) provide defences and contributions.	community flood warning scheme. Developers (and private frontagers) provide defences and contributions.
2055 - 2115	Measure	Upgrade / new defences and Redevelopment	Upgrade / new defences and Redevelopment	Upgrade / new defences and Redevelopment
	Notes	Replace and raise existing frontline defences. Developers (and private frontagers) provide defences and contributions.	Replace and raise existing frontline defences and setback defences. Developers (and private frontagers) provide defences and contributions.	Replace and raise existing frontline defences and setback defences. Developers (and private frontagers) provide defences and contributions.

Option Development Unit W24 (Cowes Town Centre, from the southern edge of Cowes Parade to Fountain Yard/Red Jet):
In this location in the short term and medium term (epochs 1 and 2) Property Level Protection measures have been identified by the Strategy as the most appropriate option to mitigate the flood risk to ground floor residential properties in the area. As the flood risk develops further over time the economic case for undertaking a capital scheme improves (see unit W25 below for more info.), and the Strategy therefore recommends undertaking a capital replacement and raising of the frontline defences from year 2055 onwards. However, significant non Grant in Aid funding sources will have to be secured in order to undertake a technically challenging capital scheme along this varied frontage, which is currently home to the town centre. In the interim it is essential for waterfront property owners to improve their own defences, and for shops and businesses to take active steps to protect themselves and mitigate the impacts of flooding.

Option Development Units W25 (Cowes, from the Red Jet/Fountain Yard to Medina Wharf) and W31 (East Cowes, from Kingston Road Power Station to Shrape Breakwater):
In these waterfront towns the management approach is the same for the preferred option. In the short and medium term, to manage the flood risk, the Strategy recommends providing several areas of Temporary Flood Barriers and Property Level Protection measures to protect the residential properties at most risk. These proposals can be found on
Figure 7-3.

As the flood risks increases over time and more properties are subject to flood risk the economic case for undertaking a capital scheme improves (due to greater potential benefits of a scheme). A capital scheme is likely to be required from 2055. This will involve the replacement / raising of the frontline defences and setback defences along this frontage. In order to undertake this capital scheme it is likely that significant non Grant in Aid funding will be required. Therefore, it is essential for waterfront property owners and businesses to continue to improve their own defences and take active steps to protect themselves and reduce the risk of flooding. Redevelopment opportunities (linked to defence improvements) will also be key to a sustainable future for the waterfront and towns.

7.10 Strategy Management Zone 6b (Medina Estuary, and East Cowes Outer Esplanade)

Strategy Management Zone 6b includes the undeveloped shores of the River Medina, and also the coast from outside the Shrape Breakwater east to Old Castle Point. This area is subject to only small flood risk, with properties being well dispersed along this long frontage.

The strategic management options considered in SMZ 6b are presented in Table 7-19.

In this largely undefended and sheltered estuarine area, the Strategy proposes no planned publically funded maintenance or investment in coastal defences, in line with the Shoreline Management Plan (2011) policy of 'no active intervention' for this area. The preferred strategic option is therefore to ***Do Nothing***, allowing natural processes to occur and for this part of the Medina frontage to evolve. It is however recognised that local erosion risks to businesses, people and coastal footpaths will need to be mitigated, or adapted to, and therefore privately funded maintenance of existing coastal infrastructure or defences will be permitted (subject to gaining the necessary consents).

In addition, privately funded property level protection measures are recommended for a small number of properties that are at significant risk of flooding.

At West Medina Mills (unit W27), no publically funded investment in coastal defences is planned, but privately funded defence improvements can be continued, in line with the SMP (2011) policy of 'hold the line' for this short, waterfront industrial unit.

Along East Cowes Outer Esplanade (from the Shrape Breakwater towards Old Castle Point, unit W32), there is currently a seawall in reasonable condition, and in this area the preferred approach is to continue minor maintenance to extend its residual life (where achievable; especially at the western end – this is the cost included in the Do Nothing option below). However, there are no proposals to replace this seawall in the medium or long term (in line with the SMP policy change set in 2011), as there are not sufficient properties at risk to justify significant expenditure in this area. Privately funded maintenance of existing coastal structures will be permitted subject to gaining the necessary consents. The local slope failure blocking seawall access at the remote eastern end (although not significantly damaging the structure itself) is an example of the likely future evolution of the area that will need to be considered on a case by case basis, as to what repairs are affordable.

Table 7-19 The whole life present value costs and benefits of the strategic management options developed for SMZ 6b

Strategic Option	WL Cost (PV £k)	WL Benefits (PV £k)	Residual Damage (PV £k)	B:C
Do Nothing	**£62**	**£0**	**£2,568**	**-**
Do Minimum	£122	£108	£2,459	0.9
Maintain	£1,293	£220	£2,348	0.2

Table 7-20 outlines the measures in each ODU that are required to implement the preferred management option in SMZ 6b; *Do Nothing.*

Table 7-20 The measures required in each ODU to implement the preferred strategic option in SMZ 6b

		W26	W27	W28	W30	W32
2015 - 2025	Measure	Do Nothing	No publically funded defence improvements	Do Nothing	Do Nothing	Do Minimum
	Notes	-	Privately funded defence improvements permitted subject to gaining the necessary consents	-	-	Minor maintenance of existing coastal structures.
2025 – 2055	Measure	Do Nothing	No publically funded defence improvements	Do Nothing	Do Nothing	Do minimum transferring to Do Nothing, with only Health and Safety actions where appropriate
	Notes	-	Privately funded defence improvements permitted (subject to gaining the necessary consents)	-	-	Transfer to Do nothing at the end of the life of the current structures
2055 - 2115	Measure	Do Nothing	No publically funded defence improvements	Do Nothing	Do Nothing	Do Nothing
	Notes	-	Privately funded defence improvements permitted subject to gaining the necessary consents	-	-	-

Option Development Units W26 (Central Medina -North West), W27 (West Medina Mills), W28 (Central Medina -South West), W30 (Central Medina -East):
The management approach for these Option Development Units is the same and involves no planned public investment in coastal or flood defences. Natural processes will be allowed to continue such as allowing the long Estuary shorelines to adapt naturally to sea level rise. However, it is recognised that there may be a requirement for local businesses, people and coastal footpaths to adapt and mitigate the impacts of erosion, and therefore, in W26, W28 and W30, privately funded maintenance of existing coastal structures will be permitted (subject to gaining the necessary consents). In W27, privately funded maintenance or improvement of the existing defences/quayside will be permitted subject to gaining the necessary consents; Consideration should be given to appropriate transitions to the surrounding naturally evolving estuary.

Option Development Unit W32 (East Cowes Outer Esplanade, from the Shrape Breakwater to Old Castle Point): In the short term the preferred approach is to continue minor maintenance to extend the residual life of the seawall where achievable (especially at the western end of the unit). Larger maintenance needs however will be assessed on a case by case basis, to determine what is affordable. When the current structures reach the end of their life, there are no proposals to replace them in the medium or long term, so only required health and safety measures will then be undertaken, and erosion risk will increase as the coastline begin to evolve naturally.

7.11 Strategy Management Zone 6c (Newport Harbour)

Strategy Management Zone 6c includes the harbour and quaysides around Newport Harbour which are subject to varying degrees of flood and erosion risk. Due to the topography of the area the flood waters do not extend far from the shoreline or become concentrated in one location. As a result a number of commercial properties close to the waterfront are at risk of flooding and if the harbour walls were allowed to fail a number of properties in close proximity are also expected to be at risk of collapse.

The strategic management options considered in SMZ 6c are presented in Table 7-21.

The preferred strategic option for SMZ 6c is to ***Maintain (and PLP) then Improve from 2055 (through redevelopment).*** This adaptive approach has been identified as the preferred option as the level of Grant in Aid funding available for an alternative capital scheme is minimal.

As part of the preferred option the quay walls will need to be maintained by the asset owners to maximise the residual life of these defences. It is recommended that commercial properties at significant risk implement and fund property level flood risk reduction and resilience measures. In addition, property level protection is recommended for a small number of residential properties. It is likely that these measures will need to be privately funded.

From 2055, as the flood risk increases, and defence structures reach the end of their service life, the preferred option is to refurbish and raise the existing quay walls. However, this is a costly option (the Present Value cost of the preferred option at SMZ 6c is approximately £1.9million (approximately £7.8million in cash terms)), and significant non Grant in Aid funding will need to be secured. The Isle of Wight Council will continue to explore funding for this longer term option to reduce flood risk to people and property and to maintain the viability of the harbourside area. A key part of reducing the funding shortfall will be to gain contributions through redevelopment. Refurbishment and improvement of harbour walls and defences may be achievable sooner as redevelopment opportunities arise. Development within the flood zone

or along the waterside will need to contribute not only to reducing site flood risk, but also towards the longer term strategic management of flood risk though improving defences or raising ground levels.

Table 7-21. The whole life present value costs and benefits of the strategic management options developed for SMZ 6c

Strategic Option	WL Cost (PV £k)	WL Benefits (PV £k)	Residual Damage (PV £k)	B:C
Do Nothing	£0	£0	£5,648	-
Do Minimum	£170	£94	£5,554	0.5
Maintain (and PLP) then Improve from 2055 (through redevelopment)	**£1,932**	**£3,366**	**£2,282**	**1.7**
Maintain (and PLP) then Improve from 2055 (through a frontline scheme)	£8,279	£4,707	£941	0.6
Improve (now)	£26,861	£5,603	£46	0.2

Table 7-22 outlines the measures in each ODU that are required to implement the preferred management option in SMZ 6b; *PLP and maintain (improve through redevelopment).*

Table 7-22. The measures required in each ODU to implement the preferred strategic option in SMZ 6c

		W29
2015 - 2025	Measure	Maintenance of existing structures and minor PLP. Redevelopment, developers and frontagers provide defences and contributions.
	Notes	-
2025 – 2055	Measure	Maintenance, PLP and refurbishment of structures at end of residual life. Redevelopment, developers and frontagers provide defences and contributions.
	Notes	-
2055 - 2115	Measure	Maintenance, PLP and refurbishment of structures. Redevelopment, developers and frontagers provide defences and contributions.
	Notes	-

Option Development Unit W29 (Newport Harbour):
Option Development Unit W29 is the entire SMZ 6c frontage. Within this unit the preferred option for the short term is for continuing maintenance of the existing structures alongside recommending minor PLP works to protect residential properties at the greatest risk of flooding. In the medium and long term, maintenance of the existing structures should be continued and

refurbishment / upgrades should be carried out at the end of the structure's residual life. Continued PLP works are also recommended during these time periods. In the long term a defence upgrade / refurbishment (from 2055) is anticipated to be costly and therefore external contributions will be required.

8. Summary

This report outlines the process by which the preferred management options along the Strategy frontage have been developed.

In summary, the first stages in the option development process were focussed on developing a set of strategic management zones and options development units. This was necessary in order to facilitate the option development process; in total six SMZs were created and were broken down into a total of 31 ODUs.

For each Strategy Management Zone a number of strategic options were developed in line with the FCERM-AG guidance. The most appropriate local level measures to implement each strategic option were then identified for each ODU.

Following detailed economic, technical, social and environmental assessments the strategic options were then appraised to identify the preferred strategic option in each SMZ.

Table 8-1 below presents the preferred strategic option for each SMZ.

Table 8-1. The preferred strategic options for each Strategy Management Zone

Zone	Preferred option	PV costs (£k)	PV Benefits (£k)	ABCR
SMZ 1	Do Nothing	£0	£0	-
SMZ 2	Do Minimum	£308	£931	3.0
SMZ 3a	Maintain (and Temporary Flood Barriers) then Improve from 2055.	£6,560	£31,854	4.9
SMZ 3b	Do Minimum with Managed Realignment between 2025 and 2055*	£3,824	£1,271	0.3
SMZ 3c	Maintain (and PLP) then Improve (2055)	£1,450	£5,514	3.8
SMZ 4	Do Nothing	£0	£0	-
SMZ 5a	Do Minimum, with community led adaption	£79	£354	4.5
SMZ 5b	Maintain	£3,641	£23,551	6.5
SMZ 6a	Sustain (with Temporary Flood Barriers and PLP) then Improve from 2055	£19,356	£57,006	2.9
SMZ 6b	Do Nothing**	£62	£0	-
SMZ 6c	Maintain (and PLP) then Improve from 2055 (through redevelopment)	£1,932	£3,366	1.7

*Environmental driver for preferred option
**Includes cost for health and safety in W32 until the end of the second epoch

Please note: Costs are presented in Present Value terms; whereby the whole life costs of an option have been discounted to provide the current worth of future sums of money. For details of the estimated cash costs for each Unit *('Capital Works cost breakdown, Present Day Cash £'*), please see Appendix F of this Strategy (within the appendix 1 table of that report).

Appendix 1: ODU Characteristics

Appendix 1 presents a number of tables which outline the key drivers behind the selection of each ODU. This was undertaken in the initial stages of the Strategy development using information from the SMP (published in 2010, adopted in 2011). (Note that the SMP period was to 2105).

ODU W1 – Tennyson Down, Alum Bay and Headon Warren

SMP unit – policy	6A.2 – NAI
Current defences and residual life	Undefended cliffs
Coastal processes	High wave energy, rapid erosion
SMP flood mapping	No flooding (cliffs)
SMP erosion bands (NAI)	Significant erosion, but the Needles Park is the only asset at risk. Buildings will not be significantly impacted for more than 40 years.
Land use (frontage maintainer)	Open space, attractions (Needles Park), farmland. (National Trust + Private)
Potential constraints	
Historical and current issues or concerns – inc KSG workshops.	

Key Driver – High cliffs, open space - no residential areas along the frontage

ODU W2 – Southern and Central Totland Bay

SMP unit – policy	6B.1 – HTL
Current defences and residual life	Seawalls with wave return with <10-25 years residual life. Splash wall to rear of footpath in places. Timber and rock groynes with 10-25 years residual life.
Coastal processes	High wave energy
SMP flood mapping	No flooding (cliffs)
SMP erosion bands (NAI)	SMP (2010) identified that there were no assets at risk in 10 years. Residential properties may be at risk after 40 years alongside businesses located at the cliff foot. After 90 years significant number of residential properties would be affected and the cliff top road.
Land use (frontage maintainer)	Recreation, residential. (IWC)
Potential constraints	
Historical and current issues or concerns – inc KSG workshops.	Potential for further landsliding to occur based on previous event.

Key Driver – Large residential area at risk from erosion. Existing defences, benefits of which should be maximised. Landslide risk.

ODU W3 – Northern Totland Bay

SMP unit – policy	6B.1 – HTL
Current defences and residual life	Seawall with steel sheet piled toe with stepped concrete apron; mainly intact, but failed along a ~100m section due to a landslide.
Coastal processes	High wave energy
SMP flood mapping	No flooding (cliffs)
SMP erosion bands (NAI)	SMP (2010) identified that a small amount of properties may be at risk after 40 years. After 90 years a further small amount of residential properties would be affected. A large landslide has occurred since the SMP was developed.
Land use (frontage maintainer)	Recreation, residential. (IWC)
Potential constraints	
Historical and current issues or concerns – inc KSG workshops.	Popular footpath has been destroyed by the Totland landslide in 2012. Residents have aspirations restore the footpath and seawall.

Key Driver – Clifftop residential area at risk from erosion. Large landslide occurred in 2012 causing a section of seawall to fail.

ODU W4 – Southern Colwell Bay

SMP unit – policy	6B.1 – HTL
Current defences and residual life	Concrete seawalls with 10 to 25 years residual life. Splash wall to rear. Timber groynes with 10 to 20 years residual life.
Coastal processes	High wave energy
SMP flood mapping	No flooding (cliffs)
SMP erosion bands (NAI)	A small amount of properties may be at risk after 40 years. After 90 years a further small amount of residential properties would be affected.
Land use (frontage maintainer)	Recreation, residential. (IWC + Private)
Potential constraints	
Historical and current issues or concerns – inc KSG workshops.	Some potential for further landsliding to occur based on previous event.

Key Driver –Residential and recreational area at risk from erosion. Existing defences, benefits of which should be maximised. Landslide risk.

ODU W5 – Central Colwell Bay

SMP unit – policy	6B.2 – NAI
Current defences and residual life	Undefended cliffs. Isolated rock armour with 10-15 years residual life near slipway. Remnant timber groynes typically having 8-12 years residual life, most disconnected from the cliff.
Coastal processes	High wave energy, net sediment movement is from southwest to northeast
SMP flood mapping	No flooding (cliffs)
SMP erosion bands (NAI)	The 40 year erosion line shows a small number of holiday homes at risk. The 90 year erosion lines shows further holiday homes at risk, not a large number.
Land use (frontage maintainer)	Recreation, holiday parks, residential (holiday homes), open space. (IWC + Private)
Potential constraints	
Historical and current issues or concerns – inc KSG workshops.	

Key Driver – High cliffs. Small number of properties at risk from erosion.

ODU W6 – Fort Albert

SMP unit – policy	6B.3 – HTL, HTL, NAI
Current defences and residual life	Concrete sea walls with 10-25 years residual life.
Coastal processes	High wave energy
SMP flood mapping	Potential flooding of Fort Albert
SMP erosion bands (NAI)	SMP (2010) identified that after 40 years erosion would mainly have an impact on Fort Albert, especially on access. After 90 years ~15 properties on top of the cliff are also shown to be at risk.
Land use (frontage maintainer)	Residential (holiday homes), open space. (IWC + Private)
Potential constraints	Fort Albert is a grade II* listed building
Historical and current issues or concerns – inc KSG workshops.	Access to Fort Albert

Key Driver – Properties are generally at risk of erosion after 40 years. Allow time for adaption.

ODU W7 – Fort Victoria Country Park

SMP unit – policy	6B.4 – NAI
Current defences and residual life	Undefended cliff
Coastal processes	Low wave energy (fetch limited)
SMP flood mapping	No flooding (cliffs)
SMP erosion bands (NAI)	No assets at risk.
Land use (frontage maintainer)	Open space (woodland). (Private)

Potential constraints	
Historical and current issues or concerns – inc KSG workshops.	

Key Driver – Open space - no assets at risk from erosion or flooding

ODU W8 – Fort Victoria and Norton

SMP unit – policy	6B.5 – HTL, NAI, NAI
Current defences and residual life	Seawalls with residual <10-25 years. Timber groynes in places.
Coastal processes	Low wave energy (fetch limited)
SMP flood mapping	Flooding of ~1 property
SMP erosion bands (NAI)	SMP (2010) identified that in the third epoch (40-90 years) Fort Victoria and a small number of residential properties (~10) are at risk.
Land use (frontage maintainer)	Residential, recreation (resort leisure club). (Private/IWC)
Potential constraints	
Historical and current issues or concerns – inc KSG workshops.	Fort Victoria Grade II listed structure at risk.

Key Driver – Small amount of properties at risk from flooding and erosion. Allow time for adaption.

ODU W9 – Norton Spit

SMP unit – policy	6C.1 – HTL
Current defences and residual life	Timber boarded breastwork walls having 10-20 years residual life, with timber groynes in places. Rock armour having 10-15 years residua life and Timber boarded breakwater with 10 years residual life (to be replaced). Nearby, seawalls around the road link with 10-25 years residual life.
Coastal processes	Low wave energy (fetch limited)
SMP flood mapping	Flooding of west Yarmouth Harbour and the A3054
SMP erosion bands (NAI)	No residential assets at risk from erosion.
Land use (frontage maintainer)	Recreation, harbour (Private), Yar Bridge and road link.
Potential constraints	
Historical and current issues or concerns – inc KSG workshops.	The Strategy must consider the intended replacement of the breakwater

Key Driver – The road needs to be protected from flooding and erosion. The breakwater protects the important harbour.

ODU W10 – Western Yar Estuary – western shore

SMP unit – policy	6C.2 – NAI
Current defences and residual life	Mostly undefended salt marsh. Some isolated structures (landing stages and structures in front of properties) which have typically residual lives of 10-20 years.
Coastal processes	Estuarine, sheltered
SMP flood mapping	Flooding of boat yard and buildings at Kings Manor Farm
SMP erosion bands (NAI)	No assets at risk from erosion.
Land use (frontage maintainer)	Recreation (boat yard), farmland. (Private)
Potential constraints	
Historical and current issues or concerns – inc KSG workshops.	

Key Driver – Very small number of properties at risk from flooding

ODU W11 – The Causeway

SMP unit – policy	6C.3 – HTL
Current defences and residual life	The stone masonry bridge has a residual of 10-15 years.
Coastal processes	Estuarine, sheltered
SMP flood mapping	A large number of residential and commercial properties are within the flood zone, the majority in Freshwater village and some near the Causeway. Also within the zone is the A3055 road.
SMP erosion bands (NAI)	No assets at risk from erosion.
Land use (frontage maintainer)	Rural. Isolated residential. (EA/IWC)
Potential constraints	Afton Manor, south of The Causeway is a grade II* listed building. But, the Causeway is not a listed building.
Historical and current issues or concerns – inc KSG workshops.	

Key Driver – Upstream of the Causeway a large number of properties are at risk from flooding

ODU W12 – Freshwater Bay

SMP unit – policy	6A.1 – HTL
Current defences and residual life	Seawalls having 10-25 years residual, there are failed timber groynes
Coastal processes	Accretion in middle of bay, erosion at flanks. Overtopping (large fetch).
SMP flood mapping	Flooding will connect Freshwater Bay and the Yar Estuary if defences fail. Flooding of carpark and nearby properties.
SMP erosion bands (NAI)	Impact on ~5 properties and the A3055 in the next 90 years.
Land use (frontage maintainer)	Recreation, residential (apartments). (IWC + Private)
Potential constraints	Freshwater Independent Lifeboat Station requires access to the water

Historical and current issues or concerns – inc KSG workshops.	The link between Yarmouth and Freshwater Bay needs to be considered

Key Driver – Linked to the Causeway by flooding of the Western Yar valley. Important to maintain transport links to West Wight.

ODU W13 – Western Yar Estuary – eastern shore

SMP unit – policy	6C.4 – NAI
Current defences and residual life	Undefended salt marsh
Coastal processes	Estuarine, sheltered
SMP flood mapping	No assets within flood zone.
SMP erosion bands (NAI)	No assets at risk from erosion.
Land use (frontage maintainer)	Farmland. (IWC)
Potential constraints	
Historical and current issues or concerns – inc KSG workshops.	Maintain the cyclepath link.

Key Driver – No assets at risk from flooding or erosion

ODU W14 – Thorley Brook to Barnfields Stream

SMP unit – policy	6C.5 – HTL, MR, NAI
Current defences and residual life	An embankment protects the mouth of the potentially tidal creek. Rock and concrete revetments having residual lives of 15-25 years. Concrete weir to Thorley Brook with 15-25 years residual life.
Coastal processes	Estuarine, sheltered
SMP flood mapping	A number of properties are within the potential flood zone, also the B3401 road and A3055 coastal road
SMP erosion bands (NAI)	SMP (2010) identified no assets at risk from erosion
Land use (frontage maintainer)	Open space (nature conservation). (EA, IWC + Private)
Potential constraints	Grazing marsh and high tide roost sites will need to be secured via the Regional Habitat Creation Programme to offset any losses in these habitats that may occur at the site following managed realignment.
Historical and current issues or concerns – inc KSG workshops.	

Key Driver – A policy of managed realignment will restore Thorley Brook and Barnfields Stream to their natural evolution to benefit nature conservation

ODU W15 – Thorley Brook to Yar Bridge

SMP unit – policy	6C.6 – HTL
Current defences and residual life	Stone filled gabion mattress revetment having 15-25 years residual. Concrete and rock revetment with 15-25 years residual.

Coastal processes	Estuarine, sheltered
SMP flood mapping	Flooding of a large number of residential properties
SMP erosion bands (NAI)	No assets at risk from erosion.
Land use (frontage maintainer)	Residential, recreation (boat yard and playing fields). (IWC + Private)
Potential constraints	
Historical and current issues or concerns – inc KSG workshops.	

Key Driver – Maintaining/improving defences will protect a large number of residential properties from flooding.

ODU W16 – Yar Bridge to Yarmouth Common

SMP unit – policy	6C.6 – HTL
Current defences and residual life	Mixed defences fronting harbour and individual properties, including steel sheet piled walls with concrete capping beam having 25+ years residual life, and stone masonry walls having 15-25 years residual life.
Coastal processes	Low wave energy, shelter from breakwater
SMP flood mapping	Flooding of a large number of residential and commercial properties
SMP erosion bands (NAI)	A number of properties are at risk over 90 years. Properties very close to the seafront will be impacted within 10 years.
Land use (frontage maintainer)	Harbour including ferry terminal, behind the harbour are commercial and residential properties (Private) including the town centre.
Potential constraints	Yarmouth Castle is a grade I listed building. The George Hotel is a grade II* listed building.
Historical and current issues or concerns – inc KSG workshops.	The ferry is an important link to the mainland and for the prosperity of the Island, especially the West Wight.

Key Driver – Maintaining/improving defences will protect a large number of residential and commercial properties from flooding. Important harbour.

