



Medway Estuary and Swale Coastal Flood and Erosion Risk Strategy

Technical Appendix H - Implementation Plan

June 2019

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1 Introduction

The aim of the Medway Estuary and Swale Coastal Flood and Erosion Strategy (hereafter known as MEASS) is to assess how to best manage the coastline to protect people, properties, designated habitat, and agricultural land from coastal flood and erosion risk. As with all flood and coastal risk management work, the wider impacts must be considered. This means that the best technical solutions for defences need to be found, while also considering the impacts and benefits for local communities, the environment, and the cost to the tax payer.

1.1 Why the Strategy is being Developed

There are currently coastal flooding and erosion risks to the communities and landowners around the Medway Estuary and Swale. Aging flood defences, rising sea levels and climate change mean that coastal flood and erosion risk to people, properties, habitat, and agricultural land will significantly increase in the coming years. Over the next 100 years it is predicted that 17,226 properties will be at an increased risk of tidal flooding (up to a 0.1%AEP event) within the MEASS area.

Currently most of the Strategy frontage is defended, especially around the Isle of Sheppey to protect the important port at Sheerness, and along the tidal River Medway to protect the Medway Towns. A significant proportion of the defences in the area are nearing the end of the design lives and the risk of failure during a storm event is high. However, it is not sustainable in the long term to continue to maintain all of the defences in their current position. Therefore, MEASS assesses how this risk can be best managed, in line with government guidance, to deliver the most sustainable FCRM management approach.

The strategy area has large extents of both intertidal and freshwater habitat which are nationally and internationally designated. Intertidal saltmarsh habitat is at risk of reducing in area as sea levels rise, 'squeezing' it against the existing defences. Freshwater habitat is at risk of quality deterioration from the failure of the defences, resulting in the inundation of saltwater, as well as the increased overtopping which could be associated from sea level rise. Therefore, MEASS is also legally obliged to assess how the adverse impacts to these designated habitats can be mitigated by realigning defences or creating compensatory areas in other locations.

1.2 Strategy Area

The Strategy area includes the Isle of Sheppey, the tidal extents of the Medway Estuary and the Swale estuary. The boundaries of the strategy area are:

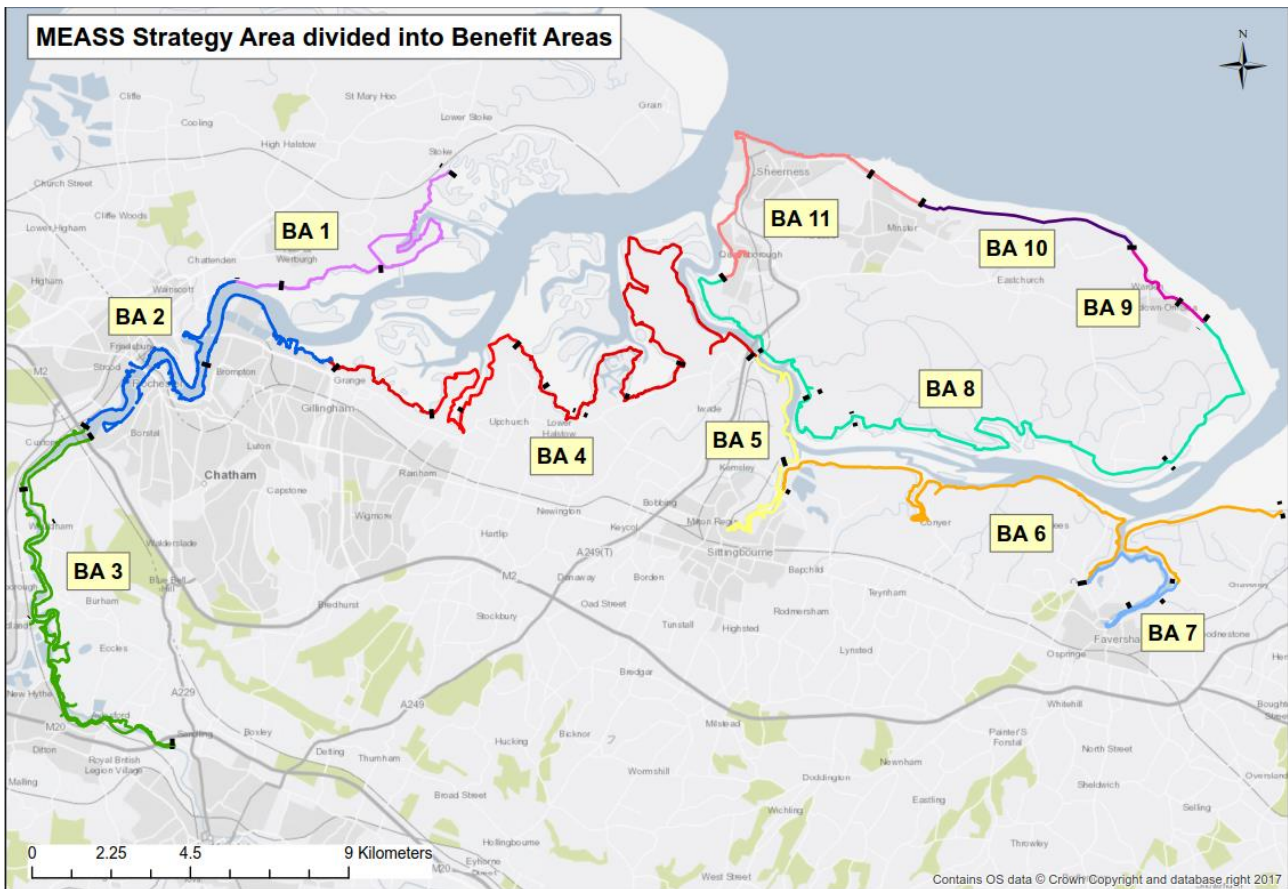
- Allington Sluice as the upstream tidal limit of the Medway;
- the village of Stoke on the Hoo Peninsula; and
- the Sportsman Public House on Cleve Marshes near Faversham.

MEASS encompasses the large urban areas of the Medway Towns including Rochester, Strood, Chatham and Gillingham; major industrial and commercial areas along the estuaries; and large swathes of rural farmland and extensive salt marsh and mudflats. Many of the rural areas are highly designated and protected for their heritage, landscape and environmental value.

1.2.1 Benefit Areas

As the Strategy frontage is approximately 120km in length, and there are complex interactions between the different land uses, the MEASS area has been broken down into 11 Benefit Areas (BAs) based on the extent of discrete flood cells. These BAs have been broken down further into 35 sub-Benefit Areas based on the SMP Policy Units (Figure 1).

Figure 1: The division of the frontage into 11 BAs and 35 sub BAs based on discrete flood cells (determined from modelling) and land use.



Source: Mott MacDonald, 2017. Contains Ordnance Survey Data © Crown copyright and database right 2015

1.3 Aims of the Strategy

MEASS assesses and considers a variety of economic, environmental, and technical approaches to manage the coastal flood and erosion risk, in order to balance the wide range of features and interests within the area.

The vision statement of MEASS is to “*work with the community to plan how we will sustainably reduce flood risk to 17,226 homes in the Medway Estuary, Swale and Sheppey over the next 100 years (under a 0.1%AEP event), whilst also protecting and enhancing the local environment.*”

Building on this vision statement a series of primary and secondary objectives for MEASS have been developed (Table 1) to drive the delivery of an effective FCRM strategy which supports as many local plans and aspirations as possible.

Table 1: MEASS Primary and Secondary Objectives

Primary Objectives	Secondary Objectives
1) Reduce flood and erosion risk to properties and infrastructure at significant or very significant risk in light of coastal change over the next 100 years.	3) Favour options that reduce the whole life costs of current defences.
2) Maintain the integrity of Natura 2000 sites (protected under the Habitat and Birds Directives) assuming the loss due to coastal squeeze of 113ha of saltmarsh habitat between years 0-20 and a further 140ha of saltmarsh habitat between years 20-50.	4) Favour options that support delivery of the Thames River Basin Management Plan. 5) Help enable local plan objectives to be realised where possible.

1.4 Key Strategy Risks

Key delivery risks for the strategy cover the large amount of third party funding required, and delivery of the intertidal and freshwater compensatory habitat required under the Habitats Regulation Assessment. A more detailed risk register has been used to undertake a Monte Carlo calculation (provided in Technical Appendix N of the Strategy) and detailed risk and mitigation tables for each frontage is provided in Appendix A of this Implementation Plan. The key risks and mitigations for the strategy are presented below in Table 2.

Table 2: High level risk schedule and mitigation

Key project risk	Adopted mitigation measure
Achieving required third party funding.	The KSL Area Team will specifically focus on the requirements for third party funding over the first five years of strategy implementation. An Integrated Landscape and Green Infrastructure Study is proposed for the first 3 years of the strategy to inform the work to identify wider opportunities and partnership funding.
Creating required intertidal compensatory habitat for SPA and Ramsar losses of saltmarsh in the estuary due to coastal squeeze.	Managed realignment sites have been identified to provide compensatory habitat. Precautionary figures have been used from modelling results to estimate saltmarsh creation within the site. There will be ongoing monitoring of the sites. Should there be any issues, additional habitat elsewhere or bringing forward other sites.
Providing required compensatory habitat due to adverse impacts on freshwater designated habitat from increased flooding or overtopping.	Freshwater habitat compensation has been identified (most of it likely to be Great Bells Farm for the first 10 years), however costs to provide freshwater compensation elsewhere has been included in the case that Great Bells Farm is not suitable.
A high spend and resources are required to undertake the schemes proposed initially in the strategy.	An exercise has been undertaken with the KSL Area Team to prioritise schemes initially identified to be undertaken over the first three years of the strategy. These have now been phased over the first 10 years of the strategy. Appendix H Implementation Plan details the priority of schemes so if they need to be moved forwards or backwards key requirements are clear to inform these decisions.
The proposals for the Solar Farm at Cleve Hill are progressed.	Chetney marshes adaptation policy could be accelerated with additional management/ breaches to create intertidal habitat earlier.
Impacts on BAP habitat at Wouldham marshes due to NAI policy.	Assessment of the alternatives at Wouldham Marshes show that there is no funding available to continue to maintain the defences. Future opportunities to mitigate damage from flooding will be reviewed as part of the KSL Habitat Creation Programme.
Uncertainty regarding landowner management plans in NAI areas – impacts on coastal squeeze and freshwater compensation requirements.	A precautionary approach has been adopted here and requirements for both coastal squeeze compensation as well as freshwater habitat compensation has still been calculated in areas of NAI.
Tailness Marsh modelling - impact on surrounding saltmarsh is greater than the expected gains.	If Tailness Marshes not taken forward, the compensation would only be short by under 1ha. This could be provided within existing sites through additional landscaping.
Achieving funding for the moderation cases.	The moderation cases require funding to maintain defences, despite the low value of benefits in the area. Early discussions with the Large Projects Review Group (LPRG) should be undertaken to ensure these cases can be delivered.

1.5 Aims of this Implementation Plan

This Implementation Plan forms an appendix to MEASS and sits alongside the Strategy to provide an outline of the key activities the Lead Local Flood Authority (Environment Agency/ Local Authority) need to undertake to implement the preferred Strategy options. The Implementation Plan coordinates information from across the Strategy Technical Appendices and presents actions, timeframes and risks associated with taking the Strategy forward. It presents information, mitigations and actions specifically from the economic assessment, Strategic Environmental Assessment and option development work that has been undertaken as part of MEASS.

The specific aims of the Plan are:

- Facilitate delivery of the FCRM programme by providing information on the key obstacles, processes, dependencies (internal and external) and activities required to enable this;
- To provide information on each BA section regarding activities, risks and dependencies;
- To provide a summary of the information required to form the business case for capital schemes, particularly those planned for the next ten years;
- Highlight key programme risks in taking the Strategy forward; and
- To summarise information to help the KSL Area Team in their assessments of planning applications.

The Implementation Plan is split into the following Sections:

- **Section 2 - Overview of the expenditure programme**
- **Section 3 - Actions and activities required for Strategy wide activities**
- **Section 4 - Actions and activities required for capital schemes**
- **Section 5 - Actions and activities required for capital Managed Realignment (MR) schemes**
- **Section 6 - Actions and activities required for freshwater designated sites**
- **Section 7 - Actions and activities required for ongoing maintenance**
- **Section 8 - Actions and activities required for No Active Intervention policy**
- **Appendices** – provide a detailed implementation plan for each BA.

1.6 Who will use this Implementation Plan?

There are a number of potential users of the Implementation Plan. Key teams are outlined in Table 3 below, but other teams within the Environmental Agency will be involved as schemes develop out of the Strategy.

Table 3: Key teams involved in implementation of MEASS

Team Name	Key Role in Strategy Implementation
KSL (Kent and South London) Area Team	Own Implementation Plan and overall delivery of the Strategy. Also includes programming teams and habitat advisory teams. Importantly, the KSL Team lead the South East Regional Habitat Creation Programme which will lead on the Managed Realignment sites and Freshwater Compensation requirements.
ncpms (National Capital Programme Management Service)	Undertake project management role in delivery of SOC, OBC, FBC, detailed design and construction of larger schemes at the request of KSL Area Team.
NEAS (National Environmental Assessment Service)	Screening at SOC stage to determine NEAS involvement of Capital Schemes. General advisor to KSL Team in environmental related matters. Can help coordinate inputs from different environmental specialists and provide Environmental Project Managers for jobs. NEAS have landscape and heritage specialists, and there is also a NEAS Area lead for KSL.
Legal and Estates	All legal and land ownership advice. Will be particularly involved where there is a need for advice regarding landowners, for managed realignment schemes, when discussing compensation, looking at legal agreements and setting up heads of terms for partnership funding agreements.

Team Name	Key Role in Strategy Implementation
Environment and Business (E&B)	Specialist advice to different projects.
Fisheries, Biodiversity and Geomorphology (part of E&B)	Specialist advice to different projects. They sit as part of the KSL Area Team.
Environment Programming and Engagement (EPE)	WFD funding spend and programming. Specialist advice to different projects.
Estuarine and Coastal Monitoring and Assessment Service (ECMAS)	Water Framework Assessment advice.
Engagement Team	Provide specialist assistance with stakeholder engagement for big projects or projects with specific issues or concerns around engagement.
Communications Team (part of DEFRA)	Support to project when issuing press releases or social media updates which go external to the Environment Agency.
Procurement (part of DEFRA Commercial Team)	Involved in all procurement as part of the Strategy activities.

1.7 How to use this Implementation Plan

Table 4 summarises how to use the Implementation Plan.

Table 4: Key aspects of the Implementation Plan

Sections	Key use of information
Section 1 - Introduction	Provides background to project and introduction to report if user isn't familiar with MEASS.
Section 2 - Overview of capital spend	Clearly sets out the timing/phasing of capital flood defence and managed realignment schemes.
Sections 3 to 8 – Activities and Actions	To find out overall approach for particular types of management policies.
Appendix A – Detailed Implementation Plan	To find out information relating to specific Benefit Area sections. Actions and information should be reviewed alongside relevant management policy section in Sections 3 to 8.
Appendix B	Additional supporting information.

2 Overview of the Implementation Plan

This section provides the overview of the annual activity, and cost (£k), required for each of the BAs to undertake:

- Strategy Wide Freshwater Compensation Assessment
- Capital Flood and Erosion Risk Management Schemes
- Capital MR Schemes (Intertidal Compensation)

Section 2.1 then presents a more detailed implementation table for capital schemes planned for the first ten years.

MEASS Implementation Plan - Overview of Capital Schemes (defence improvements and Managed Realignment sites) as well as Freshwater Compensation costs

	Year - Cost in £k (Cash Cost)																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Strategy Wide: Freshwater Compensation	-	-	-	-	1,827	6,045	-	-	-	3,867	-	-	-	-	-	3,364	-	-	-	-
BA1.2: Capital Scheme	-	-	-	-	-	100	500	6,420	6,420	-	-	-	-	-	-	-	-	-	-	-
BA1.3: Capital MR Scheme	-	-	-	-	-	-	-	-	100	198	3,295	-	-	-	-	-	-	-	-	-
BA2.1: Capital Scheme	-	-	-	-	-	-	100	500	4,534	4,534	-	-	-	-	-	-	-	-	-	-
BA2.2: Capital Scheme	-	-	-	-	-	81	122	2,029	-	-	-	-	-	-	-	-	-	-	-	-
BA2.3: Capital Scheme	-	-	100	442	3,679	3,679	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA3.2: Capital Scheme	-	-	-	-	-	-	-	80	200	561	-	-	-	-	-	-	-	-	-	-
BA3.2: Capital MR Scheme	-	-	100	156	2,606	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA3.3: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	500	4,564
BA3.4: Capital Scheme	-	-	-	-	-	100	287	2,391	2,391	-	-	-	-	-	-	-	-	-	-	-
BA4.1: Capital Scheme	-	-	-	-	-	83	125	2,086	-	-	-	-	-	-	-	-	-	-	-	-
BA4.1: Capital MR Scheme	-	-	60	150	698	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA4.4: Capital Scheme	-	-	-	-	-	-	-	65	97	405	-	-	-	-	-	-	-	-	-	-
BA4.7: Capital MR Scheme	-	-	100	150	1,021	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA5.1: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	367	6,116
BA5.2: Capital Scheme	-	-	100	192	1,600	1,600	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA5.2: Capital MR Scheme	-	-	60	150	1,328	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA6.1: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	500	6,032	6,032	-	-
BA6.2: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50	100	622
BA6.2: Capital MR Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	500	500	13,374
BA7.2a: Capital Scheme	-	-	-	-	-	100	163	2,720	-	-	-	-	-	-	-	-	-	-	-	-
BA7.2b: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	41	62	1,031
BA8.2: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	310	5,167
BA8.3: Capital Scheme	-	-	-	-	-	-	-	-	100	500	6,681	6,681	-	-	-	-	-	-	-	-
BA8.3: Capital MR Scheme	-	-	80	150	1,822	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA8.4: Capital MR Scheme	-	-	60	150	1,463	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA9.1: Capital Scheme	100	500	2,528	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA9.2: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	98	147	2,449
BA10.1: Property Adaptation	100	500	440	-	-	473	-	-	-	-	158	-	-	-	-	315	-	-	-	712
BA11.1: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	34	51	856	-	-	-	-
BA11.2: Capital Scheme	100	500	4,333	4,333	-	-	-	-	-	-	-	-	-	53	80	1,336	-	-	-	-
Total	300	1,500	8,061	6,071	19,339	12,261	1,297	16,292	13,743	9,866	6,839	6,681	-	88	231	6,370	6,032	7,021	1,986	34,036
Optimism Bias (60%)	180	900	4,837	3,643	11,604	7,357	778	9,775	8,246	5,919	4,103	4,009	-	53	139	3,822	3,619	4,213	1,191	20,421

MEASS Implementation Plan - Overview of Capital Schemes (defence improvements and Managed Realignment sites) as well as Freshwater Compensation costs

	Year - Cost in £k (Cash Cost)																			
	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058
Strategy Wide: Freshwater Compensation	-	-	-	-	18,087	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA1.2: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA1.3: Capital MR Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA2.1: Capital Scheme	-	-	-	-	-	10	20	91	-	-	-	-	-	-	-	-	-	-	-	-
BA2.2: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA2.3: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA3.2: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA3.2: Capital MR Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA3.3: Capital Scheme	4,564	-	-	-	-	-	-	-	-	-	-	-	-	-	30	50	247	-	-	-
BA3.4: Capital Scheme	-	-	-	-	-	30	50	298	-	-	-	-	-	-	-	-	-	-	-	-
BA4.1: Capital Scheme	-	-	-	-	-	30	50	16	-	-	-	-	-	-	-	-	-	-	-	-
BA4.1: Capital MR Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA4.4: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA4.7: Capital MR Scheme	6,375	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA5.1: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA5.2: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA5.2: Capital MR Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA6.1: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA6.2: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA6.2: Capital MR Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA7.2a: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA7.2b: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA8.2: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA8.3: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA8.3: Capital MR Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA8.4: Capital MR Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA9.1: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA9.2: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA10.1: Property Adaptation	-	-	-	-	-	959	-	-	-	-	498	-	-	-	-	803	-	-	-	-
BA11.1: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA11.2: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	10,939	-	-	-	18,087	1,029	120	405	-	-	498	-	-	-	30	853	247	-	-	-
Optimism Bias (60%)	6,564	-	-	-	10,852	617	72	243	-	-	299	-	-	-	18	512	148	-	-	-

MEASS Implementation Plan - Overview of Capital Schemes (defence improvements and Managed Realignment sites) as well as Freshwater Compensation costs

	Year - Cost in £k (Cash Cost)																			
	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078
Strategy Wide: Freshwater Compensation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA1.2: Capital Scheme	-	-	-	-	-	-	-	100	278	4,634	-	-	-	-	-	-	-	-	-	-
BA1.3: Capital MR Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA2.1: Capital Scheme	-	-	-	-	-	-	-	100	500	9,033	-	-	-	-	-	-	-	-	-	-
BA2.2: Capital Scheme	-	-	-	-	-	-	-	100	250	4,174	-	-	-	-	-	-	-	-	-	-
BA2.3: Capital Scheme	-	-	-	-	-	-	-	100	250	4,163	-	-	-	-	-	-	-	-	-	-
BA3.2: Capital Scheme	-	-	-	-	-	-	-	19	29	481	-	-	-	-	-	-	-	-	-	-
BA3.2: Capital MR Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA3.3: Capital Scheme	-	-	-	-	-	-	-	100	354	5,903	-	-	-	-	-	-	-	-	-	-
BA3.4: Capital Scheme	-	-	-	-	-	-	-	100	268	4,466	-	-	-	-	-	-	-	-	-	-
BA4.1: Capital Scheme	-	-	-	-	-	-	-	73	110	1,833	-	-	-	-	-	-	-	-	-	-
BA4.1: Capital MR Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA4.4: Capital Scheme	-	-	-	-	-	-	-	30	50	167	-	-	-	-	-	-	-	-	-	-
BA4.7: Capital MR Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA5.1: Capital Scheme	-	-	-	-	-	-	-	100	167	2,778	-	-	-	-	-	-	-	-	-	-
BA5.2: Capital Scheme	-	-	-	-	-	-	-	100	169	2,820	-	-	-	-	-	-	-	-	-	-
BA5.2: Capital MR Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA6.1: Capital Scheme	-	-	-	-	-	-	-	100	241	4,009	-	-	-	-	-	-	-	-	-	-
BA6.2: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA6.2: Capital MR Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA7.2a: Capital Scheme	-	-	-	-	-	-	-	86	129	2,144	-	-	-	-	-	-	-	-	-	-
BA7.2b: Capital Scheme	-	-	-	-	-	-	-	30	50	390	-	-	-	-	-	-	-	-	-	-
BA8.2: Capital Scheme	-	-	-	-	-	-	-	100	188	3,138	-	-	-	-	-	-	-	-	-	-
BA8.3: Capital Scheme	-	-	-	-	-	-	-	100	170	2,839	-	-	-	-	-	-	-	-	-	-
BA8.3: Capital MR Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA8.4: Capital MR Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA9.1: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA9.2: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA10.1: Property Adaptation	699	-	-	-	-	702	-	-	-	544	-	-	-	-	-	709	-	-	-	-
BA11.1: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA11.2: Capital Scheme	-	-	-	-	-	-	-	100	324	5,407	-	-	-	-	-	-	-	-	-	-
Total	699	-	-	-	-	702	-	1,438	3,527	58,922	-	-	-	-	-	709	-	-	-	-
Optimism Bias (60%)	419	-	-	-	-	421	-	863	2,116	35,353	-	-	-	-	-	425	-	-	-	-

MEASS Implementation Plan - Overview of Capital Schemes (defence improvements and Managed Realignment sites) as well as Freshwater Compensation costs

	Year - Cost in £k (Cash Cost)																			
	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098
Strategy Wide: Freshwater Compensation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA1.2: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA1.3: Capital MR Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA2.1: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	30	50	328	-	-	-	-
BA2.2: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA2.3: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA3.2: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA3.2: Capital MR Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA3.3: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	30	50	93	-	-	-	-
BA3.4: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	31	46	772	-	-	-	-
BA4.1: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	30	50	92	-	-	-	-
BA4.1: Capital MR Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA4.4: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA4.7: Capital MR Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA5.1: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA5.2: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA5.2: Capital MR Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA6.1: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA6.2: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA6.2: Capital MR Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA7.2a: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA7.2b: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA8.2: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA8.3: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA8.3: Capital MR Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA8.4: Capital MR Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA9.1: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA9.2: Capital Scheme	-	-	-	-	-	-	-	30	50	145	-	-	-	-	-	-	-	-	-	-
BA10.1: Property Adaptation	565	-	-	-	-	440	-	-	-	-	79	-	-	-	-	473	-	-	-	-
BA11.1: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BA11.2: Capital Scheme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	565	-	-	-	-	440	-	30	50	145	79	-	-	121	196	1,758	-	-	-	-
Optimism Bias (60%)	339	-	-	-	-	264	-	18	30	87	47	-	-	73	118	1,055	-	-	-	-

2.1 Ten year implementation plan

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Capital Schemes for Flood and Erosion Protection (cash cost in £k)										
BA1.2: Kingsnorth						100	500	6,420	6,420	
BA2.1: Strood							100	500	4,534	4,534
BA2.2: Rochester						81	122	2,029		
BA2.3: St Mary's Island			100	442	3,679	3,679				
BA3.2: Halling								80	200	561
BA3.4: Aylesford to Wouldham						100	287	2,391	2,391	
BA4.1: Riverside Country Park						83	125	2,086		
BA4.4: Ham Green								65	97	405
BA5.2: Sittingbourne			100	192	1,600	1,600				
BA7.2a: Faversham						100	163	2,720		
BA8.3: South of Sheppey									100	500
BA9.1: Leysdown	100	500	2,528							
BA10.1: Minster Cliffs Property Adaptation	100	500	440			473				
BA11.2: Sheerness	100	500	4,333	4,333						
Total Cash Cost (£k)	300	1,500	7,501	4,967	5,279	6,216	1,297	16,291	13,742	6,000
Risk (60% Optimism Bias) (£k)	180	900	4,501	2,980	3,167	3,730	778	9,775	8,245	3,600
Capital Schemes - Managed Realignment Schemes (cash cost in £k)										
BA1.3: Abbots Court MR Site										100
BA3.2: Halling MR Site			100	156	2,606					
BA4.1: Danes Hill MR Site			60	150	698					
BA4.7: Tailness MR Site			100	150	1,021					
BA5.2: Kemsley MR Site			60	150	1,328					
BA8.3: Spitend MR Site			90	150	1,822					
BA8.4: Elmley MR Site			60	150	1,463					
Total Cash Cost (£k)			470	906	8,938					100
Risk (60% Optimism Bias) (£k)			282	544	5,363					60
OM2s realised (number houses better protected)				6,161		916		154	99	115
OM3s realised* (number houses better protected)			183							
Intertidal habitat created (ha)					29					

*Note these currently do not include any houses "better protected" from the adaptation policy in BA10.1 as it is not certain that these can be counted as OM3s

3 Strategy Wide Actions and Activities

To allow the Strategy to be implemented successfully there are several strategy-wide tasks that will be undertaken, following the approval of the Strategy and throughout the lifetime of the Strategy.

There are many assumptions that the Strategy is based upon and that are likely to change over time. Ongoing monitoring and review of these will be undertaken during five-yearly Strategy reviews. Assumptions and details regarding the crest levels are presented within Technical Appendix D: Option Report (2018).

Key indicators have been identified which need monitoring and updating during the lifetime of the Strategy. Table 5 outlines these key indicators and the monitoring required, however the KSL Area Team will develop this into a monitoring plan at the start of the Strategy implementation which will also identify specific timings and areas, trigger points, data collection methods and data formatting requirements. Any updates and changes assessed by the KSL Area Team will be distributed to the key stakeholders identified in Technical Appendix L of the Strategy. It is to be noted that the key Strategy assumptions are detailed within the relevant Strategy Technical Appendices.

Table 5: Indicators to be reviewed throughout the Strategy lifetime.

Indicator	Monitoring required
Sea Level Rise predictions in modelling.	5 year reviews of Strategy to assess updated SLR projections. Changes to local/regional sea level rise projections will affect: <ul style="list-style-type: none"> - Designs (specifically the required crest heights); - Coastal squeeze calculations and therefore required compensation; and - Modelling including areas of increased water flow velocities and sediment concentrations.
Extreme events	Our knowledge of extreme events and probabilities of events occurring improves with more data and alters with changing climates. Should particular events start becoming more frequent, this affects the economics of the Strategy and the overall business case to protect to a particular standard of protection. Designs and crest levels will need to be altered as extreme event calculations get updated. If changes are in the region of +/- 10mm, then the Strategy would not require updating but parameters for OBC/detailed design of crest levels would be updated. Updates will be undertaken during the 5 yearly strategy reviews.
Condition of defences	The timing, cost and nature of works identified for different sections is very closely related to the understood condition of the defences. For the Strategy, this has been based on the AIMs data base. A condition survey will be undertaken as part of Strategic Outline Cases. The residual lives will then be compared with the residual lives set out in the ASTs (Technical Appendix E of MEASS). Should the residual life be five or more years earlier, or at very poor level, the timing of the works will be reassessed. Furthermore, should heavy rainfall or a large storm cause deterioration of defence condition more quickly than expected, emergency works will be undertaken if required.
Freshwater compensation for designated sites – uncertainty as to specific requirements.	Freshwater site surveys will be undertaken between 2018 and 2020. Detailed information regarding what is at risk will feed into the detailed compensatory habitat plans. Further details regarding environmental surveys is provided in Section 3.1.
Impacts of increased overtopping on HTL: Maintain and MR: Habitat Adaptation Sites.	Regular ongoing monitoring of freshwater habitat within the Strategy area over the longer term will be undertaken. Should adverse effects and deterioration be seen which are greater or earlier to that which has been projected in the Appropriate Assessment, additional compensation requirements will be identified. This compensation has been costed and programmed within the Strategy, however the actual programme required may change, particularly when considering sites at risk from impacts in the longer term.
Reaction of saltmarsh in the estuary to sea level rise.	During 5 year reviews of the Strategy, the evolution of the saltmarsh in the estuary will be compared to the modelling and Coastal Squeeze Study (Mott MacDonald, 2016).

Indicator	Monitoring required
	The current assumptions within the coastal squeeze calculations are that there is no increased erosion of saltmarsh, and there is no increased deposition leading to growth of saltmarsh, but that the saltmarsh loss is purely related to rising sea levels. This may not be the case, and therefore the coastal squeeze figures may be either over or under estimated.
Landowner actions in NAI areas.	If discussions lead to a landowner taking over maintenance and responsibility for defences, a review will be undertaken to determine whether compensation is required for freshwater impacts. Currently the Strategy assumes that under NAI, even if the landowner maintains the defences, this may not be to the required levels and the EA is still responsible for compensation of habitat where required.
Development of compensatory habitat (intertidal and freshwater)	Annual surveys for a minimum of 5 years following completion of construction of the compensation site will be undertaken, and then in line with monitoring plan for the site, to monitor that the required compensatory habitat develops and that the site can be designated as required from the Implementation Plan.

In addition to the indicators presented in Table 5, it is recommended that a review is required in 2021 (halfway to implementation of managed realignment sites) of the Strategy implementation programme. This will check that the managed realignment and freshwater sites are being delivered by the year they are required, and if not, appropriate measures will be put in place. This could include accelerating other schemes, or implementing some of the additional managed realignment sites which were reviewed as part of the Strategy, but were not the Preferred Option (see Technical Appendix G of the Strategy – Economic Assessment Report).

The Strategy risk register will remain a live document that is regularly reviewed and updated by the KSL Area Team, which will be used and expanded upon for each of the individual projects.

3.1 Environmental Surveys and Monitoring

The Strategic Environmental Assessment (SEA) (Technical Appendix J) provides the background to the environmental risks and mitigation requirements, as well as maps of key environmental indices. Further, the Appraisal Summary Tables (Technical Appendix E of the Strategy) provide information regarding the different environmental indicators for each Benefit Area. The surveys have been split into different themes depending on priority and details:

- Priority 1 – Freshwater surveys for NAI and MR sites in first 10 years
- Priority 2 – SPA and Ramsar designated saltmarsh surveys
- Priority 3 – Surveys for schemes to be undertaken in first 5 years
- Priority 4 – Longer term freshwater surveys
- Priority 5 – Specific scheme surveys

3.1.1 Priority 1 - Freshwater surveys for NAI and MR sites in first 10 years

The immediate requirements for environmental surveys is to survey freshwater SPA, Ramsar and SSSI habitat which will be at risk from deterioration due to either NAI or MR in the first 10 years of the Strategy. These surveys are currently being planned and will be undertaken by the KSL Area Team between 2019 and 2021 to collect at the minimum two seasons of data. The surveys will cover the interest features of the designated site as well as Phase 2 botanical surveys. The areas which will be covered by these surveys include:

- BA1.3 Hoo – Freshwater habitat within Abbots Court MR site
- BA4.2a Motney Hill to Ham Green – Freshwater habitat at risk from 2027 due to NAI
- BA8.3 South Sheppey – Freshwater habitat at Spitend MR site
- BA8.4 Elmley Round Hills – Freshwater habitat at Elmley MR site
- Great Bells Farm – as a freshwater compensation site

The EA's local team Habitat Creation Programme (HCP) lead will develop a more specific plan detailing funding and scope of surveys in the first year of implementation. A draft of this has already been completed and there is an indicative allocation of £162,000 over the first 2 years to survey 4 sites. Since funding can be limited, a prioritisation exercise has been undertaken assessing the above areas to reduce risks should funding be reduced. This exercise has determined the initial priority should be focussed on Great Bells Farm, before assessing the other areas (which are still Priority 1 areas and required surveys to allow the Strategy to progress). The work will be managed as part of the Area Habitat Creation Programme and delivered using the EA's framework contracts.