ODU W17 – Yarmouth Common to Port la Salle

SMP unit – policy	6C.6 – HTL
Current defences and residual life	Concrete wall with wave return with residual 5-10 years. Concrete walls with 10-25+ years residual life. Masonry walls with <10-25+ years residual life.
Coastal processes	Low wave energy (fetch limited)
SMP flood mapping	No assets are at risk from flooding although the seafront embankment prevents tidal flooding of Thorley Brook from the north.
SMP erosion bands (NAI)	A significant number of properties and the A3054 are at risk after 90 years. After 40

	years the footpath along the seafront will be impacted and a few properties near Port la Salle at risk.
Land use (frontage maintainer)	Recreation, residential. (IWC + Private)
Potential constraints	
Historical and current issues or concerns – inc KSG workshops.	Yarmouth Common seawall has been observed to be undermined

Key Driver – Maintaining/improving defences will protect a large number of properties and the key road link from Newport from erosion

ODU W18 – Bouldnor Copse and Hamstead

SMP unit – policy	7.1 – NAI
Current defences and residual life	Undefended cliffs
Coastal processes	Low wave energy (fetch limited)
SMP flood mapping	No assets are at risk from flooding
SMP erosion bands (NAI)	A small number of scattered properties ~5 are at risk over 90 years.
Land use (frontage maintainer)	Open space (woodland), limited residential properties. (Private)
Potential constraints	
Historical and current issues or concerns – inc KSG workshops.	

Key Driver – Undefended cliffs. Small number of properties at risk from erosion.

ODU W19 – Newtown Estuary

SMP unit – policy	7.2 – NAI
Current defences and residual life	The majority of this frontage is undefended. Some stone masonry walls with typically <10-20 years residual.
Coastal processes	Estuarine environment with twin entrance spits, littoral drift is from both sides towards the inlet
SMP flood mapping	Small number of properties within flood zone
SMP erosion bands (NAI)	No assets at risk from erosion
Land use (frontage maintainer)	Nature reserve, farmland, small residential areas. (National Trust + SERFCA + Private)
Potential constraints	
Historical and current issues or concerns – inc KSG workshops.	

Key Driver – Mostly undefended frontage. Small number of properties are within the flood zone.

ODU W20 – Thorness Bay and southern Gurnard Bay

SMP unit – policy	7.3 – NAI
Current defences and residual life	Undefended cliffs
Coastal processes	Low wave energy (fetch limited)

SMP flood mapping	No assets are at risk from flooding
SMP erosion bands (NAI)	SMP (2010) identified that there were no assets will be impacted in 10 years. A small amount of assets will be impacted within 40 years. Within 90 years ~20 properties not including caravans in the holiday park will be at risk.
Land use (frontage maintainer)	Recreation (holiday park), farmland, woodland, some small residential areas. (SERFCA + Private)
Potential constraints	
Historical and current issues or concerns – inc KSG workshops.	

Key Driver – Undefended cliffs. Small number of properties at risk from erosion.

ODU W21 – Gurnard Luck

SMP unit – policy	1A.1 – HTL, NAI, NAI
Current defences and residual life	Concrete and masonry walls (with 5-25 years residual life. = Some short groynes.
Coastal processes	Low wave energy (fetch limited)
SMP flood mapping	A large number of properties are within the flood zone
SMP erosion bands (NAI)	Over 40 years only ~1 property would be at risk. Over 90 years a number of properties and Marsh Road would be at risk.
Land use (frontage maintainer)	Residential, harbour. (Private)
Potential constraints	
Historical and current issues or concerns – inc KSG workshops.	Low lying area, some residences already adapting to flood risk by raising floor levels. A number of seafront properties combined their repair and renewal grants to repair their failing seawall.

Key Driver – Large number of properties at risk from flooding and erosion, but unlikely to qualify for national funding. Allow time for adaption.

ODU W22 – Gurnard Cliff

SMP unit – policy	1A.2 – NAI
Current defences and residual life	Mostly undefended. Some timber breast work with 15-25 years residual.
Coastal processes	Low wave energy (fetch limited)
SMP flood mapping	No flooding (cliffs)
SMP erosion bands (NAI)	~5 properties would be impacted within 90 years, the majority of these are located nr Shore Road. The potential landslide reactivation zone does not put any additional assets at risk. However, erosion and slips will progressively move the cliff line closer to the set-back cliff-top properties.
Land use (frontage maintainer)	Woodland, residential area on top of the cliff. (Private)

Potential constraints	
Historical and current issues or concerns – inc KSG workshops.	

Key Driver – Mostly undefended cliffs. Small number of properties at risk from erosion.

ODU W23 – Gurnard to Cowes Parade

SMP unit – policy	1A.3 – HTL
Current defences and residual life	Seawalls with 10-25 years residual. Rock groynes with 15-25 years residual.
Coastal processes	Low wave energy (fetch limited), weak net eastwards littoral drift
SMP flood mapping	A small number of properties are at risk from flooding, most of these are buildings at the rear of Cowes Parade.
SMP erosion bands (NAI)	SMP (2010) identified a small amount of properties are at risk within 40 years. Within 90 years a significant number of properties would be at risk and the seafront road. Prior to their loss, the rows of seafront properties would lose their road access.
Land use (frontage maintainer)	Residential, recreation (beach huts), commercial. (IWC + Private)
Potential constraints	West Cowes castle in a grade II* listed building
Historical and current issues or concerns – inc KSG workshops.	Large potential landslip reactivation zone has been identified in this area affecting the developed coastal slopes of the town.

Key Driver – Maintaining/improving defences will protect a large number of properties from erosion

ODU W24 – Cowes Town Centre to Fountain Yard

SMP unit – policy	1A.4 – HTL
Current defences and residual life	Mixed structures fronting individual private properties with waterfront access. Some concrete walls and stone masonry walls with 15-25 years residual life. Multiple slipways.
Coastal processes	Low wave energy (fetch limited)
SMP flood mapping	Flooding of a large number of residential and commercial properties
SMP erosion bands (NAI)	Properties are at risk within 40 years. Within 90 years a significant number of properties would be at risk along the High Street.
Land use (frontage maintainer)	Residential, commercial (large High Street/town centre). (Private)
Potential constraints	88 and 89 High Street are grade II* listed buildings
Historical and current issues or concerns – inc KSG workshops.	Main high street in Cowes. There are access routes to the waterfront, where there are many slipways.

Key Driver – Maintaining/improving defences will protect a large number of residential and commercial properties from flooding and erosion

ODU W25 – Cowes: Fountain Yard to Medina Wharf

SMP unit – policy	1A.4 – HTL
Current defences and residual life	Mixed structures and defences along private and commercial waterfronts. Stone and concrete masonry walls with 15 to 25 years residual. Some of the frontage is undefended. Multiple slipways.
Coastal processes	Mostly estuarine, sheltered
SMP flood mapping	Flooding of a large number of residential and commercial properties
SMP erosion bands (NAI)	A small number of properties would be at risk within 40 years. Within 90 years a large number of the waterfront industrial buildings would be at risk.
Land use (frontage maintainer)	Industrial buildings with residential streets landward, commercial buildings, wharfs and ferry terminal
Potential constraints	Most of the waterfront industrial buildings require access to the waterfront slipways.
Historical and current issues or concerns – inc KSG workshops.	Passenger ferry is an important link to the mainland and for the economy of the Island.

Key Driver – Maintaining/improving defences will protect a large number of residential and commercial properties from flooding and erosion

ODU W26 – Central Medina –north west

SMP unit – policy	1B.1 – NAI
Current defences and residual life	Undefended frontage.
Coastal processes	Estuarine, sheltered
SMP flood mapping	~1 outbuilding is within the flood zone
SMP erosion bands (NAI)	No assets at risk from erosion.
Land use (frontage maintainer)	Farmland. (IWC + Private)
Potential constraints	
Historical and current issues or concerns – inc KSG workshops.	

Key Driver – Small amount of assets at risk from flooding

ODU W27 – West Medina Mills

SMP unit – policy	1B.2 – HTL
Current defences and residual life	Sheet piled walls with residual life 26 to 70 years, and concrete wall with 10-15 years residual life.
Coastal processes	Estuarine, sheltered
SMP flood mapping	Industrial buildings at risk from flooding
SMP erosion bands (NAI)	No assets at risk from erosion.
Land use (frontage maintainer)	Small industrial area. (Private)

Potential constraints	
Historical and current issues or concerns – inc KSG workshops.	

Key Driver – Maintaining/improving defences will protect industrial buildings from the risk of flooding

ODU W28 – Central Medina - SW

SMP unit – policy	1B.3 – NAI
Current defences and residual life	Mainly undefended with minor isolated structures.
Coastal processes	Estuarine, sheltered
SMP flood mapping	A small number of assets are at risk
SMP erosion bands (NAI)	No assets at risk from erosion.
Land use (frontage maintainer)	Farmland, small residential areas, industrial area to the south is setback from the frontage. (IWC + Private)
Potential constraints	
Historical and current issues or concerns – inc KSG workshops.	

Key Driver – Small amount of assets at risk from flooding

ODU W29 – Newport Harbour

SMP unit – policy	1B.4 – HTL
Current defences and residual life	Harbour and wharfs, mixed structures. Steel sheet pile 18-26 years residual life, and concrete and masonry walls with 10-15 years residual life.
Coastal processes	Estuarine, sheltered
SMP flood mapping	A number of properties are at risk from flooding
SMP erosion bands (NAI)	No assets directly at risk from erosion.
Land use (frontage maintainer)	Industrial areas, commercial, residential. (IWC + Private)
Potential constraints	
Historical and current issues or concerns – inc KSG workshops.	

Key Driver – Large number of properties at risk from flooding including industrial facilities.

ODU W30 – Central Medina - East

SMP unit – policy	1B.5 – NAI
Current defences and residual life	Mostly undefended. Some short private structures of mixed residual life at Island Harbour and the Folly Inn.
Coastal processes	Estuarine, sheltered
SMP flood mapping	A small number of residential and commercial properties are within the flood

	zone
SMP erosion bands (NAI)	No assets at risk from erosion.
Land use (frontage maintainer)	Farmland, waste water pumping station, recreation (harbour and holiday park), disused industrial facility. (IWC + Private)
Potential constraints	
Historical and current issues or concerns – inc KSG workshops.	

Key Driver – Small number of properties within the flood zone

ODU W31 – East Cowes: Kingston Road Power Station to Shrape Breakwater

SMP unit – policy	1A.5 – HTL
Current defences and residual life	Mixed structures and defences along private and commercial waterfronts. Stone masonry walls and concrete walls with 15 to 25 years residual. Steel sheet piled walls with concrete capping with 26-70 years residual.
Coastal processes	Low wave energy (fetch limited), shelter provided by breakwater
SMP flood mapping	Significant amount of residential and commercial properties are within the flood zone
SMP erosion bands (NAI)	Erosion bands only as far south as the ferry slipway. There are low rates of erosion. Only asset at risk is the footpath along the seafront.
Land use (frontage maintainer)	Industrial facilities (including fuel depot and power station), residential, commercial buildings and wharfs, ferry terminal. (IWC + Private)
Potential constraints	Most of the waterfront industrial buildings require access to the waterfront slipways.
Historical and current issues or concerns – inc KSG workshops.	Vehicle ferry is an important link to the mainland and for the economy of the Island. Also, East Cowes town centre redevelopment plans.

Key Driver – Large number of properties at risk from flooding including industrial facilities.

ODU W32 – Shrape Breakwater to Old Castle Point

SMP unit – policy	1A.6 – HTL, NAI, NAI
Current defences and residual life	Concrete wall with 15-25 years residual. Concrete groynes with 10-15 years residual.
Coastal processes	Low wave energy (fetch limited)
SMP flood mapping	A small number of properties are within the flood zone
SMP erosion bands (NAI)	There are a small number of isolated properties that will be impacted upon by erosion within 90 years.
Land use (maintainer)	Recreation area with residential properties landward, woodland. (IWC)

Potential constraints	
Historical and current issues or concerns – inc KSG workshops.	Landslip in April 2014 has blocked the East Cowes Esplanade road near Old Castle Point.

Key Driver – Small number of properties within flood and erosion zone. Allow time for adaptation

Appendix 2: ODU Option Appraisal Process

Appendix 2 presents the options appraisal for each ODU that was carried out to help identify the most suitable local measures. Each option was appraised against 12 categories; SMP policy facilitation, flood risk management, erosion risk, cost, environmental impacts, technical feasibility, residual risk/failure, stakeholder objectives, broader outcomes, maintenance, option life and coastal processes. In each category the options were ranked with a colour code; red, amber or green. The following table outlines the classification system used for each category.

Category	Red	Amber	Green
SMP policy facilitation	Doesn't facilitate SMP policy	Partially supports / general support but localised change	Facilitates SMP policy
Flood risk management	Fails to address / mitigate risk or makes worse / results in significant flood risk	Potential to partially address / mitigate risk, results in limited flood risk or no change	Potential to improve protection and/or significantly mitigates risk or results in no significant risk
Erosion risk	Increases erosion risk or results in significant erosion risk	Potential to address / partially reduces erosion risk or results in minor erosion risk or no change	Potential to significantly reduce or remove erosion risk or results in no erosion risk
Cost	Significant cost (e.g. >£1500 per metre)	Moderate cost (e.g. £500-£1500 per metre)	Low cost (e.g. <£500 per metre)
Environmental impacts	Environmentally detrimental (significant)	Does not make significant difference to present condition	Potential for environmental enhancement
Technical feasibility	Option is technically very challenging or difficult to implement / construct	Option presents some technical challenges to implement / construct	No significant technical challenges to implement / construct
Residual risk / failure	Significant risk of failure or residual damage remains	Some residual failure / damage risk remains	No significant risk of residual damage or failure
Stakeholder objectives	Potential for major objections or goes against feedback received	Likely to be support for and against or meets some feedback received but not all	Helps achieve majority of stakeholder needs / addresses main concerns
Broader outcomes	Little potential for broader outcomes / contributions / supporting other plans and programmes	Could facilitate broader outcomes or secure a contribution (or both) / support other plans and programmes	High potential to deliver broader outcomes or secure contribution (or both) / support other programmes and plans
Maintenance	Requires significant level of ongoing maintenance	Some scheduled maintenance required	Maintenance free / minimal maintenance
Option life	Short term (< 20 years) with further interventions required	Medium term (20-50 years)	Long life (50+ years)
Coastal processes	Potential for significant magnitude impacts to coastal processes baseline	No significant changes to coastal processes baseline	Potential to beneficially impact coastal processes

ODU W1 – Tennyson Down, Alum Bay and Headon Warren

Option	SMP Policy Facilitation	Flood Risk	Erosion Risk	Cost (indicative)	Environmental Impacts	Technical Feasibility	Residual Risk / Failure	Stakeholder Objectives	Broader Outcomes	Maintenance	Option Life	Coastal Processes	
Do nothing	🟢	🟡	🟡	🟢	🟡	🟢	🔴	🔴	🟡	🟢	🟢	🟢	✔
Do minimum (maintenance)	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🟡	🔴	🔴	🟡	✘
New sea wall	🔴	🟡	🟡	🔴	🔴	🟡	🟡	🟡	🔴	🟡	🟢	🟡	✘
Cliff stabilisation (soil nailing ect.)	🔴	🟡	🟡	🟡	🟡	🔴	🟡	🟡	🟡	🟡	🟡	🟡	✘

ODU W2 – Southern and Central Totland Bay

Option	SMP Policy Facilitation	Flood Risk	Erosion Risk	Cost (indicative)	Environmental Impacts	Technical Feasibility	Residual Risk / Failure	Stakeholder Objectives	Broader Outcomes	Maintenance	Option Life	Coastal Processes	
Do nothing	🔴	🟡	🔴	🟢	🟡	🟢	🔴	🔴	🔴	🟢	🟢	🟢	✔
Do minimum (maintenance)	🟡	🟡	🟡	🟢	🟡	🟢	🟡	🔴	🔴	🔴	🔴	🟡	✘
Cliff drainage scheme	🟡	🟡	🟢	🟡	🟡	🟡	🔴	🟡	🟡	🟡	🟡	🟡	✔
Beach nourishment	🟡	🟡	🟢	🟡	🔴	🟢	🟡	🟡	🟡	🔴	🔴	🟢	✔
Revetment along existing seawall	🟢	🟡	🟢	🔴	🟡	🔴	🔴	🟡	🟡	🟡	🟡	🟡	✔
New sea wall (replace existing)	🟢	🟡	🟡	🔴	🔴	🔴	🔴	🟡	🟡	🟡	🟢	🟡	✘
Groyne replacement	🟡	🔴	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	✘
Setback dwarf wall	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🔴	🟡	🟡	🟡	✘
Revetment along front of landslip	🟢	🟡	🟡	🔴	🟡	🟡	🔴	🟡	🟡	🟡	🟡	🟡	✘
Cliff stabilisation works	🟡	🟡	🟢	🔴	🟡	🔴	🟡	🟡	🟡	🟡	🟡	🟡	✘
Monitoring	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🔴	🟡	🟡	🟡	✘
Access / pathways	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟢	🔴	🟡	🔴	🟡	✘
Emergency assistance	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🔴	🟡	🔴	🟡	✘
Evacuation plans	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🔴	🟡	🔴	🟡	✘
Planting for stabilisation	🟡	🟡	🟡	🟢	🟢	🔴	🔴	🟡	🔴	🟡	🟡	🟡	✘

ODU W3 – Northern Totland Bay

Option	SMP Policy Facilitation	Flood Risk	Erosion Risk	Cost (indicative)	Environmental Impacts	Technical Feasibility	Residual Risk / Failure	Stakeholder Objectives	Broader Outcomes	Maintenance	Option Life	Coastal Processes	
Do nothing	🔴	🟡	🔴	🟢	🟡	🟢	🔴	🔴	🔴	🟢	🟢	🟢	✓
Do minimum (maintenance)	🟡	🟡	🟡	🟢	🟡	🟢	🟡	🔴	🔴	🔴	🔴	🟡	✗
Cliff drainage scheme	🟡	🟡	🟢	🟡	🟡	🟡	🔴	🟡	🟡	🟡	🟡	🟡	✓
Beach nourishment	🟡	🟡	🟢	🟡	🔴	🟢	🟡	🟡	🟡	🔴	🔴	🟢	✓
Revetment along existing seawall	🟢	🟡	🟢	🔴	🟡	🔴	🔴	🟡	🟡	🟡	🟡	🟡	✓
New sea wall (replace existing)	🟢	🟡	🟡	🔴	🔴	🔴	🔴	🟡	🟡	🟡	🟢	🟡	✗
Setback dwarf wall	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🔴	🟡	🟡	🟡	✗
Revetment along front of landslip	🟢	🟡	🟡	🔴	🟡	🟡	🔴	🟡	🟡	🟡	🟡	🟡	✗
Cliff stabilisation works	🟡	🟡	🟢	🔴	🟡	🔴	🟡	🟡	🟡	🟡	🟡	🟡	✗
Groynes	🟡	🔴	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	✗
Monitoring	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🔴	🟡	🟡	🟡	✗
Access / pathways	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟢	🔴	🟡	🔴	🟡	✗
Emergency assistance	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🔴	🟡	🔴	🟡	✗
Evacuation plans	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🔴	🟡	🔴	🟡	✗
Planting for stabilisation	🟡	🟡	🟡	🟢	🟢	🔴	🔴	🟡	🔴	🟡	🟡	🟡	✗

ODU W4 – Southern Colwell Bay

Option	SMP Policy Facilitation	Flood Risk	Erosion Risk	Cost (indicative)	Environmental Impacts	Technical Feasibility	Residual Risk / Failure	Stakeholder Objectives	Broader Outcomes	Maintenance	Option Life	Coastal Processes	
Do nothing	🔴	🟡	🔴	🟢	🟡	🟢	🔴	🔴	🔴	🟢	🟢	🟢	✓
Do minimum (maintenance)	🟡	🟡	🟡	🟢	🟡	🟢	🟡	🔴	🔴	🔴	🔴	🟡	✗
Cliff drainage scheme	🟡	🟡	🟢	🟡	🟡	🟡	🔴	🟡	🟡	🟡	🟡	🟡	✓
Beach nourishment	🟡	🟡	🟢	🟡	🔴	🟢	🟡	🟡	🟡	🔴	🔴	🟢	✓
Revetment along existing seawall	🟢	🟡	🟢	🔴	🟡	🟡	🔴	🟡	🟡	🟡	🟡	🟡	✓
New sea wall (replace existing)	🟢	🟡	🟡	🔴	🔴	🔴	🔴	🟡	🟡	🟡	🟢	🟡	✗
Revetment along front of landslip	🟢	🟡	🟡	🔴	🟡	🟡	🔴	🟡	🟡	🟡	🟡	🟡	✗
Cliff stabilisation works	🟡	🟡	🟢	🔴	🟡	🔴	🟡	🟡	🟡	🟡	🟡	🟡	✗
Groynes	🟡	🔴	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	✗
Setback dwarf wall to stop overtopping causing cliff scour	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🔴	🟡	🟡	🟡	✗
Monitoring	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🔴	🟡	🟡	🟡	✗
Access / pathways	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟢	🔴	🟡	🔴	🟡	✗
Emergency assistance	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🔴	🟡	🔴	🟡	✗
Evacuation plans	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🔴	🟡	🔴	🟡	✗
Planting for stabilisation	🟡	🟡	🟡	🟢	🟢	🔴	🔴	🟡	🔴	🟡	🟡	🟡	✗

ODU W5 – Central Colwell Bay

Option	SMP Policy Facilitation	Flood Risk	Erosion Risk	Cost (indicative)	Environmental Impacts	Technical Feasibility	Residual Risk / Failure	Stakeholder Objectives	Broader Outcomes	Maintenance	Option Life	Coastal Processes	
Do nothing	🟢	🟡	🟡	🟢	🟡	🟢	🔴	🔴	🟡	🟢	🟢	🟢	✔
Do minimum (maintenance)	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🟡	🔴	🔴	🟡	✖
New sea wall	🔴	🟡	🟡	🔴	🔴	🟡	🟡	🟡	🔴	🟡	🟢	🟡	✖
Cliff stabilisation (soil nailing ect.)	🔴	🟡	🟡	🟡	🟡	🔴	🟡	🟡	🟡	🟡	🟡	🟡	✖

ODU W6 – Fort Albert

Option	SMP Policy Facilitation	Flood Risk	Erosion Risk	Cost (indicative)	Environmental Impacts	Technical Feasibility	Residual Risk / Failure	Stakeholder Objectives	Broader Outcomes	Maintenance	Option Life	Coastal Processes	
Do nothing	🟡	🔴	🔴	🟢	🟡	🟢	🔴	🔴	🔴	🟢	🟢	🟢	✔
Do minimum (maintenance)	🟡	🟡	🟡	🟢	🟡	🟢	🟡	🔴	🔴	🔴	🔴	🟡	✖
Crest raising (e.g. parapet on existing wall)	🟡	🟢	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	✔
Cliff drainage	🟡	🟡	🟢	🟡	🟡	🟡	🔴	🟡	🟡	🟡	🟡	🟡	✔
Refurbish (strengthen/encasement) of existing sea wall/revetme	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	✔
Revetment along existing seawall	🟡	🟡	🟢	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟢	🟡	✔
Beach nourishment	🟡	🟡	🟢	🟡	🔴	🟡	🟡	🟡	🟡	🔴	🔴	🟡	✖
Access / pathways	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟢	🟡	🔴	🔴	🟡	✖
New sea wall (replace existing)	🟡	🟡	🟡	🔴	🔴	🔴	🟢	🟡	🔴	🟡	🟢	🟡	✖
Vegetated buffer zones (erosion)	🟡	🟡	🟡	🟢	🟢	🟡	🔴	🟡	🔴	🟡	🔴	🟡	✖
Emergency assistance	🟡	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🔴	🟡	🔴	🟡	✖
Evacuation plans	🟡	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🔴	🟡	🔴	🟡	✖

ODU W7 – Fort Victoria Country Park

Option	SMP Policy Facilitation	Flood Risk	Erosion Risk	Cost (indicative)	Environmental Impacts	Technical Feasibility	Residual Risk / Failure	Stakeholder Objectives	Broader Outcomes	Maintenance	Option Life	Coastal Processes	
Do nothing	🟢	🟡	🟡	🟢	🟡	🟢	🔴	🔴	🟡	🟢	🟢	🟢	✔
Do minimum (maintenance)	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🟡	🔴	🔴	🟡	✖
New sea wall	🔴	🟡	🟡	🔴	🔴	🟡	🟡	🟡	🔴	🟡	🟢	🟡	✖
Cliff stabilisation (soil nailing ect.)	🔴	🟡	🟡	🟡	🟡	🔴	🟡	🟡	🟡	🟡	🟡	🟡	✖