3.1.2 Priority 2 – SPA and Ramsar designated saltmarsh surveys

The KSL Area Team are looking to do an assessment of saltmarsh loss over the last decade with Geomatics for both the Thames and Medway estuaries. This work will be undertaken and then compared with the Coastal Processes Study (see Technical Appendix J) to confirm or amend intertidal habitat compensation requirements.

3.1.3 Priority 3 - Surveys for schemes to be undertaken in first 5 years

Although generally, specific species, landscape and heritage surveys for the different schemes will be undertaken as part of the OBC development (see Section 4.3), there would be an efficiency saving and a risk reduction measure associated with concentrating some specific surveys on the initial schemes to be undertaken in the first 5 years. These could be combined with the Priority 1 surveys (Section 3.1.1).

Surveys would include Phase 2 botanical surveys to the National Vegetation Classification (NVC) methodology as well as vertebrate surveys and potential bird surveys. Bird surveys would include vantage point surveys to monitor flight lines to and from Managed Realignment sites. Furthermore, consideration by KSL Area Team alongside NEAS Heritage Specialists should be undertaken to look at efficiencies of undertaking initial heritage assessments and surveys as one project rather than several individual ones at scheme stage. The areas which should be surveyed include:

- BA3.2 - Halling – Priority Habitat at risk from Managed Realignment site by 2023.
- BA4.7 – Chetney – Survey of Tailness Marshes where habitat will be at risk from Managed Realignment site by 2023.
- BA6.1 - Swale Mainland – to assess the potential impacts in the future from increased overtopping to define the level of defence crest increase that is required.
- BA8.2 - Shellness and 8.3 - South of Sheppey – to assess the potential impacts in the future from increased overtopping to define the level of defence crest increase that is required.

3.1.4 Priority 4 - Longer term freshwater surveys

Further to the surveys that will be undertaken as part of the Priority 1 surveys, there is a future set of surveys (to the same scope as the Priority 1 surveys) which will be undertaken to assess risk to freshwater habitat and enable confirmation of compensatory habitat. These will be undertaken in 2029. Natural England are currently planning surveys in some of these locations, particularly focussing on ditches and potentially additional invertebrate surveys. The KSL Area Team will liaise with Natural England to share data and ensure surveys are not undertaken twice.

The surveys will focus on the following areas:

- BA4.2b: Otterham Creek to Ham Green – freshwater habitat potentially at risk from 2033 due to NAI policy.
- BA4.5: Barksore Marshes – freshwater habitat potentially at risk from 2039 due to NAI policy.
- BA4.7: Chetney Marshes – freshwater habitat potentially at risk from year 2029-2039 due to MR: Habitat Adaptation.

3.1.5 Priority 5 - Specific scheme surveys

These surveys will include, but not be limited to: landscape surveys, habitat surveys, protected species surveys, cultural/ heritage surveys, and WFD assessments.

Additional surveys and investigations will be undertaken prior to the implementation of capital schemes, managed realignment schemes or NAI policies. These requirements and the programme for these are discussed in more detail within the BA sections presented in Appendix A.

Undertaking surveys as a coherent project will provide cost efficiencies. Ensuring the data is collated, stored and shared effectively will provide increased knowledge and understanding for the different studies, designs and monitoring that will be undertaken across the Strategy. It will also allow understanding of the context of some of the interest features across the whole site and therefore better assess the impact.

3.2 Partnership Funding

Using the current government process, schemes are given a portion of the funding required towards to costs, and further funding is often required from third parties which is called partnership funding. Where proposed works will not attract 100% funding from central government, they can only go ahead by either reducing the costs (potentially by accepting a lower standard of protection) or if a local contribution is provided, or a combination of these. Funding partnerships can use local contributions to unlock national funding and increase priority, which can mean that the project can go ahead sooner. These can come through Local Authorities, developers, infrastructure providers or from the Regional Flood and Coastal Committee (RFCC) local levy. If funding cannot be found, this can lead to projects identified in the Strategy not being taken forward. In MEASS this could lead to increased flooding from overtopping as sea levels rise, as well as increased risk of collapse and failure of defences, leading to flooding and erosion of the land.

A large number of the schemes to be implemented required third party funding to allow them to be taken forward. The KSL Area Team will have a focussed and dedicated resource to investigate the third party funding requirements across the Strategy and start to develop agreements with third parties. Technical Appendix R presents the partnership funding plan for MEASS which outlines the funding required and potential funders for each Benefit Area with a capital scheme identified.

An Integrated Landscape and Green Infrastructure Study will be undertaken by the KSL Area Team to feed into the third party funding requirements. This will identify wider opportunities and help scope the OBCs to be undertaken in more detail. Similar studies undertaken for the Humber and the Thames have demonstrated this study can bring efficiencies and opportunities to third party funding discussions and at the OBC stage.

4 Actions and Activities required for Capital Schemes (Flood and Erosion Risk Management Capital Schemes)

NOTE: This does not include intertidal or freshwater compensation sites as these are assessed in Section 5 and 6 respectively.

There are a number of BAs in the Strategy where a capital scheme is required. Table 3 outlines different teams within the Environment Agency who will provide advice and assistance in different areas of the schemes.

The exact timings of these schemes vary between BAs, but the same general approach will be undertaken:

- Add scheme to the Capital Investment Programme;
- Develop a Strategic Outline Business Case (SOC) (Environment Agency projects will require one, it is recommended that schemes under the Local Authority responsibility also develop an SOC);
- Complete NEAS environmental screening and assessments;
- Develop and get an Outline Business Case (OBC) recommended for approval;
- Complete a Full Business Case (FBC) (Environment Agency projects only);
- Obtain required licences and permits;
- Contract a design and build contractor (or a detailed design consultant and contractor separately depending on the procurement route); and
- Construction.

4.1 Capital Investment Programme

For BAs where new coastal defence schemes are required, the schemes will be added to the Environment Agency's Capital Investment Programme.

4.1.1 Phasing of capital works over the first 10 years of the Strategy

Within the economics produced for the Strategy, the schemes were assessed to look at the best (economic) programme for delivery of capital works. To assess phasing of the schemes over the first ten years (so they do not all happen in the same year), a ranking system was developed which looked at providing:

- A residual life score – score of 1 for a residual life of 5 years or less; a score of 2 for a residual life of between 6 and 10 years; and a score of 3 for a residual life of greater than 10 years.
- A benefit cost ratio score – a score of 1 for a benefit cost ratio greater than 5; a score of 2 for a benefit cost ratio between 2 and 4.9; and a score of 3 for a benefit cost ratio of less than 2.
- An OM2/3 score – a score of 1 for a total OM2 and OM3 count of greater than 100; a score of 2 for a total OM2 and OM3 count between 50 and 99; and a score of 3 for a total OM2 and OM3 count of less than 50.
- A risk score – a score of 1 for projects with high PF score (>60%) and no other significant risks; a score of 2 for a PF score between 25% and 60% or a project with significant environmental/heritage risks; and a score of 3 where either the PF score is below 25% or the PF score is between 40% and 80% but the project also has significant environmental/heritage risks.

The results of the scoring and ranking are presented in Table 6.

Table 6: Table to present ranking and scoring carried out on options. The description of the scores are presented above in 4.1.1.

Benefit Area	Residual life score	BCR score	OM2/3 score	Risk score	Total score	Rank*
1.2: Kingsnorth	2	3	4	3	12	3
2.1: Strood	3	3	2	3	11	4
2.2: Rochester	3	3	2	2	10	3
2.3: St Mary's Island	3	2	1	2	8	2
3.2: Halling	3	3	3	2	11	4
3.4: Aylesford to Wouldham	3	2	2	3	10	3
4.1: Riverside Country Park	2	3	4	3	12	3
4.4: Lower Halstow	3	3	4	3	13	4
5.2: Sittingbourne	3	1	1	2	7	2
7.2a: Faversham	3	2	2	3	10	3
9.1: Leysdown	1	2	1	1	5	1
11.2: Sheerness	3	1	1	1	6	2

*The ranks are presented based on: Rank 1: residual life score of 1; Rank 2: overall score <10; Rank 3: residual life score of 2 or overall score of 10; Rank 4: overall score >10.

It is to be noted that out of the potential OM 2 and 3s associated BA's identified within Table 6, 83% would be claimed by year 4 and 95% by year 6 following the programme presented in Section 2.

4.2 Strategic Outline Business Case (SOC)

The main purpose of the SOC is to establish the need for investment; and to present the high-level results from the option development during the Strategy. The SOC builds on Strategy documents to make the case for change within the strategic case. It prepares and appraises the long list of options within the economic case; and recommends a preferred way forward, together with indicative costs, for further analysis within the OBC.

The Strategy provides enough details for the SOC to be developed directly from the results presented in the StAR and Technical Appendices.

At SOC stage NEAS will undertake a screening exercise for the scheme to determine NEAS input requirements and summarise key environmental risks and reporting requirements from consultants.

Key indicators for Strategy wide reviews are presented in Table 5. Specific scheme level assumptions will also be reviewed at SOC stage to support and confirm the need to progress to OBC stage. These specific assumptions are identified in Table 7. Table 8 outlines the Technical Appendices of MEASS where further information and details can be found.

Table 7: Assumptions and review to be undertaken at SOC stage

Assumption	Review to be undertaken
Condition of defences.	In some areas, the urgency of works is dictated by the condition of the defences and hence the residual lives of the defences. If the economic case is driven by the condition of the defences, currently this is based on the Aims database. A condition survey will be carried out to validate the urgency and programme requirements of the works.
Partnership funding.	The Partnership Funding Plan is presented in Technical Appendix R. At SOC stage the potential and programme for achieving the required Partnership Funding will be developed in more detail as in many cases achieving the required third party funding will be the key risk to the project going forward.

Assumption	Review to be undertaken
Doorstep levels.	Currently within the Strategy there is an assumed doorstep level of 0.2m for all properties. At SOC stage, the specific smaller area being assessed will be reviewed and a judgement undertaken whether a threshold level survey is needed. If it is required then this will be undertaken prior to OBC stage.
Changes /new defences relating to new developments.	If there have been new developments within the study area since the Strategy was produced, it is likely that the planning for the developments will have included requirements for flood protection. Any additional flood protection measures will be considered within the business case development.
Specific investigations/documents for OBC stage.	The SOC will review risks from this Implementation Plan, and the KSL Area Team will work with NEAS to scope the OBC in more detail.
Compensatory habitat requirements.	The Hold the Line schemes within this Strategy will cause coastal squeeze and therefore require compensation. A set of MR sites have been identified as part of the Strategy, however the implementation and progress of these will be reviewed as the programme moves towards the implementation of capital schemes. Compensation must be in place prior to the schemes being delivered.

4.3 Outline Business Case (OBC)

The main purpose of the OBC is to:

- revisit the case for change and the preferred way forward identified in the SOC;
- establish the option which optimises value for money and is technically and environmentally viable;
- outline the financial case and assess affordability; and
- demonstrate that the proposed scheme is deliverable.

The preferred option will be reviewed and a more detailed economic assessment will be undertaken. A key activity at this stage is the progression of opportunities for third party contributions to the proposed scheme.

During this stage, a detailed Environmental Impact Assessment will be undertaken in environmentally sensitive areas, with a Preliminary Environmental Impact Assessment required in others. This will review the MEASS HRA and SEA, and feed in the information from the surveys being undertaken 2018 – 2020 (Section 3) to confirm that the appropriate mitigation is undertaken and that there are no adverse effects on the designated sites. Furthermore, the environmental assessments throughout scheme development will aim to identify broader opportunities and enhancement where possible.

Heritage is generally a big risk in many of the areas of the Strategy, therefore Heritage Assessments will be required. Within the individual consideration of BAs within Appendix A as well as the supporting SEA for the Strategy, risks associated with impacts to built heritage (designated or non-designated) and archaeology have been highlighted. A number of different mitigation measures and surveys will be required across the Strategy. In particular it is worth highlighting that where there is likely to be capital works involving excavation, or large landscape changes or loss of land through Managed Realignment, non-intrusive or geophysical surveys and intrusive investigations are likely to be undertaken as there is the potential for significant buried archaeological assets in the Strategy area. Furthermore, there are a large number of designated and non-designated assets in the strategy area which will require heritage surveys at OBC stage due changes to setting, visual impact on the historic landscape and loss of heritage through inundation of land. Investigation and mitigation will be phased in nature, with the scale and intrusiveness of investigation aligned with the degree of information required.

See specific sections in Appendix A to review specific environmental risks and mitigation actions required for each area.

4.3.1 Information to develop the OBC

The OBC will be developed in the form of the five different cases: strategic, economic, commercial, financial, and management. Table 8 below highlights the key Strategy Technical Appendices which should be used to

help inform and build the basis of these cases. KSL Area Team will review the schemes required to be undertaken, and assess where this needs procurement of an appraisal consultant and ncps to oversee the project management.

Table 8: Information to inform business cases in OBCs

Business case	Key appendices
Strategic	Appendix E – AST: Presents summary of the problem in an area and key assets at risk Appendix H – Implementation Plan: Appendix A of the Implementation Plan presents a summary of the driver for the strategic case Appendix I – Modelling Report: Presents the flood risk to the areas Appendix J – SEA: Presents the key environmental legislative background for the area Appendix K – HRA: Presents the key environmental legislative background for the area
Economic	Appendix C – Damages/ Benefits Report: Lists assumptions and details from Strategy economic damages assessment Appendix D – Option Report: Lists assumptions in optioneering process for Strategy Appendix E – AST: Provides all the figures required for the economic case Appendix G – Economic Report: Provides the headline business case for each BA section and justification for the preferred option Appendix I – Modelling Report: Presents the flood risk to the areas Appendix N – Risk Register: Provides information on the Monte Carlo risk calculations
Commercial	Appendix L – Stakeholder Report: Provides information on discussions that have been held to date with industries and partners that could be involved in management or third-party funding Appendix N – Risk Register: Presents the key risks and required mitigations
Financial	Appendix F – Expenditure Profile: Presents the breakdown in spend over the first 5 years and then the first, second and third epoch Appendix H – Implementation Plan: Presents a phased approach to financial spend for the projects over the first ten years of the Strategy Appendix G – Economic Report: Provides the Partnership Funding score and information about potential third party funders
Management	Appendix H – Implementation Report: Highlights specific risks under each BA section Appendix N – Risk Register: Presents the key risks and required mitigations

4.4 Licences and Permits

It should be noted that as options are developed further and schemes identified permissions, licences and permits from Natural England (Environmental Designations), Environment Agency (Flood Risk Activity Permit), Local Authority (Planning), and the Marine Management Organisation (works in the tidal and marine environments) will be required. These permissions will be required at the OBC and FBC stage of the project to guarantee that construction can be undertaken (Table 9).

To obtain these permissions, early and ongoing consultation will be undertaken with the statutory stakeholders. There are set consultation periods that need to be taken account of when planning the completion of the OBC and FBC stages of the project. The extent of consultation required will depend upon the extent of works to be undertaken and the complexity of the design. It is important to note that in addition to statutory stakeholders, early and ongoing consultation is required with the determining organisations.

Table 9: Typical licences and permits required prior to construction. Note: This table is not an exhaustive list of permits and licences required, it only contains the major and most commonly required. Timeframes can change and further detail and contingency should be built into the project programme by the ncps Project Manager/ KSL Area Team programmer.

Organisation	Licence Required	Act/ Regulation	When it should be undertaken*	Determination Period**	Outcome
Marine Management Organisation (MMO)	Pre-application	Marine and Coastal Access Act, 2009; Marine Works Environmental Impact Assessment, 2011	FBC	Up to 5 weeks	Will determine if a full application required
	Application		FBC	Up to 13 weeks	If approved work can take place
Local Planning Authority	EIA screening	Town and Country Planning Act; Town and Country Planning Environmental Impact Assessment Regulations 2011	OBC	3 weeks	Will determine if EIA scoping required
	EIA Scoping		FBC	Up to 5 weeks	Will determine if a full EIA required
	Full EIA		FBC	Up to 16 weeks	If approved work can take place
	Application***		FBC	Up to 16 weeks	If approved work can take place
Local Planning Authority (with Natural England providing specialist advice)	HRO1	The Conservation of Habitat and Species Regulations 2010	FBC	Approximately 3 months	Will determine if a full Appropriate Assessment is required
	Habitat Regulations Appropriate Assessment	The Conservation of Habitat and Species Regulations 2010	FBC	Approximately 3 months	If approved work can take place
Environment Agency	Flood Risk Activity Permit	Water Resource Act 1991	FBC	2 months determination period	If approved work can take place
Environment Agency	WFD Assessment	Water Framework Directive	OBC	Varied	Supports planning application

* FBC = Full Business Case; OBC = Outline Business Case

** Often the extent of the consultation will depend upon the details of the preferred design.

*** Note pre-application discussion will be undertaken to help avoid unnecessary delays

4.5 Full Business Case (FBC)

The purpose of the FBC is to revisit the OBC assumptions and main findings; provide evidence that the most economically advantageous tender for the construction of the scheme has been accepted; and establish that the management arrangements for successful delivery are in place. To allow the effective delivery of the FBC there will be input from the Design and Build Contractor, or just Contractor depending on method of procurement.

The FBC will dictate that the environmental mitigations outlined in the OBC are taken forward to the final design, and that these are discussed with the Contractor to check that an accurate cost for any mitigation works is included.

4.6 Contract a Design and Build (D&B) Contractor

At the same time as the FBC is being developed, a D&B Contractor will be procured. The D&B Contractor will undertake the detailed design of the preferred option that was approved at the FBC stage, and then take this through to construction. During this stage the D&B contractor will be responsible for obtaining all the relevant licences and permits. The timing and programme for this can be lengthy and will be built into the overall project programme by the ncps Project Manager. See section 4.4 for further details.

4.7 Construction

Once the project has been approved for GiA funding and the Partnership Funding has been secured, licences and permits have been obtained and the design has been completed, construction can commence, subject to any restrictions in the licences and permits.

Following construction, there will be a requirement from the Contractor to hand over the Project Health and Safety File back to the Environment Agency. The Project Health and Safety File will contain the required information and history for the assets involved in the construction works to aid future maintenance and construction. This Health and Safety file needs to be reviewed alongside this Implementation Plan to update any maintenance or future works requirements.

5 Actions and Activities required for Capital Managed Realignment (MR) schemes

There are 9 managed realignment (MR) sites proposed as part of MEASS:

- 6 MR sites proposed in the first epoch to compensate for loss of SPA and Ramsar designated saltmarsh (115 ha)
- 1 MR site proposed in the first epoch to compensate for loss of Priority Habitat saltmarsh (10 ha)
- 1 MR site proposed in the second epoch to compensate for loss of SPA and Ramsar designated saltmarsh (203 ha)
- 1 MR site proposed in the third epoch to compensate for loss of SPA and Ramsar designated saltmarsh (175 ha)

Further information can be found in Section 3.1.5 of Technical Appendix G – Economic Report. Furthermore, a description of all the MR sites which were initially assessed, and reasons why some were rejected, can be found in Appendix A of Technical Appendix G – Economic Report.

These MR sites are vital to the Strategy, as they allow the Environment Agency to meet the legal obligation to compensate for the loss of intertidal SPA and Ramsar habitat that will be lost through coastal squeeze due to HTL in the MEASS area and address SSSI favourable conditions status with regard to coastal squeeze. The development of the MR sites is integral to gaining approval for the large hold the line capital schemes as these require compensatory habitat for coastal squeeze impacts to saltmarsh habitat which will be provided by the MR sites.

A five year process to take the site from landowner discussions and business case through to construction has been outlined as it is considered that this is the minimum time required to get these complex studies through.

If there are chances to accelerate a MR scheme this should be seen as advantageous to supporting the Strategy, however if freshwater compensation is required as part of the MR scheme this needs to be in place prior to the impact.

5.1 MR Site Business Cases

Business Cases are needed to provide more detail on the suitability of the MR sites and determine the design requirements of the site in more details as well as the costs and funding requirements. The funding for the MR sites have been assessed on a proportional basis of splitting the cost across HTL schemes for the Strategy. This is explained in Section 4 of Technical Appendix G.

The business cases will provide more detailed information on the MR sites highlighted at Strategy stage, and aim to mitigate risks and reduce costs, and provide more confidence in taking them through to design and construction.

The SOC, OBC, FBC process has been outlined in Section 4 of this Report for capital flood and erosion protection schemes. This same process will be applied here, however there will be more focus on feasibility and environmental impacts, and less on economic assessment. The business cases will provide a Cost Effectiveness Analysis rather than a Cost Benefit Analysis as they are being undertaken as part of a legal obligation to offset adverse impacts to internationally designated areas and are justified against the HTL schemes of the Strategy.

The key actions to be undertaken in the studies are summarised in Table 10.

Table 10: Actions as part of MR site business cases

Action	Description	Owner
1. NEAS screening and Procurement.	Screening to assess key environmental requirements and procurement of consultation to undertake the business cases.	KSL Area Team and NEAS.
2. Site visits.	A site visit will be undertaken to understand the locality of each of the sites, and if there are any additional risks to delivery.	KSL Area Team with NEAS, Appraisal Consultant, Early Supplier Engagement.
3. Stakeholder engagement plan.	Identify the key stakeholders for the site. Categorise the stakeholders according to level of importance and influence and undertake a stakeholder engagement plan which highlights key risks and key engagement and when the engagement needs to be.	KSL Area Team with support from Appraisal Consultants.
4. Heritage discussions.	Early discussions with Kent County Council and Historic England to consider heritage management issues. Early heritage assessments are to be focussed on MR sites that are likely have impacts on heritage assets such as Elmley Round Fields and Sittingbourne. However, it is also noted that the impacts on managed realignment and the processes for managing the loss of buried archaeology to the sea is not currently clearly understood. Early discussions with Kent County Council and Historic England will set out a process for identifying and managing these risks.	Appraisal Consultant with support from NEAS heritage.
4. Environmental surveys.	Environmental (habitat and heritage) surveys will have been undertaken by KSL Team. Review and supplement where required (ie landscape surveys, specific species surveys).	Appraisal Consultant with support from NEAS and FBG.
5. Ground Investigations	Ground conditions can be a large risk in terms of construction and design of a Managed Realignment site. Undertake early ground investigations to inform design but also to tie in with heritage assessment. This will also allow assessment of the soil conditions in terms of potential drainage and the environmental impacts on soil and hydrology from the site.	Appraisal Consultant with support from NEAS, KSL Area Team and ncprms.
6. Outline design and modelling.	Develop an outline design - look at breach location, potential scour protection required, if there would be requirement for excavation or modifying/creating creeks, embankment locations, embankment cross sections, potential for requirement for sheet piled sections (due to interactions with roads/services etc).	Appraisal Consultant with support from KSL Area Team and NEAS.
7. Environmental assessment.	Following the site visit create an Environmental Site Appraisal Plan and then incorporate in a report which builds upon the Strategy environmental assessments and the additional information from site visits and background review. This will allow an environmental baseline plan to be developed, which can be built upon at the detailed design stage.	Appraisal Consultant (Landscape Architect Lead) with support from NEAS and FBG.
8. Heritage assessment.	For MR sites in particular the heritage risk is key and specific heritage assessment will be undertaken for each MR site. This will commence with desk study including review of LiDAR and literature but will also, where relevant, include non-intrusive or geophysical surveys and intrusive surveys.	Appraisal Consultant with support from NEAS heritage.
9. Risk assessment.	Produce a risk register - use the outline design to produce a site-specific risk register. Create a Monte Carlo risk assessment to go with risk register as well as having mitigation actions and identify who may own these actions.	Appraisal Consultant with support from KSL Area Team.
10. Consideration of future management/conservation partnership.	A future management/conservation partnership will be discussed, agreed and set up which will dictate the required monitoring and maintenance following construction and who will be responsible for this.	KSL Area Team with support from NEAS and FBG.
11. Business case production and approval.	Produce the business case to get the funding approved and to confirm the preferred options.	KSL Area Team with support from ncprms and Appraisal Consultant.

5.2 Landowner Consultation (undertaken in parallel with business case)

Throughout the business case and design of the MR sites, discussions with landowners is required. The KSL Area Team will lead all landowner consultation with support from the Communications Team and Estates Team (Table 3). The next stage of discussions with landowners in the MR sites will continue from the engagement

undertaken during the Strategy. It is important that these more detailed discussions, which will focus more on legal agreements and any compensation, commence as soon as possible to reduce the risk of delays in constructing the MR site, which could impact on the legal obligations to provide compensatory intertidal habitat.

Involvement of EA Legal and Estates teams will be required to understand what needs to be discussed with the landowners and what can be offered in terms of compensation etc. These discussions and required agreements will be a core aspect of the work required for the development of the MR sites and therefore will be a part of the early work for these schemes.

5.3 Detailed Design of Capital MR Scheme

Once a feasibility assessment of the site has been undertaken and the site is deemed as a suitable MR site, the detailed design of the MR site will be undertaken. It is recommended that the following tasks are undertaken during the detailed design of a MR site:

- Building upon the Strategy modelling to provide detailed modelling of the MR site to determine:
 - whether the flows in and out of the site will maximise transitional and saltmarsh habitats whilst working with coastal processes;
 - potential impacts on the MCZ, particularly on intertidal broad scale habitat and marine habitat including intertidal mixed sediments (note that this may also require a particle size analysis as part of the modelling data collection);
 - the design and geometry of the breach to maximise flows in and out;
 - assessment of the wider impacts on the Strategy area, and the potential risks of scour/ deposition within the area (this will include assessment of velocity and shear stress analysis)
 - impacts of this on water quality;
 - areas where localised land raising/ excavation will be required to maximise the amount of intertidal habitat created;
 - whether additional scour protection at the breach is required;
 - if the size/ location of the breach will need to be moved;
 - that there are no low areas in the MR sites which are not connected as required to the creeks causing stagnated water and potential fish stranding;
 - that the location of the set-back embankments does not increase the flood risk to assets in the areas; and
 - maximise the lengths that tie into high ground to reduce the construction and maintenance costs.
- Undertake ground investigations to review the ground conditions and determine the seepage and embankment design requirements.
- Undertake Environmental Impact Assessment and Habitat Regulations Assessment to determine impacts on local area.
- Undertake stakeholder engagement following on from the OBC produced.
- In addition to the design and modelling of the MR site the relevant licences and permits will be required (see Section 4 for more detail).

On average, this process takes at least 2 years, so will be implemented as soon as possible to reduce the risk of not being able to provide suitable intertidal compensatory habitat.

5.4 Construction

Once the project has been approved for funding, licences and permits have been obtained and the design has been completed, construction will commence subject to any restrictions in the licences and permits and the

undertaking and discharging of any pre-commencement condition. The construction sequence will be carefully planned to not increase flood risk anywhere, which will involve the breach being the last element of construction.

Following construction, the Contractor will hand over the Project Health and Safety File back to the KSL Area Team. The Project Health and Safety File will contain the required information and history for the assets involved in the construction works to aid future maintenance and construction.

5.5 Post-Construction

Following construction of a MR site for compensatory habitat, the GIS files will be sent to Natural England to load onto MAGIC (<http://magic.defra.gov.uk/MagicMap.aspx>), which will confirm their protection under the National Planning Policy Framework as a compensation site.

Post-construction surveys to monitor development of the habitat will be undertaken for a minimum of five years. The timescale is likely to be increased and the design will provide a monitoring plan to provide additional detail on the monitoring requirements (which will change depending on the interest features for which compensation is being provided). The monitoring will identify when the sites reach their criteria and can be designated.

5.6 Risks associated with delivery of the MR sites

To identify appropriate Managed Realignment sites, MEASS has considered preliminary desk studies, information from landowner consultation and the Strategic Environmental Assessment. Managed Realignment sites were selected by considering key and secondary constraints:

- Key constraints – topography, impact on adjacent coastlines and wider estuary morphology, adverse impact on flood risk, location of landfill sites, and potential functionality of created habitat (i.e. whether it could provide SPA/Ramsar habitat compensation).
- Secondary constraints: impact on freshwater habitat (with the consideration of the quality and value of that freshwater habitat), land use, grade/quality of agricultural land, infrastructure present, and landowner and stakeholder feedback.

In line with European Directive 92/43/EEC on the Conservation of Natural Habitats and Wild Fauna and Flora (also known as the 'Habitats Directive') compensation for impacts to Natura 2000 sites should be delivered as close to the impact as possible. Therefore, the ideal solution regarding intertidal loss within a designated estuary site is that it is delivered in the same estuary. MEASS has followed this principle to arrive at the proposed managed realignment sites.

However, it is acknowledged that there are residual risks in taking Managed Realignment sites through detailed design and to construction; due to unknown infrastructure, ground conditions, and specific site concerns. Within MEASS, if one or two of the Managed Realignment sites cannot be taken forward, there are limited alternative options for meeting our obligation to compensate for loss of saltmarsh habitat due to coastal squeeze.

The Project Team have therefore identified potential opportunities to provide compensation from outside of the Strategy area, should this risk be realised. If compensation is required from outside of the Strategy area, the Kent & South London Area Habitat Creation Programme will assess alternative sites.

Coastal Habitat Management Plans (CHaMPs) established an approach for impacts to coastal habitat for Natura 2000 sites where suitable compensation habitat was not available within the 'Estuary Complex' being impacted. For example, the St Mary's Marshes site, currently being investigated under TEAM2100, is within the same CHaMP area (the Greater Thames Area) and is located in close proximity to the Medway Estuary. The close proximity and similar environments suggests that there may be an ecological functional link between

the proposed St Mary's Marshes Managed Realignment site and the projected Natura 2000 habitat loss in the Medway.

Further study will be carried out to identify whether the functional link exists, and whether there would be significant impacts on birds and other species. Importantly, how the birds use the site needs to be understood as the CHaMPs only considered general coastal habitats and the relationships across coastal cells. Key questions which would need to be assessed from these surveys include:

- How will birds that breed and roost on sites in MEASS be affected?
- If the birds' associated feeding areas were compensated with a site outside of the estuary, causing them to fly further, would this impact their productivity and fitness?

Following the surveys, should there be a requirement to compensate outside the estuary, and should the compensation be proved to be acceptable under the HRA, we will reconsider the position of the MEASS HRA. Specifically, we will assess whether it is preferable to continue to protect freshwater sites in the Medway and Swale rather than converting them to intertidal habitat, and how to best maintain the Natura 2000 network of sites in the Greater Thames Estuary. This would further include an updated assessment on how the estuary functions in line with the approach outlined by the Healthy Estuaries Project.

6 Actions and Activities required for Freshwater Sites

The development of freshwater habitat is critical to allow the Strategy to meet its legal requirements to maintain integrity of N2K sites.

There are a number of BAs where it is not economically viable to maintain the defences, and as such the designated freshwater habitat behind these defences could be adversely affected through increasing overtopping and inundation when the defences fail. A cost-effectiveness assessment has been undertaken to determine whether it is more economically viable to maintain the defences in their current position, or whether it is more cost-effective to create compensatory freshwater habitat elsewhere within the Strategy area. There are areas where a MR site will impact designated freshwater habitat; compensation is also required here.

This section outlines the general implementation plan for those areas where freshwater habitat compensation is required.

6.1 Requirements for Freshwater Compensation

Table 11 shows the amount of freshwater habitat that will be required through the life of the Strategy, to compensate for that lost to Managed Realignment and NAI locations. This is currently assuming a ratio for the compensation areas of 1:1 with the area projected to be impacted. Following surveys in 2019 and 2020, this ratio may be adjusted as required and agreed as part of the implementation.

Table 11: Summary of Strategy impacts on freshwater SPA/Ramsar habitat due to increased flooding

Strategy epoch	Projected loss of freshwater SPA/Ramsar habitat (ha)
Epoch 1 (0-20 years)	289 ha
Epoch 2 (21-50 years)	584 ha
Epoch 3 (51-100 years)	0*

*Although increased loss would be expected with sea level rise, the figures for Epochs 1 and 2 have been calculated using modelling which has already accounted for rise in sea level.

160.4 ha of compensatory freshwater habitat has already been procured to compensate for the loss of freshwater habitat at Elmley and Spitend Marshes (a total of 143ha is needed), through the Kent & South London Area Habitat Creation Programme. This is located at Great Bells Farm on the Isle of Sheppey, a location that means this new habitat will be contiguous with the extensive existing freshwater habitats already in this area. Great Bells Farm is planned to provide compensatory habitat for MR sites at BA8.3 and 8.4, and part compensation for the NAI policy at BA4.2a, subject to surveys planned over the next couple of years to see what is establishing at the site.

Compensatory habitat for the loss of freshwater grazing marsh at Abbott's Court would need to be secured in the first five years of the Strategy implementation. A total of 52 ha is required for freshwater compensation (for BA1.3 and 15ha for BA4.2a) by year 9. Provisional areas at Stoke Marshes on the Isle of Grain has been identified through discussions with Natural England, and the Kent and South London Area Team will be assessing these in more detail following the completion of the freshwater habitat surveys in 2020. Over 100ha have potential to be developed here which would habitat compensation for BAs 1.3 and 4.2a.

Longer term, freshwater habitat needs to be planned and developed to implement by year 20. This action is set out for the Kent and South London Area Team to develop a freshwater habitat plan in the first ten years of the Strategy within the Implementation Plan for the Strategy. Provisionally, potential suitable areas have already been discussed with Natural England and land within BA6.1 (the area between Sittingbourne and

Conyer) is likely to be one of the first areas investigated further. There is potential for around 150 ha in this area.

Longer term, around 250 to 300 ha will potentially be identified on the Isle of Sheppey with an addition 100 ha within the Medway Marshes area and 100ha within the upper Medway Estuary. These locations will be secured by the Environment Agency South East Regional Habitat Creation Programme.

There is a small window to identify and establish the required freshwater compensatory habitat. Failure to provide compensation could impact the ability to implement the Managed Realignment projects, and hence the HTL capital works. To provide confidence that the Strategy can be implemented the following risk mitigation measures have been built into the Strategy:

- The habitat required earlier on in the Strategy is located in an area close to Great Bells Farm compensatory site. More habitat is available at Great Bells Farm than required in the first 5 years of the Strategy in case a ratio more than 1:1 is required. It should be noted that ecological surveys are required at Great Bells Farm as a priority (see Section 3).
- Overall it has been assumed that more habitat may be required than a 1:1 ratio and part of the risk budget associated with the freshwater sites cost provides flexibility for this.
- Potential areas for freshwater compensation identified in the SMP have been taken forward in the Strategy and discussed further with Natural England. Natural England have identified areas that are currently being managed under agro-environmental practices. Focusing on these areas are likely to reduce the time frame required to develop the habitat and reduce costs.
- Within the Implementation Plan, it has been highlighted that the Habitat Creation Programme Report (see Section 3.1.1) will need to be updated within year 1 of implementation, and the Benefit Area specific implementation plans updated following these surveys in the following years. The surveys will allow further detail and consideration on the time which will be required to develop the required compensatory habitat.

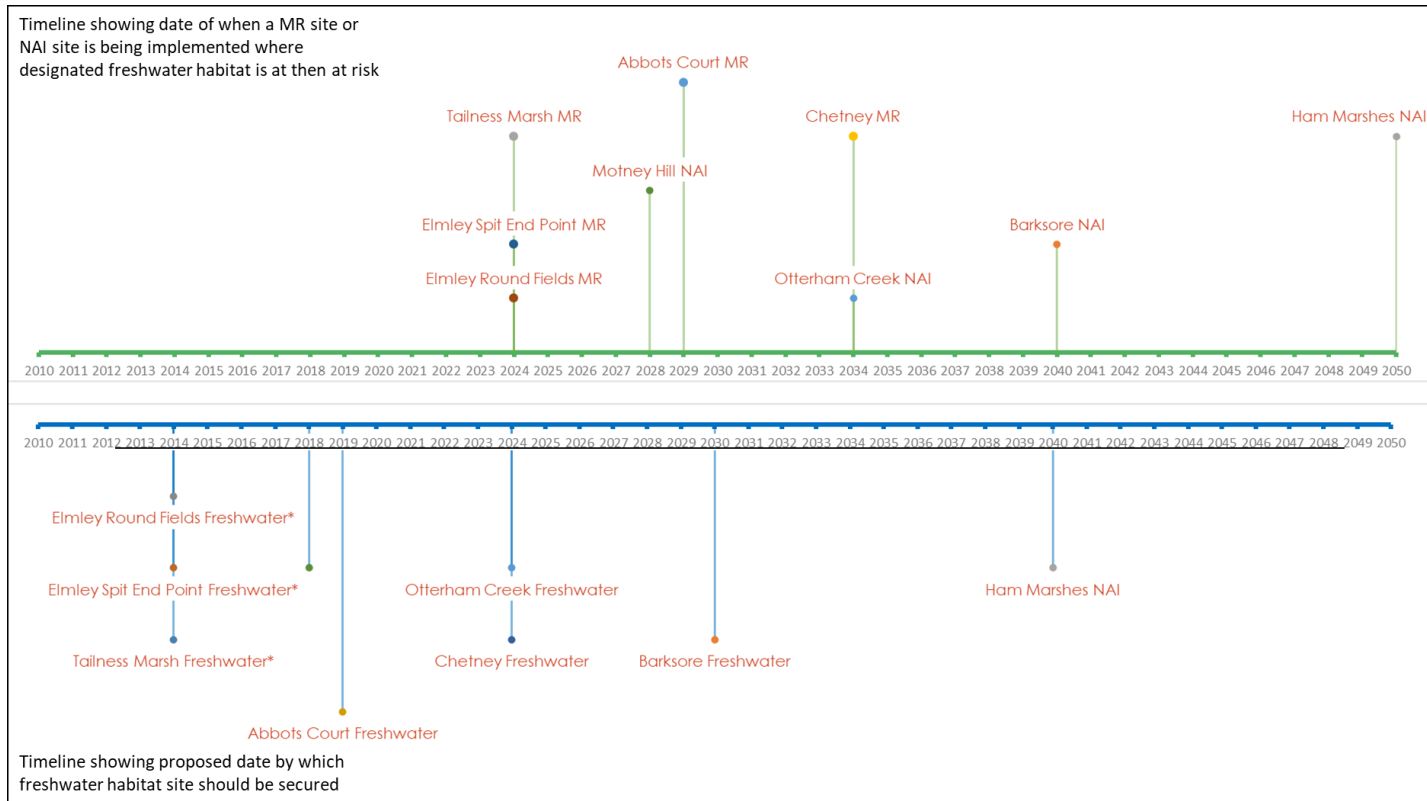
6.2 Great Bells Farm

Great Bells Farm was purchased by the Environment Agency to provide freshwater compensation within the MEASS area. The site is currently being managed by RSPB, and it is currently being developed so that the site can be classed as providing compensatory habitat. This management is being undertaken through the partnership of Environment Agency, Natural England and RSPB and will be informed through the findings of the planned freshwater surveys by the KSL Area Team.

6.3 Freshwater Compensation Development

Overall the requirements from the programme for the development of freshwater habitat is very tight and focus on activities and development in the first 2 to 3 years is required. The programme has been summarised in Figure 2. Sections 6.3.1 and 6.3.2 detail specific activities required to provide freshwater compensation in epoch 1 and 2 respectively. It should be noted that whilst initial indication of required timelines is provided below, the development of freshwater habitat can vary between 10 and 20 years and there is a dependency in developing this freshwater habitat and being able to withdraw maintenance or construction the Managed Realignment site. It is realised that there are many factors at each site which will influence the freshwater habitat; whether it is a NAI or MR site, some sites have already been developed for a number of years whereas others require design and works to develop the freshwater habitat and what interest features specifically require compensating. Therefore it is critical that the initial planning outlined in 6.3.1 and 6.3.2 below aims at identifying and securing compensatory freshwater habitat as soon as possible in the Strategy timeline.

Figure 2: Freshwater Habitat – timeline showing impacts on freshwater habitat, and required compensation



*note these sites are ones which are planning to part of the Great Bells Farm development, which has already been developing freshwater habitat for a number of years.

6.3.1 Requirements to identifying, securing and delivering new freshwater habitat for epoch 1

The planning of the freshwater sites will then be phased depending on when it is required. If Great Bells Farm is deemed suitable, then the immediate assessment will be for BA1.3 – Abbots Court MR site. It is noted from assessment of Figure 2 that the time available to develop compensatory habitat for Abbots Court MR site is very tight. Therefore as outlined in 6.1 an area which is already being developed as freshwater habitat will need to be secured as a compensation site. It is suggested that Stoke Marshes (Church Farm) could be suitable for compensation for BA1.3 however there could be a risk of “competition” from TE2100 compensation plans. The KSL Area Team will take this forward under the South East Regional Habitat Programme. Further assessments will then be undertaken in the first 10 years of the Strategy as further compensation will be required by year 20.

Year 1

Whilst the freshwater surveys are undertaken by KSL Area Team (Section 3.1) a review of the potential sites outlined in the HRA will be undertaken to determine the best sites for freshwater compensation. During this time, the suitability of Great Bells Farm will also be reviewed, as this will reduce the amount of new freshwater compensation required to be created. This desktop search will include mapping of potential freshwater compensation sites for epochs 1 and 2 (although the focus on the detail is for epoch 1). It will allow, alongside the surveys, the gathering of evidence and provide the KSL Area Team to begin enquiries with landowners for all epoch 1 requirements.

Discussions will be undertaken with Natural England, KSL Area Team and NEAS to confirm that the proposed sites are suitable, and provide guidance on any further data or surveys that need to be undertaken to allow the sites to be classed as compensatory habitat. This will also form part of the NEAS screening for further work required to take the freshwater sites forward.

Year 2

Targeted surveys will be finalised to confirm compensation requirements for freshwater habitat impacts. By the end of year 2, the required sites will be identified and in process of being secured and any management actions necessary to develop the sites into the required condition identified and agreed with NE.

Year 3

Surveys will be concluded, and sites will be secured.

6.3.2 Requirements to identifying, securing and delivering new freshwater habitat for epoch 2

The KSL Area Team will confirm the freshwater habitat requirement for epoch 2 by year 3 of the Strategy (following the freshwater surveys and the initial focus on epoch 1). Then the above actions for epoch 1 will be completed for epoch 2 sites. Work will be scheduled to provide freshwater habitat as early on in the Strategy as possible to reduce the risk of other schemes being delayed.

6.4 Landowner Consultation

Once the freshwater site locations have been confirmed, early discussions with landowners within the sites will commence by KSL Area Team. It is important that these discussions commence as soon as possible to reduce the risk of delays in constructing the freshwater site, which could impact on the legal obligations to provide compensatory freshwater habitat prior to the impact occurring.

Discussions will be held with the EA Legal and Estates teams to understand what needs to be discussed with the landowners and what can be offered in terms of compensation etc.

6.5 Design of the Freshwater Sites

Once the location of the freshwater sites has been determined and the surveys of the current freshwater habitat completed, the compensatory sites will need to be designed to check that they provide the correct compensatory habitat. This may involve earthworks in some areas, and the creation of pools in other areas. KSL Area Team may want to bring on ncpms and a design consultant to undertake this.

Assessment of the freshwater compensatory sites needs to be undertaken as one study at a Strategy-wide level. This is because it is likely that there will not be one compensatory habitat site per individual scheme, but a number of sites developed to provide compensatory habitat across the Strategy.

6.6 Funding for capital works

Based on guidance the funding for the development of the freshwater habitat will be provided by GiA. Therefore, once the sites have been determined a funding application will need to be developed and submitted to gain approval of funds to undertake the construction of the freshwater sites. This will follow the process outlined in Section 4 for developing business cases.

7 Actions and Activities required for Ongoing Maintenance

7.1 Ongoing Maintenance

In the BAs where ongoing maintenance is proposed, no capital works will be undertaken to improve the standard of protection, but the current defences will continue to be maintained (subject to funding availability). The frequency of the maintenance varies between BAs, depending on the type and condition.

Where the maintenance is a responsibility of the Environment Agency, it is assumed that the funding for the ongoing maintenance will come from the Environment Agency's general maintenance budget, subject to funding availability. The extent of defences that will require maintenance is greater than the current funding availability, and as such there will be discussion with the National Allocation Team to determine increased funding for the Asset Performance management.

Within the Strategy, as well as this Implementation Plan, all sections of flood defences, regardless of ownership or responsibility, have been included and costed.

7.2 Monitoring for Health and Safety

Although only routine maintenance (patch and repair) is undertaken on these options, it will be important that regular surveys are still undertaken for health and safety purposes. If there is a health and safety risk i.e. debris from the failure of a defence, this will be removed to protect the public.

7.3 Maintenance requirements for Structures

The maintenance requirements for different structures which have been assumed in the strategy are presented in Table 12. The ongoing work to review the condition of the structures and to keep the AIMs database up to date will also be continued in parallel.

Table 12: Maintenance requirements for different structures in MEASS

Structure	Design Life	Maintenance Frequency	Maintenance Requirements
Beach Recharge	40 years	Every 10 years	Every 10 years it is assumed 10% of initial recharge will need to be replaced. Beach recycling may be required more regularly in some areas.
Culvert	100 years	Annually	Cleaning of culvert and trash screen required at least annually.
Demountable defences	100 years	Annually	Cleaning of the demountable and dry test to be undertaken at least annually. Replacement of seals to be undertaken every 25-30 years but this has been worked into the overall cost.
Embankment	>100 years	Annually	Annual grass cutting plus minor maintenance (patch repairs) to embankment surface.
Flood Gate	50 years	Every 30 years	There will need to be cleaning and dry test to be undertaken annually, and then replacement of the flood gate every 30 years.
Concrete Revetment	25 years	Every 10 years	Patch repairs to the face of the revetment every 10 years.
Rock Revetment	60 years	Every 10 years	Localised rock movement/ re-organising every 10 years.
Seawall	100 years	Every 10 years	Patch repairs to the face of the wall every 10 years.
Sheet Piling	100 years	Every 30 years	Patch repairs to the face of the sheet piling every 30 years.

8 Actions and Activities required for No Active Intervention

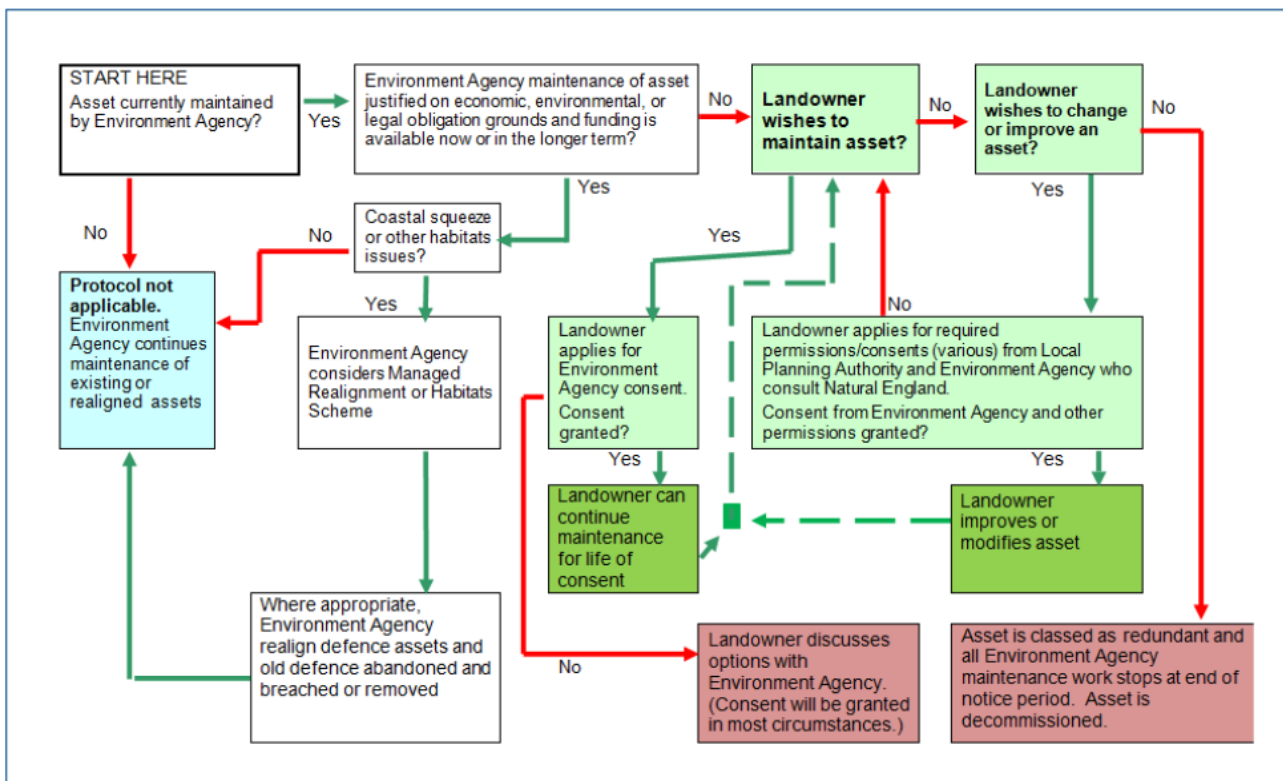
There are several frontages where it is not economically viable to maintain the defences, and as such a NAI policy will be implemented. The timing of this varies between BAs. Prior to the NAI policy being implemented and maintenance being withdrawn, there are a series of steps that will be followed. These are summarised below, but more detail can be found in the 'Protocol for the maintenance of flood and coastal risk management assets (England only)' (Environment Agency, 2014).

It is to be noted that under NAI frontages there has been no allocation of costs within the Strategy, however there will need to be ownership of implementation of the protocol and stakeholder engagement by the EA area team. Furthermore, discussions between the KSL Area Team and Estates/Legal teams (as well as other Environment Agency internal teams) will be undertaken to get up to date information about advances in guidance associated with landowner compensation.

8.1 Withdrawal of Maintenance

Based on the Environment Agency guidance there is a set protocol that needs to be followed when maintenance is going to be withdrawn. Figure 3 provides a flow chart of the decision-making process to determine how the maintenance will be withdrawn and how the Environment Agency will support landowners.

Figure 3: Stopping maintenance flowchart



Source: Appendices to the protocol for the maintenance of flood and coastal risk management assets (England only) (Environment Agency, 2014)

Where it is decided maintenance of a defence is going to stop, the Environment Agency will send a letter to the landowner outlining:

- why maintenance is going to stop;
- what maintenance work the Environment Agency currently carries out;
- recommendations for future maintenance work;
- the asset's condition and an estimate of when the landowner need to replace it;
- the proposed notice period and when maintenance will stop; and
- the environmental permits and other permissions the landowner may need to maintain the asset in future.

The period of notice will be reasonable and take into account the particular circumstances of landowners and interested parties and the factors listed below. The notice period will therefore vary in length, but will be a minimum of six months and more likely be 24 months. Longer periods may be appropriate in some instances, but this will be planned to confirm that it occurs prior to the NAI policy being implemented. To determine the length of the notice period the following factors will be considered:

- The views and needs of the landowners and affected parties;
- The overall condition of the asset at the time of stopping maintenance;
- The scale and cost of maintenance essential to guarantee the integrity of the asset;
- The expected remaining life of the assets;
- An adequate period to enable landowners and affected parties time to consider and make alternative arrangements;
- Multiple ownership issues and tenancy arrangements;
- A reasonable time to allow for flood proofing of buildings;
- Time for the landowner and affected parties to consider the implications of our decision to stop maintenance and to question and challenge the decision;
- The need for landowners and affected parties to obtain any necessary consents, approvals or permissions to continue maintenance or to seek alternative funding if appropriate;
- The current land management practices including crop rotation, growing seasons and any landowner contractual arrangements. Unless there are other overriding factors a notice period of one growing season is considered reasonable;
- The proposed stop date because the landowner and affected parties may be restricted from maintenance due to seasonal farming practices such as ploughing or harvesting; and
- Any need for the Environment Agency to undertake works necessary in order to leave the site compliant with health and safety legislation requirements prior to stopping maintenance.

During the notice period, the Environment Agency will follow the procedure below:

- The Environment Agency will continue to routinely maintain and operate the asset throughout the notice period. This may include routine beach management where necessary (for example, where shingle banks are routinely replaced).
- The Environment Agency may need to undertake works to leave the site safe. Such works may extend to creating new alternative assets if economically justifiable, but we will not do works that lower the standard of the existing flood defences.

- The Environment Agency do not aim to change our maintenance practices during the period of notice. For example the frequency or the extent of any maintenance work will not be changed.
- The condition of assets either immediately before, or during the notice period will not be significantly improved. The Environment Agency have no obligation to improve the condition of an asset to any particular standard over and above its condition at the time that a decision is taken that we will stop maintaining it.
- The Environment Agency will not deliberately worsen the condition of an asset during the notice period by reducing our level of maintenance. However, we may not be able to justify major repairs to Category Four assets during the notice period, if it becomes clear that such repair works are uneconomic and unsustainable.

At the end of the notice period the Environment Agency will stop all maintenance. Decisions about future maintenance will then be for the landowner to make. Landowners will need a permit to carry out some works.

8.2 Impacts of NAI on designated habitat

Impacts on designated habitats from NAI policies have been identified through the Strategy, see Technical Appendix J Strategic Environmental Assessment for further detail. Assessments of these impacts are not described in this section as they have been built into Section 6.

8.3 Monitoring for Health and Safety

Although all maintenance will be ceased, it will be important that regular surveys are still undertaken for health and safety purposes. If there is a risk i.e. debris from the failure of a defence this will need to be removed to protect the public.

Appendices

A.	Detailed Implementation Plan for each BA	37
B.	Defence Crest Level Increase Requirements	165
C.	Technical note on Managed Realignment at Chetney Marshes - BA4.7	169

A. Detailed Implementation Plan for each BA

The pages below outline a detailed implementation plan that has been developed for each of the BAs. It is intended that each of these plans will supplement the information in the main report to give a more detailed review of the requirements for each BA. For further detailed information on each BA section and the justification/background to the preferred option please refer to Technical Appendix E: ASTs and Technical Appendix G: Economic Report of the Strategy.

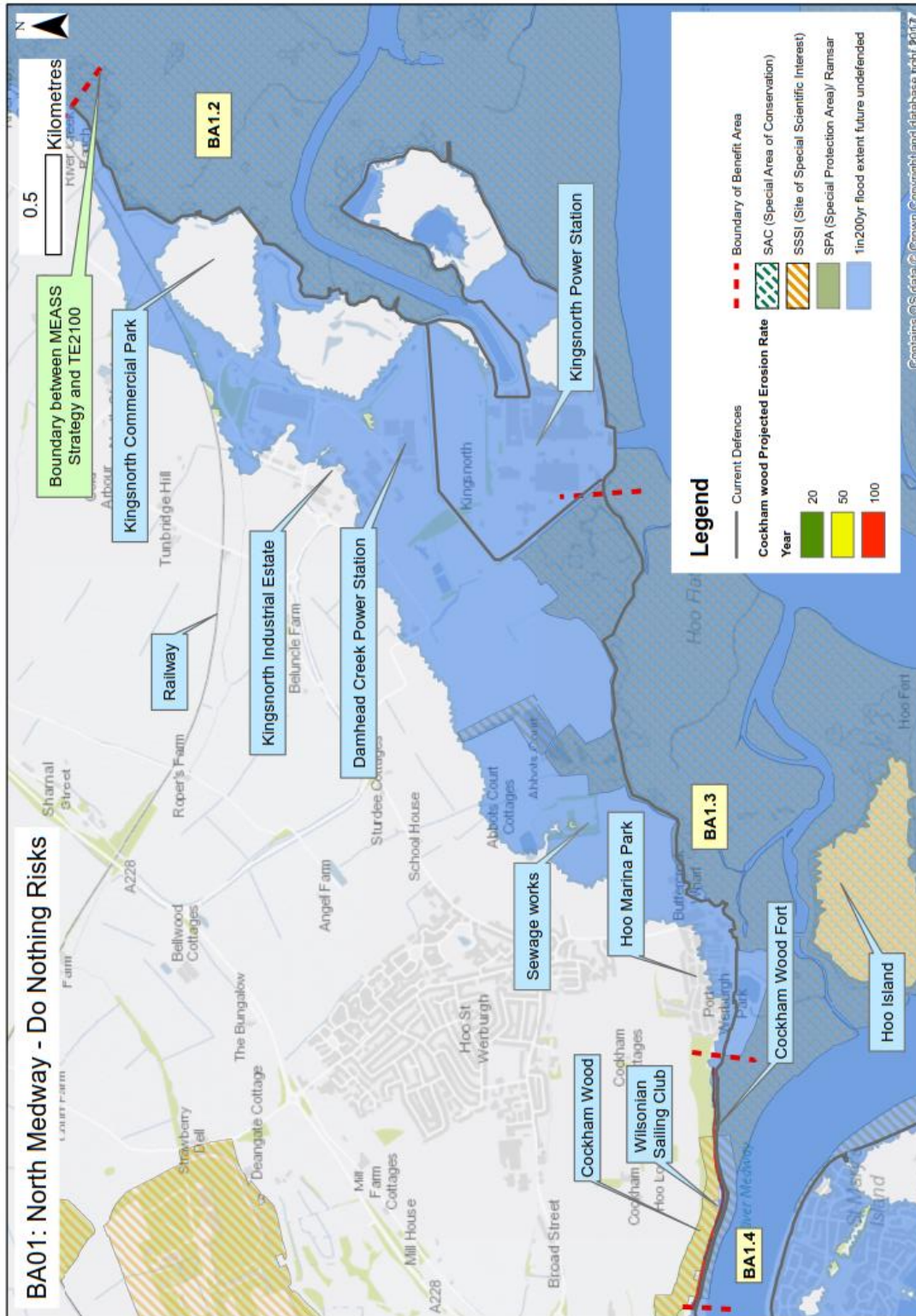
Each section includes the following information:

- Explanation of the preferred option;
- Justification for the preferred option;
- Key environmental designations at risk of being impacted;
- Overall policy for each of the epochs;
- Map;
- Key risks, mitigation measures and dependencies for the BA;
- Business case summary where a capital scheme is required in the next ten years;
- Summary of stakeholder comments and concerns;
- Detailed implementation plan for the BA– broken down into annual activities for the first 10 years and then the plan for the rest of epoch 1 (years 11-20), the second epoch and then the third epoch.

Please note that BA1.1 is now included in the Thames Estuary 2100 Strategy, and BA8.1 and 8.2 were merged to form BA8.2 to reflect the interconnectivity between these areas. BA1.1 and BA8.1 no longer exist within the Strategy.

For information regarding the crest level increases, and where these are located, please refer to the maps in Appendix B of this Report. For explanation of where these crest levels have been derived from, please refer to Section 6.2 of the Options Technical Report (Technical Appendix D of the Strategy).

A.1 BA1: North Medway

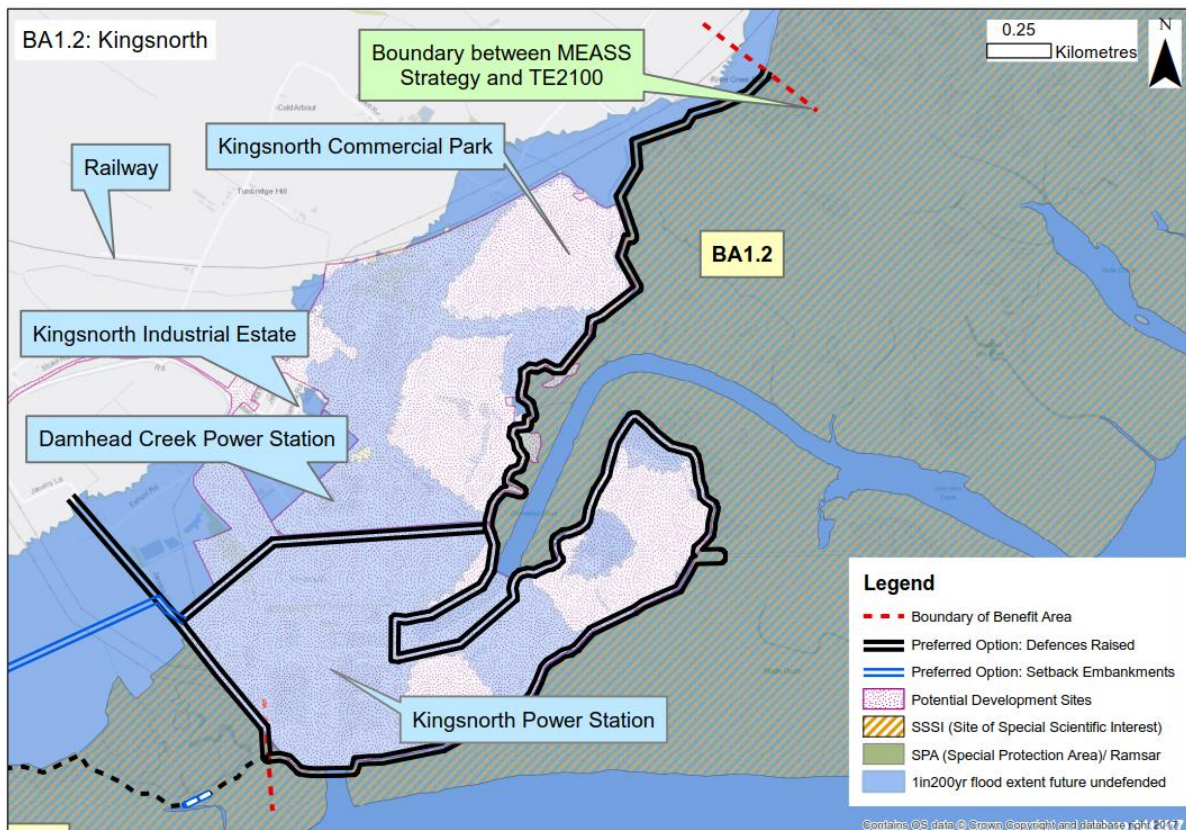


A.1.1 BA1.2: Kingsnorth

The key focus for this area is the protection to the two power stations within the Do Nothing flood zone. The standard of protection is currently high, however a proportion of the defences need to be raised. An extension to the existing embankment to prevent flooding from BA1.3 is further required. Partnership Funding score is low however this is because the benefits are concentrated on commercial and industrial activities. Discussions with the industries around funding for the defences will be required before the capital scheme is taken forward. It is to be noted that this area ties into TE2100 Strategy and there is no BA1.1.

Preferred Option	Maintain defences until year 8. Then raise (sustain) the embankment, seawall, and rock revetment in year 8.		
Description of Preferred Option	Maintenance of the current defences (embankment, seawall, rock revetment and sheet piling) for the first 7 years to the current SoP offered. Following this the defences will be raised to 5.3m AOD and then raised again in year 50 to 6.6m AOD to ensure a 0.1% SoP in 100 years taking account of sea level rise. The current average crest level of defences in this area is 5.77m AOD therefore there are only small sections which need upgrading in the short term.		
Justification	Delayed sustain option has highest NPV and BCR. It is more cost effective to raise the defences in year 8 when the defences are near the end of their residual life, and then in year 50 to raise with sea level rather than raising all initially.		
Environmental	Potential significant effects on the Medway Estuary and Marshes SPA and Ramsar and constituent qualifying features due to coastal squeeze. The saltmarsh habitats of Stoke Saltings and Slede are predicted to reduce in area due to sea level rise. Potential loss of reed bed habitat around Damhead Creek could impact on Marsh Harrier breeding.		
	2018-2038	2039-2068	2069-2118
Overall Policy	HTL Maintain until year 8 and then HTL Sustain	HTL Sustain	HTL Sustain
Defence Crest Level Required	5.3m AOD	5.3m AOD	6.6m AOD

Whole Life Cost (PV)	£22,054k	BCR	1.9	PF%	10
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Key Risks and Mitigation - BA1.2: Kingsnorth

Key Risk	Mitigation and Action	Owner
Loss of intertidal habitats due to coastal squeeze.	Strategy wide intertidal habitat compensation will be developed through MR sites. The feasibility of the MR sites will be undertaken to confirm that adequate habitat is provided.	KSL Area Team with advice from NEAS.
Third party contributions required.	Discussions will be had with key asset owners early on in 2022 when the business case is being developed.	KSL Area Team.
Visual effects and impacts upon landscape character of implementing capital works to sustain defences.	Design of flood defences (most likely earth embankments) that minimise visual impacts and impacts on the landscape character. Use materials, where hard engineering is present and will be enhanced, that reflect the cultural landscape and enhance local character. Where possible, build nature-based design into the embankments to provide broader environmental opportunities.	KSL Area Team oversee with designs led by consultant and ncpms. NEAS to provide landscape advice.
Environmental impacts.	Heritage asset risk assessment will be done as part of the OBC development in year 2023. Particular consideration to where the additional embankment will be placed which will required ground investigations and excavation. Within the Kent Downs AONB, therefore the AONB Unit will be consulted alongside the local community and NEAS landscape experts.	KSL Area Team oversee with designs led by consultant and ncpms. NEAS to provide heritage advice.
Impacts on key infrastructure.	Discussions with Kingsnorth Power Station, Kingsnorth Commercial Park and Kingsnorth Industrial Estate will be commenced in year 2019. These parties will feed into the OBC development.	KSL Area Team.
Impact on services.	The new embankment will cross land close to large industrial developments which are likely to have buried pipes and cables associated. The alignment will be considered carefully at SOC stage in relation to these.	KSL Area Team They should also consider seeking specialist advice from Early Supplier Engagement.
Potential impacts from works on estuarine rocky habitats.	Review during design and develop design to mitigate impacts.	KSL Area Team with support from design consultants.
Review opportunities to reduce carbon.	For seawall consider use of steel rather than concrete, however if concrete is required investigate possibility of using low carbon concrete. Consider material sources and transportation during design phase and limit carbon footprint where possible.	Designer.

Key Dependencies

- MR sites being approved to confirm that compensation is required for the loss of intertidal habitat due to coastal squeeze.
- Achieving third party funding contributions.
- The northern boundary of this BA is with TE2100 and as such when TE2100 is completed the interactions between the two boundaries should be reviewed to make sure that they align with each other.
- Licences and permits required for the capital scheme to include (but not be limited to): MMO, EIA Screening, preliminary WFD Assessment, HRO1, and Flood Risk Activity Permit. Depending on option design, EIA Scoping, Environmental Statement and an Appropriate Assessment may be required.

Business Case for Capital Scheme

Case	Summary
Strategic case	<ul style="list-style-type: none">• There is a need to continue to protect the nationally important infrastructure in this area.• There is a requirement to tie into the TE2100 Strategy.
Economic case	<ul style="list-style-type: none">• The Benefit Cost Ratio is above 1 due to the nationally important infrastructure.
Commercial case	<ul style="list-style-type: none">• This will be undertaken with close working and collaboration with the commercial industry partners in the area, including (but not limited to) Kingsnorth Power Station, Kingsnorth Commercial Park and Kingsnorth Industrial Estate.
Financial case	<ul style="list-style-type: none">• The PF score is low due to the focus of benefits on commercial rather than residential benefits.
Management case	<ul style="list-style-type: none">• The key risks and required mitigations are highlighted above in the risks and mitigation table and need to be implemented throughout the business case activities.