ODU W8 – Fort Victoria and Norton

Option	SMP Policy Facilitation	Flood Risk	Erosion Risk	Cost (indicative)	Environmental Impacts	Technical Feasibility	Residual Risk / Failure	Stakeholder Objectives	Broader Outcomes	Maintenance	Option Life	Coastal Processes	
Do nothing	🟡	🔴	🔴	🟢	🟡	🟢	🔴	🔴	🔴	🟢	🟢	🟢	✓
Do minimum (maintenance)	🟡	🟡	🟡	🟢	🟡	🟢	🟡	🔴	🔴	🔴	🔴	🟡	✗
Beach nourishment (groynes are present)	🟡	🟡	🟢	🟡	🔴	🟢	🟡	🟡	🟡	🔴	🔴	🟢	✓
Property level protection (resistance and resilience)	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🔴	🟡	✗
New sea wall (replace existing)	🟡	🟡	🟡	🔴	🔴	🔴	🟢	🟡	🔴	🟡	🟢	🟡	✗
Vegetated buffer zones (erosion)	🟡	🟡	🟡	🟢	🟢	🟡	🔴	🟡	🔴	🟡	🔴	🟡	✗
Crest raising (e.g. parapet on existing wall)	🟡	🟢	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	✓
Revetment along existing seawall	🟡	🟢	🟢	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟢	🟡	✓

ODU W9 – Norton Spit

Option	SMP Policy Facilitation	Flood Risk	Erosion Risk	Cost (indicative)	Environmental Impacts	Technical Feasibility	Residual Risk / Failure	Stakeholder Objectives	Broader Outcomes	Maintenance	Option Life	Coastal Processes	
Do nothing	🔴	🔴	🟡	🟢	🔴	🟢	🔴	🔴	🔴	🟢	🟢	🟢	✗
Do minimum (maintenance)	🟡	🟡	🟡	🟢	🟡	🟢	🟡	🔴	🔴	🔴	🔴	🟡	✗
Increase height of dune timber boards	🟢	🟢	🟡	🟡	🟡	🟡	🔴	🟡	🟡	🟡	🔴	🟡	✓
Replace breakwater	🟢	🟡	🟡	🔴	🔴	🟡	🟡	🟡	🟡	🟡	🟢	🟡	✓
Earth embankments along road (protection)	🟡	🟢	🟡	🔴	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	✓
Road raising	🟡	🟢	🟡	🔴	🟡	🟡	🟢	🟡	🟡	🟢	🟢	🟡	✓
Property level protection (resistance and resilience)	🔴	🟡	🟡	🟡	🟡	🟢	🟡	🟡	🟡	🟢	🔴	🟡	✓
Setback floodwalls	🟡	🟢	🟡	🔴	🟡	🔴	🟢	🔴	🔴	🟡	🟢	🟡	✗
Revetment along road	🟡	🟡	🟡	🔴	🟡	🔴	🟢	🟡	🟡	🟡	🟡	🟡	✗
Offshore reef	🟡	🟡	🟡	🔴	🔴	🔴	🟡	🟡	🟡	🟡	🟡	🟢	✗
Beach / dune nourishment	🟡	🟡	🟢	🟡	🔴	🟡	🟡	🟡	🔴	🔴	🟡	🟡	✗
Breaching of dunes and setback defences	🔴	🟢	🟡	🟡	🔴	🟡	🟡	🔴	🟡	🟡	🟡	🟡	✗
Relocation of Southern Water utility building	🔴	🟢	🟡	🟡	🟡	🟡	🟡	🔴	🔴	🟡	🟢	🟡	✗
Create intertidal habitat - bridge under A3054	🔴	🟢	🟡	🔴	🟢	🟡	🟡	🔴	🟡	🟡	🟡	🟡	✗
Vegetated buffer zones (erosion)	🟡	🟡	🟡	🟢	🟢	🟡	🔴	🟡	🔴	🟡	🔴	🟡	✗

ODU W10 – Western Yar Estuary – western shore

Option	SMP Policy Facilitation	Flood Risk	Erosion Risk	Cost (indicative)	Environmental Impacts	Technical Feasibility	Residual Risk / Failure	Stakeholder Objectives	Broader Outcomes	Maintenance	Option Life	Coastal Processes	
Do nothing	🟢	🟡	🟡	🟢	🟡	🟢	🔴	🔴	🟡	🟢	🟢	🟢	✓
Do minimum (maintenance)	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🟡	🔴	🔴	🟡	✗
New sea wall	🔴	🟡	🟡	🔴	🔴	🟡	🟡	🟡	🔴	🟡	🟢	🟡	✗

ODU W11` - The Causeway

Option	SMP Policy Facilitation	Flood Risk	Erosion Risk	Cost (indicative)	Environmental Impacts	Technical Feasibility	Residual Risk / Failure	Stakeholder Objectives	Broader Outcomes	Maintenance	Option Life	Coastal Processes	
Do nothing	🔴	🔴	🟡	🟢	🟡	🟢	🔴	🔴	🔴	🟢	🟢	🟢	✔
Do minimum (maintenance)	🟡	🟡	🟡	🟢	🟡	🟢	🟡	🔴	🔴	🔴	🔴	🟢	✖
Road raising (including bridge if required)	🟢	🟢	🟡	🔴	🟡	🟡	🟢	🟡	🟡	🟢	🟢	🟡	✔
Earth embankments	🟢	🟢	🟡	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟢	🟡	✔
Managed realignment - realign defences at A3055	🔴	🟢	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟢	🟡	✔
Property level protection (resistance and resilience)	🔴	🟡	🟡	🟡	🟡	🟢	🟡	🟡	🟡	🟢	🔴	🟡	✔
Revetments	🟢	🟡	🟡	🔴	🟡	🟡	🟡	🟡	🔴	🟡	🟡	🟡	✖
Flood storage areas / SUDS	🟡	🟡	🟡	🔴	🟡	🔴	🟡	🔴	🟡	🟢	🟢	🟡	✖
Diversion channels	🟡	🟡	🟡	🔴	🔴	🟡	🟡	🔴	🟡	🟡	🔴	🟡	✖
Channel works	🟡	🟡	🟡	🟡	🔴	🟡	🟡	🟡	🟡	🟡	🟡	🟡	✖
Dredging	🟡	🟡	🟡	🟡	🔴	🟡	🔴	🟡	🟡	🟢	🔴	🟡	✖
Property level protection (resistance and resilience)	🔴	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🔴	🟡	✖

ODU W12 – Freshwater Bay

Option	SMP Policy Facilitation	Flood Risk	Erosion Risk	Cost (indicative)	Environmental Impacts	Technical Feasibility	Residual Risk / Failure	Stakeholder Objectives	Broader Outcomes	Maintenance	Option Life	Coastal Processes	
Do nothing	🔴	🔴	🔴	🟢	🟡	🟢	🔴	🔴	🔴	🟢	🟢	🟢	✖
Do minimum (maintenance)	🟡	🟡	🟡	🟢	🟡	🟢	🟡	🔴	🔴	🔴	🔴	🟡	✖
Crest raising (e.g. parapet on existing wall)	🟢	🟢	🟡	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🟡	🟡	✔
Flood barriers / gates (slipway ect.)	🟢	🟢	🟡	🟡	🟡	🟡	🟡	🟢	🟡	🟡	🟡	🟡	✔
Setback wall (realign defences)	🟡	🟢	🟡	🔴	🟡	🟡	🟢	🔴	🟡	🟢	🟢	🟡	✔
New sea wall (replace existing)	🟢	🟢	🟡	🔴	🔴	🔴	🟢	🟡	🟡	🟡	🟢	🟡	✔
Property level protection (resistance and resilienc	🔴	🟡	🟡	🟡	🟡	🟢	🟡	🟡	🟡	🟢	🔴	🟡	✔
Realign Road	🔴	🔴	🟢	🔴	🟡	🟡	🟢	🔴	🟡	🟡	🟢	🟡	✖
Flood storage areas	🟡	🟢	🟡	🔴	🟡	🔴	🟡	🔴	🟡	🟡	🟢	🟡	✖
Offshore breakwater	🟡	🟡	🟡	🔴	🔴	🔴	🟡	🟡	🟡	🟡	🟢	🟢	✖
Beach nourishment	🟡	🟡	🟡	🟡	🔴	🟡	🟡	🟡	🟡	🔴	🔴	🟢	✖
Groynes	🟡	🔴	🟡	🟡	🔴	🟡	🟡	🟡	🟡	🟡	🟡	🟡	✖
Emergency assistance	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🔴	🟡	🔴	🟡	✖
Evacuation plans	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🔴	🟡	🔴	🟡	✖

ODU W13 – Western Yar Estuary – eastern shore

Option	SMP Policy Facilitation	Flood Risk	Erosion Risk	Cost (indicative)	Environmental Impacts	Technical Feasibility	Residual Risk / Failure	Stakeholder Objectives	Broader Outcomes	Maintenance	Option Life	Coastal Processes	
Do nothing	🟢	🟡	🟡	🟢	🟡	🟢	🔴	🔴	🟡	🟢	🟢	🟢	✔
Do minimum (maintenance)	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🟡	🔴	🔴	🟡	✖
New sea wall	🔴	🟡	🟡	🔴	🔴	🟡	🟡	🟡	🟡	🔴	🟢	🟡	✖

ODU W14 – Thorley Brook and Barnfields Stream

Option	SMP Policy Facilitation	Flood Risk	Erosion Risk	Cost (indicative)	Environmental Impacts	Technical Feasibility	Residual Risk / Failure	Stakeholder Objectives	Broader Outcomes	Maintenance	Option Life	Coastal Processes	
Do nothing	🟡	🔴	🟡	🟢	🟡	🟢	🔴	🔴	🔴	🟢	🟢	🟢	✓
Do minimum (maintenance)	🟡	🟡	🟡	🟢	🟡	🟢	🟡	🔴	🔴	🔴	🔴	🟡	✗
Breaching and setback defences with channel works (managed	🟡	🟢	🟡	🟡	🟢	🟡	🟡	🟢	🟡	🟡	🟡	🟡	✓
Regulated tidal exchange with channel works (managed realign	🟡	🟢	🟡	🟡	🟢	🔴	🟡	🟡	🟡	🟡	🟡	🟡	✓
Property level protection (resistance and resilience)	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🔴	🟡	✗
Channel works as part of managed realignment	🟡	🟡	🟡	🟡	🔴	🟡	🟡	🟡	🟡	🟡	🟡	🟡	✗

ODU W15 – Thorley Brook to Yar Bridge

Option	SMP Policy Facilitation	Flood Risk	Erosion Risk	Cost (indicative)	Environmental Impacts	Technical Feasibility	Residual Risk / Failure	Stakeholder Objectives	Broader Outcomes	Maintenance	Option Life	Coastal Processes	
Do nothing	🔴	🔴	🟡	🟢	🟡	🟢	🔴	🔴	🔴	🟢	🟢	🟢	✓
Do minimum (maintenance)	🟡	🟡	🟡	🟢	🟡	🟢	🟡	🔴	🔴	🔴	🔴	🟡	✗
Setback floodwalls / embankments	🟡	🟢	🟡	🟡	🟡	🟡	🟢	🔴	🟡	🟢	🟢	🟡	✓
Add parapet walls	🟢	🟢	🟡	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🟡	🟡	✓
Road raising (and car park)	🟡	🟢	🟡	🔴	🟡	🔴	🟢	🔴	🟡	🟡	🟢	🟡	✓
Property level protection (resistance and resilience)	🔴	🟡	🟡	🟡	🟡	🟢	🟡	🟡	🟡	🟢	🔴	🟡	✓
New sea wall (replace existing revetments)	🟢	🟢	🟡	🔴	🔴	🔴	🟢	🟡	🟡	🟡	🟢	🟡	✓
Earth embankments	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🔴	🟡	✗
Flood storage areas	🟡	🟢	🟡	🔴	🟡	🔴	🟡	🔴	🟡	🟡	🟢	🟡	✗
Realignment (creates habitat)	🟡	🟡	🟡	🟡	🟢	🟡	🟡	🔴	🟡	🟡	🟡	🟡	✓
Emergency assistance	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🔴	🟡	🔴	🟡	✗
Evacuation plans	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🔴	🟡	🔴	🟡	✗

ODU W16 – Yar Bridge to Yarmouth Common

Option	SMP Policy Facilitation	Flood Risk	Erosion Risk	Cost (indicative)	Environmental Impacts	Technical Feasibility	Residual Risk / Failure	Stakeholder Objectives	Broader Outcomes	Maintenance	Option Life	Coastal Processes	
Do nothing	🔴	🔴	🔴	🟢	🟡	🟢	🔴	🔴	🔴	🟢	🟢	🟢	✗
Do minimum (maintenance)	🟡	🟡	🟡	🟢	🟡	🟢	🟡	🔴	🔴	🔴	🔴	🟡	✗
Crest raising (e.g. parapet on existing wall)	🟢	🟢	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	✓
Setback floodwalls in Harbour	🟡	🟢	🟡	🟡	🟡	🟡	🟢	🟡	🟡	🟢	🟢	🟡	✓
Flood gates / temporary defences in waterfront access routes (	🟢	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	✓
New sea wall (replace existing)	🟢	🟢	🟡	🔴	🟡	🔴	🟢	🟡	🟡	🟡	🟢	🟡	✓
Road raising/land raising	🟡	🟢	🟡	🔴	🟡	🔴	🟢	🔴	🟡	🟡	🟢	🟡	✓
Property level protection (resistance and resilience)	🔴	🟡	🟡	🟡	🟡	🟢	🟡	🟡	🟡	🟢	🔴	🟡	✓
Flood storage areas / SUDS (improve drainage)	🟡	🟡	🟡	🔴	🟡	🔴	🟡	🔴	🟡	🟡	🟢	🟡	✗
Offshore reef	🟡	🟡	🟡	🔴	🔴	🔴	🟡	🟡	🟡	🟡	🟡	🟢	✗
Raise buildings	🟡	🟢	🟡	🔴	🟡	🔴	🟢	🟡	🔴	🟡	🟡	🟡	✗
Beach nourishment	🟡	🟡	🟢	🟡	🔴	🟡	🟡	🟡	🟡	🔴	🔴	🟡	✗
Emergency assistance	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🟡	🟡	🔴	🟡	✗
Evacuation plans	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🟡	🟡	🔴	🟡	✗
Community / local options (warning systems / plans)	🟡	🟡	🟡	🟢	🟡	🟢	🟡	🔴	🟡	🟡	🔴	🟡	✓
Tidal barrage	🟢	🟢	🟡	🔴	🔴	🔴	🟡	🟡	🔴	🟡	🟡	🔴	✗
Relocation (emergency services ect.)	🔴	🟢	🟡	🟡	🟡	🟡	🟡	🔴	🟡	🟡	🟡	🟡	✗

ODU W17 – Yarmouth Common to Port la Salle

Option	SMP Policy Facilitation	Flood Risk	Erosion Risk	Cost (indicative)	Environmental Impacts	Technical Feasibility	Residual Risk / Failure	Stakeholder Objectives	Broader Outcomes	Maintenance	Option Life	Coastal Processes	
Do nothing	🔴	🟡	🔴	🟢	🟡	🟢	🔴	🔴	🔴	🟢	🟢	🟢	✓
Do minimum (maintenance)	🟡	🟡	🟡	🟢	🟡	🟢	🟡	🔴	🟡	🔴	🔴	🟡	✗
Crest raising (e.g. parapet on existing wall)	🟢	🟢	🟡	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🟡	🟡	✓
New sea wall (replace existing)	🟢	🟡	🟢	🔴	🔴	🔴	🟢	🟡	🟡	🟡	🟢	🟡	✓
Breaching (culvert/regulated tidal exhange) existing defences th	🔴	🟡	🟡	🟡	🟢	🔴	🟡	🔴	🔴	🟡	🟡	🟡	✗
Toe protection works	🟢	🟡	🟢	🟡	🟡	🟡	🟡	🟢	🟡	🟡	🟡	🟡	✓
Beach nourishment	🟡	🟡	🟢	🟡	🔴	🟡	🟡	🟡	🟡	🔴	🟡	🟡	✗
Create harbour entrance	🔴	🟡	🟢	🔴	🔴	🔴	🟡	🔴	🔴	🟡	🟡	🟡	✗
Groynes	🟡	🔴	🟡	🟡	🔴	🟡	🟡	🟡	🟡	🟡	🟡	🟡	✗

ODU W18 – Bouldnor Copse and Hamstead

Option	SMP Policy Facilitation	Flood Risk	Erosion Risk	Cost (indicative)	Environmental Impacts	Technical Feasibility	Residual Risk / Failure	Stakeholder Objectives	Broader Outcomes	Maintenance	Option Life	Coastal Processes	
Do nothing	🟢	🟡	🟡	🟢	🟡	🟢	🔴	🔴	🟡	🟢	🟢	🟢	✓
Do minimum (maintenance)	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🟡	🔴	🔴	🟡	✗
New sea wall	🔴	🟡	🟡	🔴	🔴	🟡	🟡	🟡	🔴	🟡	🟢	🟡	✗

ODU W19 – Newtown Estuary

Option	SMP Policy Facilitation	Flood Risk	Erosion Risk	Cost (indicative)	Environmental Impacts	Technical Feasibility	Residual Risk / Failure	Stakeholder Objectives	Broader Outcomes	Maintenance	Option Life	Coastal Processes	
Do nothing	🟢	🟡	🟡	🟢	🟡	🟢	🔴	🔴	🟡	🟢	🟢	🟢	✓
Do minimum (maintenance)	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🟡	🔴	🔴	🟡	✗
New sea wall	🔴	🟡	🟡	🔴	🔴	🟡	🟡	🟡	🔴	🟡	🟢	🟡	✗

ODU W20 – Thorness Bay and southern Gurnard Bay

Option	SMP Policy Facilitation	Flood Risk	Erosion Risk	Cost (indicative)	Environmental Impacts	Technical Feasibility	Residual Risk / Failure	Stakeholder Objectives	Broader Outcomes	Maintenance	Option Life	Coastal Processes	
Do nothing	🟢	🟡	🟡	🟢	🟡	🟢	🔴	🔴	🟡	🟢	🟢	🟢	✓
Do minimum (maintenance)	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🟡	🔴	🔴	🟡	✗
New sea wall	🔴	🟡	🟡	🔴	🔴	🟡	🟡	🟡	🔴	🟡	🟢	🟡	✗

ODU W21 – Gurnard Luck

Option	SMP Policy Facilitation	Flood Risk	Erosion Risk	Cost (indicative)	Environmental Impacts	Technical Feasibility	Residual Risk / Failure	Stakeholder Objectives	Broader Outcomes	Maintenance	Option Life	Coastal Processes	
Do nothing	🟡	🔴	🔴	🟢	🟡	🟢	🔴	🔴	🔴	🟢	🟢	🟢	✓
Do minimum (maintenance)	🟡	🟡	🟡	🟢	🟡	🟢	🟡	🔴	🔴	🔴	🔴	🟡	✗
Property level protection (resistance and resilience)	🟡	🟡	🟡	🟡	🟡	🟢	🟡	🟡	🟡	🟢	🔴	🟡	✓
New sea wall (replace existing)	🟡	🟢	🟡	🔴	🔴	🟡	🟢	🟡	🔴	🟡	🟢	🟡	✓
Relocation of properties (to Hilton Rd/Cockleton Ln area)	🟡	🟢	🟡	🔴	🟡	🔴	🟢	🔴	🔴	🟡	🟢	🟡	✗
Drainage	🟡	🟡	🟡	🟡	🟡	🔴	🟡	🟡	🟡	🟡	🟡	🟡	✗
Emergency assistance	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🔴	🟡	🔴	🟡	✗
Evacuation plans	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🔴	🟡	🔴	🟡	✗

ODU W22 – Gurnard Cliff

Option	SMP Policy Facilitation	Flood Risk	Erosion Risk	Cost (indicative)	Environmental Impacts	Technical Feasibility	Residual Risk / Failure	Stakeholder Objectives	Broader Outcomes	Maintenance	Option Life	Coastal Processes	
Do nothing	🟢	🟡	🟡	🟢	🟡	🟢	🔴	🔴	🟡	🟢	🟢	🟢	✓
Do minimum (maintenance)	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🟡	🔴	🔴	🟡	✗
New sea wall	🔴	🟡	🟡	🔴	🔴	🟡	🟡	🟡	🟡	🟡	🟢	🟡	✗
Cliff stabilisation (soil nailing ect.)	🔴	🟡	🟢	🟡	🟡	🔴	🟡	🟡	🔴	🟡	🟡	🟡	✗

ODU W23 – Gurnard to Cowes Parade

Option	SMP Policy Facilitation	Flood Risk	Erosion Risk	Cost (indicative)	Environmental Impacts	Technical Feasibility	Residual Risk / Failure	Stakeholder Objectives	Broader Outcomes	Maintenance	Option Life	Coastal Processes	
Do nothing	🔴	🔴	🔴	🟢	🟡	🟢	🔴	🔴	🔴	🟢	🟢	🟢	✗
Do minimum (maintenance)	🟡	🟡	🟡	🟢	🟡	🟢	🟡	🔴	🔴	🔴	🔴	🟡	✗
New sea wall (replace existing)	🟢	🟢	🟡	🔴	🔴	🔴	🟡	🟡	🔴	🟡	🟢	🟡	✗
Slope stabilisation	🟡	🟡	🟢	🟡	🟡	🟡	🔴	🟡	🟡	🟡	🟡	🟡	✓
Crest raising & storm gates (e.g. parapet on existing wall)	🟢	🟢	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	✓
Setback floodwalls	🟡	🟢	🟡	🔴	🟡	🟡	🟢	🟡	🟡	🟢	🟢	🟡	✓
Property level protection (resistance and resilience)	🔴	🟡	🟡	🟡	🟡	🟢	🟡	🟡	🟡	🟢	🔴	🟡	✓
Revetment along existing seawall	🟢	🟡	🟢	🔴	🔴	🟡	🔴	🟡	🟡	🟡	🟡	🟡	✓
Improved drainage along road	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	✓
Revetment along existing seawall	🟢	🟡	🟡	🔴	🟡	🔴	🟡	🟡	🔴	🟡	🟢	🟡	✗
Raise road (manage surface water from overtopping)	🟡	🟢	🟡	🔴	🟡	🔴	🟡	🔴	🟡	🟡	🟡	🟡	✗
Beach nourishment	🟡	🟡	🟢	🟡	🔴	🔴	🟡	🟡	🟡	🔴	🟡	🟡	✗
Groynes	🟡	🔴	🟡	🟡	🔴	🟡	🟡	🟡	🟡	🟡	🟡	🟡	✗
Property level protection (resistance and resilience)	🔴	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🔴	🟡	✗
Emergency assistance	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🟡	🟡	🔴	🟡	✗
Evacuation plans	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🟡	🟡	🔴	🟡	✗

ODU W24 – Cowes Town Centre to Fountain Yard

Option	SMP Policy Facilitation	Flood Risk	Erosion Risk	Cost (indicative)	Environmental Impacts	Technical Feasibility	Residual Risk / Failure	Stakeholder Objectives	Broader Outcomes	Maintenance	Option Life	Coastal Processes	
Do nothing	🔴	🔴	🔴	🟢	🟡	🟢	🔴	🔴	🔴	🟢	🟢	🟢	✗
Do minimum (maintenance)	🟡	🟡	🟡	🟢	🟡	🟢	🟡	🔴	🔴	🔴	🔴	🟡	✗
Crest raising (e.g. parapet on existing wall)	🟢	🟢	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	✓
Setback floodwalls	🟡	🟢	🟡	🔴	🟡	🟡	🟢	🟡	🟡	🟢	🟢	🟡	✓
Flood barriers / temporary defences	🟡	🟢	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	✓
Property level protection (resistance and resilience)	🔴	🟡	🟡	🟡	🟡	🟢	🟡	🟡	🟡	🟢	🔴	🟡	✓
New sea wall (replace existing)	🟢	🟢	🟡	🔴	🔴	🔴	🟡	🟡	🔴	🟡	🟢	🟡	✗
Land raising	🟢	🟢	🟡	🔴	🟡	🔴	🟡	🔴	🟡	🟡	🟡	🟡	✗
Emergency assistance	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🟡	🟡	🔴	🟡	✗
Evacuation plans	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🟡	🟡	🔴	🟡	✗
Sustainable urban drainage systems / improve	🟡	🟢	🟡	🔴	🟡	🟡	🟡	🟡	🟡	🟡	🟢	🟡	✓
Vegetated buffer zones	🟡	🔴	🟡	🟢	🟢	🟡	🔴	🟡	🔴	🟡	🔴	🟡	✗
Relocation (emergency services ect.)	🔴	🟢	🟡	🟡	🟡	🟡	🟡	🔴	🔴	🟡	🟢	🟡	✗