Implementation Plan - BA1.2: Kingsnorth

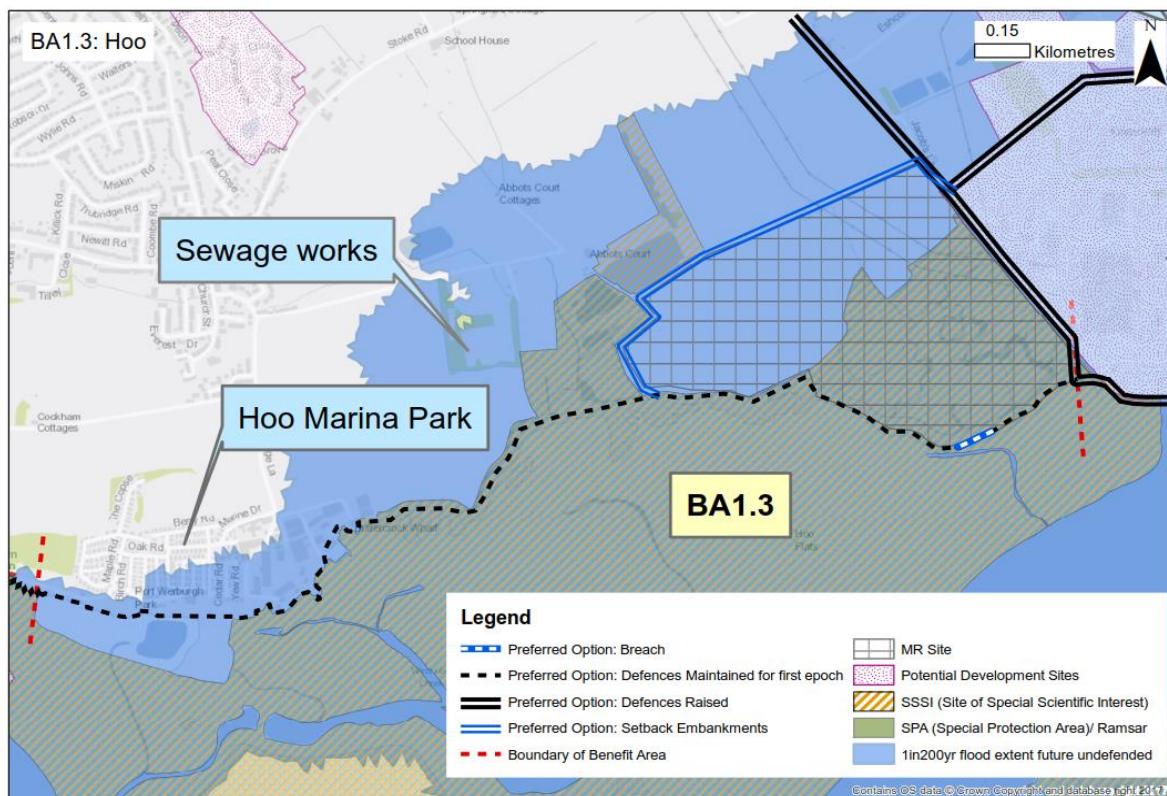
Year	Capital Scheme	Ongoing Maintenance
2019	Mitigation & Action: MR feasibility study	Annual maintenance – mowing of embankments and patch and repair
2020	Mitigation & Action: Discussions with Kingsnorth Power Station, Kingsnorth Commercial Park and Kingsnorth Industrial Estate to discuss inputs to business case development and funding	Annual maintenance – mowing of embankments and patch and repair
2021		Annual maintenance – mowing of embankments and patch and repair
2022		Annual maintenance – mowing of embankments and patch and repair
2023	OBC procurement including NEAS screening Mitigation & Action: Heritage risk assessment Mitigation & Action: Early Supplier Engagement to assess impacts and risks of services	Annual maintenance – mowing of embankments and patch and repair
2024	Start to develop the OBC - detailed economic assessment – review options and develop outline design – stakeholder engagement – third party contributions – environmental assessment – licenses and permits discussions Mitigation & Action: Ensure landscape and biodiversity opportunities feed into optioneering. Mitigate though design impacts on estuarine rocky habitats	Annual maintenance – mowing of embankments and patch and repair
2025	Finalise business case and undertake detailed design - early contractor involvement – refine option design – stakeholder engagement – obtain licenses and permits	Annual maintenance – mowing of embankments and patch and repair
2026	Construction works to raise the embankment, seawall, and rock revetment	
2027	Finalise construction works	
2028		Annual maintenance – mowing of embankments and patch and repair
2029 – 2039		Annual maintenance – mowing of embankments and patch and repair Capital maintenance in years 2031 and 2034 - seawalls and rock revetments
2040 – 2069	2066 - Develop the business case for the second phase of capital works 2067 - Finalise the business case and undertake detailed design 2068 - Construction works to raise the embankment, seawall, rock revetment and sheet piling	Annual maintenance – mowing of embankments and patch and repair Capital maintenance in years 2042, 2045, 2052, 2055, and 2062 – rock revetment and seawalls every decade, sheet piling every 30 years
2070 – 2119		Annual maintenance – mowing of embankments and patch and repair Capital maintenance in years 2077, 2087, 2097, and 2107– rock revetment, seawalls and sheet piling Capital maintenance to be undertaken in year 2077, 2087, 2097, and 2107. Works will be undertaken every decade on the rock revetment

A.1.2 BA1.3: Hoo

A managed realignment site will be developed in the east of this BA section after year 10 following current activities on the site. This will provide intertidal compensation for the Strategy. The rest of the area will be maintained for 25 years before moving to NAI. Specific engagement with landowners and residents in this area is critical to reducing risks with this scheme.

Preferred Option	Ongoing maintenance until year 25, followed by No Active Intervention (NAI). Managed Realignment site at the east of the site with freshwater habitat compensation required in year 11.		
Description of Preferred Option	Maintenance (patch and repair) of the current defences (earth embankments and rock revetment) for the first 25 years. After this all maintenance will be ceased which will increase the risk of failure of the defences. Additionally, construction of a MR site from year 11 to the east of the BA to help compensate for the strategy wide coastal squeeze impacts. Setback embankments would be constructed to manage tidal water and a breach in the current defences created. This will also require compensatory freshwater habitat.		
Justification	Due to the limited assets at risk in the area, options to hold the line long term do not provide a BCR above one. The current defences have a 25-year median residual life. If patch and repair maintenance continues, the overall BCR is above one and the NPV is positive, enabling HTL policy in the short term. The justification for the MR site is related to the Strategy wide requirement for coastal squeeze compensation.		
Environmental	Potential significant effects on the Medway Estuary and Marshes SPA and Ramsar and SSSI and constituent qualifying features due to coastal squeeze in the first 25 years. Once the policy of NAI is implemented after year 25, there may be loss of designated freshwater grazing marsh, and adverse effects on the connectivity of the freshwater habitats. Freshwater habitat compensation will be required from year 11 due to the managed realignment site in this area.		
	2018-2038	2039-2068	2069-2118
Overall Policy	HTL Maintain with MR	MR and NAI	MR and NAI
Defence Crest Level Required	5m AOD 6.1m for setback defence	N/A – NAI 6.1m for setback defence	N/A – NAI 6.1m for setback defence

Whole Life Cost (PV)	£147k	BCR	2.3	PF%	13
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Key Risks and Mitigation - BA1.3: Hoo

Key Risk	Mitigation and Action	Owner
Provision of satisfactory compensatory freshwater habitat.	Undertake freshwater surveys. Determine appropriate compensation sites. Following the surveys, the potential freshwater compensation sites proposed in the Strategy will be reviewed and updated (dependant on the outcomes of the surveys).	KSL Area Team with support from NEAS.
Landowner buy-in to the creation of the freshwater compensation site.	Conversations will be undertaken with landowners to ensure that there is buy-in for the creation of the compensatory freshwater habitat.	KSL Area Team.
Potential impacts of increased overtopping on infrastructure.	Further engagement with the landowners, in particular the sewage works, Abbots Court Nursing Home and Hoo Marina Park, will be undertaken 2 years prior to implementation of the NAI policy.	KSL Area Team.
Hoo Park Marina at risk.	Due to Hoo Park Marina consisting of caravans, little FDGiA funding is available for their protection. Early engagement with them regarding potential options for private maintenance to be undertaken.	KSL Area Team.
Agreeing MR site with landowners.	Undertake early discussions on wider benefits and opportunities and set up legal agreements.	KSL Area Team.
Visual effects and impacts upon landscape character of implementing capital works to sustain defences and constructing new setback embankments - potential delays to design stage.	Design flood defences (most likely earth banks) that minimise visual impacts and impacts on the landscape character. Use materials, where hard engineering is present and will be enhanced, that reflect the cultural landscape and enhance local character. Look for opportunities to introduce mitigation planting to enhance landscape character and minimise visual impact of proposals.	NEAS with support from design consultants.
Unknown archaeological risk from new embankments and Managed Realignment Site.	In-depth archaeological desk study to be carried out as one of the first activities in the design of the Managed Realignment site. Desk study to influence further investigations which may include trial pits, non-intrusive or geophysical surveys, ground investigations.	NEAS heritage specialist with support from appraisal consultants.
Risk of breach and MR site causing increased scour and increased tidal prism.	More detailed modelling at design stage to be undertaken to confirm velocity and shear stress changes. Design will mitigate potential impacts and improve scour protection elsewhere if required.	KSL Area Team with support from design consultant.
Impacts of soil conditions on design and environment for Managed Realignment site.	There is evidence to suggest former fields have an impermeable podzol layer which effects the drainage of newly forming saltmarsh and mudflat. Undertake a core during early GI to understand ground conditions. If poor, alternatives include ploughing, crop stripping etc.	KSL Area Team with support from design consultant and NEAS.
Review opportunities to reduce carbon.	For MR site, consider sourcing embankment material from borrow pit within the site – GI works would be required to investigate this. Consider material sources and transportation during design phase and limit carbon footprint where possible.	Designer.

Impacts on freshwater designated (SPA and Ramsar) habitat assessment

Freshwater compensation is required as part of the Managed Realignment site scheme due to part of the Managed Realignment site being currently designated freshwater habitat. Freshwater site to be developed potentially north east of the Benefit Area (on the Isle of Grain) following freshwater surveys in the first year.

Key Dependencies

- Strategy wide environmental reviews to assess the requirements for the freshwater habitat requirements.
- Suitable freshwater compensation to be established prior to implementing the NAI policy.
- Engagement with landowners to be undertaken two years prior to implementing the NAI policy.
- Licences and permits required for the MR scheme to include (but not be limited to): MMO, Footpaths, EIA Screening, EIA Scoping, Environmental Statement, preliminary WFD Assessment, HRO1, Appropriate Assessment and Flood Risk Activity Permit. Depending on option design, a Tree Protection Order may be required.

Stakeholders

- Key concerns from residents around long term impacts on Hoo Park Marina.
- Potential concerns around agreeing MR site with landowners.
- Key concerns around loss of income from agricultural land – need to engage and assess actual impact (i.e. frequency and depth)

Implementation Plan - BA1.3: Hoo

Year	Strategy Wide Activities	Capital MR Scheme	Freshwater Compensation	Ongoing Maintenance	No Active Intervention
2019	Update of HCP Report with detailed scope and programme for surveys. Surveys of the Priority 1 sites to determine the freshwater compensatory habitat requirement	Assessment of survey requirements within HCP report	Assessment of survey requirements within HCP report	Maintenance – mowing of embankments and patch and repair	
2020	Surveys of the SPA and Ramsar sites to determine the freshwater compensatory habitat requirement				
2021	Mitigation & Action: Freshwater compensation sites reviewed and finalised National DEFRA review of HCP Report	Mitigation & Action: Agree required compensation	Mitigation & Action: Determine potential locations of freshwater compensation sites and agree funding	Maintenance – mowing of embankments and patch and repair	
2022			Landowner engagement in compensation site Mitigation & Action: Landowner engagement		
2023	National DEFRA review of HCP Report		Landowner engagement in compensation site Compensation site design and funding application for compensation site	Maintenance – mowing of embankments and patch and repair	
2024	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation		Review and implement freshwater compensation site		
2025	National DEFRA review of HCP Report	Mitigation & Action: Landowner consultation in MR site Mitigation & Action: Archaeological desk study NEAS screening and business case production for MR site	Review and implement freshwater compensation site	Maintenance – mowing of embankments and patch and repair	
2026		Landowner consultation in MR site Business case for MR site	Review and implement freshwater compensation site		

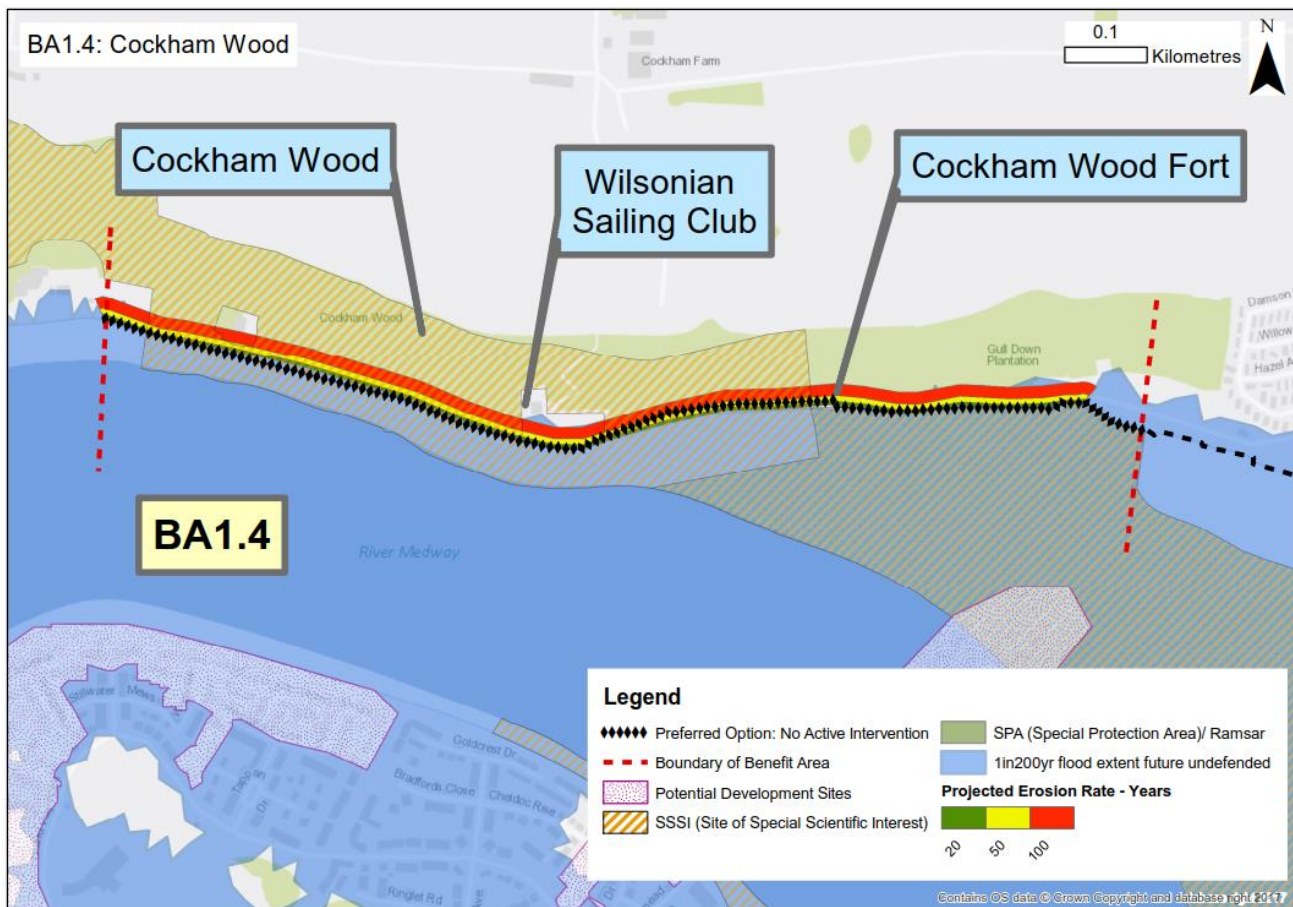
Year	Strategy Wide Activities	Capital MR Scheme	Freshwater Compensation	Ongoing Maintenance	No Active Intervention
		Mitigation & Action: GI to include test on soil conditions			
2027	National DEFRA review of HCP Report	Detailed design of MR site Environmental impact assessment of the MR site Mitigation & Action: Modelling to assess risk of downstream scour	Review and implement freshwater compensation site	Maintenance – mowing of embankments and patch and repair	
2028		Detailed design of MR site Application for permits and licenses	Review and implement freshwater compensation site		
2029 – 2039	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation Every 2 years - National DEFRA review of HCP Report	2029- Construction of set-back embankments 2029- Construction of breach 2030 to 2034 – Annual surveys of MR site to determine the colonisation of the intertidal habitat	2029 – Confirmation of required compensatory habitat creation	Years 2028, 2030, 2032, 2034, 2037 and 2038 maintenance – mowing of embankments and patch and repair	2030 – Landowner engagement regarding withdrawal of maintenance Mitigation & Action: Review of potential impacts following NAI with landowners
2040 – 2069	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation Every 2 years - National DEFRA review of HCP Report				2040 – Landowner engagement regarding maintenance withdrawal 2042 – Maintenance ceases and NAI implemented
2070 – 2119	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation Every 2 years - National DEFRA review of HCP Report				Maintenance ceased and NAI implemented

A.1.3 BA1.4: Cockham Wood

Cockham Wood is an area of undefended cliffs which are open to active coastal erosion. The cliffs are SSSI protected for their geological features and the long term management plan is continued No Active Intervention. This is no change from the current approach. Cockham Wood Fort is likely to become at risk from erosion in the long term.

Preferred Option	No Active Intervention (NAI).		
Description of Preferred Option	There are currently no defences in the area, and the SMP policy is NAI. This policy will be maintained, and no new defences will be constructed. Rate of cliff retreat will increase with sea level rise, but this will support the SSSI designation at the site.		
Justification	No short listed options were identified to provide erosion protection long this frontage. NAI aligns with SMP policy and requirements of the SSSI.		
Environmental	This option is not likely to have significant effects on any designated sites and their constituent qualifying features as the cliffs are left naturally to erode. This supports the designation for the geology in the Tower Hill to Cockham Wood SSSI.		
	2018-2038	2039-2068	2069-2118
Overall Policy	NAI	NAI	NAI
Defence Crest Level Required	N/A - NAI	N/A - NAI	N/A - NAI

Whole Life Cost (PV)	£-	BCR	N/A	PF%	N/A
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Key Risks and Mitigation - BA1.4: Cockham Wood

Key Risk	Mitigation and Action	Owner
Potential cultural heritage impacts.	Potential loss of the Cockham Wood Fort, however the impacts cannot be mitigated due to the SSSI designation. Engagement will be undertaken with Historic England.	KSL Area Team with support from NEAS heritage specialists.
Potential impacts on BAP habitat.	There is potential erosion of Priority Habitat, although this is in line with the SSSI designation. No action associated.	N/A

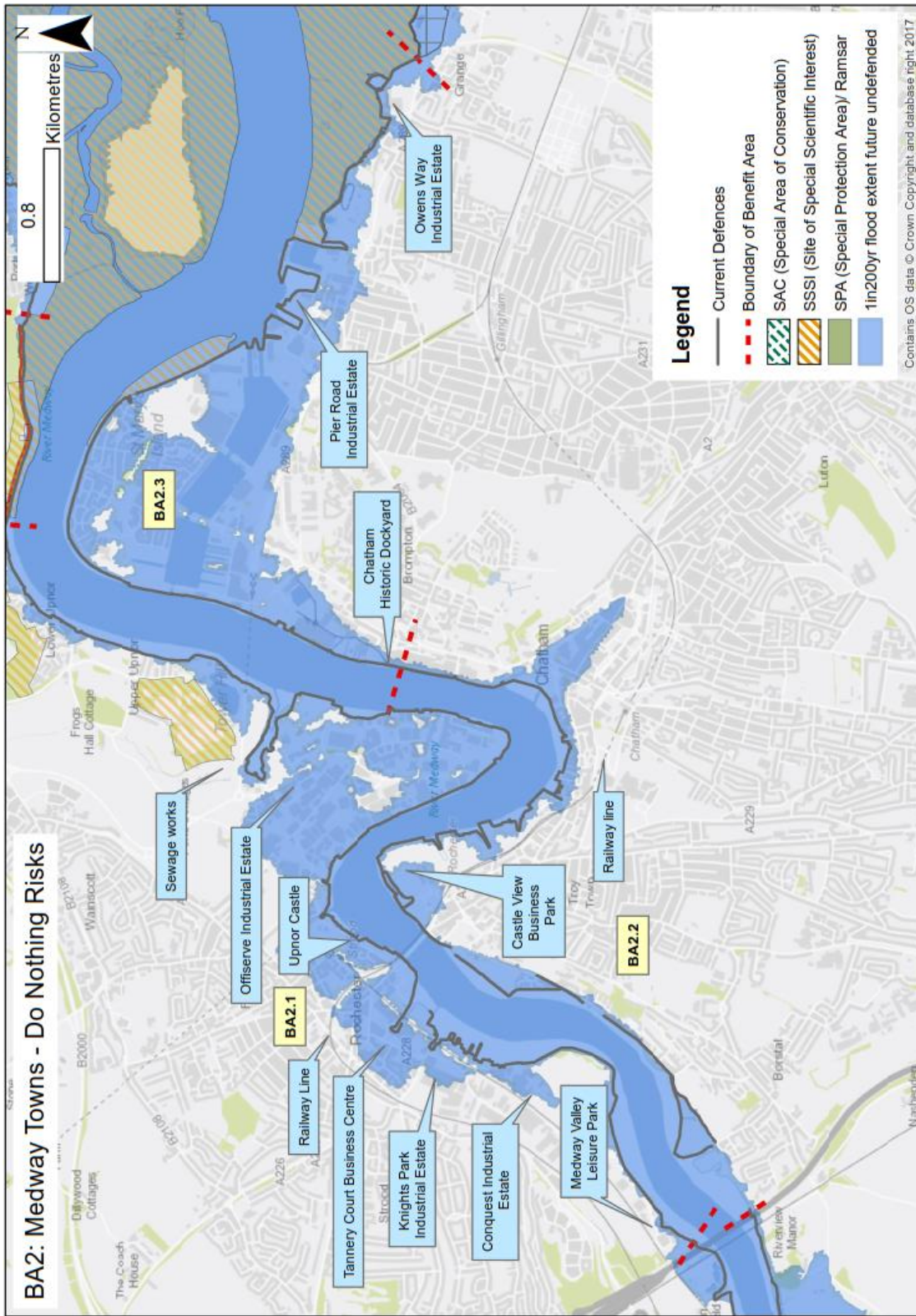
Key Dependencies

- N/A (it is to be noted that as this area currently is managed as a NAI site, the additional landowner engagement required when withdrawing maintenance does not apply here).

Implementation Plan - BA1.4: Cockham Wood

Year	No Active Intervention
2019	NAI. Health and safety surveys undertaken
2020	NAI. Health and safety surveys undertaken
2021	NAI. Health and safety surveys undertaken
2022	NAI. Health and safety surveys undertaken
2023	NAI. Health and safety surveys undertaken Mitigation and Action: Engage with Historic England regarding erosion risk to Cockham Wood Fort
2024	NAI. Health and safety surveys undertaken
2025	NAI. Health and safety surveys undertaken
2026	NAI. Health and safety surveys undertaken
2027	NAI. Health and safety surveys undertaken
2028	NAI. Health and safety surveys undertaken
2029 – 2039	NAI. Health and safety surveys undertaken
2040 – 2069	NAI. Health and safety surveys undertaken
2070 – 2119	NAI. Health and safety surveys undertaken

A.2 BA2: Medway Towns

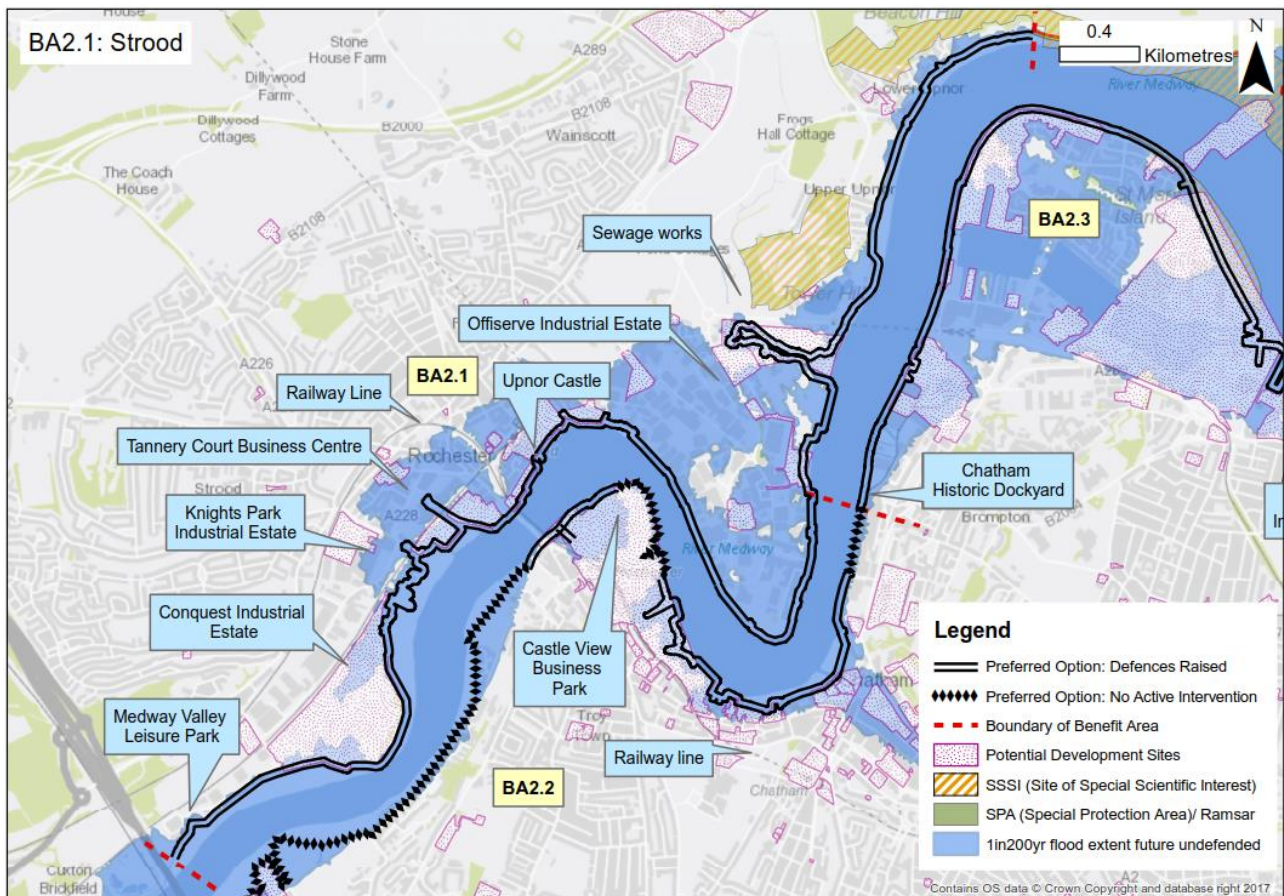


A.2.1 BA2.1: Strood

There are a large number of residential and commercial properties at risk from flooding in this area if defences are not kept in place. Just under half of the defences in this section need increasing in crest level in the short term, to bring the standard of protection up to a 1%AEP. The PF score is low and third party funding will be required. At the next stage, specific flood cells should be studied in more detail to see if efficiencies can be gained through reducing the length of frontage where defences need to be raised.

Preferred Option	Raise (sustain) embankments, walls, flood gates and revetments.		
Description of Preferred Option	This option involves improving the current SoP provided by the defences to 1% AEP SoP with sea level rise; in year 9 to 5.1m AOD and then in year 50 to 6.2m AOD to continue to provide protection in line with sea level rise.		
Justification	This option has the highest BCR, NPV and a high incremental BCR, However it is to be noted that there is still a significant amount of contributions that will be required to allow the scheme to progress. It has one of the highest environmental rankings from the short list of options. There is a higher economic justification for raising the defences in the short term rather than waiting for defences to reach their residual life to provide increased flood risk in the short term.		
Environmental	This option is not predicted to have any direct or indirect impacts on any designated sites and their constituent qualifying features. Impacts on the heritage landscape will be carefully considered through the design.		
	2018-2038	2039-2068	2069-2118
Overall Policy	HTL Sustain	HTL Sustain	HTL Sustain
Defence Crest Level Required	5.1m AOD	5.1m AOD	6.2m AOD

Whole Life Cost (PV)	£20,534k	BCR	1.9	PF%	14
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Key Risks and Mitigation - BA2.1: Strood

Key Risk	Mitigation and Action	Owner
Visual effects and impacts upon landscape character of implementing capital works to sustain defences – potential delays to design stage.	Use materials that reflect the cultural landscape and enhance local character. Designer will liaise with heritage and landscape specialists within the EA as well as Kent County Council.	KSL Area Team and design consultants.
Third party contributions required.	Discussions will be undertaken with key asset owners early on in 2024 when the business case is being developed. This will include the sewage works and the different industrial estates and business centres along the river frontage.	KSL Area Team.
Potential cultural/heritage impacts.	A detailed archaeological assessment will be undertaken prior to commencing works. This will be undertaken in consultation with Historic England and Kent County Council Heritage Team.	KSL Area Team with support from NEAS heritage specialists and appraisal consultants.
Impacts on Kent Downs Area of Outstanding Natural Beauty.	Within the Kent Downs AONB, therefore the AONB Unit will be consulted alongside the local community and NEAS landscape experts.	KSL Area Team with support from NEAS.
Impacts from works on Upnor Castle which is Grade 1 Listed.	Kent County Council and Historic England will be consulted early in the process to mitigate the visual impact on Upnor Castle. This will be done through consideration of materials used and a heritage assessment will be completed.	NEAS in particular the heritage specialist.
Potential tentacled lagoon worm presence.	Environmental surveys at OBC to determine presence/absence and provide mitigation during construction.	NEAS with support from appraisal consultant.
Review opportunities to reduce carbon.	For concrete defences investigate possibility of using low carbon concrete. Consider use of steel rather than concrete for seawall. Consider material sources and transportation during design phase and limit carbon footprint where possible.	Designer.

Key Dependencies

- MR sites being approved to ensure that compensation is required for the loss of intertidal habitat due to coastal squeeze.
- Achieving third party funding contributions.
- Licences and permits required for the capital scheme to include (but not be limited to): MMO, preliminary WFD Assessment, Listed Buildings, EIA Screening and Flood Risk Activity Permit.

Business Case for Capital Scheme

Case	Summary
Strategic case	<ul style="list-style-type: none"> • Residential and commercial properties at risk from overtopping and flooding. • Defences and river front integral to the overall character and personality of the town.
Economic case	<ul style="list-style-type: none"> • The Benefit Cost Ratio is above 1 and there are a number of potential OM2s associated with the works.
Commercial case	<ul style="list-style-type: none"> • This will be undertaken with collaboration with Medway Council.
Financial case	<ul style="list-style-type: none"> • The PF score is low and third-party funding required and the key risk for the Project.
Management case	<ul style="list-style-type: none"> • The key risks and required mitigations are highlighted above in the risks and mitigation table and need to be implemented throughout the business case activities. • The different flood cells within the section may provide opportunity to fast-track particular parts of the scheme if third party funding is an issue.