ODU W25 – Fountain Yard to Medina Wharf

Option	SMP Policy Facilitation	Flood Risk	Erosion Risk	Cost (indicative)	Environmental Impacts	Technical Feasibility	Residual Risk / Failure	Stakeholder Objectives	Broader Outcomes	Maintenance	Option Life	Coastal Processes	
Do nothing	🔴	🔴	🔴	🟢	🟡	🟢	🔴	🔴	🔴	🟢	🟢	🟢	✗
Do minimum (maintenance)	🟡	🟡	🟡	🟢	🟡	🟢	🟡	🔴	🔴	🔴	🔴	🟡	✗
Crest raising (e.g. parapet on existing wall)	🟢	🟢	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	✓
Setback floodwalls	🟡	🟢	🟡	🔴	🟡	🟡	🟢	🟡	🟡	🟢	🟢	🟡	✓
Flood barriers / temporary defences	🟡	🟢	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	✓
Property level protection (resistance and resilience)	🔴	🟡	🟡	🟡	🟡	🟢	🟡	🟡	🟡	🟢	🔴	🟡	✓
Land raising	🟢	🟢	🟡	🔴	🟡	🔴	🟡	🔴	🟡	🟡	🟡	🟡	✗
New sea wall (replace existing)	🟢	🟢	🟡	🔴	🔴	🔴	🟡	🟡	🔴	🟡	🟢	🟡	✗
Emergency assistance	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🟡	🟡	🔴	🟡	✗
Evacuation plans	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🟡	🟡	🔴	🟡	✗
Sustainable urban drainage systems / improve	🟡	🟢	🟡	🔴	🟡	🟡	🟡	🟡	🟡	🟡	🟢	🟡	✓
Vegetated buffer zones	🟡	🔴	🟡	🟢	🟢	🟡	🔴	🟡	🔴	🟡	🔴	🟡	✗
Relocation (emergency services ect.)	🔴	🟢	🟡	🟡	🟡	🟡	🟡	🔴	🔴	🟡	🟢	🟡	✗

ODU W26 – Central Medina – NW

Option	SMP Policy Facilitation	Flood Risk	Erosion Risk	Cost (indicative)	Environmental Impacts	Technical Feasibility	Residual Risk / Failure	Stakeholder Objectives	Broader Outcomes	Maintenance	Option Life	Coastal Processes	
Do nothing	🟢	🟡	🟡	🟢	🟡	🟢	🔴	🔴	🟡	🟢	🟢	🟢	✓
Do minimum (maintenance)	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🟡	🔴	🔴	🟡	✗
New sea wall	🔴	🟡	🟡	🔴	🔴	🟡	🟢	🟡	🔴	🟡	🟢	🟡	✗

ODU W27 – West Medina Mills

Option	SMP Policy Facilitation	Flood Risk	Erosion Risk	Cost (indicative)	Environmental Impacts	Technical Feasibility	Residual Risk / Failure	Stakeholder Objectives	Broader Outcomes	Maintenance	Option Life	Coastal Processes	
Do nothing	🔴	🔴	🟡	🟢	🟡	🟢	🔴	🔴	🔴	🟢	🟢	🟢	✓
Do minimum (maintenance)	🟡	🟡	🟡	🟢	🟡	🟢	🟡	🟡	🔴	🔴	🔴	🟡	✗
Setback floodwalls	🟡	🟢	🟡	🟡	🟡	🟡	🟢	🟡	🟡	🟢	🟢	🟡	✓
Property level protection (resistance and resilience)	🔴	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🔴	🟡	✗
Crest raising (e.g. parapet on existing wall)	🟢	🟢	🟡	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🟡	🟡	✓
New sea wall (replace existing)	🟢	🟢	🟡	🔴	🔴	🔴	🟡	🔴	🔴	🟡	🟢	🟡	✗
Temporary / demountable defences	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	✓

ODU W28 – Central Medina – SW

Option	SMP Policy Facilitation	Flood Risk	Erosion Risk	Cost (indicative)	Environmental Impacts	Technical Feasibility	Residual Risk / Failure	Stakeholder Objectives	Broader Outcomes	Maintenance	Option Life	Coastal Processes	
Do nothing	🟢	🟡	🟡	🟢	🟡	🟢	🔴	🔴	🟡	🟢	🟢	🟢	✓
Do minimum (maintenance)	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🟡	🔴	🔴	🟡	✗
New sea wall (replace existing)	🔴	🟡	🟡	🔴	🔴	🟡	🟢	🟡	🔴	🟡	🟢	🟡	✗

ODU W29 – Newport Harbour

Option	SMP Policy Facilitation	Flood Risk	Erosion Risk	Cost (indicative)	Environmental Impacts	Technical Feasibility	Residual Risk / Failure	Stakeholder Objectives	Broader Outcomes	Maintenance	Option Life	Coastal Processes	
Do nothing	🔴	🔴	🟡	🟢	🟡	🟢	🔴	🔴	🔴	🟢	🟢	🟢	✓
Do minimum (maintenance)	🟡	🟡	🟡	🟢	🟡	🟢	🟡	🔴	🔴	🔴	🔴	🟡	✗
Crest raising (e.g. parapet on existing wall)	🟢	🟢	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	✓
Property level protection (resistance and resilience)	🔴	🟡	🟡	🟡	🟡	🟢	🟡	🟡	🟡	🟢	🔴	🟡	✓
New harbour walls (replace existing)	🟢	🟢	🟡	🔴	🔴	🔴	🟢	🟡	🟡	🟡	🟢	🟡	✓
Land raising	🟢	🟢	🟡	🔴	🟡	🔴	🟡	🔴	🟡	🟡	🟡	🟡	✗
Flood storage areas / SUDS	🟡	🟡	🟡	🔴	🟡	🔴	🟡	🔴	🟡	🟡	🟢	🟡	✗
Temporary / demountable defences	🟡	🟡	🟡	🟡	🟡	🔴	🟡	🟡	🟡	🟡	🟡	🟡	✗
Emergency assistance	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🔴	🟡	🔴	🟡	✗
Evacuation plans	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🔴	🟡	🔴	🟡	✗

ODU W30 – Central Medina – East

Option	SMP Policy Facilitation	Flood Risk	Erosion Risk	Cost (indicative)	Environmental Impacts	Technical Feasibility	Residual Risk / Failure	Stakeholder Objectives	Broader Outcomes	Maintenance	Option Life	Coastal Processes	
Do nothing	🟢	🟡	🟡	🟢	🟡	🟢	🔴	🔴	🟡	🟢	🟢	🟢	✓
Do minimum (maintenance)	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🟡	🔴	🔴	🟡	✗
New sea wall	🔴	🟡	🟡	🔴	🔴	🟡	🟢	🟡	🔴	🟡	🟢	🟡	✗

ODU W31 – Kingston Road Power Station to Shrape Breakwater

Option	SMP Policy Facilitation	Flood Risk	Erosion Risk	Cost (indicative)	Environmental Impacts	Technical Feasibility	Residual Risk / Failure	Stakeholder Objectives	Broader Outcomes	Maintenance	Option Life	Coastal Processes	
Do nothing	🔴	🔴	🔴	🟢	🟡	🟢	🔴	🔴	🔴	🟢	🟢	🟢	✗
Do minimum (maintenance)	🟡	🟡	🟡	🟢	🟡	🟢	🟡	🔴	🔴	🔴	🔴	🟡	✗
Increase height of inland dwarf wall (to north)	🟡	🟡	🟡	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🟡	🟡	✓
Crest raising (e.g. parapet on existing wall)	🟢	🟢	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	✓
Setback floodwalls	🟡	🟢	🟡	🔴	🟡	🟡	🟢	🟡	🟡	🟢	🟢	🟡	✓
Flood barriers / temporary defences	🟡	🟢	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	✓
New sea wall (replace existing)	🟢	🟢	🟡	🔴	🔴	🔴	🟡	🟡	🔴	🟡	🟢	🟡	✗
Property level protection (resistance and resilience)	🔴	🟡	🟡	🟡	🟡	🟢	🟡	🟡	🟡	🟢	🔴	🟡	✓
Land raising	🟢	🟢	🟡	🔴	🟡	🔴	🟡	🔴	🟡	🟡	🟡	🟡	✗
Emergency assistance	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🟡	🟡	🔴	🟡	✗
Evacuation plans	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🟡	🟡	🔴	🟡	✗
Sustainable urban drainage systems / improve	🟡	🟢	🟡	🔴	🟡	🟡	🟡	🟡	🟡	🟡	🟢	🟡	✓
Vegetated buffer zones	🟡	🔴	🟡	🟢	🟢	🟡	🔴	🟡	🔴	🟡	🔴	🟡	✗
Relocation (emergency services ect.)	🔴	🟢	🟡	🟡	🟡	🟡	🟡	🔴	🔴	🟡	🟢	🟡	✗

ODU W32 – Shrape Breakwater to Old Castle Point

Option	SMP Policy Facilitation	Flood Risk	Erosion Risk	Cost (indicative)	Environmental Impacts	Technical Feasibility	Residual Risk / Failure	Stakeholder Objectives	Broader Outcomes	Maintenance	Option Life	Coastal Processes	
Do nothing	🟡	🔴	🔴	🟢	🟡	🟢	🟡	🔴	🔴	🟢	🟢	🟢	✓
Do minimum (maintenance)	🟡	🟡	🟡	🟢	🟡	🟢	🟡	🔴	🔴	🔴	🔴	🟡	✗
Crest raising (e.g. parapet on existing wall)	🟡	🟢	🟡	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🟡	🟡	✓
Temporary / demountable defences	🟡	🟢	🟡	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🟡	🟡	✓
Improve drainage in road	🟡	🟡	🟡	🟡	🟡	🔴	🟡	🟡	🟡	🟡	🟡	🟡	✗
Slope stabilisation (landward of road)	🟡	🟡	🟡	🔴	🟡	🔴	🟡	🟡	🟡	🟡	🟡	🟡	✗
New sea wall (replace existing)	🟡	🟢	🟢	🔴	🔴	🔴	🟢	🟡	🔴	🟡	🟢	🟡	✓
Property level protection (resistance and resilience)	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🔴	🟡	✗

Appendix 3: Capital Works cost breakdown (Present Day Cash £) by SMZ for the Preferred Option Only Including Optimism Bias.

Please note: schemes will need to be delivered at combined public and private cost

Assumptions:

The below tables are based on the following assumptions: do minimum and maintenance costs have been rounded to the nearest £100, capital works costs have been rounded to the nearest £100, refurbishment costs and costs of replacing temporary flood barriers are included in capital works, lengths are given to the nearest 10m, temporary flood barriers assumed to have a £2000 a year storage and deployment cost per area, refurbishment technique costed assumed to last 20 years, after a new structure is constructed (i.e. frontline wall) it is assumed no maintenance had to occur for the first 20 years, costs have been based on current unit rates and are likely to vary in the future, residual life estimates for existing structures are based on visual condition inspection and Environment Agency guidance.

SMZ1	2015 - 2025				2025 - 2055				2055 - 2115				*Cash Cost Summary £*			
	Works	Details	Cash Cost £		Works	Details	Cash Cost £		Works	Details	Cash Cost £		*Total Cost 2015 - 2025*	*Total Cost 2025 - 2055*	*Total Cost 2055 - 2115*	*Total Cost 2015 - 2115*
			Captial Works	Maintenance/ Do Minimum			Captial Works	Maintenance/ Do Minimum			Captial Works	Maintenance/ Do Minimum				
W1	Do Nothing	No active intervention. No planned works.	-	-	Do Nothing	No active intervention. No planned works.	-	-	Do Nothing	No active intervention. No planned works.	-	-	-	-	-	-
													Total Cost SMZ1 over 100 year Strategy period (2015 - 2115) =			-

SMZ2	2015 - 2025				2025 - 2055				2055 - 2115				*Cash Cost Summary £*			
	Works	Details	Cash Cost £		Works	Details	Cash Cost £		Works	Details	Cash Cost £		*Total Cost 2015 - 2025*	*Total Cost 2025 - 2055*	*Total Cost 2055 - 2115*	*Total Cost 2015 - 2115*
			Captial Works	Maintenance/ Do Minimum			Captial Works	Maintenance/ Do Minimum			Captial Works	Maintenance/ Do Minimum				
W2	Do Minimum	Access and health and safety at £2900 per year	-	£29,000	Do Minimum	Access and health and safety at £2900 per year and CCMA Plan	-	£103,000	Do Minimum	Access and health and safety at £2900 per year	-	£174,000	*£29,000*	*£103,000*	*£174,000*	*£306,000*
W3	Do Minimum	Access and health and safety at £1700 per year	-	£17,000	Do Minimum	Access and health and safety at £1700 per year and CCMA Plan	-	£67,000	Do Minimum	Access and health and safety at £1700 per year	-	£102,000	*£17,000*	*£67,000*	*£102,000*	*£186,000*
W4	Do Minimum	Access and health and safety at £1800 per year	-	£18,000	Do Minimum	Access and health and safety at £1800 per year and CCMA Plan	-	£70,000	Do Minimum	Access and health and safety at £1800 per year	-	£108,000	*£18,000*	*£70,000*	*£108,000*	*£196,000*
W5	Do Minimum	Access and health and safety at £300 per year	-	£3,000	Do Minimum	Access and health and safety at £300 per year and CCMA Plan	-	£25,000	Do Minimum	Access and health and safety at £300 per year	-	£18,000	*£3,000*	*£25,000*	*£18,000*	*£46,000*
W6	Do Minimum	Access and health and safety at £1700 per year	-	£17,000	Do Minimum	Access and health and safety at £1700 per year and CCMA Plan	-	£67,000	Do Minimum	Access and health and safety at £1700 per year	-	£102,000	*£17,000*	*£67,000*	*£102,000*	*£186,000*
W7	Do Nothing	No active intervention. No planned w orks.	-	-	Do Nothing	No active intervention. No planned w orks.	-	-	Do Nothing	No active intervention. No planned w orks.	-	-	*£0*	*£0*	*£0*	*£0*
													Total Cost SMZ2 over 100 year Strategy period (2015 - 2115) =			*£920,000*

SMZ3a	2015 - 2025				2025 - 2055				2055 - 2115				*Cash Cost Summary £*			
	Works	Details	Cash Cost £		Works	Details	Cash Cost £		Works	Details	Cash Cost £		*Total Cost 2015 - 2025*	*Total Cost 2025 - 2055*	*Total Cost 2055 - 2115*	*Total Cost 2015 - 2115*
			Captial Works	Maintenance/ Do Minimum			Captial Works	Maintenance/ Do Minimum			Captial Works	Maintenance/ Do Minimum				
W8	Do Minimum	Access and health and safety at £1900 per year	-	£19,000	Do Minimum	Access and health and safety at £3400 per year	-	£57,000	Do Minimum	Access and health and safety at £3400 per year	-	£114,000	*£19,000*	*£57,000*	*£114,000*	*£190,000*
W9	Maintain	Maintain existing structures at £4400 per year	-	£44,000	Maintain (& Refurb)	Maintain existing structures at £4400 per year, 680m refurbishment beginning from end of residual life (2035)	£598,000	£132,000	Maintain (& Refurb) and Frontline Defences	Maintain frontage, earth bunds or new walls to prevent erosion of road and improve flood standard of protection	£4,128,000	£176,000	*£44,000*	*£730,000*	*£4,304,000*	*£5,078,000*
W15	Maintain and Temporary Flood Barriers	Maintain existing structures at £4000 per year, 200m of temporary flood barriers	£82,000	£60,000	Maintain (& Refurb) and Temporary Flood Barriers	Maintain existing structures at £4000 per year - 610m refurbishment at end of residual life (2035), replace temporary flood barriers when required	£497,000	£180,000	Maintain (& Refurb) and Setback Defences	Maintain existing structures at £4000 per year - continued refurbishment. New 470m setback defences (flood bunds & gates).	£1,830,000	£300,000	*£142,000*	*£677,000*	*£2,130,000*	*£2,949,000*
W16	Maintain and Temporary Flood Barriers	Maintain existing structures at £5600 per year, 200m of temporary flood barriers	£82,000	£76,000	Maintain (& Refurb) and Temporary Flood Barriers	Maintain existing structures at £5600 per year - 860m refurbishment at end of residual life (2035), replace temporary flood barriers when required	£837,000	£228,000	Maintain (& Refurb), Frontline Wall and Setback Defences	Maintain existing structures at £5600 per year - continued refurbishment. New 270m Frontline Wall to north and 100m setback defences (flood wall & gates)	£7,946,000	£396,000	*£158,000*	*£1,065,000*	*£8,342,000*	*£9,565,000*
W17	Maintain	Maintain existing structures at £5300 per year	-	£53,000	Maintain (& Refurb)	Maintain existing structures at £5300 per year, 810m refurbishment at end of residual life (2025)	£2,268,000	£159,000	Maintain (& Refurb)	Maintain existing structures at £5300 per year, continued refurbishment	£2,268,000	£318,000	*£53,000*	*£2,427,000*	*£2,586,000*	*£5,066,000*
													Total Cost SMZ3a over 100 year Strategy period (2015 - 2115) =			*£22,848,000*

SMZ3b	2015 - 2025				2025 - 2055				2055 - 2115				Cash Cost Summary £			
	Works	Details	Cash Cost £		Works	Details	Cash Cost £		Works	Details	Cash Cost £		Total Cost 2015 - 2025	Total Cost 2025 - 2055	Total Cost 2055 - 2115	Total Cost 2015 - 2115
			Captial Works	Maintenance/ Do Minimum			Captial Works	Maintenance/ Do Minimum			Captial Works	Maintenance/ Do Minimum				
W10	Do Minimum	Access and health and safety at £300 per year	-	£3,000	Do Minimum	Access and health and safety at £300 per year	-	£9,000	Do Minimum	Access and health and safety at £300 per year	-	£18,000	*£3,000*	*£9,000*	*£18,000*	*£30,000*
W13	Do Minimum	Access and health and safety at £1900 per year	-	£19,000	Do Minimum	Access and health and safety at £1900 per year	-	£57,000	Do Minimum	Access and health and safety at £1900 per year	-	£114,000	*£19,000*	*£57,000*	*£114,000*	*£190,000*
W14	Maintain	Maintain existing structures at £1400 per year	-	£14,000	Managed Realignment	Managed Realignment would include new flood defences for property at increased risk	£5,300,000	£30,000	Maintain	Maintain new structures at £3000 per year	-	£180,000	*£14,000*	*£5,330,000*	*£180,000*	*£5,524,000*
													Total Cost SMZ3b over 100 year Strategy period (2015 - 2115) =			*£5,744,000*

SMZ3c	2015 - 2025				2025 - 2055				2055 - 2115				Cost Summary £			
	Works	Details	Cash Cost £		Works	Details	Cash Cost £		Works	Details	Cash Cost £		Total Cost 2015 - 2025	Total Cost 2025 - 2055	Total Cost 2055 - 2115	Total Cost 2015 - 2115
			Captial Works	Maintenance/ Do Minimum			Captial Works	Maintenance/ Do Minimum			Captial Works	Maintenance/ Do Minimum				
W11	Maintain, Property Level Protection and Flood Warning / Emergency Response Plan	Maintain existing structures at £750 per year, PLP for residential properties at very significant risk and flood warning / emergency response plan at £500 per year	£40,000	£12,500	Maintain (& Refurb) and Property Level Protection	Maintain existing structures at £750 per year - 115m refurbishment at end of residual life (2030), PLP for residential properties at very significant risk and flood warning / emergency response plan at £500 per year	£601,000	£37,500	Setback Defences	310m long	£1,360,000	£120,000	*£52,500*	*£638,500*	*£1,480,000*	*£2,171,000*
W12	Maintain	Maintain existing structures at £2000 per year	-	£20,000	Maintain (& Refurb)	Maintain existing structures at £2000 per year, 310m refurbishment at end of residual life (2025)	£838,000	£60,000	Maintain (& Refurb)	Maintain existing structures at £2000 per year, continued refurbishment	£838,000	£120,000	*£20,000*	*£898,000*	*£958,000*	*£1,876,000*
													Total Cost SMZ3c over 100 year Strategy period (2015 - 2115) =			*£4,047,000*

SMZ4	2015 - 2025				2025 - 2055				2055 - 2115				Cash Cost Summary £			
	Works	Details	Cash Cost £		Works	Details	Cash Cost £		Works	Details	Cash Cost £		Total Cost 2015 - 2025	Total Cost 2025 - 2055	Total Cost 2055 - 2115	Total Cost 2015 - 2115
			Captial Works	Maintenance/ Do Minimum			Captial Works	Maintenance/ Do Minimum			Captial Works	Maintenance/ Do Minimum				
W18	Do Nothing	No active intervention. No planned works.	-	-	Do Nothing	No active intervention. No planned works.	-	-	Do Nothing	No active intervention. No planned works.	-	-	-	-	-	-
W19	Do Nothing	No active intervention. No planned works.	-	-	Do Nothing	No active intervention. No planned works.	-	-	Do Nothing	No active intervention. No planned works.	-	-	-	-	-	-
W20	Do Nothing	No active intervention. No planned works.	-	-	Do Nothing	No active intervention. No planned works.	-	-	Do Nothing	No active intervention. No planned works.	-	-	-	-	-	-
													Total Cost SMZ4 over 100 year Strategy period (2015 - 2115) =			-

SMZ5a	2015 - 2025				2025 - 2055				2055 - 2115				Cash Cost Summary £			
	Works	Details	Cash Cost £		Works	Details	Cash Cost £		Works	Details	Cash Cost £		Total Cost 2015 - 2025	Total Cost 2025 - 2055	Total Cost 2055 - 2115	Total Cost 2015 - 2115
			Captial Works	Maintenance/ Do Minimum			Captial Works	Maintenance/ Do Minimum			Captial Works	Maintenance/ Do Minimum				
W21	Do Minimum and Flood Warning / Emergency Response Plan	Access and health and safety at £1700 per year and flood warning / emergency response plan at £500 per year	-	£22,000	Do Minimum and Flood Warning / Emergency Response Plan and Adaption	Access and health and safety at £1700 per year and flood warning / emergency response plan at £500 per year, development and implementation of CCMA Plan	-	£82,000	Do Minimum / Adaption	Access and health and safety at £1700 per year, flood warning / emergency response plan at £500 per year and implementation of CCMA Plan	-	£132,000	*£22,000*	*£82,000*	*£132,000*	*£236,000*
W22	Do Minimum	Access and health and safety at £300 per year	-	£3,000	Do Minimum	Access and health and safety at £300 per year	-	£9,000	Do Minimum	Access and health and safety at £300 per year	-	£18,000	*£3,000*	*£9,000*	*£18,000*	*£30,000*
													Total Cost SMZ5a over 100 year Strategy period (2015 - 2115) =			*£266,000*

SMZ5b	2015 - 2025				2025 - 2055				2055 - 2115				Cash Cost Summary £			
	Works	Details	Cash Cost £		Works	Details	Cash Cost £		Works	Details	Cash Cost £		Total Cost 2015 - 2025	Total Cost 2025 - 2055	Total Cost 2055 - 2115	Total Cost 2015 - 2115
			Captial Works	Maintenance/ Do Minimum			Captial Works	Maintenance/ Do Minimum			Captial Works	Maintenance/ Do Minimum				
W23	Maintain	Maintain existing structures at £16300 per year	-	£163,000	Maintain (& Refurb)	Maintain existing structures at £16300 per year, 2.5km refurbishment at end of residual life (2030)	£5,400,000	£489,000	Maintain (& Refurb)	Maintain existing structures at £16300 per year, continued refurbishment	£5,400,000	£978,000	*£163,000*	*£5,889,000*	*£6,378,000*	*£12,430,000*
													Total Cost SMZ5b over 100 year Strategy period (2015 - 2115) =			*£12,430,000*

SMZ6a	2015 - 2025				2025 - 2055				2055 - 2115				Cash Cost Summary £			
	Works	Details	Cash Cost £		Works	Details	Cash Cost £		Works	Details	Cash Cost £		Total Cost 2015 - 2025	Total Cost 2025 - 2055	Total Cost 2055 - 2115	Total Cost 2015 - 2115
			Captial Works	Maintenance/ Do Minimum			Captial Works	Maintenance/ Do Minimum			Captial Works	Maintenance/ Do Minimum				
W24	Maintain and Property Level Protection	Maintain existing structures at £2800 per year, PLP for residential properties at very significant risk	£40,000	£28,000	Maintain (& Refurb) and Property Level Protection	Maintain existing structures at £2800 per year - 435m refurbishment at end of residual life (2035), replace PLP when required	£502,000	£84,000	Frontline Wall	300m long	£6,192,000	£112,000	*£68,000*	*£586,000*	*£6,304,000*	*£6,958,000*
W25	Maintain, Temporary Flood Barriers and Property Level Protection	Maintain existing structures at £21800 per year, PLP for residential properties at very significant risk and 700m of temporary flood barriers	£350,000	£258,000	Maintain (& Refurb), Temporary Flood Barriers and Property Level Protection	Maintain existing structures at £21800 per year - 3.3km refurbishment at end of residual life (2035), replace PLP and temporary flood barriers when required	£3,558,000	£774,000	Frontline Wall and Setback Defences	1000m long	£20,640,000	£872,000	*£608,000*	*£4,332,000*	*£21,512,000*	*£26,452,000*
W31	Maintain, Temporary Flood Barriers and Property Level Protection	Maintain existing structures at £19600 per year, PLP for residential properties at very significant risk and 600m of temporary flood barriers	£311,000	£236,000	Maintain (& Refurb), Temporary Flood Barriers and Property Level Protection	Maintain existing structures at £19600 per year - 3.0km refurbishment at end of residual life (2035), replace PLP and temporary flood barriers when required	£3,446,000	£708,000	Frontline Wall and Setback Defences	1200m long	£24,768,000	£784,000	*£547,000*	*£4,154,000*	*£25,552,000*	*£30,253,000*
													Total Cost SMZ6a over 100 year Strategy period (2015 - 2115) =			*£63,663,000*

SMZ6b	2015 - 2025				2025 - 2055				2055 - 2115				Cash Cost Summary £			
	Works	Details	Cash Cost £		Works	Details	Cash Cost £		Works	Details	Cash Cost £		Total Cost 2015 - 2025	Total Cost 2025 - 2055	Total Cost 2055 - 2115	Total Cost 2015 - 2115
			Captial Works	Maintenance/ Do Minimum			Captial Works	Maintenance/ Do Minimum			Captial Works	Maintenance/ Do Minimum				
W26	Do Nothing	No active intervention. No planned works.	-	-	Do Nothing	No active intervention. No planned works.	-	-	Do Nothing	No active intervention. No planned works.	-	-	-	-	-	-
W27	Do Nothing	No publically funded defence improvements.	-	-	Do Nothing	No publically funded defence improvements.	-	-	Do Nothing	No publically funded defence improvements.	-	-	-	-	-	-
W28	Do Nothing	No active intervention. No planned works.	-	-	Do Nothing	No active intervention. No planned works.	-	-	Do Nothing	No active intervention. No planned works.	-	-	-	-	-	-
W30	Do Nothing	No active intervention. No planned works.	-	-	Do Nothing	No active intervention. No planned works.	-	-	Do Nothing	No active intervention. No planned works.	-	-	-	-	-	-
W32	Do Minimum	Access and health and safety at £2800 per year	-	£28,000	Do Minimum	Access and health and safety at £2800 per year	-	£84,000	Do Nothing	No active intervention. No planned works.	-	-	£28,000	£84,000	£0	£112,000
													Total Cost SMZ6b over 100 year Strategy period (2015 - 2115) =			£112,000

SMZ6c	2015 - 2025				2025 - 2055				2055 - 2115				Cash Cost Summary £			
	Works	Details	Cash Cost £		Works	Details	Cash Cost £		Works	Details	Cash Cost £		Total Cost 2015 - 2025	Total Cost 2025 - 2055	Total Cost 2055 - 2115	Total Cost 2015 - 2115
			Captial Works	Maintenance/ Do Minimum			Captial Works	Maintenance/ Do Minimum			Captial Works	Maintenance/ Do Minimum				
W29	Maintain, Property Level Protection and Flood Warning / Emergency Response Plan	Maintain existing structures at £10400 per year, PLP for residential properties at very significant risk and flood warning / emergency response plan at £500 per year	£30,000	£109,000	Maintain (& Refurb) and Property Level Protection	Maintain existing structures at £10400 per year - 1.6km refurbishment at end of residual life (2040), PLP for residential properties at very significant risk and flood warning / emergency response plan at £500 per year	£1,655,000	£327,000	Maintain (& Refurb) and Property Level Protection	Maintain existing structures at £10400 per year - continued refurbishment, PLP for residential properties at very significant risk and flood warning / emergency response plan at £500 per year	£5,030,000	£654,000	£139,000	£1,982,000	£5,684,000	£7,805,000
													Total Cost SMZ6c over 100 year Strategy period (2015 - 2115) =			£7,805,000

Total Cost of all SMZs over 100 year Strategy period (2015 - 2115) =	£117,835,000

Appendix 4: Gurnard Marsh – Additional Studies (Technical note)

Technical Note

Project:	**West Wight Coastal Flood and Erosion Risk Management Strategy**	Job No:	**47072378**
Subject:	**Gurnard Luck – Additional Studies**		
Prepared by:	**Jonathan Short**	Date:30/09/16	
Checked by:	**Adrian Wright**	Date:30/09/16	
Approved by:	**Paul Norton**	Date:30/09/16	
Client review:	**IWC**	25/10/16	

1) Introduction

This note provides a summary of the findings from additional studies undertaken by Capita AECOM at Gurnard Luck, Isle of Wight. These studies were commissioned following some community and resident objections to the draft preferred option (property and community level resistance and resilience followed by adaptation in the longer term) recommended by the West Wight Coastal Flood and Erosion Risk Management Strategy (April 2016).

The scope of activities undertaken in the additional study, and summarised in this note, include:

- Analyse newly commissioned topographic survey (laser scan) data for the frontage (CCO, July 2016) and compare to the elevations used in the WW Strategy flood risk modelling.
- Establish through further visual investigation the condition, residual life and crest heights of the existing walls, flood gates and timber barriers (including recent repairs);
- Measure and validate property threshold levels (targeted spot height surveys of individual properties). Confirm wall crest heights and potential tie in points for the potential small scheme idea proposed by residents during the consultation (includes survey and interpretation);
- Refine the TUFLOW model with updated seawall height, location and accounting for latest data and survey information to include the effect of culverts at the bridge;
- Re-run the updated TUFLOW hydrodynamic model to simulate baseline tidal flooding for a range of extreme events (in order to derive more robust damages (and benefits). Sensitivity test fluvial / tide locking impacts;
- Generate tidal modelling animations for a range of return period events in order to simulate the mechanisms and flow routes into Gurnard Luck in order to provide a more informed and detailed understanding of flooding;

- Assess and propose cost effective and robust engineering options to achieve a 1 in 75 yr Return Period (1.33% AEP) (RP) and 1 in 200 year (0.5% AEP) RP Standard of Protection (SoP) to mitigate tidal flooding and provide cost estimations for these proposed solutions;

- Using the updated model confirm if the proposed minor scheme interventions are technically feasible, and ascertain associated scheme benefits;

- Update economic appraisal of scheme options and provide updated Partnership Funding Scores (and likely funding shortfalls);

- Present findings to discuss and confirm affordability and delivery potential for the scheme (with IWC and residents); and

- Update Strategy preferred option (as required).

2) Background

Gurnard Marsh is a small low lying coastal community with a history of flooding from tidal, overtopping and fluvial events (due to tide locking). A number of recorded incidents of flooding have been logged over the past few decades with this number is expected to increase with future predicted sea level rise projections (UKCP09). Some residents have carried out self-help measures to adapt to these risks by improving property level resilience (such as raising properties on stilts) as well as repairing private sea defences and groynes with private funding and grant funding received following the floods of winter 2013/14 to also reduce the risk of erosion. An Environment Agency flood warning system is also in place to help residents prepare for flooding.

Photo 1. Flooding at Gurnard Luck Bridge (Marsh Road) from a tidal surge event (10th March 2008).

The approved Isle of Wight Shoreline Management Plan 2011 recommended a policy of 'Hold the Line' at Gurnard Luck within epoch 1 and then 'No Active Intervention' thereafter. This policy was reflective of a lack of public funding for future defences, whist recognising the aspirations and measures the

residents were undertaking to protect themselves in the short-term (please see the SMP Chapter 4.2 for further information www.coastalwight.gov.uk/smp). The SMP was prepared prior to the introduction of the 'partnership funding' system and based on previous rules Grant in Aid funding for schemes was unlikely, and additional funding sources were not identified.

The 2016 West Wight Coastal Flood and Erosion Risk Management Strategy (CFERMS) updated flood and erosion risk mapping, option costs and benefits for Gurnard Luck, however the limitations of strategic level decisions were recognised for this complicated multisource flood and erosion risk area.

The preferred option proposed in the draft Strategy for consultation (March 2016) is described below:

SMZ 5a Preferred Strategic Option: Privately funded community and property level flood resistance and resilience at Gurnard Luck (up to 2055). Private maintenance of existing assets permitted (subject to the usual consents). In the longer term accept that flood risk will increase due to sea level rise but provide a Coastal Change Management Area Plan to support the No Active Intervention policy. Do Minimum (maintain health and safety) at Gurnard cliff.

PV Cost*	PV Benefits*	Benefit:Cost ratio
£239,000	£1,637,000	6.8 : 1

In the short term Property Level Protection and community resilience measures are recommended to reduce flood risk to a small number of properties. Due to lack of available funding, it is likely that these measures will need to be privately funded.

From 2025 onwards a Coastal Change Management Area plan will be developed and implemented by the council to help facilitate community adaptation to increasing levels of risk posed by sea level rise.

Allow natural processes to continue but ensure health and safety compliance.

Strategy preferred option - commentary

This community area is at risk of both tidal and fluvial flooding, and also wave overtopping. There is also erosion risk along the frontage as demonstrated by the recent localised wall failure in front of the Beach Chalets, which has since been repaired through a community led scheme and flood recovery funding.

In the short to medium term up to 2055, community led property level protection and continued community resilience is recommended at Gurnard Luck to reduce flood risk to a small number of properties. Some properties have recently received flood recovery grant monies. The Isle of Wight Council (IWC) will not be prioritising any publically funded investment in coastal defences or maintenance in this area. EA operation of control structures at the mouth of Gurnard Luck stream is expected to continue whilst feasible. Privately funded maintenance of existing coastal defences will be permitted (subject to gaining the necessary consents).

Some properties in Gurnard Luck have already taken action to adapt to flood risk by raising the level of their properties. In the future, as the multiple risks from tidal flooding, fluvial flooding and erosion increase, the community will need to continue to adapt, as outlined in the approved Isle of Wight Shoreline Management Plan (2011, chapter 4.2).

As the risks increase in the future due to sea level rise, the IWC will work with communities to develop and implement a 'Coastal Change Management Area Plan which will clearly set out the strategy to respond to and adapt with the risks, under a policy of 'No Active Intervention'. This adaptation process will be supported by the IWC planning process.

For the adjacent Gurnard Cliff area there is very limited risk to assets and the preferred option is to allow natural processes to continue.

Consultation feedback

A considerable level of engagement feedback was received on the draft Strategy proposals, particularly from local residents. Residents proposed alternative options such as dwarf walls around the harbour to address the risks. A petition was also received after the end of the public consultation phase, requesting more to be done protect Gurnard Marsh.

3) Additional studies

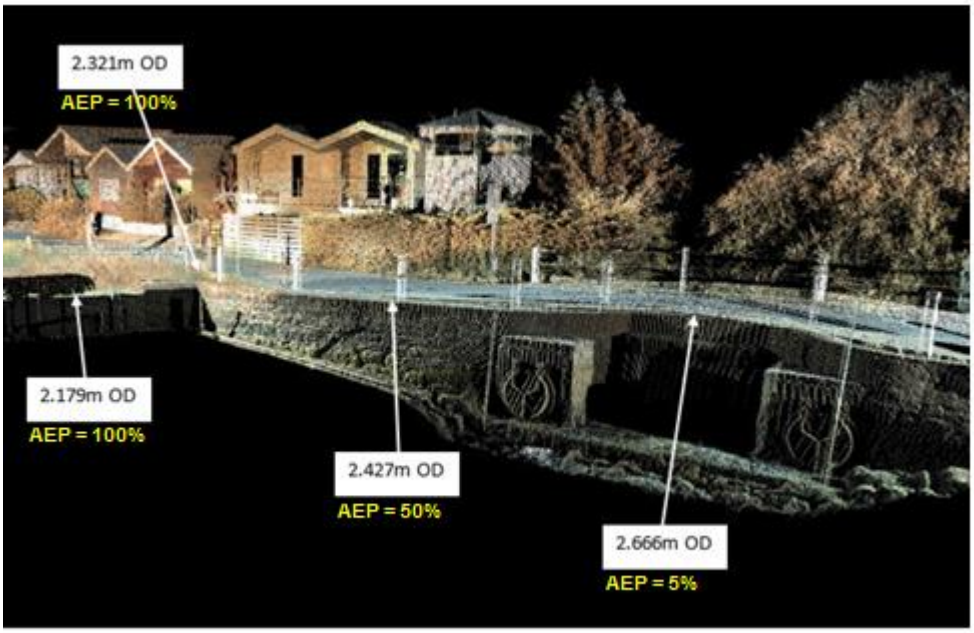
3.1 Review and new topographic survey data for the frontage (CCO Laser Scan Survey, July 2016) and evaluate significance of data

IWC commissioned AECOM to analyse new CCO topographic survey data and summary report for Gurnard Marsh (supplied 29th July 2016).

A laser scan topographic survey of the Gurnard Marsh frontage was carried out by the Channel Coastal Observatory on July 19th 2016. This generated high resolution point cloud coverage of the foreshore, defences and coastal frontage including the harbour.

Summary plots were also provided with spot-height information interpreted for key locations along the frontage. These were analysed and the indicative standards of protection expressed as an Annual Exceedance Probability (the percentage chance of experiencing an event of this magnitude in any given year, often abbreviated as AEP) were mapped onto the corresponding survey heights (see example – Figure 1). The set of images showing elevations along the frontage is provided in Appendix A to this technical note.

Figure 1. Example Topographic Survey Data Output from CCO Laser Scan Survey (July 2106) with Interpretation of Tidal Standard of Protection Carried Out



Discussion

Although the crest heights vary along the frontage, the upstand wall along much of the frontage is shown to have a typical crest level of around 2.8 – 3.1 m ODN which equates to a present day Standard of Protection (based on extreme still water levels) of 1.33 – 0.5 % AEP (1 in 75 yr – 1 in 200 yr return period). This SoP (Standard of Protection) range does not include the influence of waves however, and in reality the standard of protection provided by the existing seawall is likely to be lower than this.

Elevations are notably lower around the harbour to Gurnard Luck, where there is no edge protection or coastal flood defences. Currently, existing land levels with the exception of Gurnard Bridge provide a low SoP against tidal flooding roughly equivalent to a present day 100% AEP (1 in 1 yr return period) still water level. The crest level of the top of the bridge equates to a present day 5% AEP extreme water level event (1 in 20 year return period). It should be noted that the SoP offered by these assets will reduce over time as a result of projected sea level rise.

Extreme Water Levels for Gurnard Marsh

Present and future extreme still water levels for Gurnard were estimated in The Strategy using Environment Agency water level and climate change guidance (Table 1). For further information on coastal process and the prediction of extreme water levels see Strategy Appendix C (Coastal Processes, March 2016)

Table 1. Existing and predicted future extreme water levels (mOD) for Gurnard.

Gurnard		Medium Emissions Scenario 95% + Storm Surge			
		Extreme Water Level (mOD)			
Return Period (years)	**%AEP**	**2015**	**2025**	**2055**	**2115**
1	100	2.35	2.41	2.61	3.13
2	50	2.43	2.49	2.69	3.22
5	20	2.53	2.59	2.80	3.34
10	10	2.60	2.66	2.87	3.42
20	5	2.67	2.73	2.95	3.50
50	2	2.76	2.82	3.05	3.61
75	1.33	2.79	2.85	3.08	3.65
100	1	2.82	2.88	3.11	3.68
200	0.5	2.88	2.94	3.17	3.75
500	0.2	2.97	3.04	3.27	3.86
1000	0.01	3.03	3.10	3.34	3.93

It should be noted that when assessing schemes to deliver particular standards of protection, the design height of structures needs to be in excess of these levels (to a greater or lesser degree) depending on the location. E.g. front line structures may need to be higher to account for additional waves superimposed on still water levels, whereas setback structures may need minimal additional height (freeboard) to deal with small waves, settlement etc.

3.2 Site investigation

AECOM coastal engineers undertook a site visit and visual inspection of Gurnard Luck on 16th August 2016. The purpose of this visit was to:

- Update / validate asset condition (through visual inspection);
- Ground truth and check crest heights and identify low spots in defences;
- Assess and confirm potential scheme options and alignments;
- Confirm length and likely defence function of timber barriers; and
- Update / validate estimates of property threshold levels.

The site inspection was carried out in sunny conditions with light breezes with High Tide at 11.05am.

Photo 2. Gurnard Luck Harbour at High Tide.

Following the site visit the following conclusions / updates were made:

- Many properties have raised floor levels (up to 2.5 m ODN). Requirements identified and undertaken to update property threshold levels and further account for these in the economic appraisal and valuation benefits (Photo 5);

- Current defence alignment and elevations validated and requirements to more accurately depict defence alignment and elevations within the TUFLOW model confirmed;

- Flap valves checked and measured. Need to include flap valve effects within the modelling;

- A 90m stretch of timber boards along the frontage were inspected. Whilst offering reduction in overtopping risk they cannot be relied on as tidal flood defences. Therefore, assume land levels behind as representative of tidal defence height in the model in this area; and

- Scheme options and alignments to provide a 1 in 75 yr or 1 in 200 yr SoP identified (see Section 3.4).

Photo 3 and 4. Sea Wall and Timber Board Defences (left – photo 3) and Flap Valves Under the Bridge Closed at High Tide (right – photo 4).

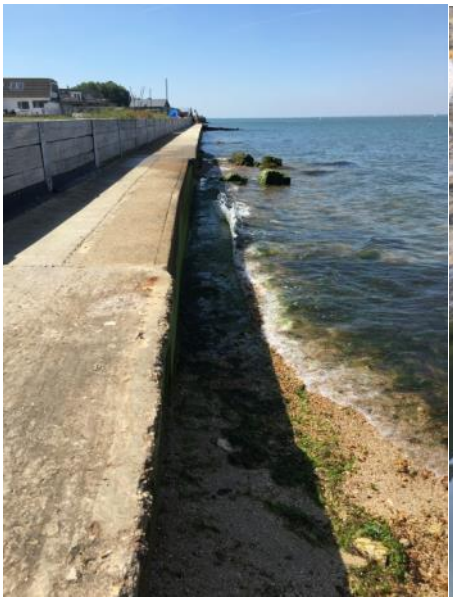


Photo 5 – Many properties have raised floor levels which were Included in the updated modelling and Benefit Cost Assessment.

3.3 Modelling updates

Following the analysis of the laser scan data (CCO, 2016) and site survey (Aug, 2016), AECOM undertook a further review of the TUFLOW hydrodynamic model setup (JBA updated 2014, re. Strategy Appendix D) used in the West Wight CFERMS (Strategy) at Gurnard Luck to establish the level of modelling uncertainty and if required, make necessary updates and refinements.

The following tasks were undertaken:

- General overview of the model setup and application;
- Reviewed and updated the applied seawall / defence positions and crest heights in the model based on the CCO topographic survey data (July 2016); and
- Included impact of structures (flapped culverts) at the bridge draining away water from the Luck (at the bridge).

Following the model updates, the complete range of baseline tidal return period events (20 events) were re-run (excluding potential scheme proposals) in order to simulate and map the tidal flood risk, and the impact of sea level rise under a 'Do Nothing' scenario.

The Environment Agency also provided time series data (30th August 2016) for the Gurnard Luck water levels. This covered the period 2004 to March 2015 at 15 minute intervals. This dataset was analysed and reviewed and it included some gaps and corrections. As the data only provides levels (above the bed) and not fluvial discharges as requested it was not possible to use the data in the modelling to test potential tide locking or fluvial flood risk using the model. The water level time series data indicates that the road level has been exceeded on several occasions over the 11-year data period. However, without further information such as rainfall, measured tide levels, river discharge it was not possible within the limits of the scope of work to identify the dominant drivers (i.e. tidal, tide locking, fluvial) behind the water level exceedances.

Records of previous flooding have been made available and were reviewed showing that a range of flood events affecting properties have occurred on average every few years, with some attributed to tidal, some to tide locking and some to fluvial events. Generally however, the dominant source of risk is shown to be tidal flooding. Overtopping presents a further flood risk although local measures such as setback dwarf walls and timber boards have been installed along the frontage to reduce this flood risk.

Modelling animations and investigating tidal flood propagation

Extreme tidal flood events were simulated for the Strategy using the TUFLOW hydrodynamic model. Static 2D maximum flood depth maps were produced for a range of return periods and these were used to underpin the economic appraisal.

In order to explore further the propagation of tidal flooding at Gurnard Luck, including identifying flow paths and low spots, several modelling animations were created for 1.33% and 0.5% AEP events for the 2015 baseline and also a 1.33% AEP event with the residents proposals around the harbour included (see accompanying files).

These animations show that initial onset of inundation occurs around the bridge as this is a low spot along the frontage. This inundation quickly fills the Luck and floodplain behind and this then starts to

flood properties along Marsh Road 'via the backdoor'. This pattern of onset is also in-keeping with anecdotal observations. Under more extreme events (1.33% AEP upwards) flood inundation (and drainage of flood water) also flows directly across the frontage. In reality the presence of timber boards will reduce this effect but will not prevent tidal inundation. See annotated screen shots (Figures 2 – 4 below) showing a 1 in 200 yr RP (0.5% AEP) tidal event.

Wave overtopping has not been considered in the modelling as reliable overtopping data was not available. Wave overtopping events have the potential to affect the site also although this is not currently simulated in the modelling. Overtopping impacts are likely to be of a second order impact in relation to the tidal flood risk. Mitigation measures such as raised timber boards and setback walls along the frontage are already in place to reduce the potential flooding risk from wave overtopping.

Figure 2 – Onset of Tidal Inundation

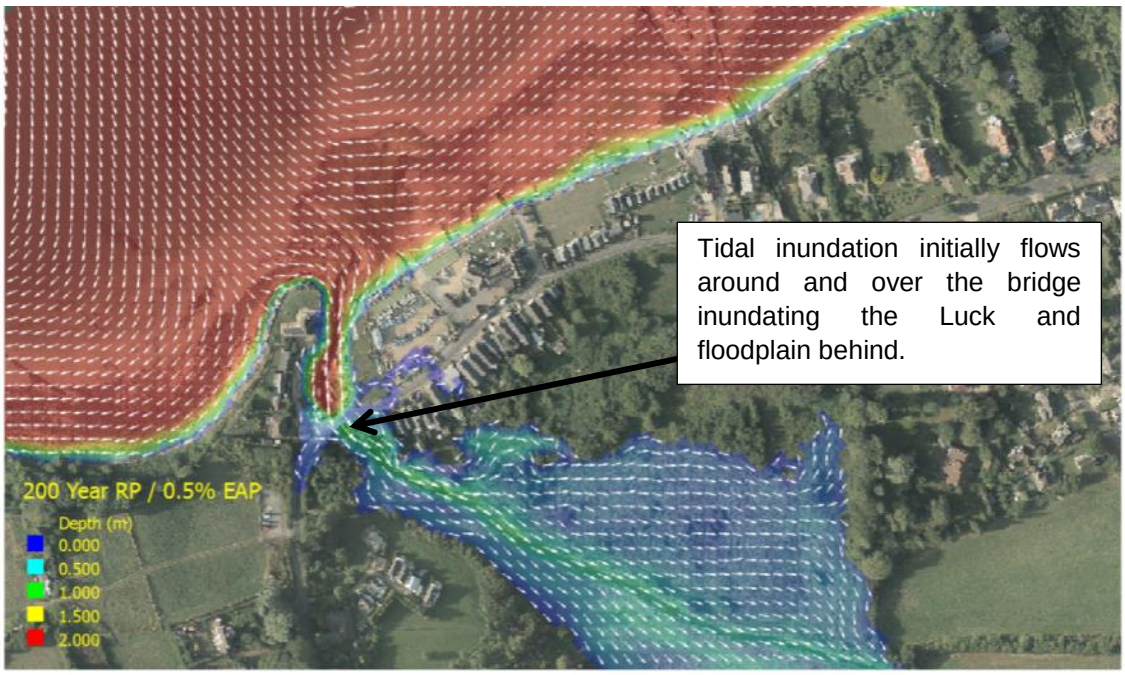


Figure 3 – Onset of Tidal Flooding via the 'Back Door'.