Implementation Plan - BA2.1: Strood

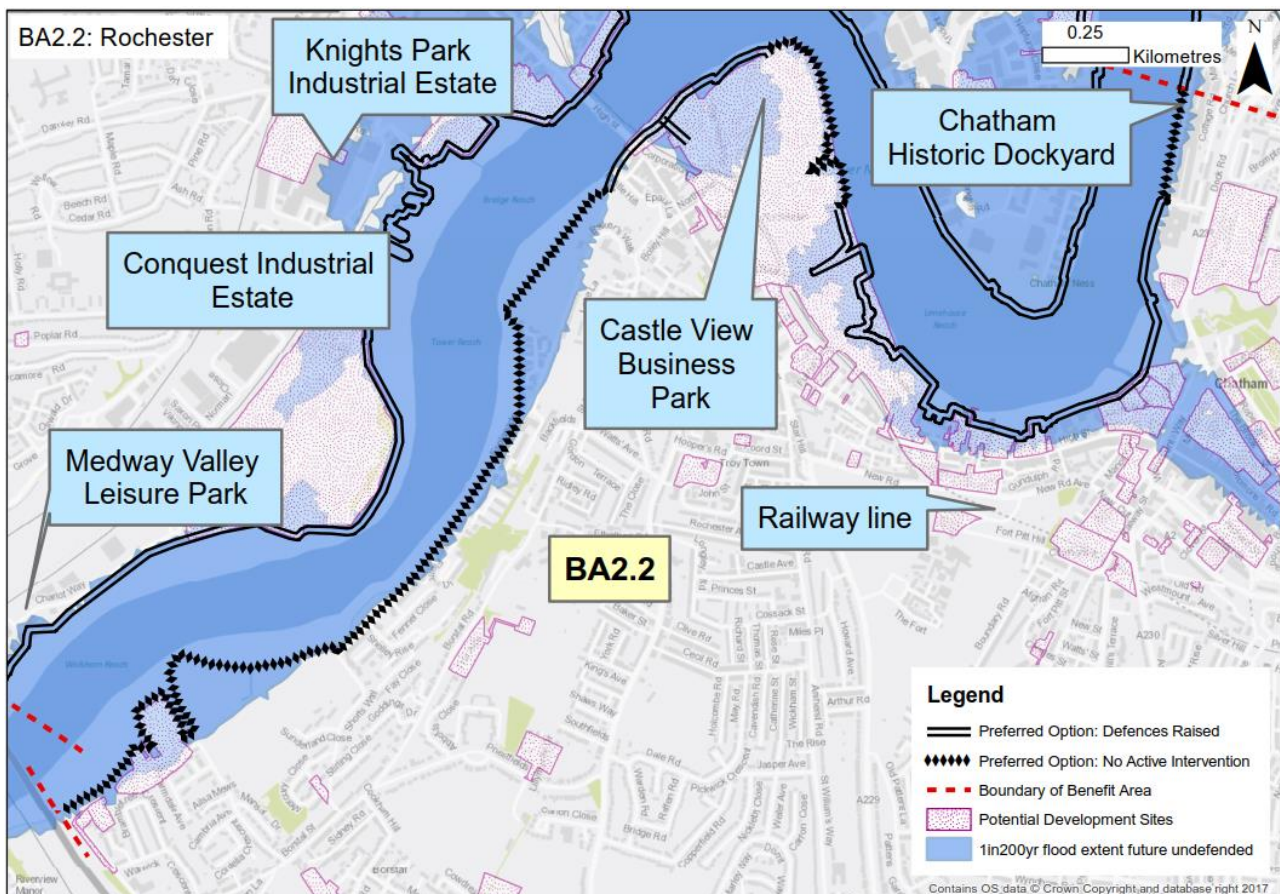
Year	Capital Scheme	Ongoing Maintenance
2019		Annual maintenance – embankments, seawalls, rock and concrete revetment and sheet piling
2020		Annual maintenance – embankment mowing and patch and repair
2021		Annual maintenance – mowing of embankments
2022		Annual maintenance – embankment mowing and patch and repair
2023		Annual maintenance – embankment mowing and patch and repair
2024	OBC procurement including NEAS screening Mitigation & Action: Discussions with key asset owners and Kent Downs AONB	Annual maintenance – embankment mowing and patch and repair
2025	Start to develop the OBC - detailed economic assessment – review options and develop outline design – stakeholder engagement – third party contributions – environmental assessment – licenses and permits discussions Mitigation & Action: Environmental survey assess presence/absence of tentacled lagoon worm Mitigation & Action: Archaeological assessment	Annual maintenance – embankment mowing and patch and repair
2026	Finalise business case and undertake detailed design - early contractor involvement – refine option design – stakeholder engagement – obtain licenses and permits	Annual maintenance – embankment mowing and patch and repair
2027	Construction works to raise the embankment, seawall, rock and concrete revetments and sheet piling	
2028	Finalise construction works	
2029 – 2039		Annual maintenance – embankment mowing and patch and repair Capital maintenance in year 2029 – revetments, walls and sheet piling
2040 – 2069	2044 – Business case for repairs to concrete revetment 2045 – Finalise business case and undertake detailed design for concrete revetment 2046 – Capital works on concrete revetment 2066 – Business case for second phase of works 2067 – Finalise business case and undertake detailed design for second phase of works 2068 – Construction works to raise the embankment, seawall and rock revetment	Annual maintenance – embankment mowing and patch and repair Capital maintenance in years 2039, 2049, and 2059 – rock revetment and seawalls Capital maintenance in year 2049 – sheet piling
2070 – 2119	2092 – Business case for repairs to concrete revetment 2093 – Finalise business case and undertake detailed design for concrete revetment 2094 – Capital works on concrete revetment	Annual maintenance – embankment mowing and patch and repair Capital maintenance in years 2077, 2087, 2097 and 2107 – rock revetment and seawalls Capital maintenance in years 2079 and 2109 – sheet piling

A.2.2 BA2.2: Rochester

Although the policy here is HTL in localised sections, the areas of NAI are areas of high ground. These areas are therefore not related to flood risk either now or in 100 years taking into account sea level rise. The initial works need to focus on upgrading the condition of the assets. Furthermore, they will raise the low crest level areas to be in line with the rest of the section to provide protection from 1%AEP flood event. Funding and maintenance of the defences needs to be discussed with industries in the area and importantly Medway Council.

Preferred Option	Raise (sustain) seawalls and sheet piling in localised areas.		
Description of Preferred Option	Localised raising of the defences to protect properties and assets at risk of flooding around Rochester and Chatham against a 0.1% AEP with sea level rise. The localised defences will be raised in year 8 to 5.4m AOD and then in year 50 to 6.8m AOD to continue to provide protection in line with sea level rise. The rest of the BA will have a NAI approach as the structures tie into high ground and are not associated with flood risk.		
Justification	Localised HTL option is the only option which provides a BCR above 1. This option will still provide protection to all residential properties at risk of flooding to at least a 1% AEP. In the NAI areas there is limited assets at risk due to the rising ground. There is a higher economic justification for raising the defences in the short term rather than waiting for defences to reach their residual life to provide increased flood risk protection in the short term.		
Environmental	This option is not predicted to have any direct or indirect impacts on any designated sites and their constituent qualifying features. Impacts on the heritage landscape will be carefully considered through the design.		
	2018-2038	2039-2068	2069-2118
Overall Policy	HTL Sustain with localised NAI	HTL Sustain with localised NAI	HTL Sustain with localised NAI
Defence Crest Level Required	5.4m AOD	5.4m AOD	6.8m AOD

Whole Life Cost (PV)	£5,417k	BCR	1.1	PF%	18
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Key Risks and Mitigation - BA2.2: Rochester

Key Risk	Mitigation and Action	Owner
Visual effects and impacts upon landscape character of implementing capital works to sustain defences – potential delays to design stage.	Use materials that reflect the cultural landscape and enhance local character. Designer will liaise with heritage and landscape specialists within the EA as well as Kent County Council.	KSL Area Team and design consultants.
Third party contributions required.	Discussions will be undertaken with key asset owners early on in 2023 when the business case is being developed.	KSL Area Team.
Potential cultural/ heritage impacts.	A detailed archaeological assessment will be undertaken prior to commencing works. This will be undertaken in consultation with Historic England and the Kent County Council Heritage department. There is a particular risk around the tie in of defences by Chatham Dock Yard and maintaining the character/landscape in this area.	KSL Area Team with support from NEAS heritage specialist and appraisal consultant.
Impact of failing defences where formalised flood defences are not needed.	Although only some of the section of river is required to maintain the flood defences, the rest of the quay walls in the section have a function outside of flood protection and this will to be discussed with Medway Council at OBC stage.	KSL Area Team.
Impacts on Kent Downs Area of Outstanding Natural Beauty.	Within the Kent Downs AONB, therefore the AONB Unit will be consulted alongside the local community and NEAS landscape experts.	KSL Area Team with support from NEAS.
Requirement for a setting assessment	The Local Authority and Historic England will be consulted on whether a setting assessment is required.	NEAS.
Potential tentacled lagoon worm presence.	Environmental surveys at OBC to determine presence/absence and provide mitigation during construction.	NEAS with support from appraisal consultant.
Review opportunities to reduce carbon.	For seawall consider use of steel rather than concrete, however if concrete is required investigate possibility of using low carbon concrete. Consider material sources and transportation during design phase and limit carbon footprint where possible.	Designer.

Key Dependencies

- MR sites being approved to ensure that compensation is required for the loss of intertidal habitat due to coastal squeeze.
- Achieving third party funding contributions.
- Licences and permits required for the capital scheme to include (but not be limited to): MMO, preliminary WFD Assessment, Listed Buildings, EIA Screening, and Flood Risk Activity Permit.

Business Case for Capital Scheme

Case	Summary
Strategic case	<ul style="list-style-type: none"> • Residential and commercial properties at risk from overtopping and flooding. • Defences and river front integral to the overall character and personality of the town. • The historical heritage along the river front is important theme for the development of the capital works design.
Economic case	<ul style="list-style-type: none"> • The Benefit Cost Ratio is above 1 and there are a number of potential OM2s associated with the works.
Commercial case	<ul style="list-style-type: none"> • The procurement plan for the business case will be undertaken with collaboration with Medway Council.
Financial case	<ul style="list-style-type: none"> • The PF score is low and third-party funding required. Collaboration and engagement with the industrial areas along the river front and Medway Council will be important.
Management case	<ul style="list-style-type: none"> • The key risks and required mitigations are highlighted above in the risks and mitigation table and need to be implemented throughout the business case activities.

Implementation Plan - BA2.2: Rochester

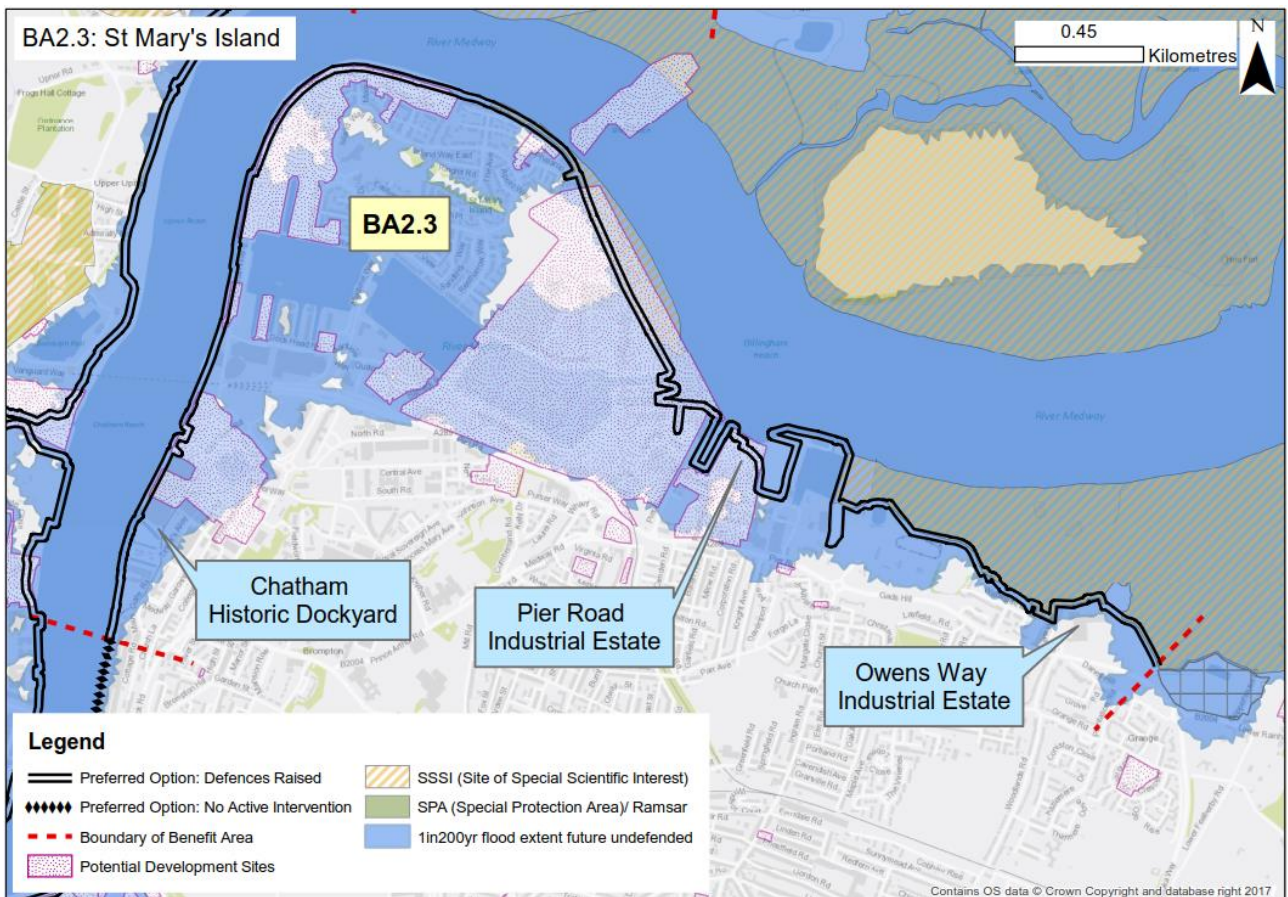
Year	Capital Scheme	Ongoing Maintenance
2019		Patch and repair maintenance of seawalls and sheet piling
2020		
2021		
2022		
2023	OBC Procurement including NEAS screening Mitigation & Action: Discussions with key asset owners on third party funding and with Kent Downs AONB Mitigation & Action: NEAS screening to consider requirements for setting assessment	
2024	Start to develop the OBC - detailed economic assessment – review options and develop outline design – stakeholder engagement – third party contributions – environmental assessment – licenses and permits discussions Mitigation & Action: Archaeological assessment Mitigation & Action: Quay wall flood protection review with Medway Council Mitigation & Action: Environmental survey to assess presence/absence of tentacled lagoon worm	
2025	Finalise business case and undertake detailed design - early contractor involvement – refine option design – stakeholder engagement – obtain licenses and permits	
2026	Construction works to raise the seawall and sheet piling	
2027		
2028		
2029 – 2039		2029 – seawall maintenance
2040 – 2069	2066 – Business case for second phase of works 2067 – Finalise business case and undertake detailed design for second phase of works 2068 – Construction works to raise the seawall and sheet piling	Capital maintenance in years 2039, 2049, and 2059 – seawalls Capital maintenance in year 2049 – sheet piling
2070 – 2119		Capital maintenance in years 2077, 2087, 2097 and 2107 – seawalls Capital maintenance in years 2079 and 2109 – sheet piling

A.2.3 BA2.3: St Mary's Island

The area around St Mary's Island needs to be upgraded to bring some of the lower sections of defences in line with a constant standard of protection to flooding. Currently there are several organisations who are involved in the maintenance of defences and therefore a coordinated approach is required. Third party funding agreements are a key consideration. Medway Council and the aspirations for Chatham Historic Dock will be integrated into the scheme decision making.

Preferred Option	Raise (sustain) embankments, walls, flood gates, and sheet piling.		
Description of Preferred Option	This option involves improving the SoP provided by the defences to 0.5% AEP SoP with sea level rise; in year 5 to 5.1m AOD and then in year 50 to 6.3m AOD to continue to provide protection in line with sea level rise.		
Justification	This option has the highest NPV and incremental BCR of over 5. It should be noted that the Upgrade option also presents a BCR of greater than one (but not an incremental BCR greater than 1) and therefore the SoP could be increased at OBC stage depending on third party contributions available. There is a higher economic justification for raising the defences in the short term rather than waiting for defences to reach their residual life to provide increased flood risk protection in the short term.		
Environmental	This option is not predicted to have any direct or indirect impacts on any designated sites and their constituent qualifying features. Impacts on the heritage landscape will be carefully considered through the design.		
	2018-2038	2039-2068	2069-2118
Overall Policy	HTL Sustain	HTL Sustain	HTL Sustain
Defence Crest Level Required	5.1m AOD	5.1m AOD	6.3m AOD

Whole Life Cost (PV)	£16,124k	BCR	3.9	PF%	33
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Key Risks and Mitigation - BA2.3: St Mary's Island

Key Risk	Mitigation and Action	Owner
Visual effects and impacts upon landscape character of implementing capital works to sustain defences – potential delays to design stage.	Use materials that reflect the cultural landscape and enhance local character. Designer will liaise with heritage and landscape specialists within the EA as well as Kent County Council.	KSL Area Team and design consultants.
Third party contributions required.	Discussions will be had with key asset owners early on in 2021 when the business case is being developed.	KSL Area Team.
Potential cultural heritage impacts – particularly to the Historic Dockyard.	A detailed archaeological assessment will be undertaken prior to commencing works. This will be undertaken in consultation with Historic England and Kent County Council Heritage Department. The heritage landscape and character around Chatham Historic Docks is a key consideration from the start of the scheme development.	KSL Area Team with support from NEAS heritage specialists and appraisal consultants.
Impacts on Kent Downs Area of Outstanding Natural Beauty.	Within the Kent Downs AONB, therefore the AONB Unit will be consulted alongside the local community and NEAS landscape experts.	KSL Area Team with support from NEAS.
Potential tentacled lagoon worm presence.	Environmental surveys at OBC to determine presence/absence and provide mitigation during construction.	NEAS with support from appraisal consultant.
Review opportunities to reduce carbon.	For seawall consider use of steel rather than concrete, however if concrete is required investigate possibility of using low carbon concrete. Consider material sources and transportation during design phase and limit carbon footprint where possible.	Designer.

Key Dependencies

- MR sites being approved to ensure that compensation is required for the loss of intertidal habitat due to coastal squeeze.
- Achieving third party funding contributions.
- Licences and permits required for the capital scheme to include (but not be limited to): MMO, preliminary WFD Assessment, Listed Buildings, EIA screening, and Flood Risk Activity Permit.

Business Case for Capital Scheme

Case	Summary
Strategic case	<ul style="list-style-type: none"> • Residential and commercial properties at risk from overtopping and flooding. • Defences and river front integral to the overall character and personality of the town. • The historical heritage along the river front is important theme for the development of the business case scheme.
Economic case	<ul style="list-style-type: none"> • The Benefit Cost Ratio is above 1 and there are a large number of potential OM2s associated with the works.
Commercial case	<ul style="list-style-type: none"> • The procurement plan for the business case will be undertaken with collaboration with Medway Council.
Financial case	<ul style="list-style-type: none"> • The PF score is low and third-party funding required. • This will be undertaken with collaboration with Medway Council and the industrial areas along the river front. Chatham Maritime Trust currently maintain some of the defences along this section and will need to be key stakeholders within the business case.
Management case	<ul style="list-style-type: none"> • The key risks and required mitigations are highlighted above in the risks and mitigation table and need to be implemented throughout the business case activities.

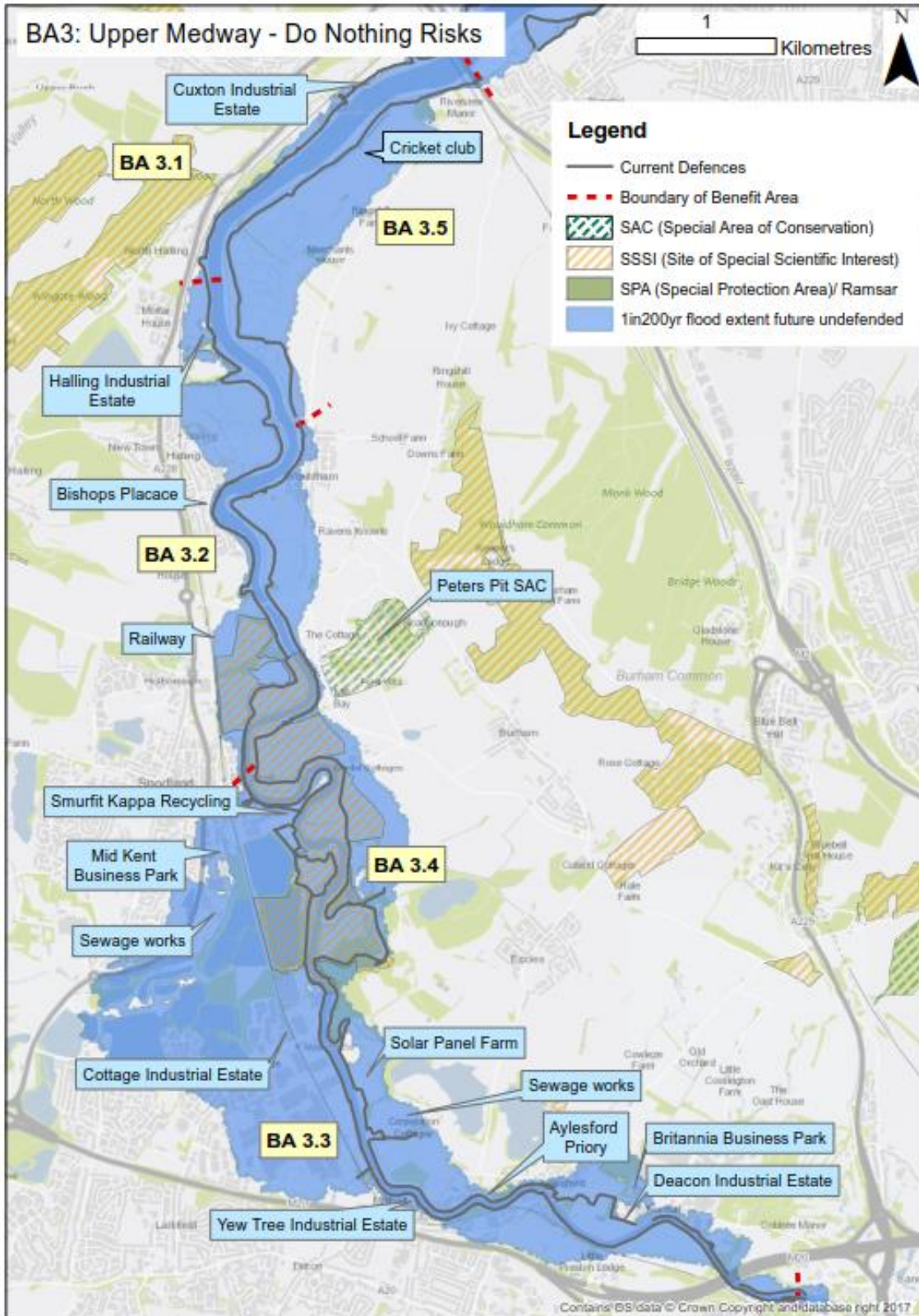
Stakeholders

- There are a number of different organisations who currently maintain the defences, particularly around St Mary's Island, and therefore engagement on this prior to OBC writing will be undertaken.
- Medway Council have aspirations for the Chatham Docks area which will feed into the objectives for the scheme.
- Recent works in developing the area of Chatham Docks aligns with this Strategy and key parties should be involved in the future.

Implementation Plan - BA2.3: St Mary's Island

Year	Capital Scheme	Ongoing Maintenance
2019		Annual maintenance – mowing of embankments and patch and repair Patch and repair maintenance of seawall and sheet piling
2020	OBC procurement including NEAS screening	Annual maintenance – mowing of embankments and patch and repair
2021	Start to develop the OBC - detailed economic assessment – review options and develop outline design – stakeholder engagement – third party contributions – environmental assessment – licenses and permits discussions Mitigation & Action: Discussions with key asset owners around third party funding and asset maintenance responsibility Mitigation & Action: Archaeological assessment Mitigation & Action: Environmental survey assess presence/absence of tentacled lagoon worm	Annual maintenance – mowing of embankments and patch and repair
2022	Finalise business case and undertake detailed design - early contractor involvement – refine option design – stakeholder engagement – obtain licenses and permits	Annual maintenance – mowing of embankments and patch and repair
2023	Construction works to raise the embankment, seawall and sheet piling. Replace and raise the flood gate	
2024	Continue construction works to raise the embankment, seawall and sheet piling. Replace and raise the flood gate	
2025		Annual maintenance – mowing of embankments and patch and repair
2026		Annual maintenance – mowing of embankments and patch and repair
2027		Annual maintenance – mowing of embankments and patch and repair
2028		Annual maintenance – mowing of embankments and patch and repair
2029 – 2039		Annual maintenance – mowing of embankments and patch and repair Capital maintenance in year 2029 - seawalls
2040 – 2069	2066 – Business case for second phase of works 2067 – Finalise business case and undertake detailed design for second phase of works 2068 – Construction works to raise the embankment, seawall, sheet piling and flood gate	Annual maintenance – mowing of embankments and patch and repair Capital maintenance in years 2039, 2049, and 2059 – seawalls Capital maintenance in year 2049 – sheet piling and flood gates
2070 – 2119		Capital maintenance in years 2077, 2087, 2097 and 2107 – seawalls Capital maintenance in years 2079 and 2109 – sheet piling Capital maintenance in year 2097 – flood gate

A.3 BA3: Upper Medway

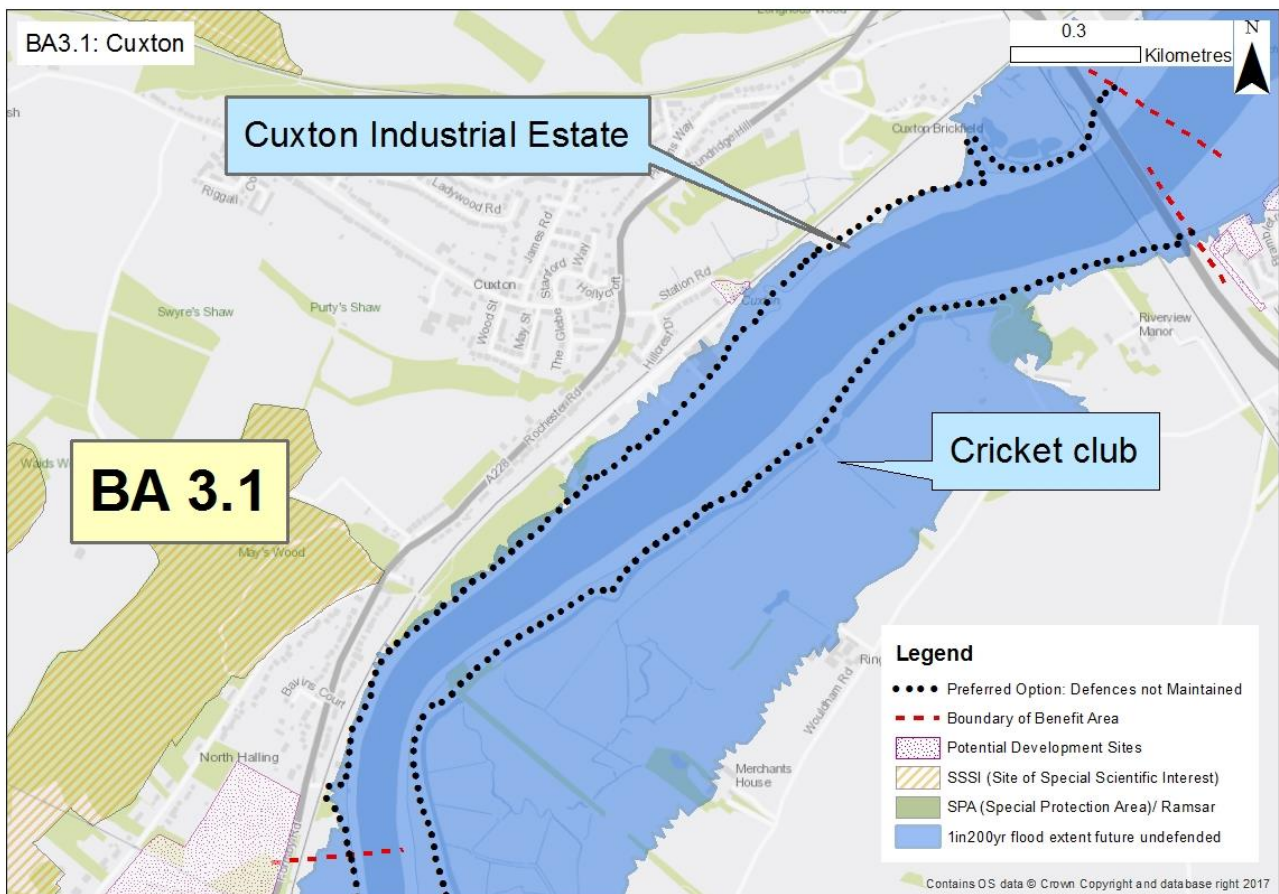


A.3.1 BA3.1: Cuxton

There is limited flood risk within this area due to the railway embankment providing a barrier to the flood pathway. Therefore, there is no economic justification or drive to continue to maintain flood embankments. However, potential changes to the maintenance and use of the railway embankment in the future could affect the flood risk to the area behind the embankment.

Preferred Option	No Active Intervention (NAI).		
Description of Preferred Option	All maintenance will be ceased and the current defences will not be maintained. There will be an increased risk of overtopping and the defences will be at risk from failure from year 20 causing increased risk of overflow flooding.		
Justification	No short listed options were identified with BCRs above one which provided increased protection. There are limited assets at risk from flood damages in the area.		
Environmental	This option is not predicted to have any direct or indirect impacts on any designated sites and their constituent qualifying features.		
	2018-2038	2039-2068	2069-2118
Overall Policy	NAI	NAI	NAI
Defence Crest Level Required	N/A - NAI	N/A - NAI	N/A - NAI

Whole Life Cost (PV)	£0	BCR	N/A	PF%	N/A
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Key Risks and Mitigation - BA3.1: Cuxton

Key Risk	Mitigation and Action	Owner
Potential impacts to the base of the railway embankment.	Conversations will be undertaken with National Rail to advise them of the potential risk to the embankments for the railway line.	KSL Area Team.
Rights of way.	The impacts on rights of way will be reviewed in more detail and mitigated by providing set back access if required.	KSL Area Team.

Key Dependencies

- It is to be noted that as this area is currently managed as a NAI site, the additional landowner engagement required when withdrawing maintenance does not apply here.
- Relying on the railway line as part of the flood protection. If National Rail decide to no longer run the line the railway embankment will need to become an asset and be maintained as it provides the flood protection to the area.
- If footpath needs to be realigned, footpath consents will need to be obtained.

Implementation Plan - BA3.1: Cuxton

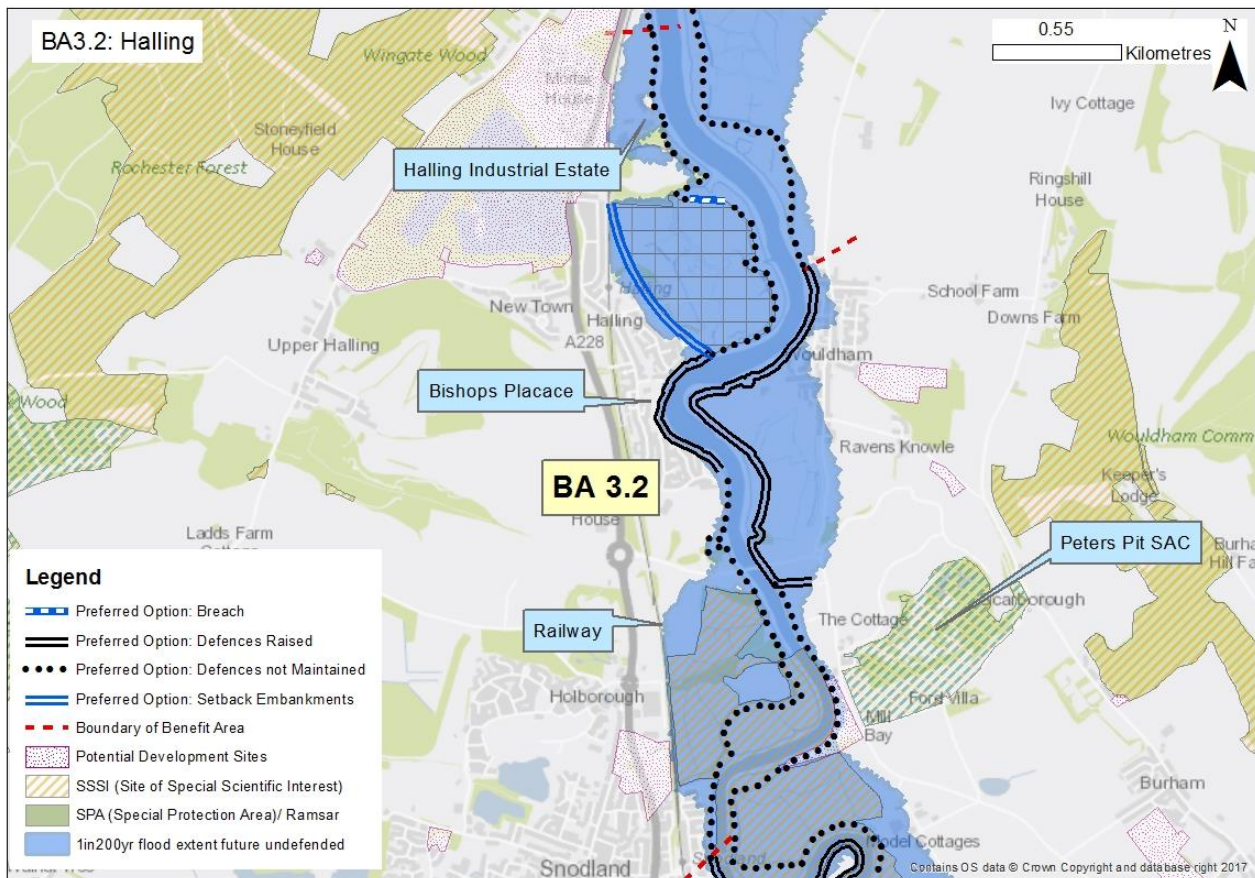
Year	No Active Intervention
2019	NAI implemented, health and safety surveys undertaken
2020	NAI implemented, health and safety surveys undertaken
2021	NAI implemented, health and safety surveys undertaken
2022	NAI implemented, health and safety surveys undertaken
2023	NAI implemented, health and safety surveys undertaken
2024	NAI implemented, health and safety surveys undertaken
2025	NAI implemented, health and safety surveys undertaken
2026	NAI implemented, health and safety surveys undertaken
2027	NAI implemented, health and safety surveys undertaken
2028	NAI implemented, health and safety surveys undertaken
2029 – 2039	NAI implemented, health and safety surveys undertaken 2033 - Mitigation and Action: Discussions with National Rail to advise impacts from defence failure 2033 - Mitigation and Action: Consider impacts on rights of way and whether footpath needs to be re-located
2040 – 2069	NAI implemented, health and safety surveys undertaken
2070 – 2119	NAI implemented, health and safety surveys undertaken

A.3.2 BA3.2: Halling

The majority of this benefit area is rural and therefore the raising of defences will be focussed in the area of Halling. The Halling Marshes currently regularly overtop and the plan is to create set back embankments and breach the site. This Managed Realignment site will provide compensatory habitat for saltmarsh habitat impacted by coastal squeeze. The length of the set back embankment will be less than the current embankments and help protect Halling from flood risk. Current Priority Habitat at Halling Marshes will be impacted by the Managed Realignment site and the environmental assessment at scheme stage will need to identify mitigation for these impacts.