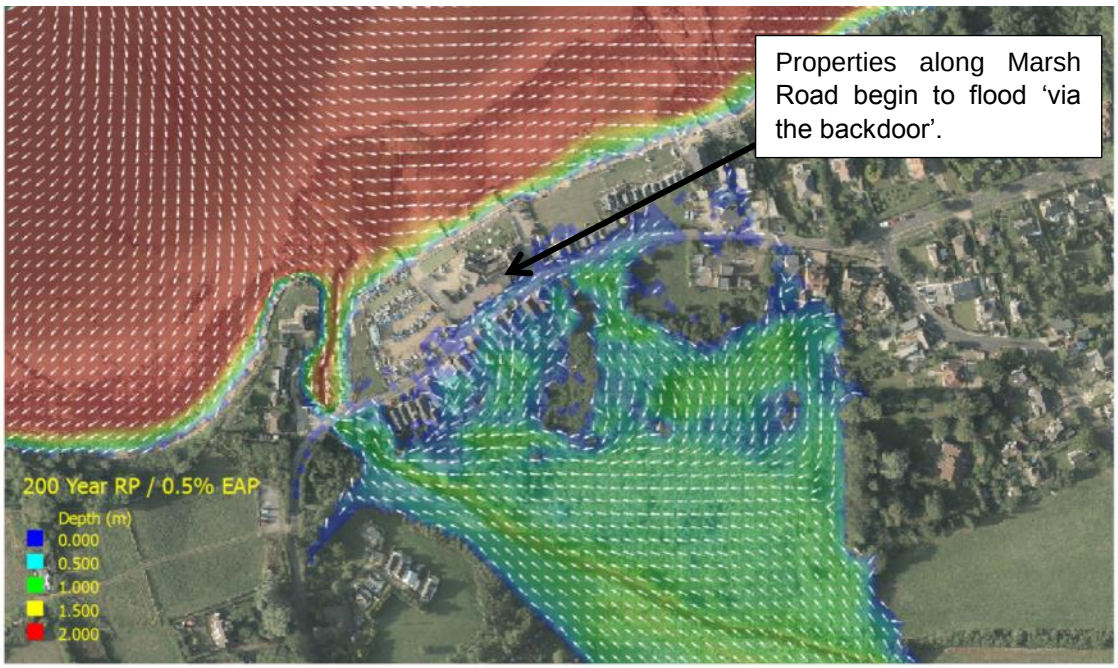
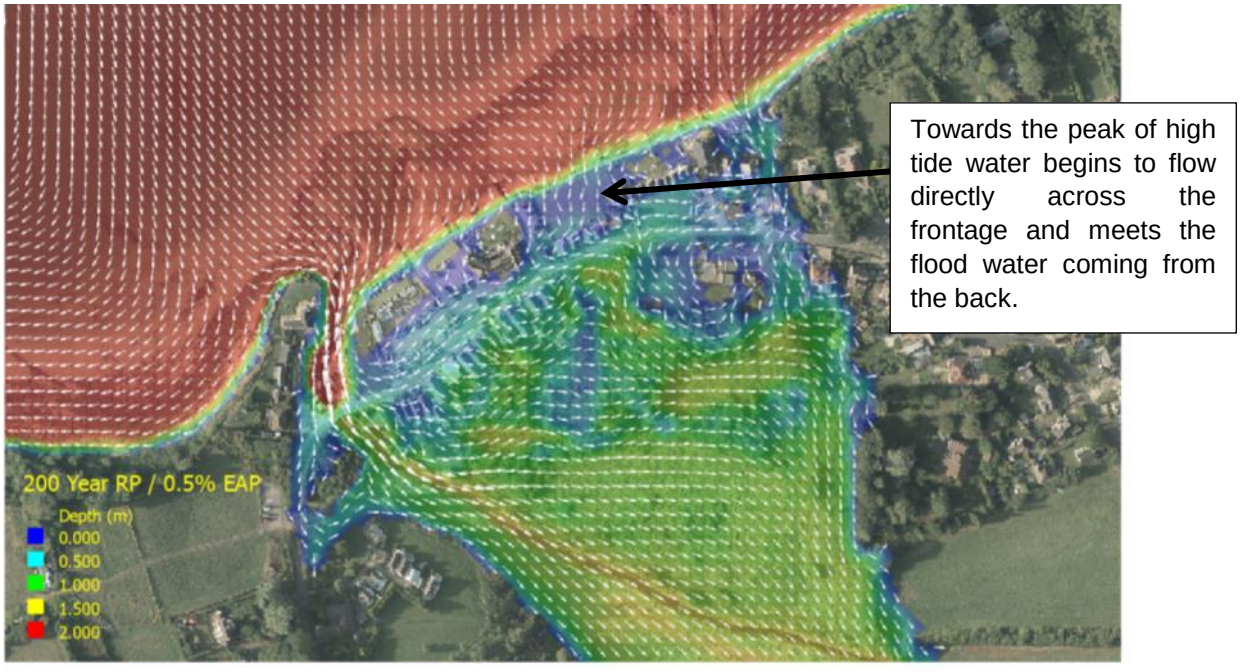


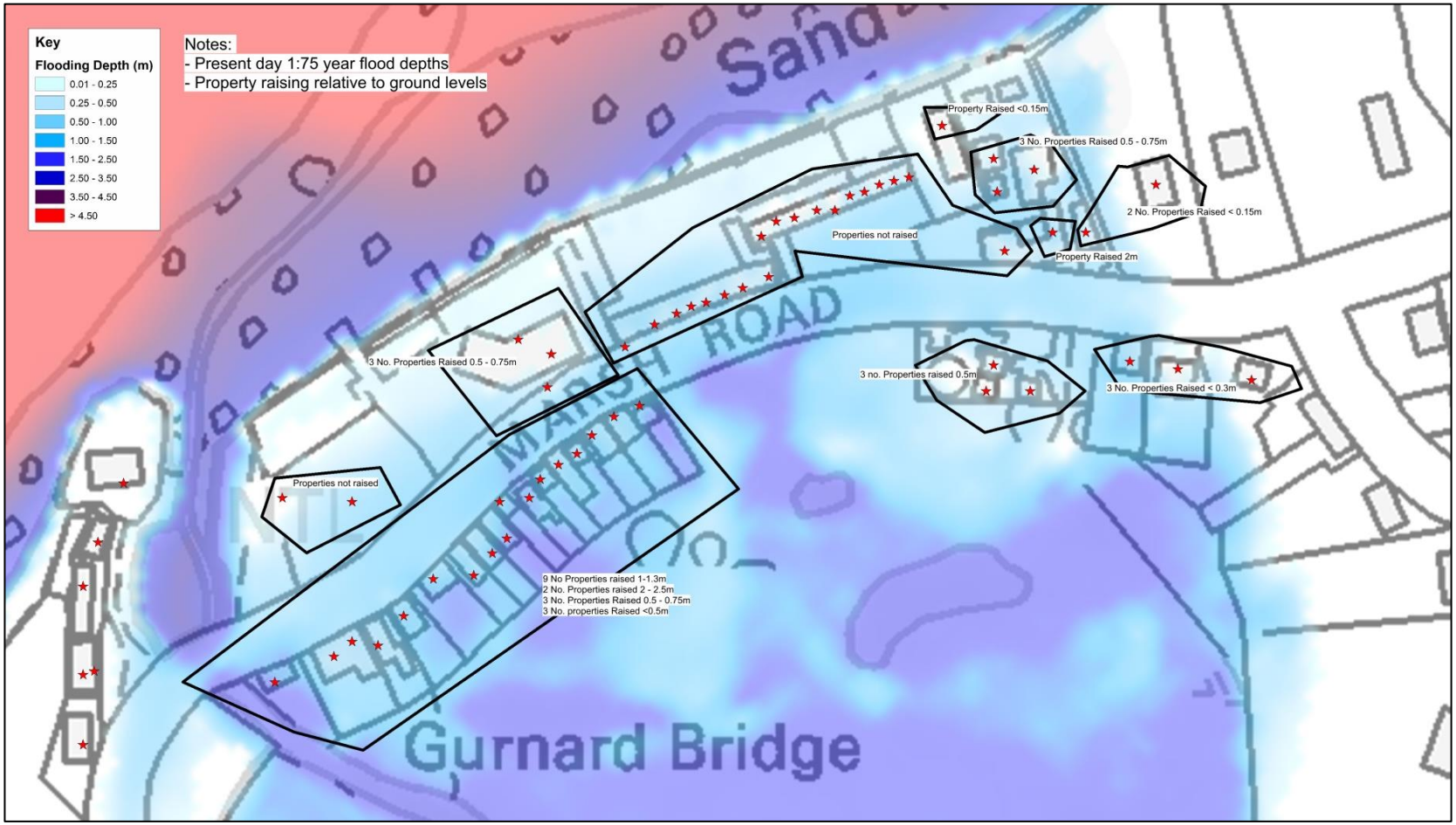
Figure 4 – Flood Risk Near the Peak of a 1 in 200 yr (0.5% AEP) RP Event (Present Day).



Update to Property Threshold Levels

Many of the properties within the study area have raised floor levels. During the site visit the floor levels of properties were recorded and have been incorporated into the economic assessment. Figure 5 presents the property threshold levels.

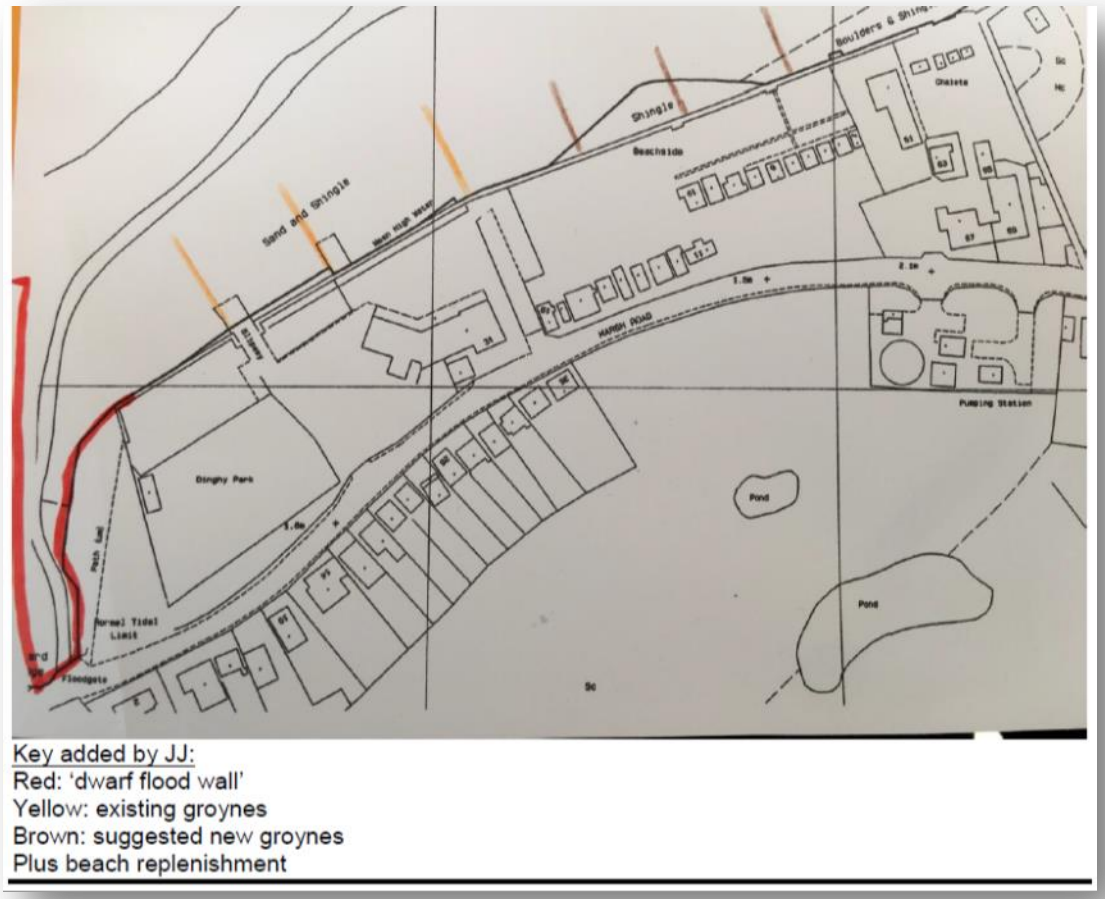
Figure 5 – Updated property threshold levels (mapping reproduced from the Ordnance Survey digital data with the permission of the controller HMSO © crown copyright and database rights 2016 Ordnance Survey 100019229



3.4 Assess and Propose Most Cost Effective but Robust Engineering Options to Achieve 1 in 75 yr RP (1.33% AEP) and 1 in 200 yr RP (0.5% AEP) SoP and Provide Cost Estimations

During the 'Strategy Consultation Phase' detailed feedback and suggestions were received from residents at Gurnard Luck with an idea for a scheme to address tidal flood risk (Figure 6), utilising existing private defences in the area and identifying/addressing further low points.

Figure 6 – Sketched Options Proposed by Residents for Gurnard Marsh (letter 28/06/16)*



These option proposals were considered and investigated further through a site visit (August 2016) by AECOM coastal engineers to assess the technical feasibility of the proposed schemes. As identified by the residents proposals, and confirmed by modelling and site inspection, the harbour and bridge area is low-lying. The prevention of tidal inundation over this frontage would be key to improving the current Standard of Protection within Gurnard Luck.

In order to achieve a 1 in 75 yr RP (1.33% AEP) Standard of Protection (SoP) against tidal flooding there is also a need to raise the elevations along a 90 m stretch of the coastal frontage. It was noted during the site visit that the timber boards present along this frontage will reduce overtopping but will not provide robust protection against tidal inundation due to 'tidal surges'. The interventions recommended to deliver this protection are shown in Figure 7 with indicative potential alignments marked on site

photographs (Photos 6 to 10), including defences set slightly back from the shoreline itself. Indicative cross section illustrations of typical reinforced concrete floodwall and an earth bund measures are provided in Figure 8.

An achievable design life of these types of structures, with maintenance, has been estimated to be until the end of epoch 2 (approximately 45 years). It is important to note that due to sea level rise the Standard of Protection (SoP) will fall over time from a 1 in 75yr RP (1.33% AEP) in the present day to less than 1 in 10 yr RP (10% AEP) by the end of the scheme life. A more extreme flood event could also occur at any time that could overtop these modest SoP defences.

The groyne upgrades and beach nourishment proposed by residents would provide benefit in helping to maintain defences, reduce overtopping and improve amenity value. However, this is not an integral requirement as part of a tidal flood risk reduction scheme so has not been included in the costing, economic appraisal or partnership funding assessment which focuses on the core elements of a potential scheme. It should be noted that these additional elements would add further costs.

It should also be noted that Grant in Aid (GiA) funding (where eligible) will only pay for / towards the minimum, but robust, 'no frills' intervention required in achieving a certain SoP. When developing alignments this has been considered, for example on the eastern side of the harbour, where the shortest defence length is being proposed (rather than a more costly longer alignment that may be better suited to amenity uses such as boat storage). Should such modifications or enhancements be requested, the additional cost to accommodate them would need to be paid for through non GiA contributions. Should scheme options be taken forward the works would need to consider how best to accommodate the footpath along the harbourside.

Figure 7 – Options Identified to Deliver a 1 in 75yr RP (1.33% AEP) SoP (present day) (*mapping reproduced from the Ordnance Survey digital data with the permission of the controller HMSO © crown copyright and database rights 2016 Ordnance Survey 100019229

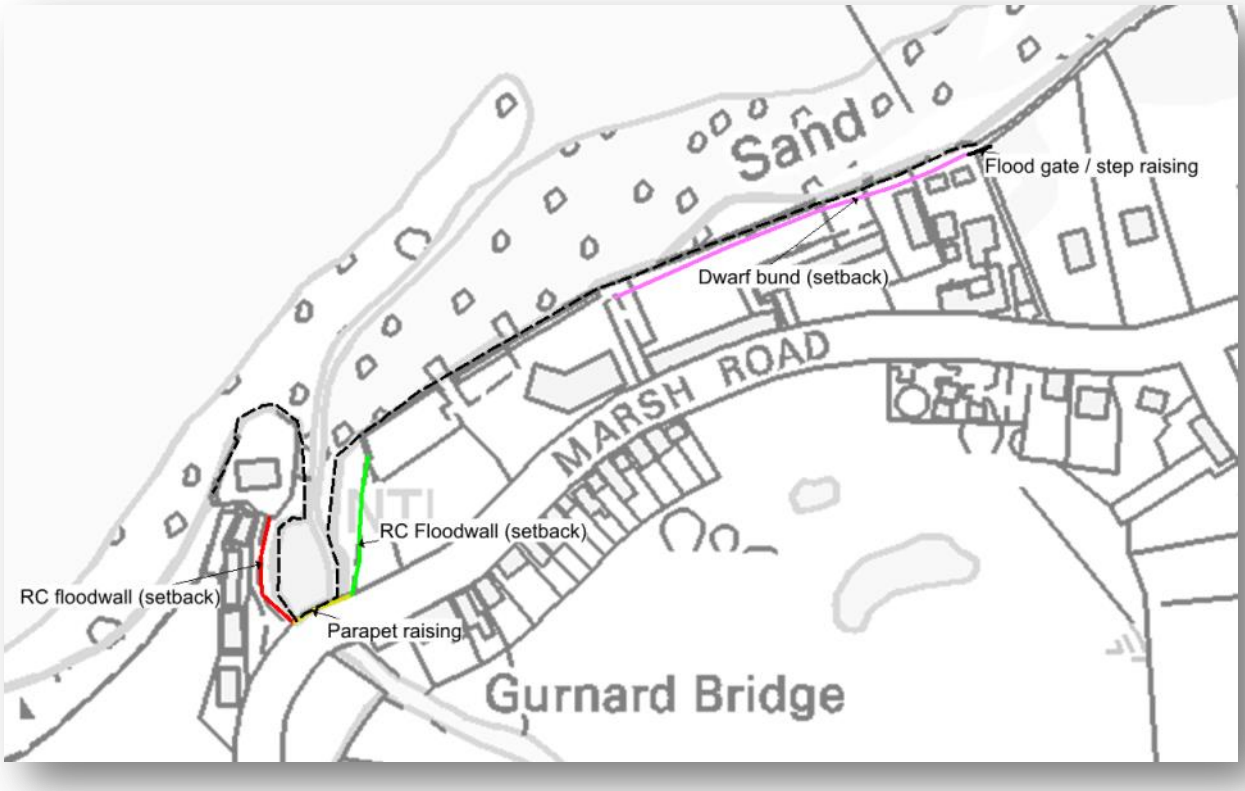
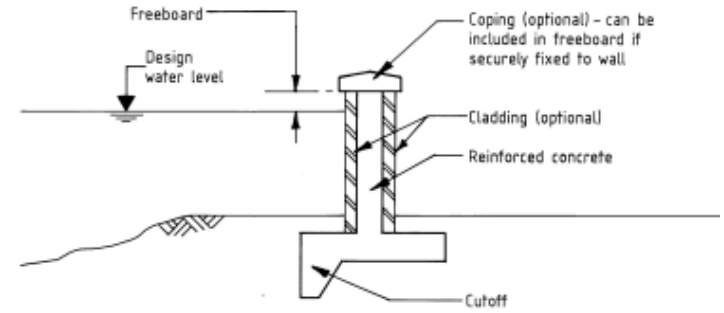
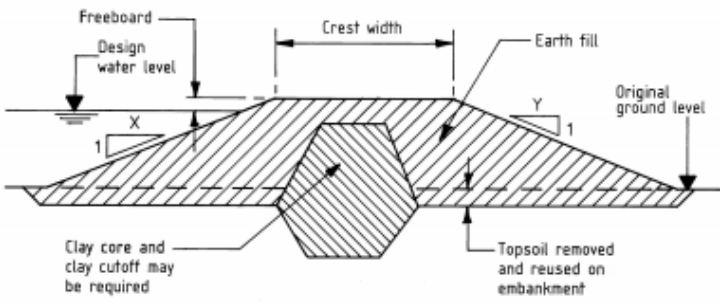


Figure 8. Illustrative cross section through a setback floodwall (top) and a setback earth bund / embankment (bottom). Source: modified from Environment Agency FCERM libraries - FDG2-Ch9-Final4a.doc (2009)



Typical floodwall schematic illustrating the main components of a setback re-inforced concrete floodwall. A cutoff is often required to reduce seepage under the wall (in which case it would generally be deeper than illustrated). The cutoff also helps to stabilise the wall (against sliding –



Typical flood embankment with a much larger footprint than a floodwall and therefore requires considerably more space. A clay core may be required to reduce seepage through the embankment. This can be trenched into the foundation to reduce seepage underneath the embankment.

Photo 6 – Proposed Alignment of the Raised Defence (Setback Floodwall or Earth Bund) on the Eastern Side of the Harbour.

Photo 7 – Parapet Raising of the Bridge Required.

Photo 8 – Parapet Raising Going into a Setback Floodwall on the Western Side of the Harbour Which Could Run Along the Side of the Access Road and Tie into Defences Towards the Harbour Entrance.

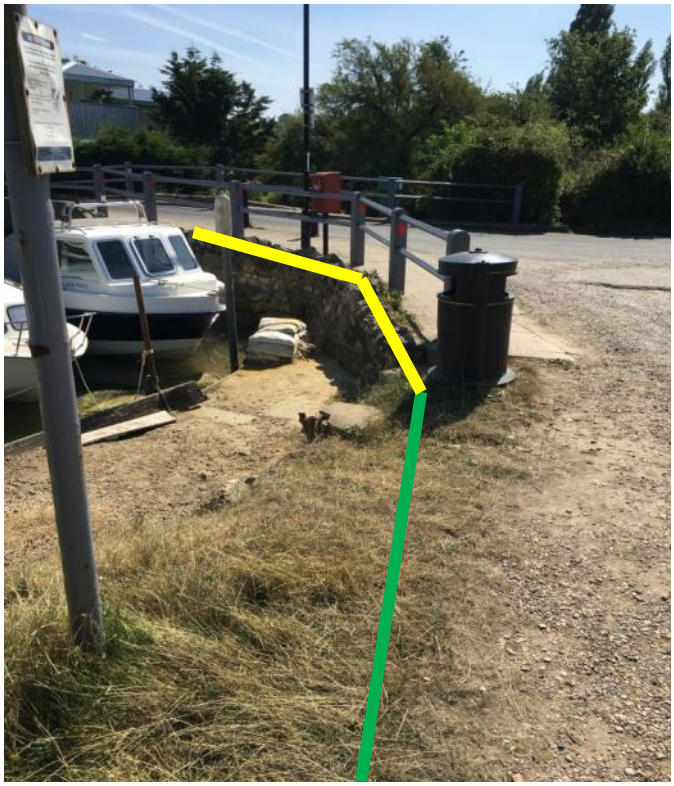


Photo 9 – Setback Low Earth Bund / Dwarf Wall Required Along a 90m Section of the Frontage Behind the Timber Boards.

Photo 10 – Flood Gate or Step Raising Required at a Low Point (Footpath) at the Eastern End of the Frontage.

Scheme to deliver 1 in 200 yr (0.5% AEP) SoP (present day)

The difference between a 1 in 75 yr RP and a 1 in 200 yr RP tidal water level is small (10 cm). Therefore, in order to achieve the higher SoP this additional height is required in addition to the interventions. The tie in locations remain the same as in the 1 in 75 yr SoP scheme as the levels of the adjacent structures are shown to be of sufficient elevation (>2.88 m ODN which is the 1 in 200 yr RP water level).

It should be noted that neither of the small schemes identified address the potential erosion risk from the currently undefended coastline to the west of Gurnard Luck (where erosion risk increases, especially in the longer term). The SMP policy and Strategy preferred option for this coastline is for No Active Intervention, and new defences are not proposed for this undefended area.

Throughout the West Wight Coastal Strategy area (2016) and across the Isle of Wight in the Shoreline Management Plan (2011) there are no areas where new defences are proposed on a currently undefended coastline.

Option costing

Cost estimates for the schemes providing 1 in 75 yr (1.33% AEP) and 1 in 200 yr (0.5% AEP) SoP against tidal flooding were developed based on best available information using a variety of sources.

In order to determine the height of the structures required, a GIS inspection of elevations was carried out for the identified defence alignments. This allowed the necessary height of each defence structure to be established (and these are shown in Tables 2 and 3 below). Typical cross-sections for each structure were then used in developing unit costs. Maintenance costs for these structures were then estimated and included as it is required to provide the whole life costs in the Partnership Funding calculation. Costs for subsequent more detailed appraisals for funding application and design were also estimated (based on engineering judgement) and were included in the assessment.

Cost estimations were built up from rates provided in civil engineering price books (e.g. SPONS, 2014) and Environment Agency guidance coupled with experience and benchmarking of similar projects. The costs (Table 2 & 3) are presented as of July 2016 and include a 60 % optimism bias as per FCERM-AG Guidance (national Flood and Coastal Erosion Risk Management – Appraisal Guidance) for strategic level cost assessments such as this. It should be noted that these cost estimates have been produced in line with the latest requirements of national guidance, and not benefited from early contractor involvement or budget cost advice at this strategic level.

Table 2 – Capital Design and Construction cost estimation for the interventions required to provide a 1 in 75 yr SoP against tidal flooding (Cash £)

Type	Location	length (m)	Av height (m) including freeboard	Cost (£)
Setback Dwarf Bund	Behind timber boards	130	0.5	£79,000
Gate / Steps	Footpath at eastern end of frontage	2	1	£13,000
Parapet raising	Bridge	22	0.5	£23,000
Setback RC Floodwall	Around harbour (both sides)	89	0.6	£161,000
Total		**243**	**0.6**	**£276,000**

Table 3 – Capital Design and Construction cost estimation for the interventions to provide a 1 in 200 yr SoP against tidal flooding (Cash £)

Type	Location	length (m)	Av height (m) including freeboard	Cost (£)
Setback Dwarf Bund	Behind timber boards	130	0.6	£104,000
Gate / Steps	Footpath at eastern end of frontage	2	1.1	£14,000
Parapet raising	Bridge	22	0.6	£29,000
Setback RC Floodwall	Around harbour (both sides)	89	0.7	£184,000
Total		**243**	**0.7**	**£331,000**

It is important to note that capital construction costs (above) form part of the total scheme costs, but that there are also other additional costs. For both SoP schemes the whole life present value maintenance costs are estimated to be about £38,000 (or £80,000 in cash terms). There would also be maintenance requirements for the existing private defences in the area. In addition, further survey costs, appraisal costs for OBC (Outline Business Case) preparation (including further examining multiple sources of

flood risk), environmental and planning consents will be needed, and is estimated at £40,000 (cash). Securing funding for these additional costs, including maintenance costs, is also integral to progressing any scheme (nb. further information is provided in Table 5 below).