Preferred Option	Construct new setback embankments at Halling Marshes. Raise (sustain) embankments, walls and flood gates in localised areas.		
Description of Preferred Option	Localised raising of the defences to protect properties and assets at risk of flooding around Halling against a 5%AEP with sea level rise. The localised defences will be raised to 5.1m AOD in year 8 and then in year 50 to 6.1m AOD to continue to provide protection in line with sea level rise. The rest of the BA will have a NAI approach and management will cease on the defences. Additionally, construction of a MR site from year 5 at Halling marsh to help compensate for the strategy wide coastal squeeze impacts. Setback embankments would be constructed to manage tidal water and a breach in the current defences created.		
Justification	Localised HTL sensitivity provides the only option with a BCR above 1 and a positive NPV, and will provide protection to all residential properties at risk of flooding to at least a 5% AEP. In the NAI areas there is limited assets at risk due to the rising ground. MR site at Halling Marshes is required to help compensate for coastal squeeze of saltmarsh Priority Habitat across the Strategy in the first and second epochs.		
Environmental	There may be a change to the habitat type in the Holborough to Burham Marshes SSSI due to uncontrolled saline intrusion once the defences fail in year 25.		
	2018-2038	2039-2068	2069-2118
Overall Policy	HTL Sustain and MR with localised NAI	HTL Sustain and MR with localised NAI	HTL Sustain and MR with localised NAI
Defence Crest Level Required	5.1m AOD	5.1m AOD	6.1m AOD

Whole Life Cost (PV)	£1,725k	BCR	1.6	PF%	28
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Key Risks and Mitigation - BA3.2: Halling

Key Risk	Mitigation and Action	Owner
Visual effects and impacts upon landscape character of implementing capital works to sustain defences and constructing new setback embankments - potential delays to design stage.	Design flood defences (most likely earth banks) that minimise visual impacts and impacts on the landscape character. Use materials, where hard engineering is present and will be enhanced, that reflect the cultural landscape and enhance local character. Look for opportunities to introduce mitigation planting to enhance landscape character and minimise visual impact of proposals.	NEAS with support from design consultants.
Potential release of contaminants from Halling Cement Works Historic Landfill.	The potential impacts due to inundation after the localised NAI policy is implemented will be reviewed and assessed in more detail.	KSL Area Team with support from appraisal consultants and NEAS.
Potential impacts on Priority Habitat.	The impacts on Priority Habitat from the Managed Realignment site will be assessed following ecological surveys and mitigated through the environmental assessment at scheme stage.	NEAS and FBG team.
Unknown archaeological risk from new embankments and Managed Realignment Site.	In-depth archaeological desk study to be carried out as one of the first activities in the design of the Managed Realignment site. Desk study to influence further investigations which may include trial pits, non-intrusive or geophysical surveys, ground investigations.	NEAS heritage specialists with support from appraisal consultant.
Rights of way.	The impacts on rights of way will be reviewed in more detail at the project level and mitigated by providing set back access if required.	NEAS.
Potential impact on Bishops Palace.	If the development is likely to impact the Scheduled Bishops Palace then Historic England will be consulted early in the process. The potential visual impact on the historic landscape will also be assessed.	NEAS heritage specialists with support from appraisal consultant.
Risk of breach and MR site causing increased scour and increased tidal prism.	More detailed modelling at design stage to be undertaken to confirm velocity and shear stress changes. Design will mitigate potential impacts and improve scour protection elsewhere if required.	KSL Area Team with support from design consultant.
Impacts of soil conditions on design and environment.	There is evidence to suggest former fields have an impermeable podzol layer which effects the drainage of newly forming saltmarsh and mudflat. Undertake a core during early GI to understand ground conditions. If poor, alternatives include ploughing, crop stripping etc.	KSL Area Team with support from design consultant and NEAS.
Review opportunities to reduce carbon.	For MR site, consider sourcing embankment material from borrow pit within the site – GI works would be required to investigate this. For seawall consider use of steel rather than concrete, however if concrete is required investigate possibility of using low carbon concrete. Consider material sources and transportation during design phase and limit carbon footprint where possible.	Designer.

Key Dependencies

- Business case sign off for MR scheme – could be efficiencies from undertaking as a Strategy wide business case looking at all epoch 1 MR sites.
- Landowner buy-in to the Managed Realignment scheme.
- Achieving third party funding contributions for HTL sections.
- Agreement around mitigation requirements for the impacts on the Priority Habitat.
- There could be a benefit of bringing forward the capital scheme to be undertaken at the same time as the MR scheme and undertake the construction together.
- There are risks associated with obtaining the land or getting planning approval for the Managed Realignment site. Should the Managed Realignment Site not be constructed, the flood defence scheme at Halling will be impacted and the length of defences required will be longer. This would mean the required amount of third party funding would increase.
- Licences and permits required for the capital scheme to include (but not be limited to): MMO, preliminary WFD Assessment, Listed Buildings, EIA Screening, and Flood Risk Activity Permit.
- Licences and permits required for the MR scheme to include (but not be limited to): MMO, preliminary WFD Assessment, Footpaths, EIA Screening, EIA Scoping, Environmental Statement, Protected Species, HRO1, Appropriate Assessment, and Flood Risk Activity Permit. Depending on option design, a Tree Protection Order may be required.

Business Case for Capital Scheme - BA3.2: Halling

Case	Summary
Strategic case	<ul style="list-style-type: none"> Residential properties at risk from overtopping and flooding. Chance to tie-in defences with set back defences which will reduce future maintenance, provide coastal squeeze compensation for saltmarsh Priority Habitat (contributing to epoch 1 and 2 requirements) and provide flood protection to Halling.
Economic case	<ul style="list-style-type: none"> The Benefit Cost Ratio is above 1.
Commercial case	<ul style="list-style-type: none"> Procurement efficiencies could be met through aligning schemes.
Financial case	<ul style="list-style-type: none"> The PF score is low and third-party funding will be required. There could be a benefit of bringing forward the capital scheme to be undertaken at the same time as the MR scheme and undertake the construction together.
Management case	<ul style="list-style-type: none"> The key risks and required mitigations are highlighted above in the risks and mitigation table and need to be implemented throughout the business case activities. Stakeholder engagement here is important.

Stakeholders

- Natural England have concerns about potential impacts to Priority Habitat. Opportunities to create good quality habitat should be maximised here.
- Local residents in Halling are keen to see improvements to defences by the river but are more worried about space and visual impacts.

Implementation Plan - BA3.2: Halling

Year	Strategy Wide Activities	Capital Scheme	Capital MR Scheme	Ongoing Maintenance
2019	Update of HCP Report with detailed scope and programme for surveys. Surveys of the Priority 1 sites to determine Priority Habitat and SSSI site compensation requirements		Assessment of survey requirements within HCP report NEAS screening and business case production for MR site Landowner consultation in MR site Mitigation & Action: Archaeological desk study	Annual maintenance – mowing of embankments and patch and repair Patch and repair maintenance of seawall
2020	Freshwater surveys on Priority Habitat and SSSI sites	Mitigation & Action: Review of impacts due to NAI	Landowner consultation in MR site Business case for MR site Mitigation & Action: GI to include test on soil conditions	Annual maintenance – mowing of embankments and patch and repair
2021	Mitigation & Action: Freshwater compensation sites reviewed and finalised National DEFRA review of HCP Report		Detailed design of MR site Environmental impact assessment of the MR site Mitigation & Action: Assess impact on public rights of way Mitigation & Action: Assess potential impacts on Priority Habitat Mitigation & Action: Modelling to assess risk of downstream scour	Annual maintenance – mowing of embankments and patch and repair
2022			Detailed design of MR site Application for permits and licenses	Annual maintenance – mowing of embankments and patch and repair
2023	National DEFRA review of HCP Report		Construction of set-back embankments Construction of breach	Annual maintenance – mowing of embankments and patch and repair
2024			Surveys of MR site to determine the colonisation of the intertidal habitat	Annual maintenance – mowing of embankments and patch and repair
2025	National DEFRA review of HCP Report	OBC procurement including NEAS screening	Surveys of MR site to determine the colonisation of the intertidal habitat	Annual maintenance – mowing of embankments and patch and repair
2026		Start to develop the OBC - detailed economic assessment – review options and develop outline design – stakeholder engagement – third party contributions – environmental assessment – licenses and permits discussions Mitigation & Action: Assess impacts of scheme on Bishops Palace and mitigate where required Mitigation & Action: Assess opportunities for nature-based options to reduce visual impacts Mitigation & Action: Assess risk from landfill	Surveys of MR site to determine the colonisation of the intertidal habitat	Annual maintenance – mowing of embankments and patch and repair

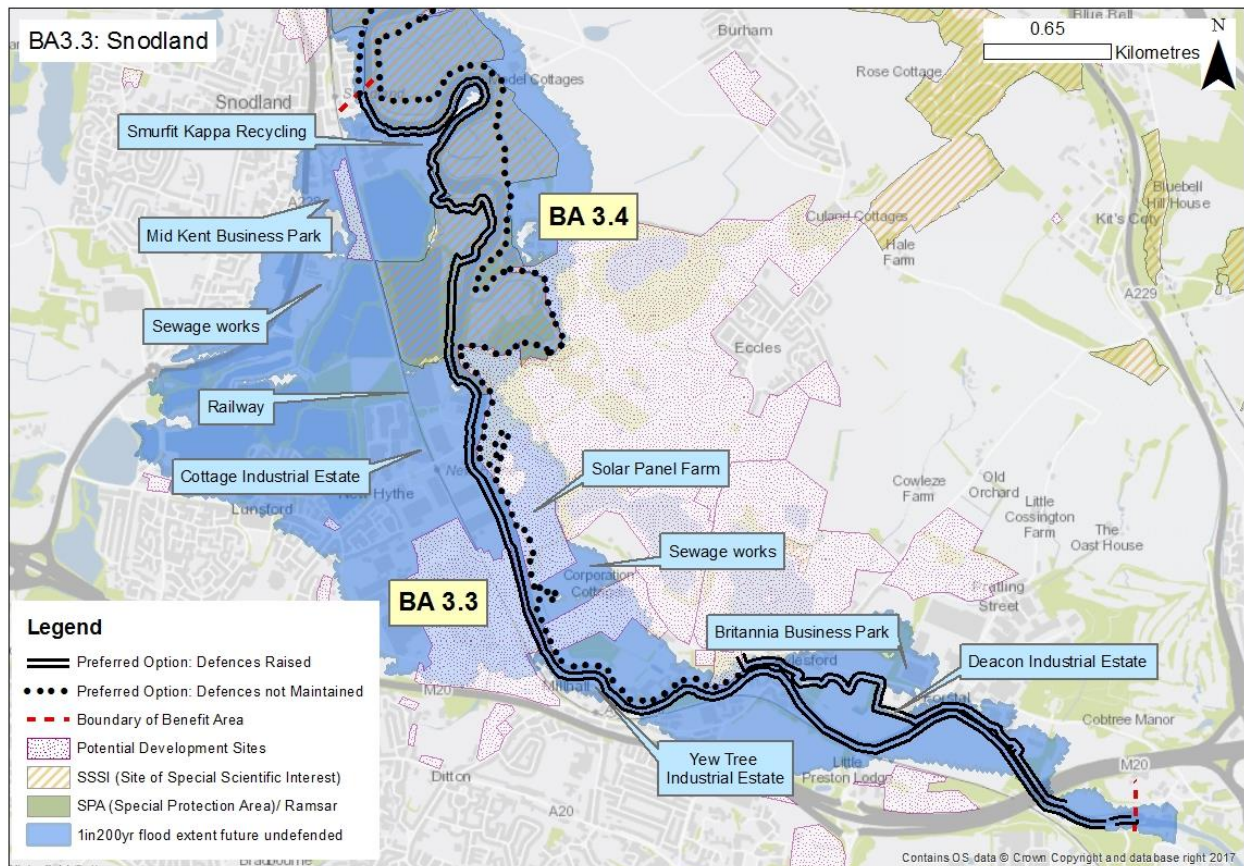
Year	Strategy Wide Activities	Capital Scheme	Capital MR Scheme	Ongoing Maintenance
2027	National DEFRA review of HCP Report	Finalise business case and undertake detailed design - early contractor involvement – refine option design – stakeholder engagement – obtain licenses and permits Mitigation & Action: Review rights of way	Surveys of MR site to determine the colonisation of the intertidal habitat	Annual maintenance – mowing of embankments and patch and repair
2028		Construction works to raise the embankment, seawall and flood gates	2029 – surveys of MR site to determine the colonisation of the intertidal habitat	Annual maintenance – mowing of embankments and patch and repair
2029 – 2039	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation Every 2 years - National DEFRA review of HCP Report			Annual maintenance – mowing of embankments and patch and repair 2029 – Patch and repair maintenance of seawall
2040 – 2069	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation Every 2 years - National DEFRA review of HCP Report	2066 – Business case for second phase of works 2067 – Finalise business case and undertake detailed design for second phase of works 2068 – Construction works to raise the embankment and seawall		Annual maintenance – mowing of embankments and patch and repair 2039, 2049 and 2059 - Patch and repair maintenance of seawall
2070 – 2119	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation Every 2 years - National DEFRA review of HCP Report			Annual maintenance – mowing of embankments and patch and repair 2077, 2087, 2097 and 2107 – Patch and repair maintenance of seawall

A.3.3 BA3.3: Snodland

Although there are large lengths of defences in this section, the number of industries, infrastructure, properties and SSSI habitat at risk along the section justify maintenance of the embankments. The flood protection assets generally have good residual lives, so maintenance is planned for the first epoch with larger capital works planned for later. There are only small sections which need raising in terms of crest level. Much of the work will be focussed on asset maintenance and raising the small sections which are lower than others. Due to the existing areas of SSSI habitat, opportunities to enhance habitat as part of the scheme should be investigated.

Preferred Option	Raise (sustain) embankments, walls and flood gates from year 20.		
Description of Preferred Option	Maintenance of the current defences (embankment, seawall and rock revetment) for the first 20 years to the current SoP offered. Following this the defences will be raised to 6m AOD and then raised again in year 50 to 7.4m AOD to provide a 0.1% SoP in 100 years taking account of sea level rise.		
Justification	Delayed sustain option has an incremental BCR of greater than 3 and better environmental scoring compared to the Maintain option. It is more cost effective to raise the defences in year 5 when the defences are near the end of their residual life, and then in year 50 to raise with sea level rather than raising all initially.		
Environmental	This option is not predicted to have any direct or indirect impacts on any designated sites and their constituent qualifying features. The increased SoP provided by improving the defence will protect the Holborough to Burham Marshes SSSI.		
	2018-2038	2039-2068	2069-2118
Overall Policy	HTL Maintain	HTL Sustain	HTL Sustain
Defence Crest Level Required	Current crest levels	6m AOD	7.4m AOD

Whole Life Cost (PV)	£17,628k	BCR	12.1	PF%	76
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Key Risks and Mitigation - BA3.3: Snodland

Key Risk	Mitigation and Action	Owner
Visual effects and impacts upon landscape character of implementing capital works to sustain defences - potential delays to design stage.	The design of the flood defences (most likely embankments) will minimise visual impacts and impacts on the landscape character through the use of materials which can enhance the natural environment and that reflect the cultural landscape and enhance local character where appropriate. Look for opportunities to introduce mitigation planting to enhance landscape character and minimise visual impact of proposals.	KSL Area Team with support from NEAS and appraisal consultants.
Third party contributions required.	Discussions will be had with key asset owners early on in 2036 when the business case is being developed. This will include owners on different industrial estates, New Hythe Railway, Aylesford line and New Hythe Lane Historic Landfill.	KSL Area Team.
Rights of way.	The impacts on rights of way will be reviewed in more detail at the project level and mitigated by providing set back access if required.	NEAS.
Interactions with fluvial flood risks in the area.	The OBC will consider the crossovers and requirements of fluvial flood risk in this section as well as tidal flood risk.	KSL Area Team.
Works being required on Aylesford Bridge.	Aylesford Bridge is Grade 1 Listed and Scheduled therefore if works are required on the bridge the planning department will be consulted early in the planning process.	Neas heritage specialists with support from appraisal consultant.
Review opportunities to reduce carbon.	For seawall consider use of steel rather than concrete, however if concrete is required investigate possibility of using low carbon concrete. Consider material sources and transportation during design phase and limit carbon footprint where possible.	Designer.

Key Dependencies

- Achieving third party funding contributions.
- Licences and permits required for the capital scheme to include (but not be limited to): MMO, preliminary WFD Assessment, EIA Screening, Protected Species, and Flood Risk Activity Permit. Depending on option design, EIA Scoping and a Tree Protection Order may be required.

Implementation Plan - BA3.3: Snodland

Year	Capital Scheme	Ongoing Maintenance
2019		Annual maintenance – mowing of embankments and patch and repair of embankments and flood gates Patch and repair maintenance of seawall, rock and concrete revetments and sheet piling
2020		Annual maintenance – mowing of embankments and patch and repair of embankments and flood gates
2021		Annual maintenance – mowing of embankments and patch and repair of embankments and flood gates
2022		Annual maintenance – mowing of embankments and patch and repair of embankments and flood gates
2023		Annual maintenance – mowing of embankments and patch and repair of embankments and flood gates
2024		Annual maintenance – mowing of embankments and patch and repair of embankments and flood gates
2025		Annual maintenance – mowing of embankments and patch and repair of embankments and flood gates
2026		Annual maintenance – mowing of embankments and patch and repair of embankments and flood gates
2027		Annual maintenance – mowing of embankments and patch and repair of embankments and flood gates
2028		Annual maintenance – mowing of embankments and patch and repair of embankments and flood gates Patch and repair maintenance of concrete and rock revetments
2029 – 2039	<p>2035 – OBC procurement and NEAS screening</p> <p>2035 – Mitigation & Action: Discussions with key asset owners regarding third party funding</p> <p>2035 – Mitigation & Action: Consider interactions with fluvial flood risk</p> <p>2035 – Mitigation & Action: Consider impacts on Aylesford Bridge (Grade 1 Listed)</p> <p>2036 – Start to develop the OBC - detailed economic assessment – review options and develop outline design – stakeholder engagement – third party contributions – environmental assessment – licenses and permits discussions</p> <p>2036 – Mitigation & Action: Review of rights of way</p> <p>2037 – Finalise business case and undertake detailed design - early contractor involvement – refine option design – stakeholder engagement – obtain licenses and permits</p> <p>2038-2039 – Construction of the first phase of HTL sustain works</p>	<p>Annual maintenance – mowing of embankments and patch and repair of embankments and flood gates</p> <p>2034 – Patch and repair maintenance of seawalls, revetments and sheet piling</p>
2040 – 2069	<p>2053 – Develop OBC for concrete revetment</p> <p>2054 – Finalise business case and undertake detailed design for concrete revetment</p> <p>2055 – Construct concrete revetment</p> <p>2066 – Develop OBC for phase two of HTL sustain works</p> <p>2067 – Finalise business case and undertake detailed design for phase two</p> <p>2078 – Raise the embankment, seawall and rock revetment for phase two</p>	<p>Annual maintenance – mowing of embankments and patch and repair of embankments and flood gates</p> <p>2046 and 2056 – Patch and repair maintenance of seawall</p>

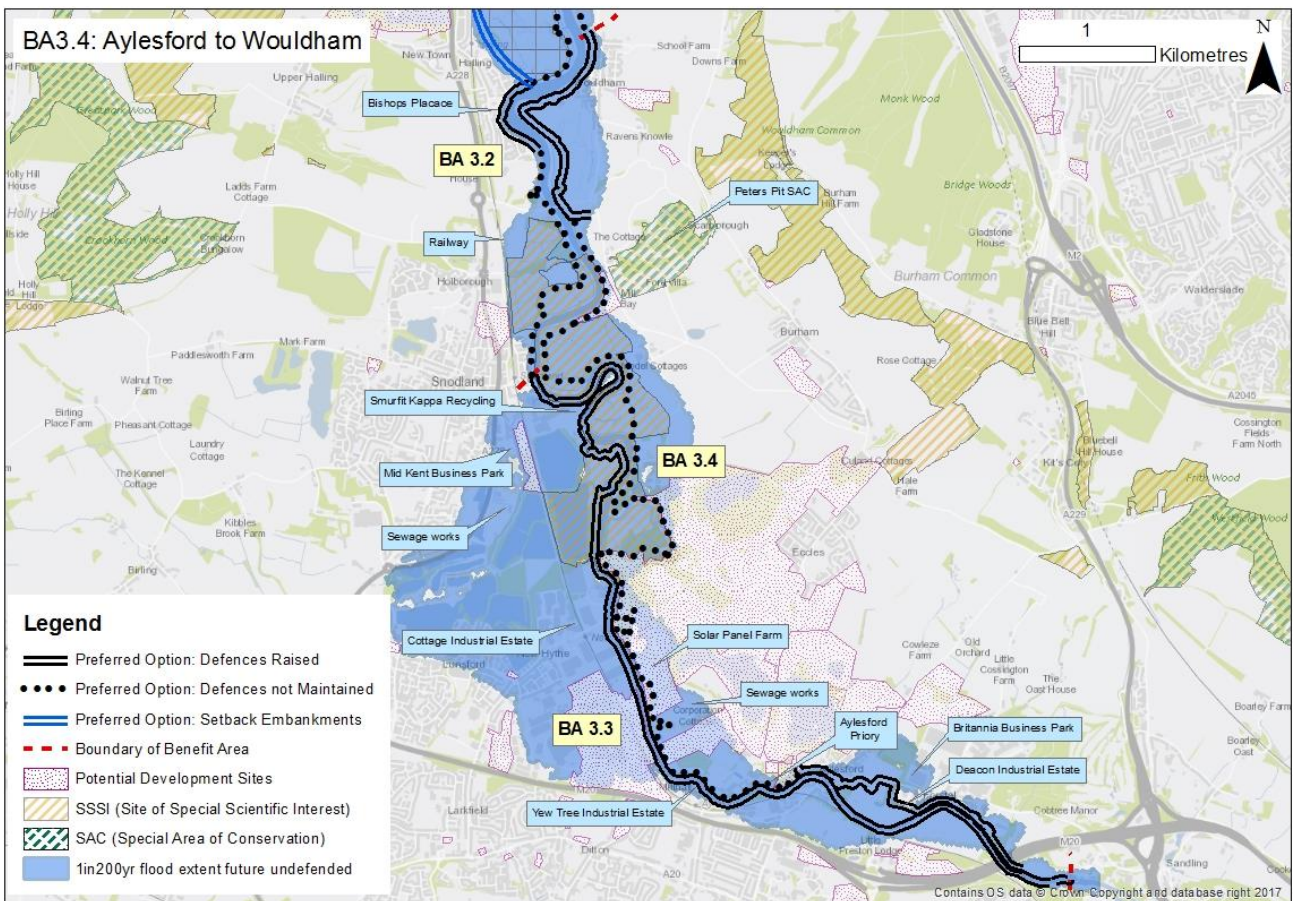
Year	Capital Scheme	Ongoing Maintenance
2070 – 2119	2092 – Develop OBC for concrete revetment 2093 – Finalise business case and undertake detailed design for concrete revetment 2094 – Construct concrete revetment	Annual maintenance – mowing of embankments and patch and repair of embankments and flood gates 2077, 2087, 2097 and 2107 – Patch and repair maintenance of seawall and revetments 2079 and 2109 – Patch and repair maintenance of sheet piling

A.3.4 BA3.4: Aylesford to Wouldham

Localised HTL will concentrate defences and maintenance in areas with significant assets at risk. Other areas generally have higher ground and limited flood risk. The height of the current defences needs to be raised to increase the standard of protection to the area. The exact location of defences will affect the potential adverse impacts on SSSI areas. Any impacts will need to be assessed through surveys and mitigated at scheme stage. Due to the existing areas of SSSI habitat here, opportunities to enhance habitat as part of the scheme should be investigated.

Preferred Option	Raise (sustain) embankments, walls and flood gates in localised areas.		
Description of Preferred Option	Localised raising of the defences around Aylesford and Wouldham to protect properties and assets at risk of flooding against a 0.1%AEP with sea level rise. The localised defences will be raised in year 8 to 5.9m AOD and then in year 50 to 7.5m AOD to continue to provide protection in line with sea level rise. The rest of the BA will have a NAI approach and management will cease on the defences		
Justification	Localised HTL sensitivity provides the only short listed option with a positive NPV and a BCR above 1. This option will provide protection to all residential properties at risk of flooding to at least a 0.1% AEP. In the NAI areas there is limited assets at risk due to the rising ground. There is a higher economic justification for raising the defences in the short term rather than waiting for defences to reach their residual life to provide increased flood risk protection in the short term.		
Environmental	Risk from overtopping to the freshwater habitats and Holborough to Burham Marshes SSSI.		
	2018-2038	2039-2068	2069-2118
Overall Policy	HTL Sustain with localised NAI	HTL Sustain with localised NAI	HTL Sustain with localised NAI
Defence Crest Level Required	5.9m AOD	5.9m AOD	7.5m AOD

Whole Life Cost (PV)	£10,708k	BCR	2.0	PF%	16
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Key Risks and Mitigation - BA3.4: Aylesford to Wouldham

Key Risk	Mitigation and Action	Owner
Visual effects and impacts upon landscape character of implementing capital works to sustain defences - potential delays to design stage.	Design flood defences (most likely earth banks) that minimise visual impacts and impacts on the landscape character. Use materials, where hard engineering is present and will be enhanced, that reflect the cultural landscape and enhance local character. Look for opportunities to introduce mitigation planting to enhance landscape character and minimise visual impact of proposals.	KSL Area Team with support from NEAS and appraisal consultant.
Potential release of contaminants from Historic Landfill.	The potential impacts due to inundation after the localised NAI policy is implemented will be reviewed and assessed in more detail.	KSL Area Team with support from appraisal consultant.
Potential impacts on SSSI and Priority Habitat.	The impacts on SSSI and Priority Habitat will depend on the final lengths of embankments. At scheme stage impacts will be assessed, using information from ecological surveys, and mitigation agreed as part of the environment assessment.	NEAS.
Third party contributions required.	Discussions will be had with key asset owners early on in 2023 when the business case is being developed.	KSL Area Team.
Rights of way.	The impacts on rights of way will be reviewed in more detail at the project level and mitigated by providing set back access if required.	NEAS.
Weight restrictions on Forstal Road for construction traffic.	Defined Management Plan developed to assess potential routes and agree with relevant Highways Authorities.	KSL Area Team with support from Early Supplier Engagement.
Review opportunities to reduce carbon.	For seawall consider use of steel rather than concrete, however if concrete is required investigate possibility of using low carbon concrete. Consider material sources and transportation during design phase and limit carbon footprint where possible.	Designer.

Key Dependencies

- Achieving third party funding contributions for HTL sections.
- Agreement of required mitigation for impacts on the SSSI and Priority Habitat.
- Overall approach and consideration of SSSI habitat in the area and long term plans for the development of this habitat.
- Licences and permits required for the capital scheme to include (but not be limited to): MMO, preliminary WFD Assessment, Footpaths, Listed Buildings, EIA Screening, Protected Species, and Flood Risk Activity Permit. Depending on option design, EIA Scoping, an Environmental Statement and a Tree Protection Order may be required.

Business Case for Capital Scheme

Case	Summary
Strategic case	<ul style="list-style-type: none"> • Residential properties at risk from overtopping and flooding. • SSSI habitat to protect/adapt where required. • Interactions with fluvial flood risk to be considered as well.
Economic case	<ul style="list-style-type: none"> • The Benefit Cost Ratio is above 1.
Commercial case	<ul style="list-style-type: none"> • Procurement route likely to follow the Environment Agency framework and standard procurement practices.
Financial case	<ul style="list-style-type: none"> • The PF score is low and third-party funding will be required.
Management case	<ul style="list-style-type: none"> • The key risks and required mitigations are highlighted above in the risks and mitigation table and will be considered and implemented throughout the business case activities. • Opportunities for developing wider habitat outcomes to be considered as part of scheme development. • There are a complex interaction of stakeholders to be considered as part of this scheme.

Stakeholders

- Kent County Council and Highways Authorities will be engaged regarding construction methods and vehicle movements, in particular in relation to works by Forstal Road.

Implementation Plan - BA3.4: Aylesford to Wouldham

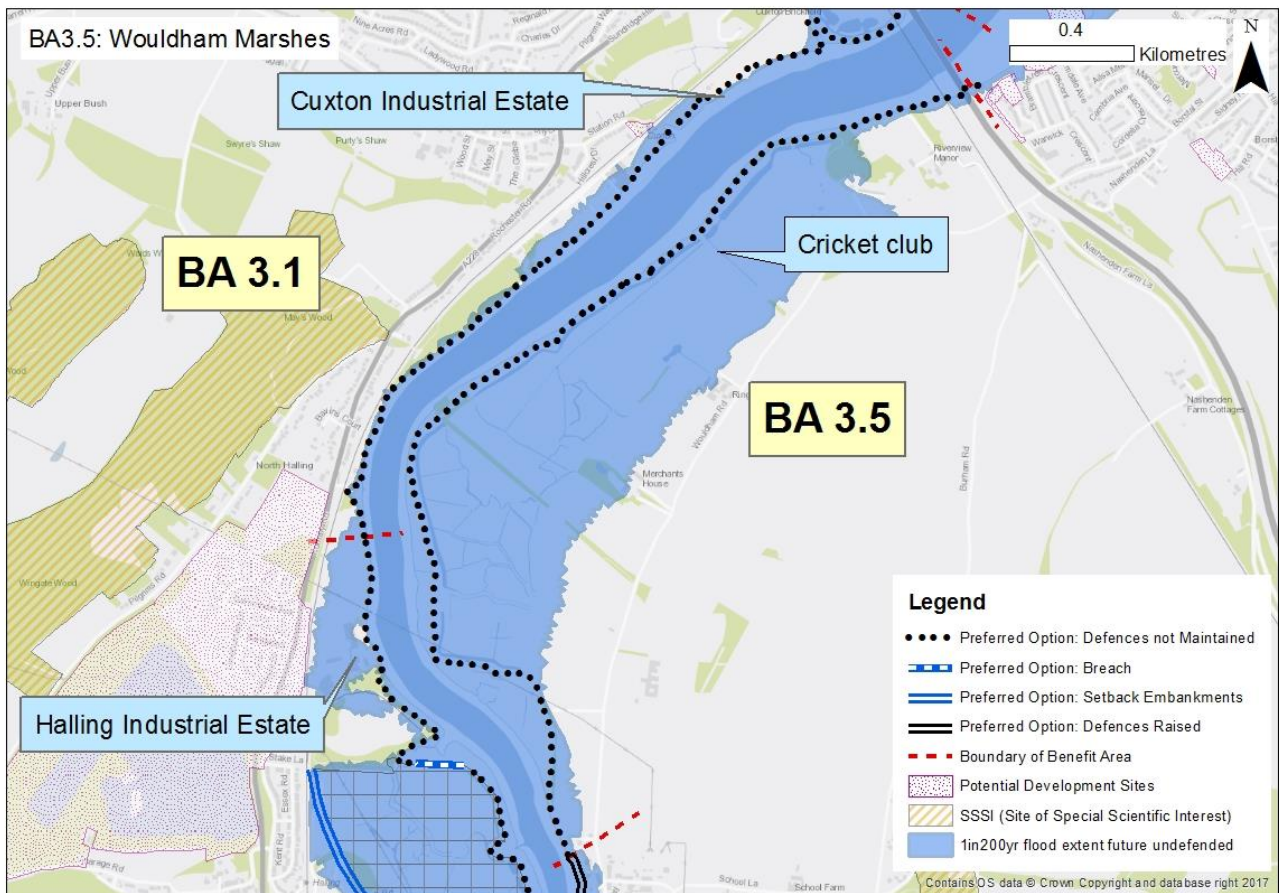
Year	Capital Scheme	Ongoing Maintenance
2019		Localised annual maintenance – mowing of embankments and patch and repair of embankments
2020		Localised patch and repair maintenance of seawall, rock and concrete revetments and sheet piling
2021		Localised annual maintenance – mowing of embankments and patch and repair of embankments
2022		Localised annual maintenance – mowing of embankments and patch and repair of embankments
2023	OBC procurement and NEAS screening Mitigation & Action: Discussions with key asset owners regarding third party funding	Localised annual maintenance – mowing of embankments and patch and repair of embankments
2024	Start to develop the OBC - detailed economic assessment – review options and develop outline design – stakeholder engagement – third party contributions – environmental assessment – licenses and permits discussions Mitigation & Action: Assess impact on SSSI, Priority Habitat, rights of way, and landfill	Localised annual maintenance – mowing of embankments and patch and repair of embankments
2025	Finalise business case and undertake detailed design - early contractor involvement – refine option design – stakeholder engagement – obtain licenses and permits Mitigation & Action: Develop Management Plan for approval regarding construction vehicle routes	Localised annual maintenance – mowing of embankments and patch and repair of embankments
2026	Construction works to raise the embankment, seawall and flood gates in localised areas	
2027	Construction works to raise the embankment, seawall and flood gates in localised areas	
2028		Localised annual maintenance – mowing of embankments and patch and repair of embankments
2029 – 2039		Localised annual maintenance – mowing of embankments and patch and repair of embankments 2029 – Localised patch and repair maintenance of seawalls and revetments
2040 – 2069	2044 – Develop OBC for concrete revetment 2045 – Finalise business case and undertake detailed design for concrete revetment 2046 – Construct concrete revetment 2066 – Develop OBC for phase two of capital works 2067 – Finalise business case and undertake detailed design for phase two 2068 – Raise the embankment, seawall, revetments and sheet piling for phase two	Localised annual maintenance – mowing of embankments and patch and repair of embankments 2039 and 2059 – Localised patch and repair maintenance of revetments and seawalls 2049 – Localised patch and repair maintenance of rock revetment, sheet piling, seawalls and flood gates 2054 and 2064 – Maintenance of concrete revetment
2070 – 2119	2092 – Develop OBC for concrete revetment 2093 – Finalise business case and undertake detailed design for concrete revetment 2094 – Construct concrete revetment	Localised annual maintenance – mowing of embankments and patch and repair of embankments 2077, 2087, 2097 and 2107 – Localised patch and repair maintenance of revetments and seawalls 2079 and 2109 – Maintenance of sheet piling 2102 and 2112 – Maintenance of concrete revetment

A.3.5 BA3.5: Wouldham Marshes

Assessment of the alternatives at Wouldham Marshes show that there is no economic justification to continue to maintain the defences. This is the case even when looking at the short term due to the low residual life of the defences and hence level of works which would be needed. The ground rises to high ground. Properties will be at risk from flooding under extreme events as well as Priority Freshwater Grazing marsh. Although there is no justification for a flood risk management scheme here, there may be potential for a habitat improvement project in the future.

Preferred Option	No Active Intervention.		
Description of Preferred Option	All maintenance will be ceased and the current defences will not be maintained. There will be an increased risk of overtopping and the defences will be at risk from failure from year 5 causing increased risk of overflow (breach) flooding.		
Justification	No short listed options were identified which would provide increased protection and with BCRs above one. There are limited assets at risk from flood damages in the area. There could be wider opportunities related to the Priority Habitat in the area for third parties to undertake works here in the future.		
Environmental	This option is not predicted to have direct or indirect impacts on any designated sites and their constituent qualifying features. However, there will be impacts on Priority Habitat freshwater grazing marsh.		
	2018-2038	2039-2068	2069-2118
Overall Policy	NAI	NAI	NAI
Defence Crest Level Required	N/A - NAI	N/A - NAI	N/A - NAI

Whole Life Cost (PV)	£0	BCR	N/A	PF%	N/A
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Key Risks and Mitigation - BA3.5: Wouldham Marshes

Key Risk	Mitigation and Action	Owner
Potential release of contaminants from historic landfill.	The potential impacts due to inundation after the NAI policy is implemented will be reviewed and assessed in more detail.	KSL Area Team.
Rights of way.	The impacts on rights of way will be reviewed in more detail at the project level and mitigated by providing set back access if required.	NEAS.
Potential impacts on Priority Grazing Marsh from increased overtopping and flooding.	Future opportunity for habitat improvement scheme by either Environment Agency or third party.	KSL Area Team with support from NEAS.

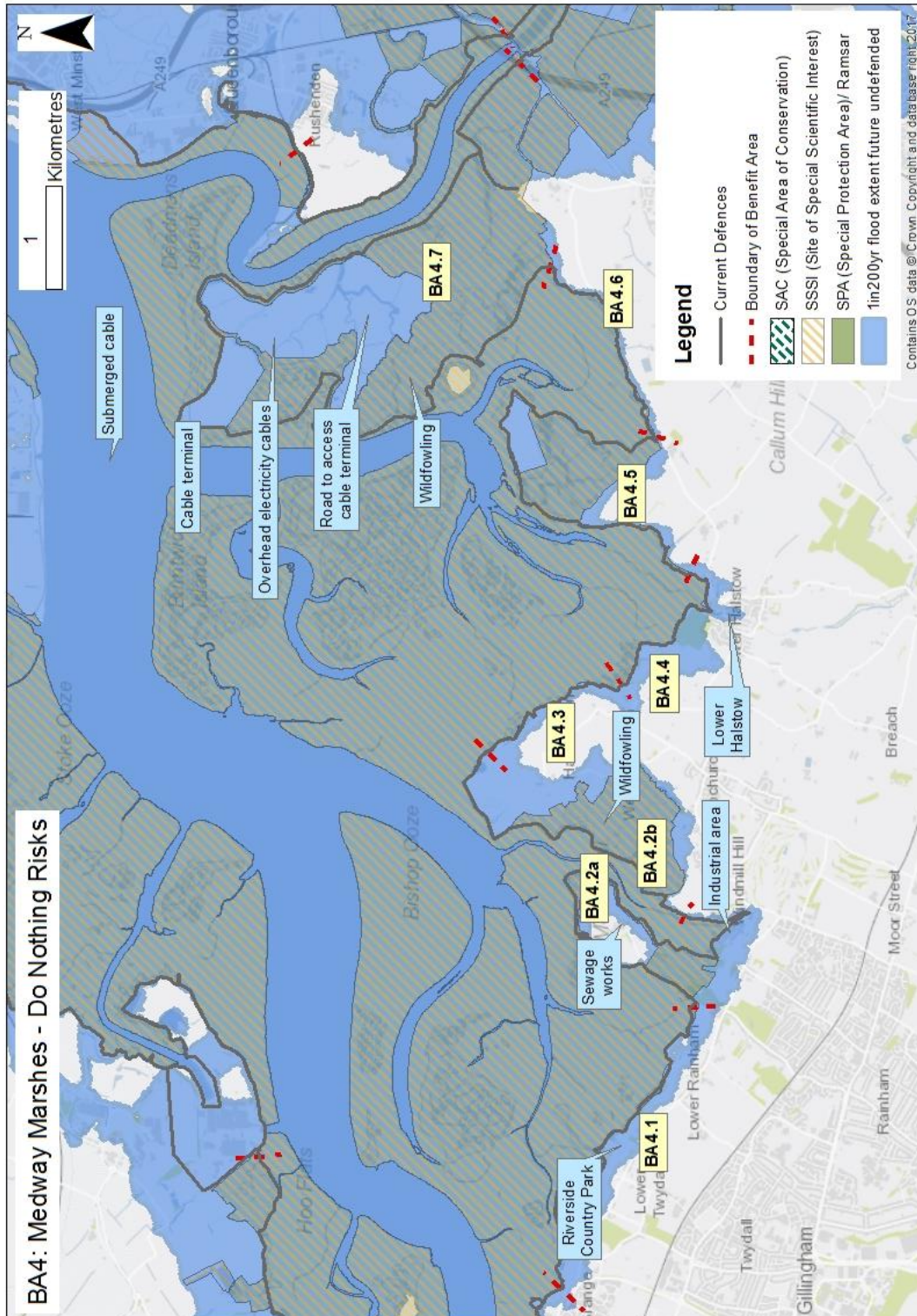
Key Dependencies

- Successful landowner engagement for implementation of withdrawal of maintenance protocol.

Implementation Plan - BA3.5: Wouldham Marshes

Year	No Active Intervention
2019	Discussions with landowners regarding NAI policy Mitigation & Action: Assess NAI impacts on landfill risk and public rights of way Mitigation & Action: Assess potential for wider habitat creation/ improvement scheme
2020	Discussions with landowners regarding NAI policy
2021	NAI implemented, health and safety surveys undertaken
2022	NAI implemented, health and safety surveys undertaken
2023	NAI implemented, health and safety surveys undertaken
2024	NAI implemented, health and safety surveys undertaken
2025	NAI implemented, health and safety surveys undertaken
2026	NAI implemented, health and safety surveys undertaken
2027	NAI implemented, health and safety surveys undertaken
2028	NAI implemented, health and safety surveys undertaken
2029 – 2039	NAI implemented, health and safety surveys undertaken
2040 – 2069	NAI implemented, health and safety surveys undertaken
2070 – 2119	NAI implemented, health and safety surveys undertaken

A.4 BA4: Medway Marshes

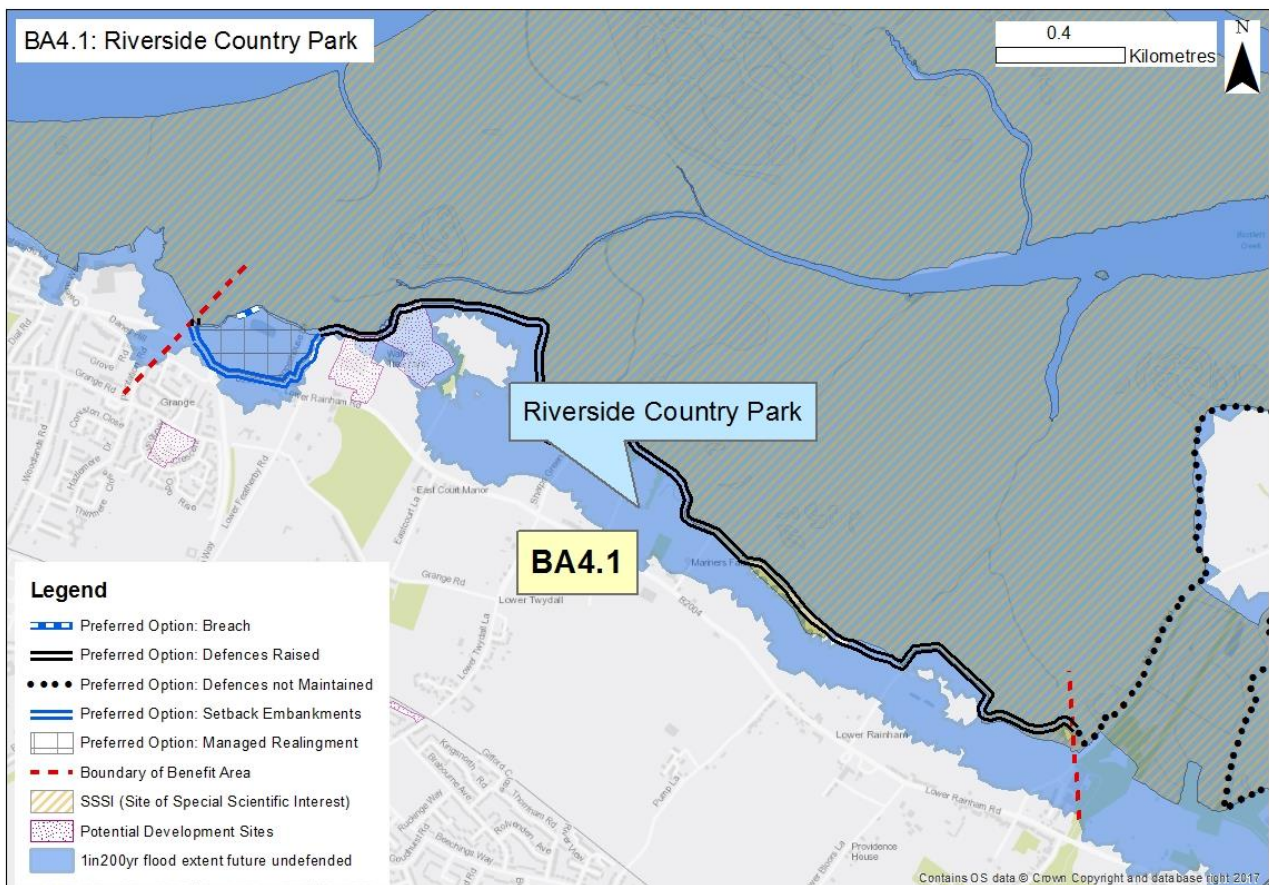


A.4.1 BA4.1: Riverside Country Park

Although this section currently does not need much maintenance, there is an economic case to raise the defence crest level. Future raising with sea level rise will be required. A small managed realignment site is also proposed to reduce future maintenance and provide compensation to coastal squeeze. Many of the benefits in this section are related to tourism/recreation impacts related to the Riverside Country Park.

Preferred Option	Construct new setback embankments (for the Managed Realignment site) at Danes Hill and sustain embankments, walls, and flood gates around other areas.		
Description of Preferred Option	Most of the defences along the coastline will be raised to increase the SoP in line with sea level rise. In year 8 the defences will be raised to 4.9m AOD, and in year 50 the defences will be raised to 5.9m AOD to provide a 2%AEP SoP in line with sea level rise. Additionally, construction of a MR site from year 5 to the west of the BA will provide compensatory habitat for the strategy wide coastal squeeze impacts. Setback embankments would be constructed to manage tidal water and a breach in the current defences created.		
Justification	HTL sustain has the highest NPV and BCR from the economic assessment. There is a higher economic justification for raising the defences in the short term rather than waiting for defences to reach their residual life to provide increased flood risk protection in the short term. MR site at Danes Hill is required to help compensate for coastal squeeze across the Strategy in the first epoch. This option has a BCR above 1 and the habitat in the MR site is required to help compensate for coastal squeeze across the Strategy in the first epoch.		
Environmental	There may be potential significant effects on the intertidal Medway Estuary and Marshes SPA and Ramsar and its constituent qualifying features due to coastal squeeze.		
	2018-2038	2039-2068	2069-2118
Overall Policy	HTL Sustain and MR	HTL Sustain and MR	HTL Sustain and MR
Defence Crest Level Required	4.9m AOD	4.9m AOD	5.9m AOD

Whole Life Cost (PV)	£4,846k	BCR	1.9	PF%	13
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Key Risks and Mitigation - BA4.1: Riverside Country Park

Key Risk	Mitigation and Action	Owner
Visual effects and impacts upon landscape character of implementing capital works to sustain defences and constructing new setback embankments - potential delays to design stage.	Use materials that reflect the cultural landscape and enhance local character. Look for opportunities to introduce mitigation planting to replace lost vegetation, enhance landscape character and minimise visual impact of proposals.	KSL Area Team with support from design consultant
Landowner buy-in to the creation of a MR site.	Conversations will be undertaken with the landowner to provide more detail e.g. year of construction, to ensure that they continue to provide support to the scheme.	KSL Area Team.
Unknown archaeological risk from new embankments and Managed Realignment Site.	In-depth archaeological desk study will be carried out as one of the first activities in the design of the Managed Realignment site and other key risk areas where the design identifies requirements for excavation. Desk study will influence further investigations which may include trial pits, non-intrusive or geophysical surveys, ground investigations.	NEAS heritage specialist with support from appraisal consultants.
Rights of way.	The impacts on rights of way will be reviewed in more detail at the project level and mitigated by providing set back access if required.	NEAS.
Interactions with Riverside Country Park as an important local amenity site.	Interactions with the Riverside Country Park will form an important part of the OBC engagement process.	KSL Area Team.
Changes to guidance on benefits assessment (particularly tourism).	Many of the benefits in this area are related to tourism and recreation. The guidance on assessing tourism is currently going through review and any changes could have a big impact for the proposed scheme funding.	KSL Area Team with support from ncpms.
Impacts on estuarine rocky habitats.	Limit footprint increases to the landward side of defences to minimise impacts.	NEAS.
Impacts of soil conditions on design and environment for Managed Realignment site.	There is evidence to suggest former fields have an impermeable podzol layer which effects the drainage of newly forming saltmarsh and mudflat. Undertake a core during early GI to understand ground conditions. If poor, alternatives include ploughing, crop stripping etc.	KSL Area Team with support from design consultant and NEAS.
Risk of breach and MR site causing increased scour and increased tidal prism.	More detailed modelling at design stage to be undertaken to confirm velocity and shear stress changes. Design will mitigate potential impacts and improve scour protection elsewhere if required.	KSL Area Team with support from design consultant.
Review opportunities to reduce carbon.	For MR site, consider sourcing embankment material from borrow pit within the site – GI works would be required to investigate this. For seawall consider use of steel rather than concrete, however if concrete is required investigate possibility of using low carbon concrete. Consider material sources and transportation during design phase and limit carbon footprint where possible.	Designer.

Key Dependencies

- Landowner buy-in to the Managed Realignment scheme.
- Achieving third party funding contributions for HTL sections.
- Licences and permits required for the capital scheme to include (but not be limited to): MMO, EIA Screening, preliminary WFD Assessment, HRO1, and Flood Risk Activity Permit. Depending on option design, EIA Scoping, an Environmental Statement, an Appropriate Assessment and a Tree Protection Order may be required.
- Licences and permits required for the MR scheme to include (but not be limited to): MMO, Footpaths, EIA Screening, EIA Scoping, Environmental Statement, preliminary WFD Assessment, HRO1, Appropriate Assessment and Flood Risk Activity Permit. Depending on option design a Tree Protection Order may be required.

Business Case for Capital Scheme

Case	Summary
Strategic case	<ul style="list-style-type: none"> Residential properties at risk from overtopping and flooding. Maintaining the recreational use of the frontage, particularly the Riverside Country Park.
Economic case	<ul style="list-style-type: none"> The Benefit Cost Ratio is above 1. There is a recreational case as well as OM2s for the scheme.
Commercial case	<ul style="list-style-type: none"> Procurement route likely to follow the Environment Agency framework and standard procurement practices.
Financial case	<ul style="list-style-type: none"> The PF score is low and third-party funding will be required.
Management case	<ul style="list-style-type: none"> The key risks and required mitigations are highlighted above in the risks and mitigation table and need to be implemented throughout the business case activities. Riverside Country Park needs to be a key stakeholder in the development of the scheme.

Implementation Plan - BA4.1: Riverside Country Park

Year	Capital Scheme	Capital MR Scheme	Ongoing Maintenance
2019		Assessment of survey requirements within HCP report NEAS screening and business case production for MR site Mitigation & Action: Landowner consultation in MR site Mitigation & Action: Archaeological desk study	Annual maintenance – mowing of embankments and patch and repair Patch and repair maintenance of revetments
2020		Landowner consultation in MR site Business case for MR Site Mitigation & Action: GI to include test on soil conditions	Annual maintenance – mowing of embankments and patch and repair
2021		Detailed design of MR site Environmental impact assessment of the MR site Mitigation & Action: Assess impacts on public right of way Mitigation & Action: Modelling to assess risk of downstream scour	Annual maintenance – mowing of embankments and patch and repair
2022		Detailed design of MR site Application for permits and licenses	Annual maintenance – mowing of embankments and patch and repair
2023	OBC procurement including NEAS screening Mitigation & Action: Review any changes to guidance on recreation /tourism benefit assessment	Construction of set-back embankments Construction of breach	Annual maintenance – mowing of embankments and patch and repair
2024	Start to develop the OBC - detailed economic assessment – review options and develop outline design – stakeholder engagement – third party contributions – environmental assessment – licenses and permits discussions Mitigation & Action: Review impacts on Rights of Way Mitigation & Action: Interaction with Riverside Country Park Mitigation & Action: Develop designs to mitigate impacts on estuarine rocky habitat	Surveys of MR site to determine the colonisation of the intertidal habitat	Annual maintenance – mowing of embankments and patch and repair
2025	Finalise business case and undertake detailed design - early contractor involvement – refine option design – stakeholder engagement – obtain licenses and permits	Surveys of MR site to determine the colonisation of the intertidal habitat	Annual maintenance – mowing of embankments and patch and repair
2026	Construction works to raise the embankments, seawall and concrete and rock revetments	Surveys of MR site to determine the colonisation of the intertidal habitat	
2027		Surveys of MR site to determine the colonisation of the intertidal habitat	Annual maintenance – mowing of embankments and patch and repair
2028		Surveys of MR site to determine the colonisation of the intertidal habitat	Annual maintenance – mowing of embankments and patch and repair
2029 – 2039			Annual maintenance – mowing of embankments and patch and repair 2029 – Patch and repair maintenance of seawall

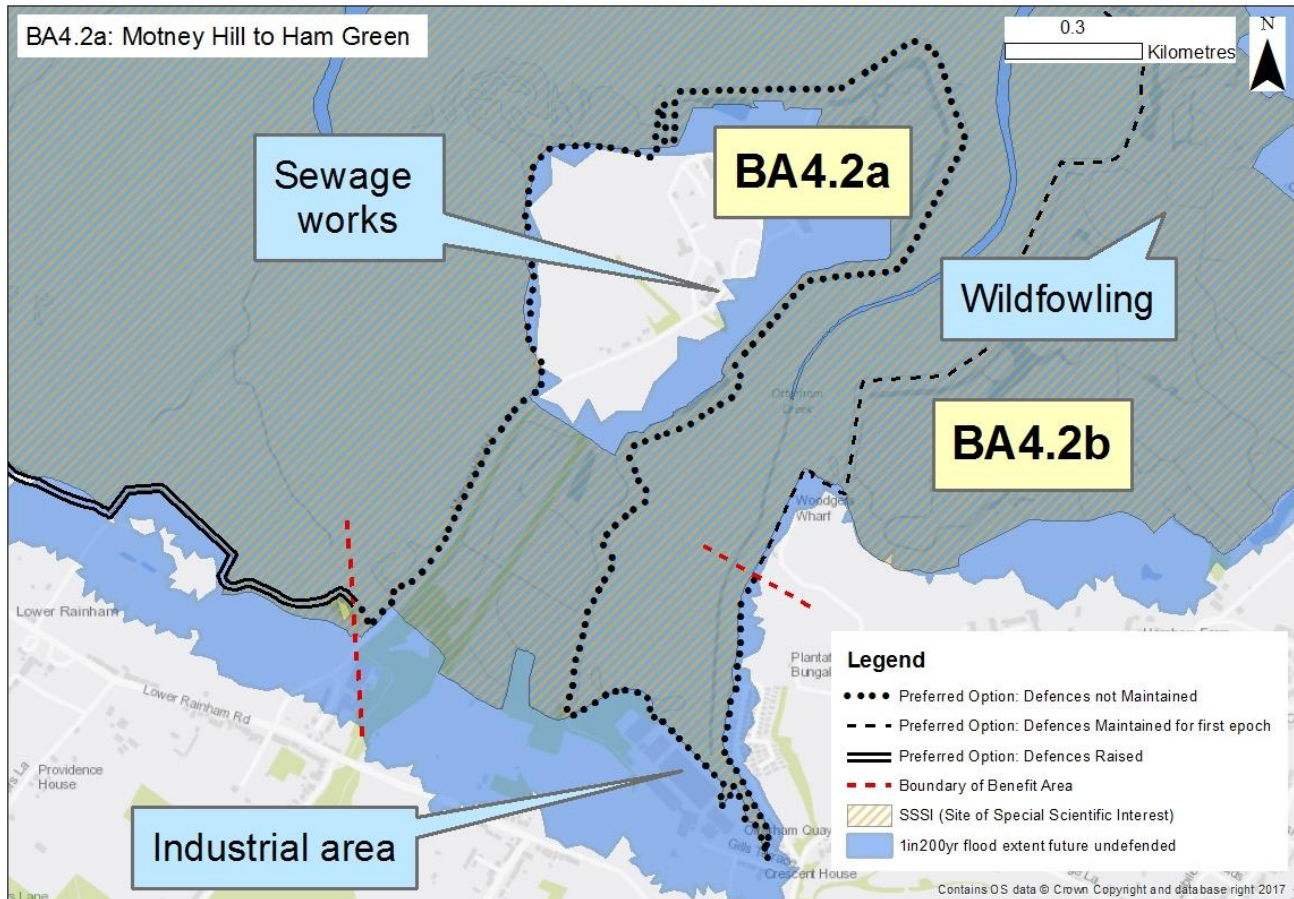
Year	Capital Scheme	Capital MR Scheme	Ongoing Maintenance
			2029 – Maintenance of concrete revetment 2031 – Maintenance of rock revetment
2040 – 2069	2044 – Develop business case for concrete revetment 2045 – Finalise business case and undertake detailed design for concrete revetment 2046 – Construct concrete revetment 2066 – Business case for second phase of works 2067 – Finalise business case and undertake detailed design for second phase of works 2068 – Construction works to raise the embankment, seawall and revetment		Annual maintenance – mowing of embankments and patch and repair 2039, 2049 and 2059 - Patch and repair maintenance of seawall and concrete revetment 2041, 2051, and 2061 – Maintenance of rock revetment
2070 – 2119	2092 – Develop the business case for concrete revetment 2093 – Finalise business case and undertake detailed design for concrete revetment 2094 – Construct concrete revetment		Annual maintenance – mowing of embankments and patch and repair 2077, 2087, 2097 and 2107 – Patch and repair maintenance of seawall and rock revetment 2077, 2087, 2102 and 2112 – Maintenance of concrete revetment

A.4.2 BA4.2a: Motney Hill to Ham Green

This is a proposed NAI area, with current defences expected to start failing by year 9. The flood risk here is in the south of the section. Although the cottages and Southern Water assets are not at risk of direct flooding due to the topography, the access is at risk. Discussions with Southern Water have been started and it is important to work with them going forward during the implementation of NAI. Freshwater compensation is required due to impacts on freshwater SPA and Ramsar designated habitat.

Preferred Option	No Active Intervention (NAI) with freshwater compensation required by year 9 (capital works in year 4).		
Description of Preferred Option	It is not economically viable to maintain the defences, as such all maintenance will be ceased and there will be risk of failure of the defences from year 9 which would result in the inundation of the designated freshwater habitat. Therefore, compensatory freshwater habitat will need to be developed by year 4 to allow it to be in place prior to failure of the defences in year 9.		
Justification	No short listed options were identified which would provide increased protection and with BCRs above one/positive NPVs. However, under law, it is required that the freshwater habitat is protected, so compensatory freshwater habitat will be required.		
Environmental	Overtopping and failure of the defences will result in the degradation of reed bed habitat within the Medway Estuary and Marshes SPA and Ramsar.		
	2018-2038	2039-2068	2069-2118
Overall Policy	NAI with freshwater habitat compensation	NAI with freshwater habitat compensation	NAI with freshwater habitat compensation
Defence Crest Level Required	N/A – NAI policy	N/A – NAI policy	N/A – NAI policy

Whole Life Cost (PV)	£0	BCR	N/A	PF%	N/A
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Key Risks and Mitigation - BA4.2a: Motney Hill to Ham Green

Key Risk	Mitigation and Action	Owner
Potential impacts on Southern Water sewage works.	The potential risks to Southern Water will be discussed with them regarding future plans for the area. It is unlikely that GiA funding will be available for this area, so Southern Water will need to manage the risks.	KSL Area Team.
Potential release of contaminates from the landfill site.	The potential impacts due to inundation after the NAI policy is implemented will be reviewed and assessed in more detail.	KSL Area Team with support from Environment and Business.
Understanding of freshwater habitat which is at risk.	Further surveys are required to provide more information on the functionality and species composition for the freshwater habitat. Surveys will inform a study determining the damage expected and the compensatory habitat required.	KSL Area Team supported by NEAS and FBG.
Provision of satisfactory compensatory freshwater habitat.	It has been proposed that Great Bells Farm can be used as compensatory habitat for freshwater compensation in the first 10 years. Surveys of the habitat that will be lost will inform the management of Great Bells to provide habitat of the same type. Discussions will be held with NE, RSPB and the EA to confirm that the habitat is of sufficient quality. Great Bells farm can then be classed as compensatory habitat and designated accordingly. Should Great Bells Farm not be suitable, and further works cannot be undertaken to improve the suitability of Great Bells Farm, additional compensation sites will be required.	KSL Area Team with support from NEAS.

Impacts on freshwater designated (SPA and Ramsar) habitat assessment

Option for managing impacts	Freshwater Habitat Compensation	Maintaining and Raising the defences in line with sea level rise
Cost (PV £k)	£2,000k	£7,512k
Other comments	32ha of freshwater habitat compensation required	Coastal squeeze of the intertidal SPA if the defences are held
Ranking	1	2

Dependencies

- Strategy wide environmental reviews to assess the requirements for the freshwater habitat requirements.
- Finding a suitable freshwater compensation site if Great Bells Farm is not deemed appropriate for compensation requirements.

Stakeholders

- Southern Water discussions to be continued from initial early discussions in the Strategy.

Implementation Plan - BA4.2a: Motney Hill to Ham Green

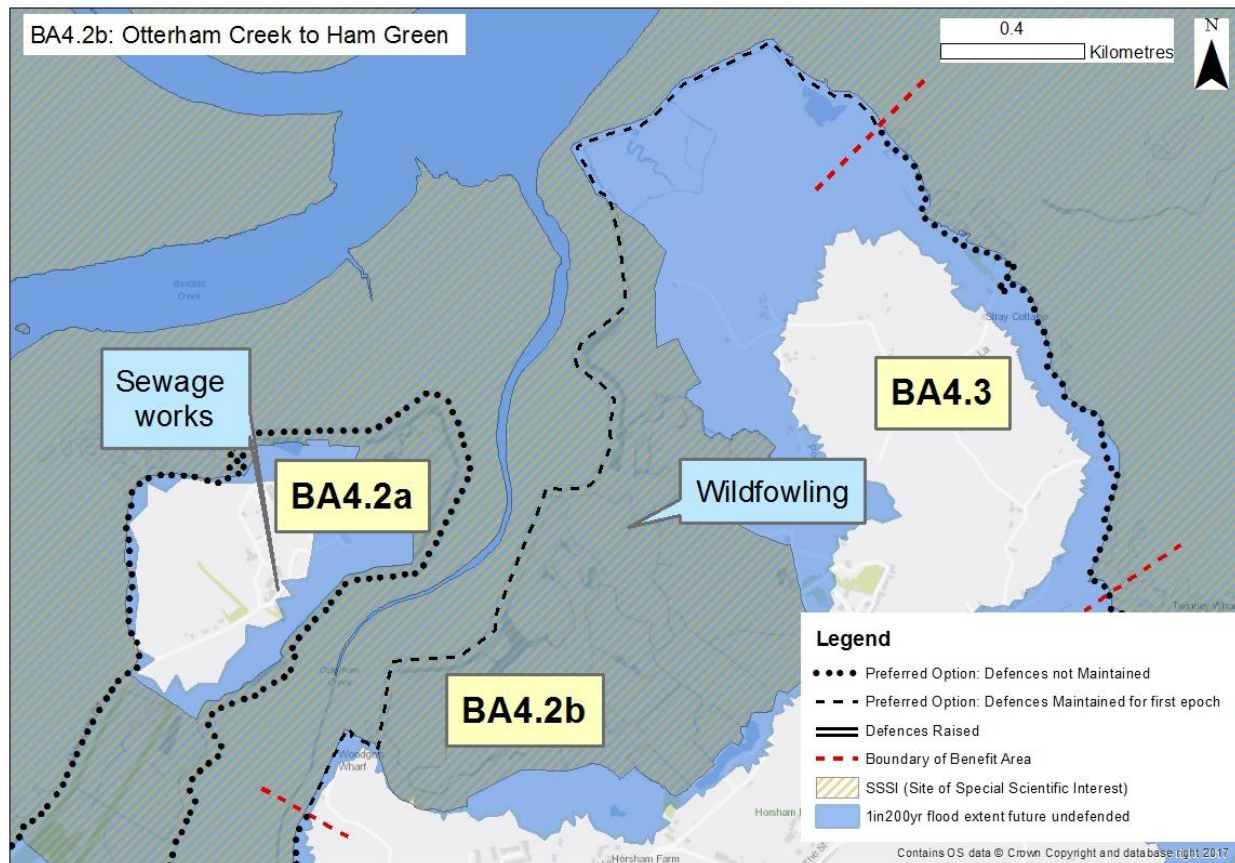
Year	Strategy Wide Activities	Freshwater Compensation	No Active Intervention
2019	Update of HCP Report with detailed scope and programme for surveys. Surveys of the Priority 1 sites to determine the freshwater compensatory habitat requirement	Determination of suitability of Great Bells Farm as freshwater compensation, if not suitable review other locations for compensation Mitigation & Action: Freshwater habitat surveys	Discussions with landowners regarding NAI policy Mitigation & Action: Southern Water discussions Mitigation & Action: Review impacts of NAI option on landfill
2020	Surveys of the SPA and Ramsar sites to determine the freshwater compensatory habitat requirement	Determination of suitability of Great Bells Farm as freshwater compensation, if not suitable review other locations for compensation If not suitable landowner consultation in newly identified areas If not suitable develop design for new compensation site	Discussions with landowners regarding NAI policy
2021	Mitigation & Action: Freshwater compensation sites reviewed and finalised National DEFRA review of HCP Report	If not suitable develop funding application for new compensation areas	NAI implemented, health and safety surveys undertaken
2022		If not suitable create compensatory habitat	NAI implemented, health and safety surveys undertaken
2023	National DEFRA review of HCP Report		NAI implemented, health and safety surveys undertaken
2024	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation		NAI implemented, health and safety surveys undertaken
2025	National DEFRA review of HCP Report		NAI implemented, health and safety surveys undertaken
2026			NAI implemented, health and safety surveys undertaken
2027	National DEFRA review of HCP Report		NAI implemented, health and safety surveys undertaken
2028			NAI implemented, health and safety surveys undertaken
2029 – 2039	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation Every 2 years - National DEFRA review of HCP Report		NAI implemented, health and safety surveys undertaken
2040 – 2069	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation Every 2 years - National DEFRA review of HCP Report		NAI implemented, health and safety surveys undertaken
2070 – 2119	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation Every 2 years - National DEFRA review of HCP Report		NAI implemented, health and safety surveys undertaken

A.4.3 BA4.2b: Otterham Creek to Ham Green

Due to the residual life left in the defences, and the agricultural land and freshwater habitat being protected, ongoing maintenance without capital works is justifiable in the short term. However, as the defences start to fail after year 15, this section will move to NAI approach. Currently the land is well managed for agricultural and freshwater habitat purposes and discussions around maintenance with the landowners will be required. Should impacts to the freshwater designated habitat occur through a NAI approach compensatory habitat will be required.