Schemes which would provide a precautionary much higher standard of protection over the full 100-year period to mitigate climate change and sea level rise have not been costed in detail as part of this study, however a 'ball park' estimate is provided. This would involve a considerably larger and longer length scheme, with new defence heights required along the front and back of the village, almost encircling it. Indicative cost estimations to achieve this are > £3m with a very significant (greater than 80%) external / stakeholder contribution likely to be needed to deliver this given a very low (<20%) Partnership Funding Score that is likely. This cost estimate also excludes defences which would also be needed to mitigate the risk from retreat of the undefended coast to the west of the site, and no new defences are proposed in that area. This erosion risk increases in the longer term and also needs to be considered when understanding future flood risk to Gurnard Marsh.

3.6 Updated Economic appraisal

Updated Do Nothing Damages (100 year appraisal period)

Flood related damages
The updated model was used to derive whole life tidal flood damages under a baseline 'Do nothing' scenario. The updated property threshold levels were also accounted for in the calculation of damages. As per the 'Strategy', other associated indirect flood damages such as vehicle damage, health impacts, emergency clear up costs and flood refuge costs were also included in the assessment.

Erosion damages
Erosion estimates for the frontage were updated by IoW Council (July 2016) following revised residual life estimates for defence assets along the frontage (July 2016), to take account of recent repairs. These were used to estimate the whole life erosion damages under this baseline scenario.

A summary of the updated present value flood and erosion damages for a 100-year period under a 'Do Nothing (DN)' scenario is presented in Table 4. The total damage has reduced (now £6m Present Value) compared to the Draft WW Strategy numbers (Present Value whole life damage of £9m), mainly due to the inclusion of more accurate and up to date defence levels within the model and refined estimations of property threshold levels.

Table 4. Updated 'Do Nothing' Flood and Erosion Damages (PV £k)

Option name	Do Nothing
Name & SoP (where relevant)	
COSTS:	
PV capital costs	0
PV operation and maintenance costs	0
PV other	0
Optimism bias adjustment	0
PV negative costs (e.g. sales)	
PV contributions	
Total PV Costs £k excluding contributions	0
Total PV Costs £k taking contributions into account	0
BENEFITS:	
PV monetised flood damages	4,006
PV monetised flood damages avoided	
PV monetised erosion damages	2,008
PV monetised erosion damages avoided (protected)	
Total monetised PV damages £k	6,014
Total monetised PV benefits £k	
PV damages (Environmental)	
PV damages avoided/benefits (from scoring and weighting)	
PV benefits from ecosystem services	
Total PV damages £k	6,014

Economic appraisal of scheme options – 45 year appraisal period.

The numerical model was used to simulate the presence of the two different SoP schemes identified (with updated existing sea wall heights and proposed harbour-side and water-front flood defence elements) and the outputs were used to generate benefits. The majority of the benefit generated is from increased protection against tidal flooding, although some of the damage avoided is from delaying the onset of erosion through maintenance of new and existing structures.

Figures 9 and 10 show the properties that would fall within the benefit areas of the 1:75 and 1:200 year SoP small schemes. The benefits vary by property and depend upon the type of property, the depth of flooding (of the Do Nothing scenario) and the degree to which floor levels have been raised.

Figure 9 – properties within the benefit area for 1:75 year SoP scheme. Present day Do Nothing 1:75 year flood mapping shown (mapping reproduced from the Ordnance Survey digital data with the permission of the controller HMSO © crown copyright and database rights 2016 Ordnance Survey 100019229)

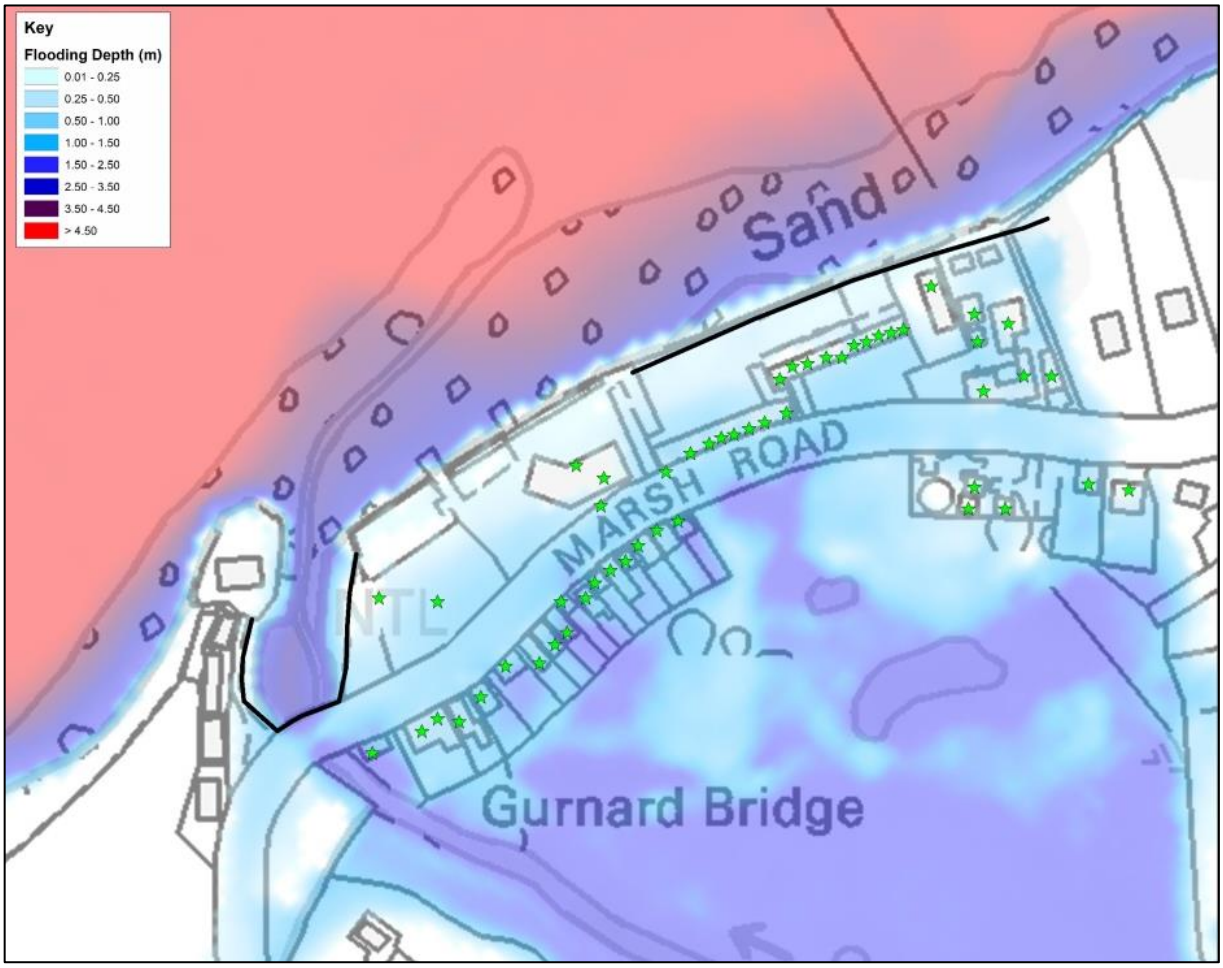
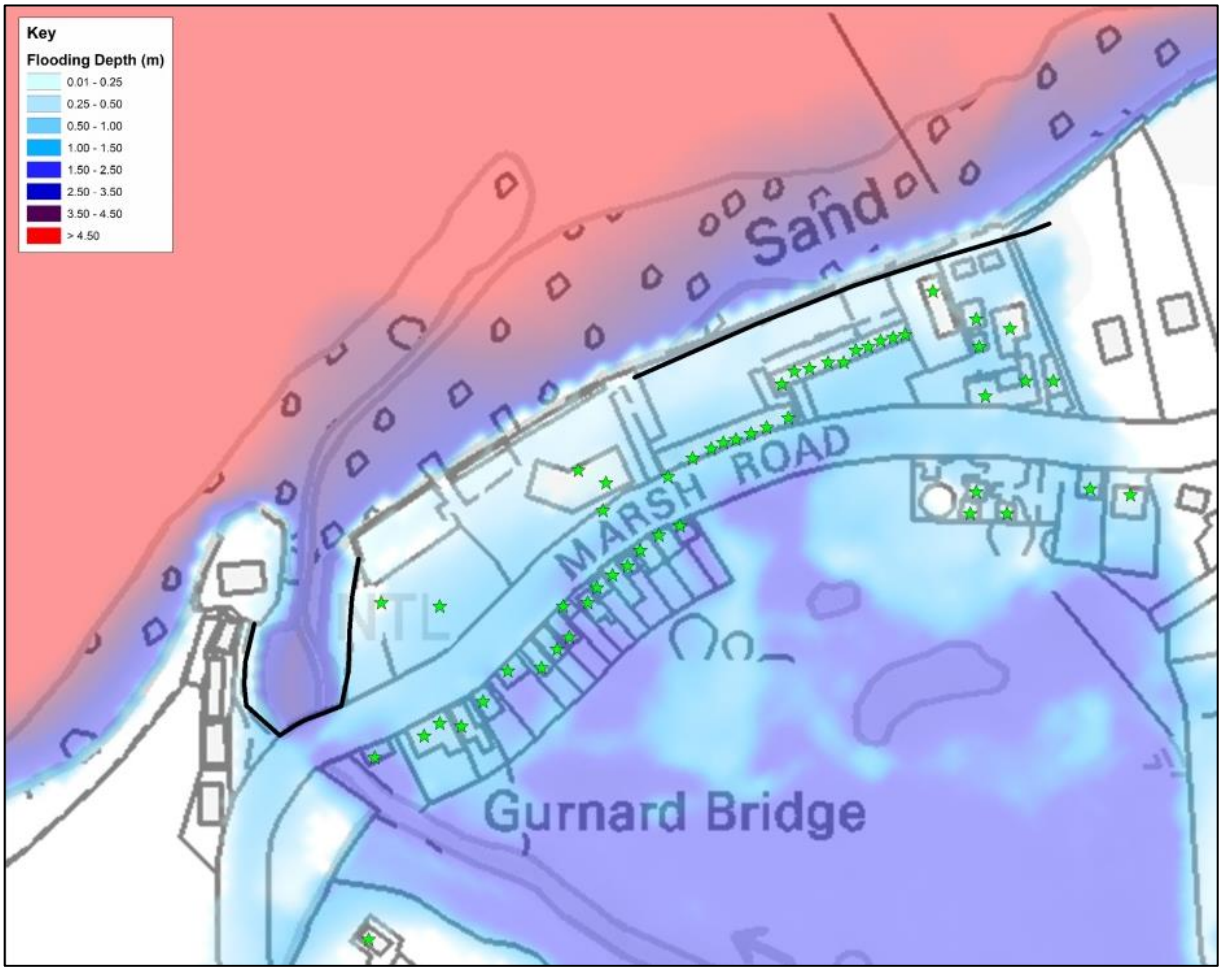


Figure 10 – properties within the benefit area for 1:200 year SoP scheme. Present day Do Nothing 1:200 year flood mapping shown (mapping reproduced from the Ordnance Survey digital data with the permission of the controller HMSO © crown copyright and database rights 2016 Ordnance Survey 100019229)



An assessment of the potential funding sources for a small scheme has been undertaken. The table below (Table 5) provides an indication of the Partnership Funding (PF) scores for the two potential small schemes, and the potential national Grant in Aid (GiA) funding contributions and the local funding contributions that would be required for a scheme to proceed. The schemes achieve a PF scores of approximately 50%. Scores of 100% and over are required to secure government funding, therefore significant local funding contributions would be required to make up the funding shortfall to unlock some potential Grant in Aid. Further information on the funding system is available in Chapter 11 of the Main Strategy Report.

The appraisal (Table 5) also shows that both scheme options investigated deliver relatively healthy *benefit-cost* ratios of over 5:1 (for the short to medium term). There is however, remaining uncertainty at present over these figures, as this assessment has used the available data to date but further suitable data is needed in order to simulate or quantify potential risks from fluvial / tide locking flood sources. The dominant risk to the area is from tidal flooding, and these benefits estimated relate to the improved protection against this source of flooding. However there may still be residual damage from other sources of flooding as the interventions put forward do not mitigate these (and could potentially enhance

tide locking risk through raising defences around the bridge, therefore these risks would require further consideration as a first step towards progressing any future scheme).

Therefore, in the absence of further information, some high level provisions were made at this stage in the economic appraisal to account for residual risk. This included allowing 10% of the Annual Average Damage avoided to be 'put back in' as a residual damage to make some allowance for the potential damage impacts from other sources.

Conservative assumptions were made in the Outcome Measures 2 counts in the Partnership Funding calculations. For the higher SoP scheme, properties were only moved to 'Moderate risk' in the PF calculation to reflect uncertainty over the risk of flooding from other sources coupled with the fact that they only just move to 200yr SoP (and not higher) and then the SoP immediately starts declining over time due to sea level rise.

As a sensitivity test, the impact of moving the properties to low risk (<1:200 yr risk) in the PF calculator was assessed for the 1:200 yr SoP scheme, and this results in the raw PF scores improve by 3% and the contributions required fall by approximately £11,000.

An additional sensitivity test including/excluding the nine seafront chalets in the PF calculation was carried out. The inclusion of these additional properties increases the OM1 and OM2 benefits with no additional cost and resulted in a minor increase in the raw PF scores by 7% (thus reducing the contributions required by £24k for the 1:75yr SoP scheme and by £27k for the 1:200 yr SoP scheme.

Table 5. Economic Appraisal summary over 45 year appraisal period

	Do Nothing	1 in 75 yr (1.33% AEP) SoP Scheme	1 in 200 yr (0.5% AEP) SoP Scheme
Damages (PV £K)	3,363	1,490	996
Benefits (PV £K)	0	1,873	2,367
Whole Life Costs (PV £K)	0	354*	409*
Benefit:Cost Ratio	-	5.3	5.5
Raw PartnershipFunding (PF) Score	-	55%	54%
Potential GiA towards upfront Capital costs (£k cash)**	-	174	201
Potential Non GiA Contribution Needed Towards Up Front Capital Costs***	-	142	170
Contribution Required for Future Maintenance (PV £K)******	-	38	38

NB. This table is supported by PF Calculators.

Notes:

*Includes £40k scheme appraisal costs, design costs, construction costs and also ongoing maintenance costs (nb. please see the explanation under Table 3 for further information on these costs).

****The GiA amount potentially available is subject to the required contributions being obtained.**

***Based on a threshold PF score of 100% (this is minimum threshold, and could be higher if annual GiA requirements are stretched).

****Ongoing maintenance costs will not be eligible for GiA and will also need to be funded through non GiA contributions. Please see the notes under Table 3 for further information on these costs.

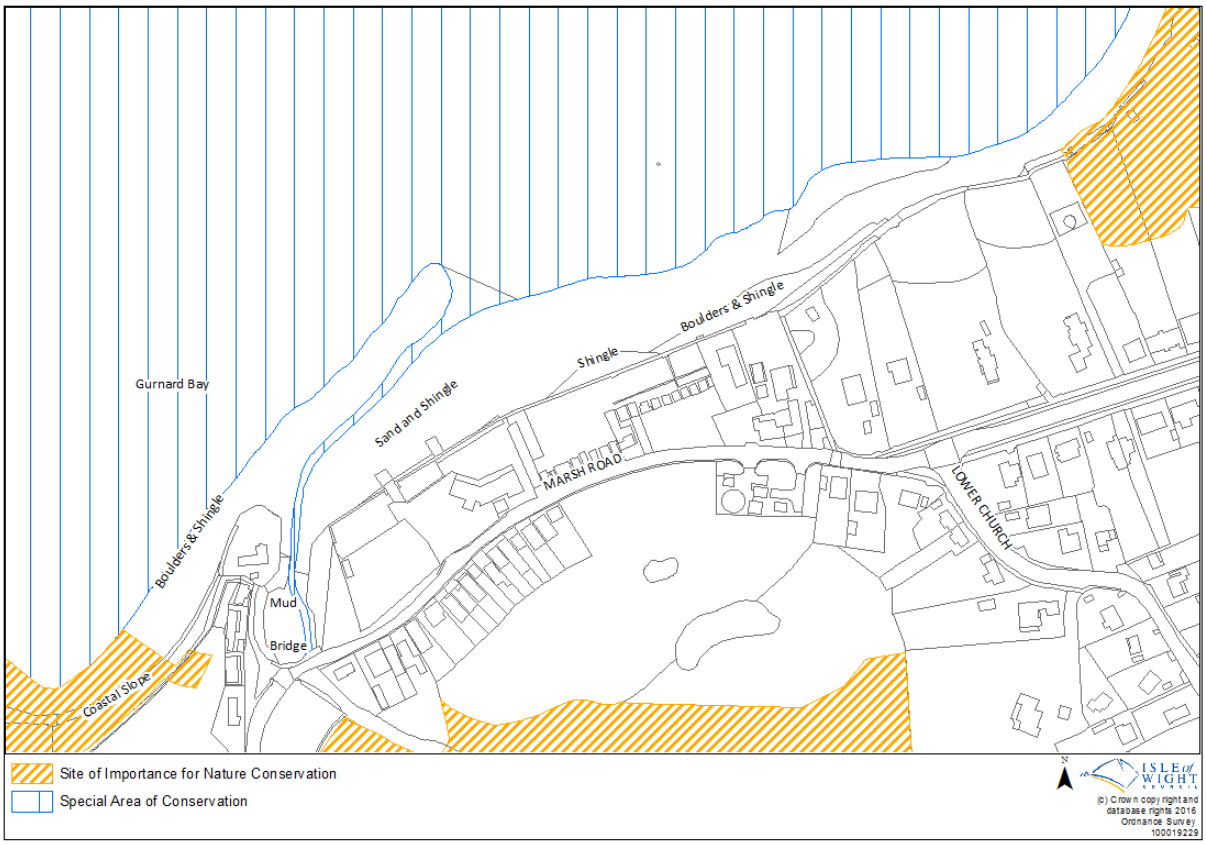
3.7 Environmental Considerations

Consideration of environmental constraints and potential impacts will be important, if either scheme idea is progressed further.

The international environmental designation of the Solent Maritime Special Area of Conservation (SAC) boundary is located adjacent to the shoreline at Gurnard Luck, but does not extend up to the high water mark at this location (Figure 11). It includes the offshore zone and a narrow stripin the centre of the harbour channel, although this approaches closer to the eastern shore at the southern end of the harbour. The defence elements proposed above are not located within the SAC, and especially if the set-back proposals are considered, would therefore not be anticipated to impact upon the SAC, although full and careful consideration of environmental impacts would be needed as part of any scheme design, seeking the necessary approvals, and during construction activities.

It should also be noted that the Solent area and north-west coast of the Isle of Wight is under consideration as a proposed Special Protection Area (SPA) and Marine Conservation Zone (MCZ).

Figure 11 – Environmental designations at Gurnard Luck



4) Discussion, recommendations and limitations.

Discussion in relation to proposed schemes:

The additional studies and updated appraisal undertaken demonstrates there is an economic justification for the schemes proposed to reduce tidal flood risk, although government funding towards them would be limited.

There is merit, from an incremental benefit cost perspective, in considering the higher SoP scheme, as the additional spend required to deliver the higher 1 in 200 yr (0.5% AEP) SoP, is exceeded by the additional benefit delivered.

However, the Partnership Funding calculations demonstrate that these schemes could potentially receive just over 50% GiA funding, subject to the remaining funding shortfall being met through external / non GiA contributions. The contributions required for these 1 in 75 yr (1.33% AEP) SoP and 1in 200 yr (0.5% AEP) SoP schemes are approximately £142k and £170k respectively, for the initial capital works.

In addition, future maintenance costs would need to be funded through non GiA sources by the asset owners/landowners, and securing agreement of this would be integral to progressing a scheme, as such a scheme would be reliant on the present defences as well as new defence elements.

These costs exclude other aspects such as beach nourishment or groyne upgrades. Although these may provide some additional or wider benefits they are not seen as integral requirements to delivering the schemes explored, which address the primary risk from tidal flooding, and these aspects would add further additional costs.

The contributions required could potentially also include ‘contributions in kind’ such as landowners undertaking elements of defences themselves, subject to obtaining the required consents (e.g. building the earth bund required along the seaward frontage to a required standard). Such measures could reduce the funding shortfall, so long as it could be agreed and demonstrated that they are adequately designed and engineered to the required standards. Other elements of the costs would however require upfront financial contributions. Formal agreements would be required for all contributions.

In the event of local funding contributions not being available to progress a coordinated scheme, the information provided by these additional studies (including the survey of existing defence heights and an improved understanding of future risks and the propagation of flood events) provides information which may be of assistance to landowners and the local community.

Review of Draft Strategy preferred option:

The site surveys and additional studies carried out in this additional package of work have also been used to inform a review of the current draft preferred option recommended by the WW Strategy which is for community and property level resistance and resilience. Further property inspection has shown that traditional Property Level Protection measures such as flood proof doors, air bricks and non-return valves are unlikely to be technically suitable for the majority of properties at most significant risk of flooding. This is because many of the properties are timber chalet style residences that do not lend themselves easily to flood proofing.

Alternative mitigation measures which are likely to be more effective at a property level would include raising floor levels where appropriate, and subject to planning consent (as many properties have already done) to reduce frequency of inundation, and also internal *resilience* measures such as flood resistant

flooring or raising electrics to reduce damage in incidents of flooding. It should be noted that such measures would not qualify for GiA funding however and would need to be paid for by the homeowner. The preferred Strategy option has been updated to this effect. Privately-funded maintenance of existing coastal defences will also be permitted (subject to gaining the necessary consents).

Whether there is solely property level resilience, or the addition of a more formal minor scheme (in the short term), it is clear that in the medium to longer term (post 2060), if climate change and sea level rise occurs as currently projected, the option of continuing to protect Gurnard Luck against flooding will become increasingly difficult to sustain. The community would need to be almost entirely encircled by large raised defences which would be disproportionately costly and it is therefore recommended that the longer term Strategy option, which is to continue to adapt and produce a Coastal Change Management Area plan, remains unchanged. The 2011 *Shoreline Management Plan* policy, of changing from 'Hold the Line' to 'No Active Intervention' in the medium term (from 2025), which reflects the increasing future risks, also remains.

The potential idea of a small scheme to reduce risks to existing properties in the short-medium term is currently unfunded. Therefore the Strategy preferred approach remains to adapt to the current and future flood and erosion risks, as outlined above. However, the potential for a small scheme providing a modest standard of protection has been added to the Strategy Main Report, *if* local funding can be secured to progress the proposal.

- *Please see the finalised wording of the preferred approach for area 5a in Chapter 9 of the Main Strategy Report (and above in the finalised Options Appendix) for full information.*

The question therefore remains of is whether there is universal local support (by all those affected) for recommending implementation of raised defences (to improve the SoP at Gurnard Luck in the short term), and is the required non-GiA funding contribution available to enable the delivery of a scheme?

It is also important to note that in the event of a small scheme being undertaken, adaptation and flood resilience will still be required within the community. Although such a scheme could provide an improved and modest level of protection to existing properties, it would be of a relatively short-term nature. The standard of protection will fall over time (with predicted sea-level rise) and there would also be the risk of a large-scale event exceeding the height of defences. In the longer-term adaptation will still be needed in this low-lying area in the face of increasing risks. Development control would still need to ensure inappropriate development is not permitted due to the declining SoP and the relatively short term nature of the protection provided.

Limitations, uncertainties and assumptions:

Significant uncertainty remains over the potential residual risk posed by fluvial flooding and flooding stemming from tide locking. The data required to fully assess these risks has not been available for this study which has used the best available information (and taken it to the limit of what is achievable at a Strategy level).

Before progressing further with any scheme, it will be key to understand the flood risk interactions to ensure that a potential tidal flood risk reduction scheme would not increase the flood risk from other sources (e.g. the risk of exacerbating the tide locking effect of the Gurnard Luck by potentially impounding additional volumes of water from discharging into the sea), regardless of funding availability. In future, if there is agreed intent to progress a scheme, and if the required contributions could be found, a more detailed appraisal of flood risk would be needed as the first stage to support the development of a funding application (Outline Business Case).

During such appraisals, which would be required prior to the development of the Outline Business Case, the quantitative assessment of these other sources of flooding would be needed and the resulting impacts on the economic and partnership funding appraisal would need to be reflected. The assessment of joint probability of extreme fluvial tidal events will be a key part. If this risk is shown to be significant, further interventions may be needed to mitigate it, or else the benefits currently shown could be diluted and the amount of potential GiA funding may reduce. If further works are needed as part of the scheme to address these other sources of risk, it would increase the cost of the scheme and with it further increase the funding shortfall (contribution required). In addition, wider environmental assessment (including consideration of visual or access impacts) will also need to be needed.

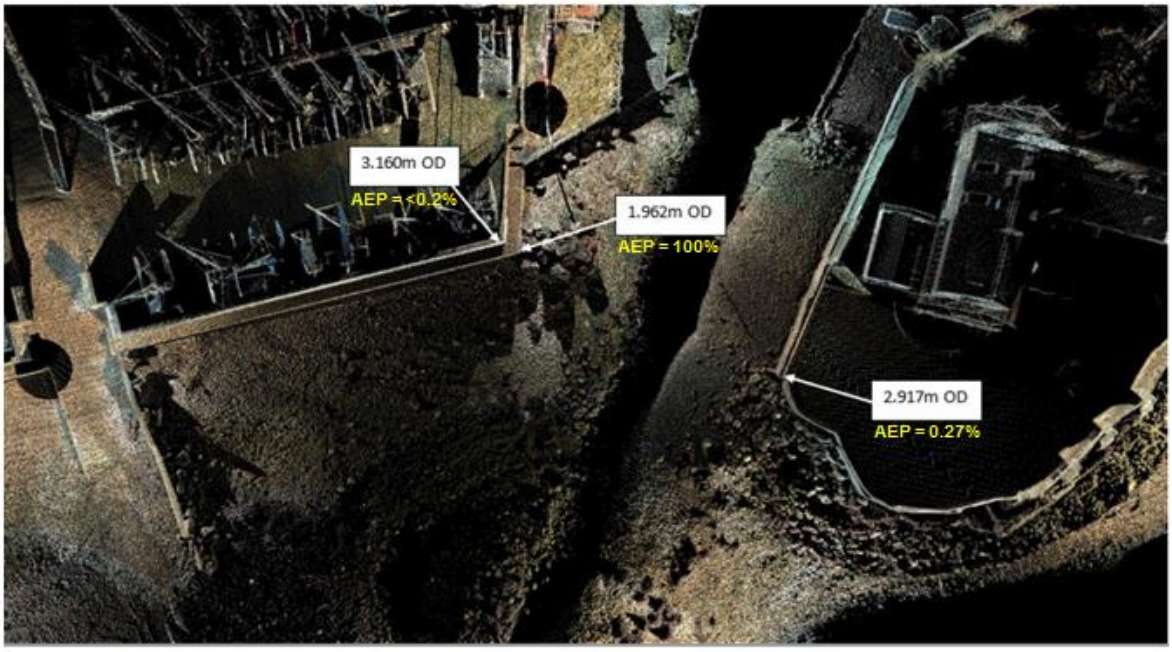
A scheme would require seeking the relevant approvals (including regarding funding, environment and planning), and would be judged in full accordance with relevant policies and procedures at the time.

Cost estimates

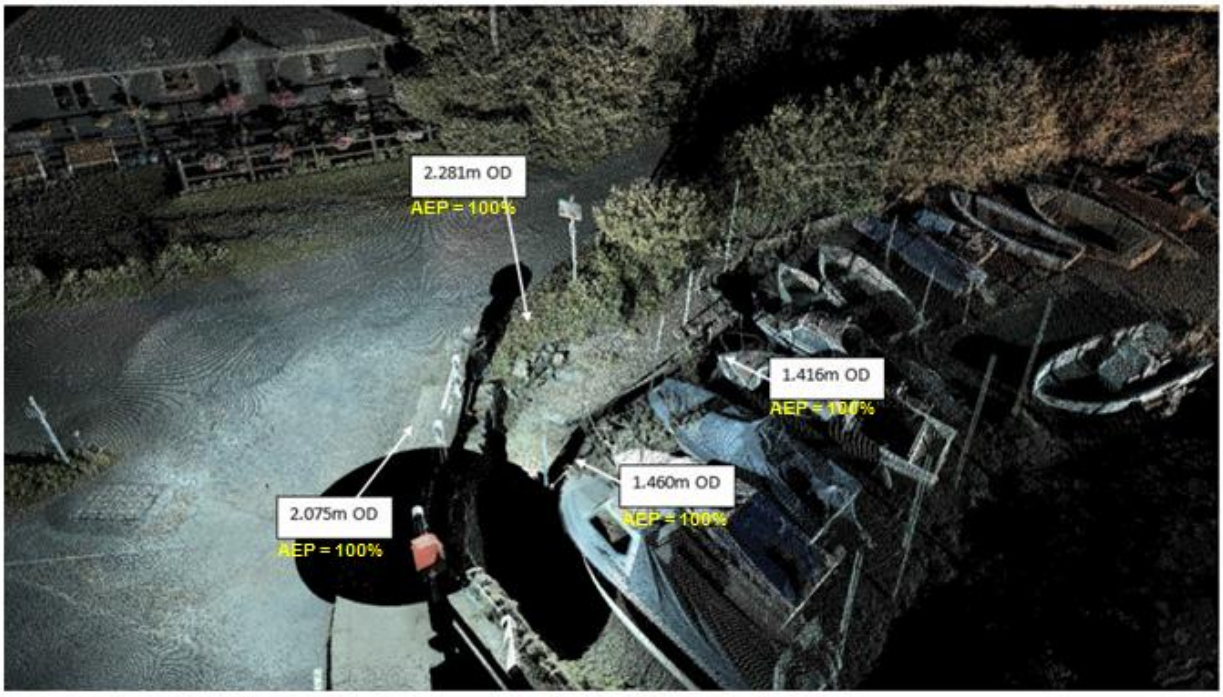
The cost estimates for the schemes put forward in this note follow the standard FCERM Appraisal Guidance including the recommended level of optimism bias of 60% to cover uncertainty and unforeseen risks and cost increases. It could be that alternative lower cost methods or solutions may be feasible, any saving would serve to reduce the contribution required to achieve the required partnership funding score to attain GiA, and would require further full appraisal at Scheme level. It should also be noted that the timing of any Grant in Aid would be uncertain, dependent on national priorities, but the securing of local funding contributions would be fundamental to informing and influencing this allocation process.

Appendix A – Interpretation of tidal Standard of Protection of frontage elevations shown in the CCO laserscan survey

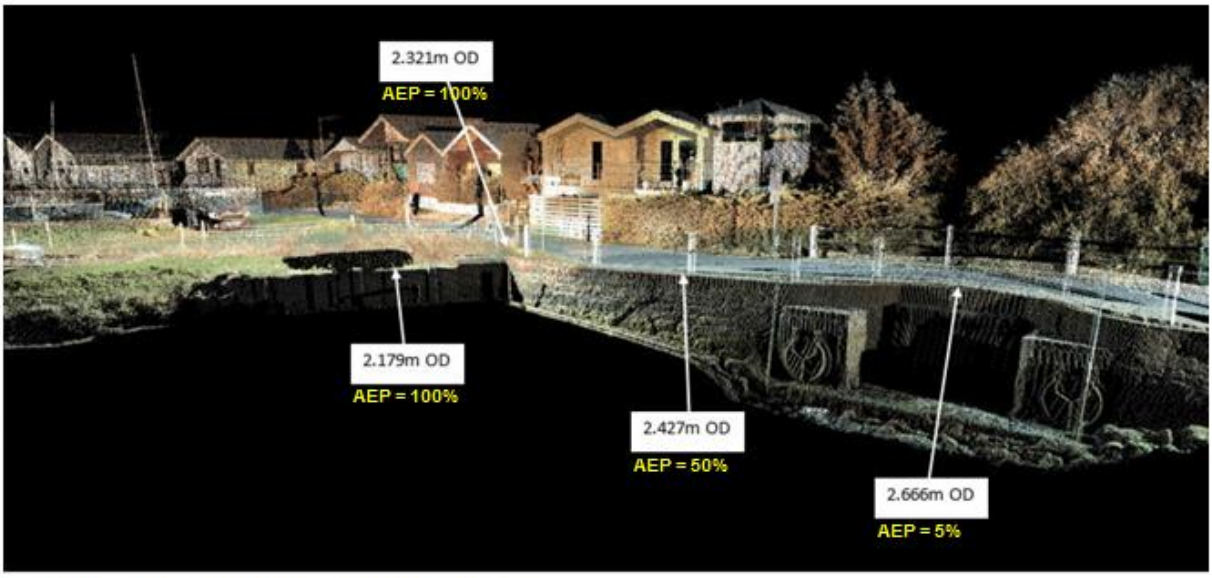
Western Headland



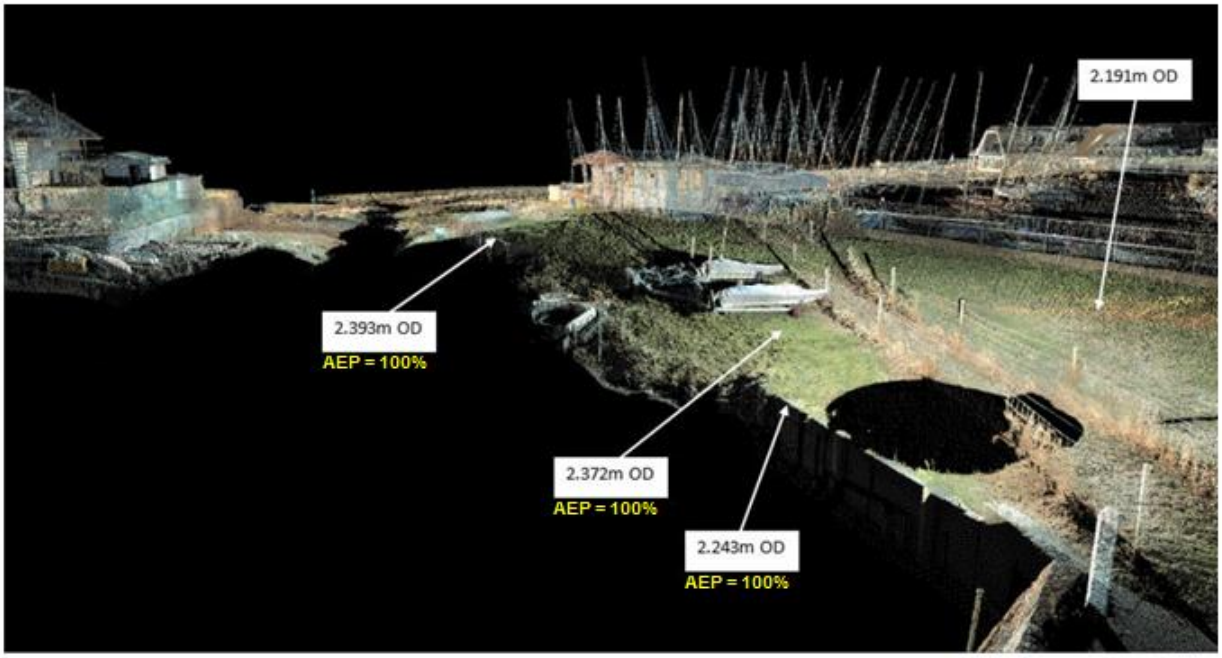
Harbour Entrance



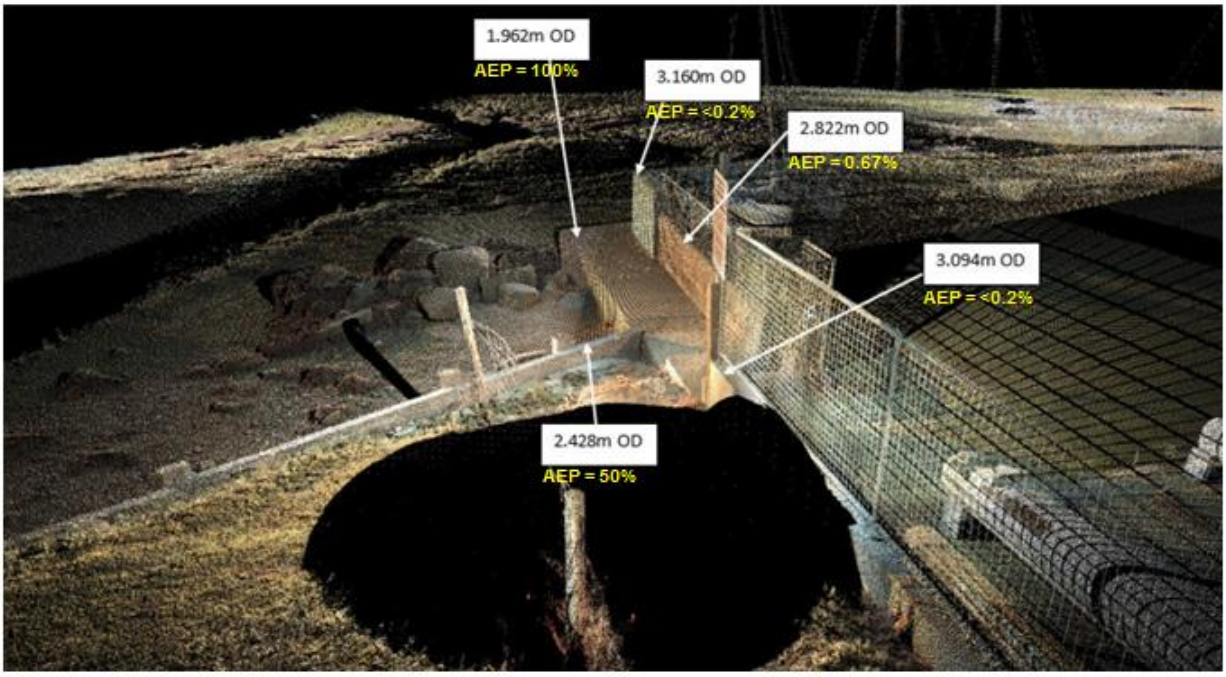
Western shore of the harbour, from the bridge



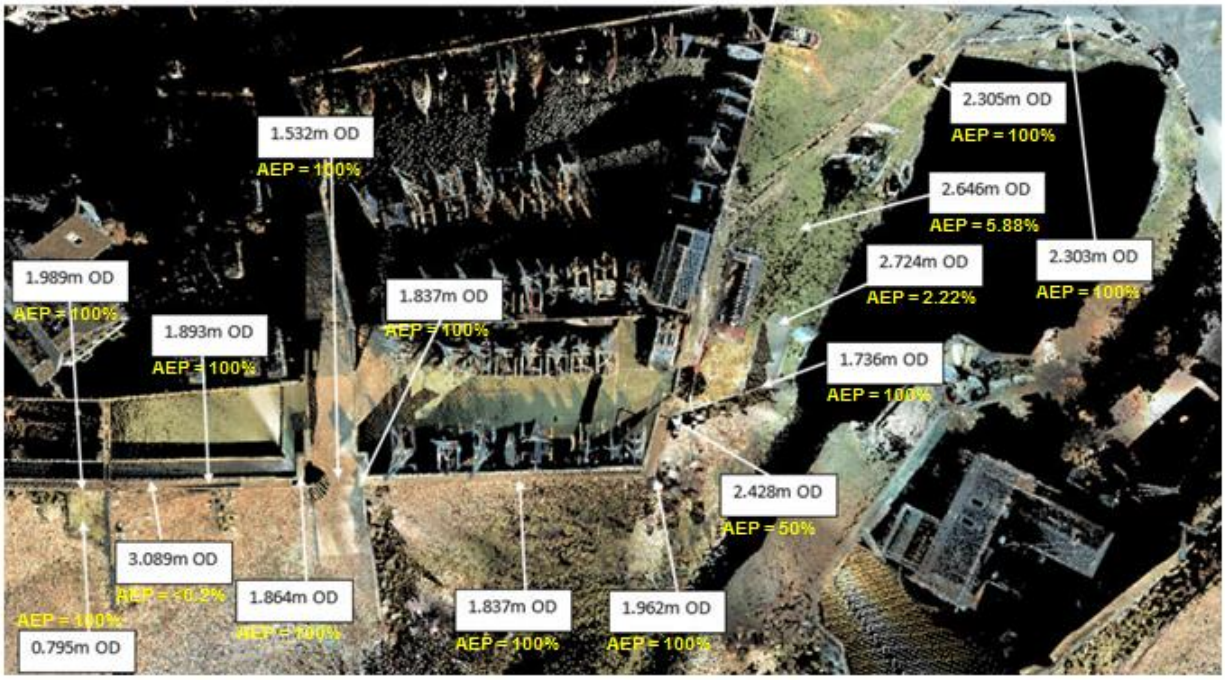
Back of the harbour, looking south east. (Including the road bridge)



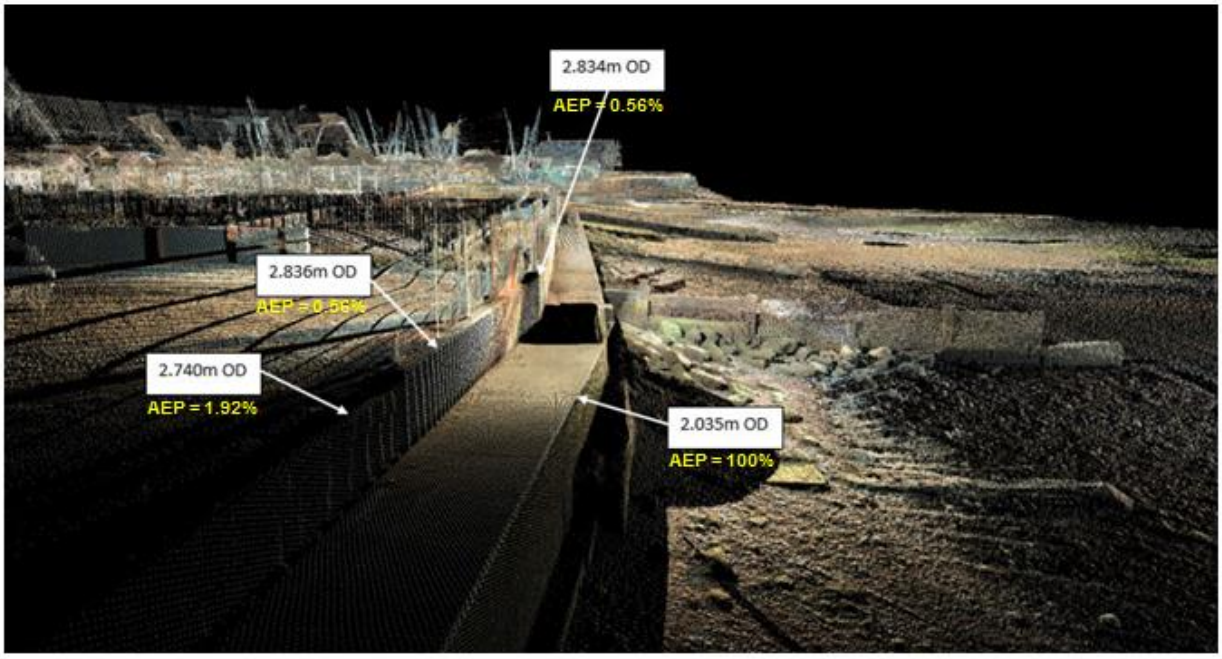
Eastern shore of the harbour, from the bridge



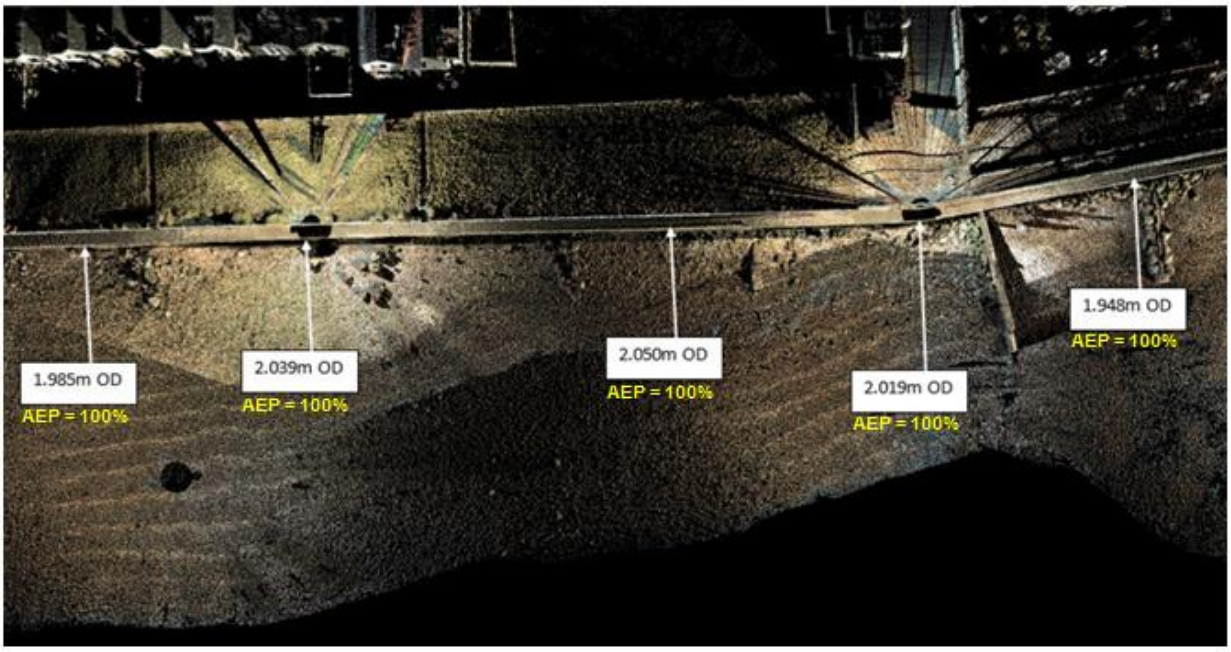
Eastern mouth of the harbour (looking north)



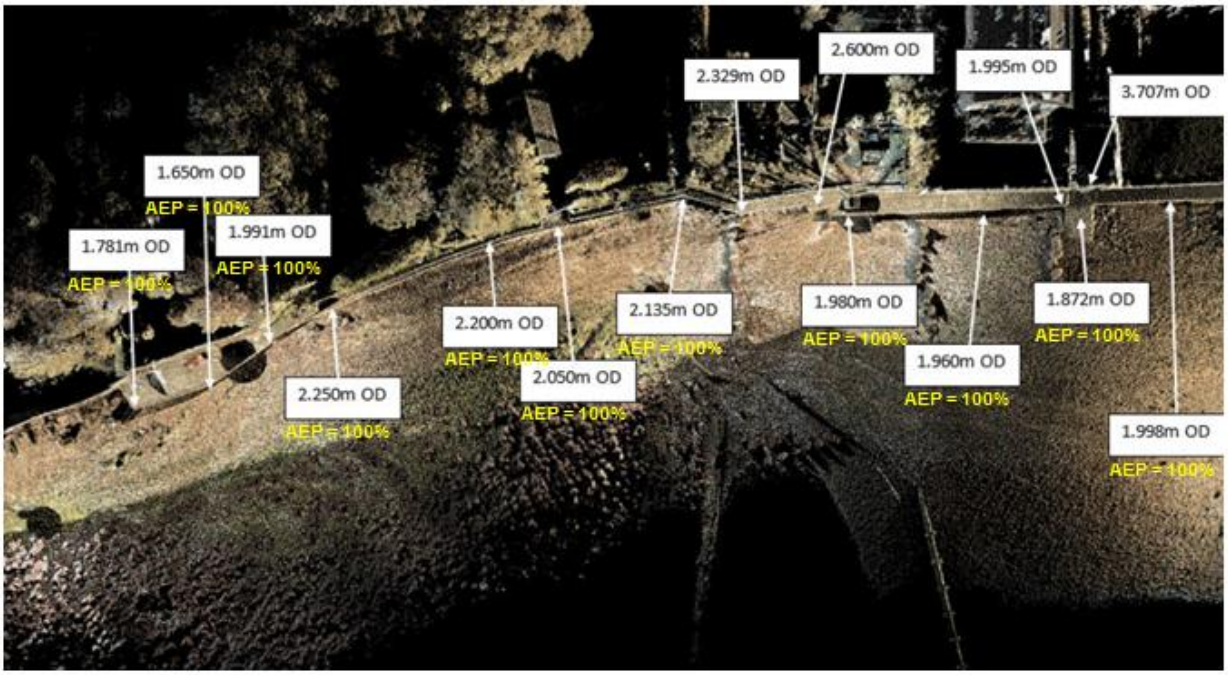
Aerial view of the harbour, boatyard and restaurant frontage



Eastern end of the restaurant frontage (looking west)



Central frontage, in front of the chalets



Eastern end of the frontage