Preferred Option	Ongoing maintenance until year 15, followed by No Active Intervention (NAI) and freshwater compensation required by 15 (capital works in year 10).		
Description of Preferred Option	Maintenance (patch and repair) of the current defences (earth embankments) for the first 15 years to the current SoP offered. After this all maintenance will be ceased which will increase the risk of failure of the defences which would result in the inundation of the designated freshwater habitat. Therefore, compensatory freshwater habitat will need to be developed by year 10 to allow it to be in place prior to failure of the defences from year 15.		
Justification	Due to the limited assets at risk in the area, options to Hold the Line in the long term do not provide a BCR above one. The current defences have a 15-year median residual life. If patch and repair maintenance continues, the overall BCR is above one and the NPV is positive, enabling HTL policy in the short term. The cost for habitat compensation reduces the BCR below one however is required by law due to the impacts the NAI option will have on the habitat.		
Environmental	There are potential significant effects on the intertidal Medway Estuary and Marshes SPA and Ramsar and constituent qualifying features due to coastal squeeze.		
	2018-2038	2039-2068	2069-2118
Overall Policy	HTL Maintain until year 15 followed by NAI with freshwater compensation	NAI with freshwater habitat compensation	NAI with freshwater habitat compensation
Defence Crest Level Required	As now	N/A - NAI	N/A - NAI

Whole Life Cost (PV)	£43k	BCR	7.3	PF%	62
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Key Risks and Mitigation - BA4.2b: Otterham Creek to Ham Green

Key Risk	Mitigation and Action	Owner
Provision of satisfactory compensatory freshwater habitat.	Based on the results of the freshwater surveys acceptable compensatory habitat will be found prior to the loss of the freshwater habitat in year 15. Should the defences continue to be held by the landowner and increased with sea level rise, freshwater compensation may not be required.	KSL Area Team with support from NEAS.
Discussions and agreements with landowners.	Further detailed discussion will be held with the landowner to agree ownership and any future maintenance of defences from year 15.	KSL AREA Team.

Impacts on freshwater designated (SPA and Ramsar) habitat assessment

Option for managing impacts	Freshwater Habitat Compensation	Maintaining and Raising the defences in line with sea level rise
Cost (PV £k)	£3,243k	£4,781k
Other comments	Significant area (88ha) of freshwater habitat compensation required.	Coastal squeeze of the intertidal SPA and Ramsar if the defences are held
Ranking	1	2

Dependencies

- Strategy wide environmental reviews to assess the requirements for the freshwater habitat requirements.
- Ongoing maintenance over the first epoch requires coastal squeeze mitigation through Managed Realignment sites elsewhere in the Strategy.
- Finding a suitable freshwater compensation site.
- Ongoing review of the defences and whether the landowner continues to maintain the defences. Should the defences be continued to be maintained, freshwater compensation may not be required.

Stakeholders

- The landowners in this section currently maintain the land to help enhance biodiversity and are likely to want to continue to maintain defences in the long term.

Implementation Plan - BA4.2b: Otterham Creek to Ham Green

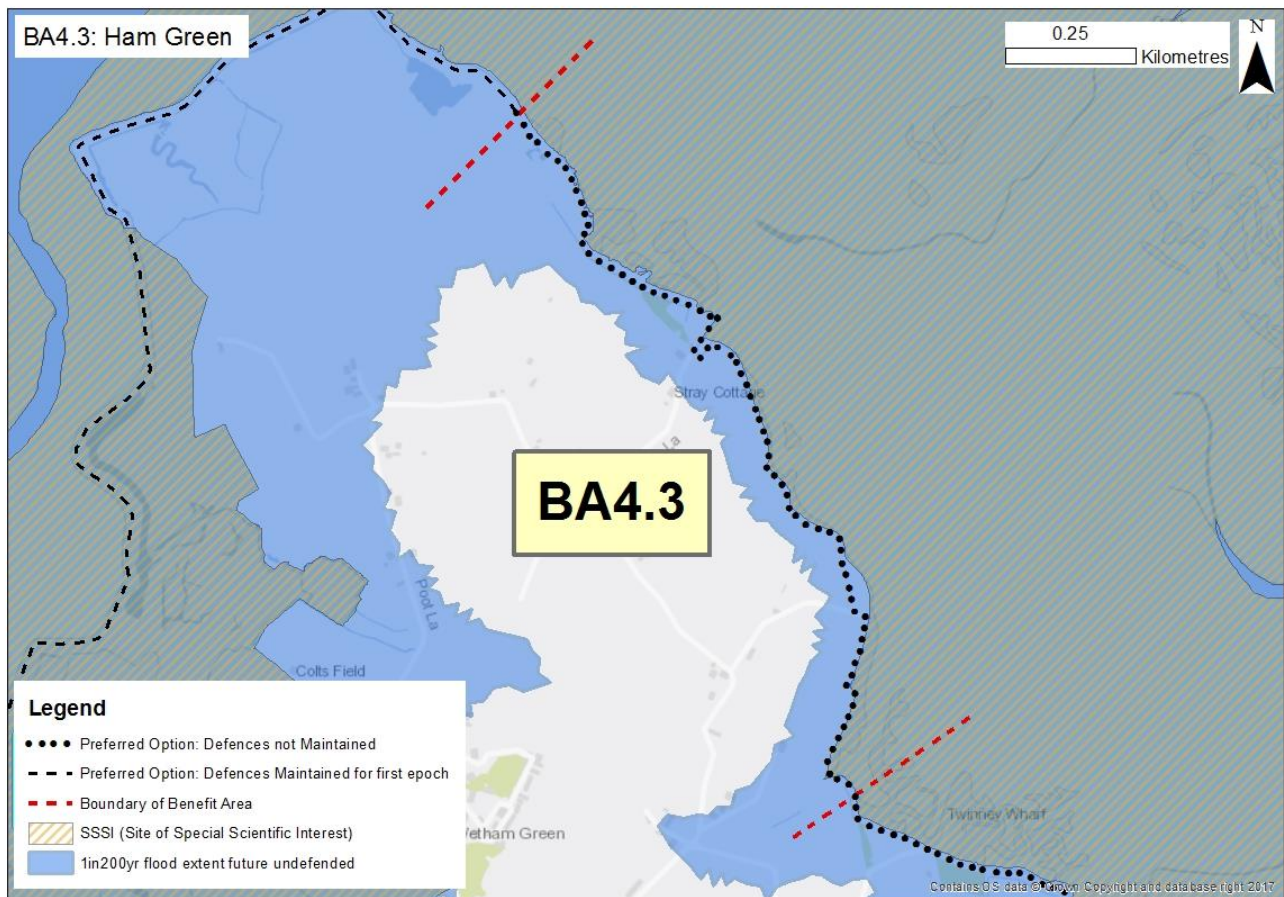
Year	Strategy Wide Activities	Freshwater Compensation	Ongoing Maintenance	No Active Intervention
2019	Update of HCP Report with detailed scope and programme for surveys. Surveys of the Priority 1 sites to determine the freshwater compensatory habitat requirement	Assessment of survey requirements within HCP report	Annual maintenance – mowing of embankments and patch and repair	
2020	Surveys of the SPA and Ramsar sites to determine the freshwater habitat requirement			
2021	Mitigation & Action: Freshwater compensation sites reviewed and finalised National DEFRA review of HCP Report	Mitigation & Action: Determine potential locations of freshwater compensation sites and agree funding and timescales	Annual maintenance – mowing of embankments and patch and repair	
2022		Undertake discussions with landowners in compensation sites		
2023	National DEFRA review of HCP Report	Undertake discussions with landowners in compensation sites	Annual maintenance – mowing of embankments and patch and repair	
2024	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation	Review and implement freshwater compensation site		
2025	National DEFRA review of HCP Report	Review and implement freshwater compensation site	Annual maintenance – mowing of embankments and patch and repair	
2026		Review and implement freshwater compensation site		
2027	National DEFRA review of HCP Report	Review and implement freshwater compensation site	Annual maintenance – mowing of embankments and patch and repair	Mitigation & Action: Landowner engagement regarding withdrawal of maintenance
2028		Review and implement freshwater compensation site	Annual maintenance – mowing of embankments and patch and repair	
2029 – 2039	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation Every 2 years - National DEFRA review of HCP Report	2029 – Confirmation of required compensatory habitat creation	Annual maintenance until 2032 – mowing of embankments and patch and repair	2031 – Landowner engagement regarding withdrawal of maintenance 2033 – NAI implemented and health and safety surveys undertaken annually
2040 – 2069	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation Every 2 years - National DEFRA review of HCP Report			NAI implemented and health and safety surveys undertaken annually
2070 – 2119	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation Every 2 years - National DEFRA review of HCP Report			NAI implemented and health and safety surveys undertaken annually

A.4.4 BA4.3: Ham Green

This is an area where the land rises into high ground and therefore there is limited flood risk. With no assets at risk from flooding the policy here is NAI.

Preferred Option	No Active Intervention (NAI).		
Description of Preferred Option	There are currently no defences in the area, and the SMP policy is NAI. This policy will be maintained, and no new defences will be constructed. There will be an increased risk of overtopping and the defences will be at risk from failure from year 20.		
Justification	No short listed options were identified which would provide increased protection and with BCRs above one/positive NPVs.		
Environmental	A NAI policy should allow natural processes and limit the impacts on the environment.		
	2018-2038	2039-2068	2069-2118
Overall Policy	NAI	NAI	NAI
Defence Crest Level Required	N/A – NAI policy	N/A – NAI policy	N/A – NAI policy

Whole Life Cost (PV)	£0	BCR	N/A	PF%	N/A
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Key Risks and Mitigation - BA4.3: Ham Green

Key Risk	Mitigation and Action	Owner
Rights of way.	The impacts on rights of way will be reviewed in more detail at the project level and mitigated by providing set back access if required.	NEAS.

Dependencies

N/A (it is to be noted that as this area currently is managed as a NAI site, the additional landowner engagement required when withdrawing maintenance does not apply here).

Implementation Plan - BA4.3: Ham Green

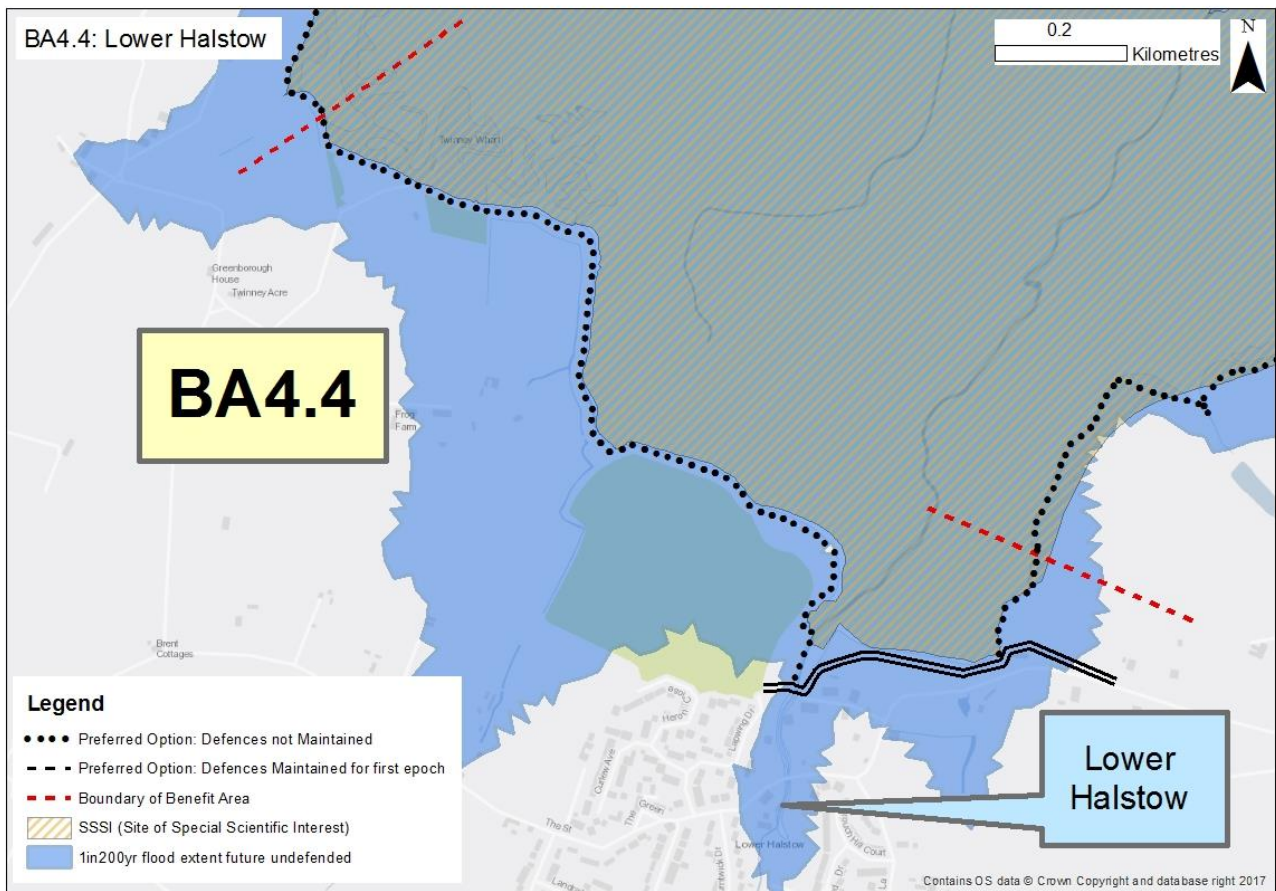
Year	No Active Intervention
2019	NAI implemented, health and safety surveys undertaken Mitigation & Action: Review impacts on rights of way
2020	NAI implemented, health and safety surveys undertaken
2021	NAI implemented, health and safety surveys undertaken
2022	NAI implemented, health and safety surveys undertaken
2023	NAI implemented, health and safety surveys undertaken
2024	NAI implemented, health and safety surveys undertaken
2025	NAI implemented, health and safety surveys undertaken
2026	NAI implemented, health and safety surveys undertaken
2027	NAI implemented, health and safety surveys undertaken
2028	NAI implemented, health and safety surveys undertaken
2029 – 2039	NAI implemented, health and safety surveys undertaken
2040 – 2069	NAI implemented, health and safety surveys undertaken
2070 – 2119	NAI implemented, health and safety surveys undertaken

A.4.5 BA4.4: Lower Halstow

Funding for defences for the whole section cannot be justified and therefore defence maintenance and improvement should be focussed on protecting the village of Lower Halstow. Small additional lengths of embankments will be required to prevent flooding from adjacent sections. There are concerns from residents around impacts on the adjacent brickfields site.

Preferred Option	Raise (sustain) embankment and revetment in localised areas.		
Description of Preferred Option	Localised raising of the defences to protect the village of Lower Halstow against a 1%AEP with sea level rise. The defences will be raised in year 10 to 5.2m AOD and then in year 50 to 6.0m AOD to continue to provide protection in line with sea level rise. The rest of the BA will have a NAI approach and management will cease on the defences.		
Justification	Localised HTL sensitivity provides the only solution with a BCR above 1 and a positive NPV. This option will provide protection to all residential properties at risk of flooding to at least a 1% AEP. In the NAI areas there is limited assets at risk due to the rising ground.		
Environmental	Where the defences are raised there may be a risk of coastal squeeze, which could have limited adverse effects on the Medway Estuary and Marshes SPA and Ramsar habitat. In the NAI areas there will be the opportunity for the natural roll-back of the intertidal habitat, reducing the impacts of coastal squeeze. There will be no impacts on designated freshwater habitat.		
	2018-2038	2039-2068	2069-2118
Overall Policy	HTL Sustain with localised NAI	HTL Sustain with localised NAI	HTL Sustain with localised NAI
Defence Crest Level Required	5.2m AOD (for sustain section)	5.2m AOD (for sustain section)	6.0m AOD (for sustain section)

Whole Life Cost (PV)	£814k	BCR	1.1	PF%	8
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Key Risks and Mitigation - BA4.4: Lower Halstow

Key Risk	Mitigation and Action	Owner
Visual effects and impacts upon landscape character of implementing capital works to sustain defences.	Use materials that reflect the cultural landscape and enhance local character. Look for opportunities to introduce mitigation planting to replace lost vegetation, enhance landscape character and minimise visual impact of proposals.	KSL Area Team with support from design consultant.
Loss of intertidal habitats due to coastal squeeze.	Strategy wide intertidal habitat compensation developed through MR sites. The feasibility of the MR sites will be undertaken to confirm that adequate habitat will be provided.	KSL Area Team with support from NEAS.
Third party contributions required.	Discussions will be had with key asset owners early on in 2025 when the business case is being developed.	KSL Area Team.
Impacts to historic buildings.	Impacts of capital works to historic listed buildings in Lower Halstow will be mitigated through the design of the works. Level of impact will be assessed through a Heritage Assessment, and early consultation will be had with the Local Authority if listing building consent is required.	NEAS heritage specialist with support from appraisal consultant.
Stakeholder engagement.	Early public engagement will be undertaken as there is a keen interest by the residents around the defences.	KSL Area Team.
Rights of way.	The impacts on rights of way will be reviewed in more detail at the project level and mitigated by providing set back access if required.	NEAS.
Impacts of NAI to the brickfields amenity site.	Increased overtopping could impact the habitat and recreational use. The development of the OBC will consider whether the boundary can be extended to include the brickfields site area.	KSL Area Team.
Impacts of NAI to Twinney Wharf.	Early engagement with owners to consider detailed impacts. KSL Area Team to offer to share information from Strategy modelling.	KSL Area Team.
Review opportunities to reduce carbon.	For concrete defences investigate possibility of using low carbon concrete. Consider material sources and transportation during design phase and limit carbon footprint where possible.	Designer.

Key Dependencies

- MR sites being approved to ensure that compensation is required for the loss of intertidal habitat due to coastal squeeze.
- Achieving third party funding contributions.
- Licences and permits required for the capital scheme to include (but not be limited to): MMO licence, preliminary WFD Assessment, footpath relocation licence, Listed Building Consent, EIA Screening, HR01 and Flood Risk Activity Permit.

Business Case for Capital Scheme

Case	Summary
Strategic case	<ul style="list-style-type: none"> • Residential properties at risk from overtopping and flooding. • Heritage properties in Lower Halstow to protect from flooding.
Economic case	<ul style="list-style-type: none"> • The Benefit Cost Ratio is above 1. • Number of OM2s associated with this Scheme.
Commercial case	<ul style="list-style-type: none"> • Procurement route likely to follow the Environment Agency framework and standard procurement practices.
Financial case	<ul style="list-style-type: none"> • The PF score is low and third-party funding will be required.
Management case	<ul style="list-style-type: none"> • The key risks and required mitigations are highlighted above in the risks and mitigation table and need to be implemented throughout the business case activities. • Early public engagement is important in this business case.

Stakeholders

- A number of concerns from local residents including:
 - Risk of flooding of Lower Halstow from adjacent NAI areas
 - Impacts of NAI at brickfields site
 - Impact on Twinney Wharf
- Lower Halstow Parish Council is an important stakeholder to keep informed of developments.

Implementation Plan - BA4.4: Lower Halstow

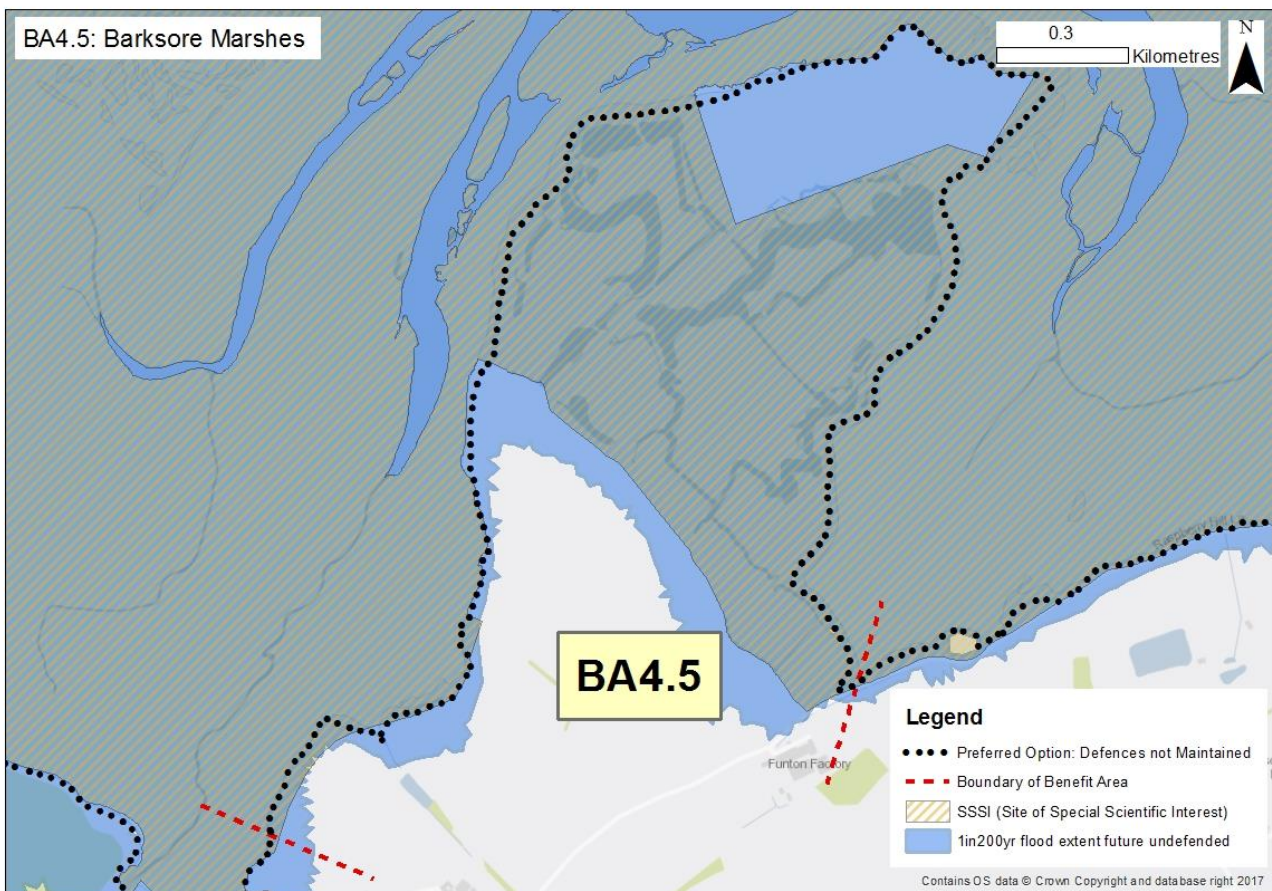
Year	Capital Scheme	Ongoing Maintenance
2019	Mitigation & Action: MR feasibility study	Localised annual maintenance – mowing of embankments and patch and repair of embankments Localised patch and repair maintenance of seawalls
2020		Localised annual maintenance – mowing of embankments and patch and repair of embankments
2021		Localised annual maintenance – mowing of embankments and patch and repair of embankments
2022		Localised annual maintenance – mowing of embankments and patch and repair of embankments
2023		Localised annual maintenance – mowing of embankments and patch and repair of embankments
2024		Localised annual maintenance – mowing of embankments and patch and repair of embankments
2025	OBC procurement and NEAS screening Mitigation & Action: Discussions with key asset owners on funding potential Mitigation & Action: Undertake early stakeholder/public engagement. Engage with owners of Twenny Wharf	Localised annual maintenance – mowing of embankments and patch and repair of embankments
2026	Start to develop the OBC - detailed economic assessment – review options and develop outline design – stakeholder engagement – third party contributions – environmental assessment – licenses and permits discussions Mitigation & Action: Mitigate impacts to historic buildings Mitigation & Action: Assess opportunities to extend OBC boundary for HTL policy Mitigation & Action: Assess impacts on public rights of way	Localised annual maintenance – mowing of embankments and patch and repair of embankments
2027	Finalise business case and undertake detailed design - early contractor involvement – refine option design – stakeholder engagement – obtain licenses and permits	Localised annual maintenance – mowing of embankments and patch and repair of embankments
2028	Construction works to raise the embankment, seawall and flood gates in localised areas	
2029 – 2039		Localised annual maintenance – mowing of embankments and patch and repair of embankments 2029 – Localised patch and repair maintenance of seawalls
2040 – 2069	2066 – Develop OBC for phase two of capital works 2067 – Finalise business case and undertake detailed design for phase two 2068 – Raise the embankment, seawall, revetments and sheet piling for phase two	Localised annual maintenance – mowing of embankments and patch and repair of embankments 2039, 2049 and 2059 – Localised patch and repair maintenance of seawalls
2070 – 2119		Localised annual maintenance – mowing of embankments and patch and repair of embankments 2077, 2087, 2097 and 2107 – Localised patch and repair maintenance of seawalls

A.4.6 BA4.5: Barksore Marshes

For the length of defences required here compared to the assets and land that are being protected, there is no economic case to continue to maintain and replace the defences. The defences currently are in good condition and therefore it is expected that there would be increased risk to flooding from year 21. Freshwater compensation will be required by year 21 to mitigate the impacts on the designated freshwater SPA and Ramsar site.

Preferred Option	No Active Intervention (NAI) with freshwater compensation required by year 21 (capital works in year 16).		
Description of Preferred Option	It is not economically viable to maintain the defences, as such all maintenance will be ceased. This will increase the risk of failure of the defences which could result in the inundation of the designated freshwater habitat. Therefore, compensatory freshwater habitat will need to be developed by year 16 to allow it to be in place prior to failure of the defences from year 21.		
Justification	No short listed options were identified which would provide increased protection and with BCRs above one/positive NPVs. Habitat compensation is required by law due to the impacts the NAI option will have on the habitat.		
Environmental	Impact on freshwater habitat as part of the Medway Estuary and Marshes SPA and Ramsar site. Compensation will be required.		
	2018-2038	2039-2068	2069-2118
Overall Policy	NAI with freshwater habitat compensation	NAI with freshwater habitat compensation	NAI with freshwater habitat compensation
Defence Crest Level Required	N/A – NAI policy	N/A – NAI policy	N/A – NAI policy

Whole Life Cost (PV)	£0	BCR	N/A	PF%	N/A
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Key Risks and Mitigation - BA4.5: Barksore Marshes

Key Risk	Mitigation and Action	Owner
Potential release of contaminants from the landfill site.	The potential impacts due to inundation after the NAI policy is implemented will be reviewed and assessed in more detail.	KSL Area Team.
Provision of satisfactory compensatory freshwater habitat.	Based on the results of the freshwater surveys acceptable compensatory habitat will be found prior to the loss of the freshwater habitat in year 21. Should the defences continue to be held by the landowner and increased with sea level rise, freshwater compensation may not be required.	KSL Area Team with support from NEAS.

Impacts on freshwater designated (SPA and Ramsar) habitat assessment

Option for managing impacts	Freshwater Habitat Compensation	Maintaining and raising the defences in line with sea level rise
Cost (PV £k)	£2,381k	£2,572k
Other comments	Significant area (77ha) of freshwater habitat compensation required	Coastal squeeze of the intertidal SPA if the defences are held
Ranking	1	2

Dependencies

- Strategy wide environmental reviews to assess the requirements for the freshwater habitat requirements.
- Finding a suitable freshwater compensation site.
- Ongoing review of the defences and whether the landowner continues to maintain the defences. Should the defences be continued to be maintained, freshwater compensation may not be required.

Implementation Plan - BA4.5: Barksore Marshes

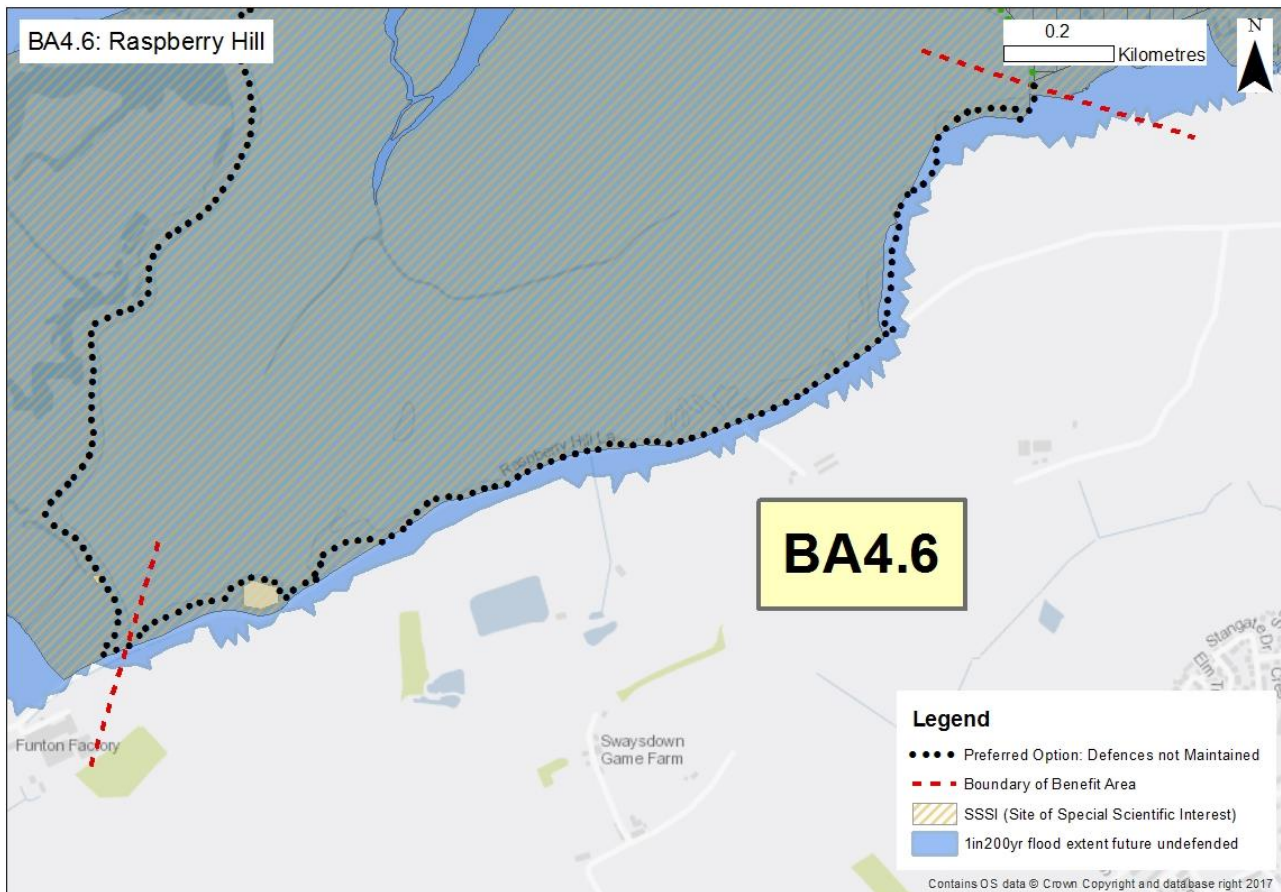
Year	Strategy Wide Activities	Freshwater Compensation	No Active Intervention
2019	Update of HCP Report with detailed scope and programme for surveys. Surveys of the Priority 1 sites to determine the freshwater compensatory habitat requirement	Assessment of survey requirements within HCP report	Discussions with landowners regarding NAI policy Mitigation & Action: Review impacts due to NAI policy on landfill site
2020	Surveys of the SPA and Ramsar sites to determine the freshwater compensatory habitat requirement		Discussions with landowners regarding NAI policy
2021	Mitigation & Action: Freshwater compensation sites reviewed and finalised National DEFRA review of HCP Report	Mitigation & Action: Determine potential locations of freshwater compensation sites and agree funding and timescales	NAI implemented, health and safety surveys undertaken
2022		Landowner discussion in compensation areas	NAI implemented, health and safety surveys undertaken
2023	National DEFRA review of HCP Report	Landowner discussions in compensation areas	NAI implemented, health and safety surveys undertaken
2024	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation	Review and implement freshwater compensation site	NAI implemented, health and safety surveys undertaken
2025	National DEFRA review of HCP Report	Review and implement freshwater compensation site	NAI implemented, health and safety surveys undertaken
2026		Review and implement freshwater compensation site	NAI implemented, health and safety surveys undertaken
2027	National DEFRA review of HCP Report	Review and implement freshwater compensation site	NAI implemented, health and safety surveys undertaken
2028		Review and implement freshwater compensation site	NAI implemented, health and safety surveys undertaken
2029 – 2039	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation Every 2 years - National DEFRA review of HCP Report	2029-2036 - Review and implement freshwater compensation site 2036 – Confirmation of required compensatory habitat creation	NAI implemented, health and safety surveys undertaken
2040 – 2069	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation Every 2 years - National DEFRA review of HCP Report		NAI implemented, health and safety surveys undertaken
2070 – 2119	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation Every 2 years - National DEFRA review of HCP Report		NAI implemented, health and safety surveys undertaken

A.4.7 BA4.6: Raspberry Hill

Due to the mudflat and saltmarsh seaward of this section, the wave climate here is very small and the flood risk therefore also small. There could be longer term potential erosion issues to the road, however this is a minor road and the long term nature of the risk means that NAI is the preferred policy here.

Preferred Option	No Active Intervention (NAI).		
Description of Preferred Option	There are currently no defences in the area, and the SMP policy is NAI. This policy will be maintained, and no new defences will be constructed. There will be an increased risk of overtopping and the defences will be at risk of failing from year 25. It is noted that Raspberry Hill Lane might be at increased risk of flooding due to overtopping.		
Justification	No short listed options were identified with BCRs above one which provided increased protection.		
Environmental	A NAI policy should allow natural processes and limit the impacts on the environment.		
	2018-2038	2039-2068	2069-2118
Overall Policy	NAI	NAI	NAI
Defence Crest Level Required	N/A -NAI policy	N/A -NAI policy	N/A -NAI policy

Whole Life Cost (PV)	£0	BCR	N/A	PF%	N/A
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Key Risks and Mitigation - BA4.6: Raspberry Hill

Key Risk	Mitigation and Action	Owner
Potential inundation/ loss (from erosion) of Raspberry Hill Lane.	Due to the No Active Intervention policy it will not be possible to mitigate against the potential impacts, but the potential risks will be monitored in the future and discussed with the Local Authority Highways department.	KSL Area Team.

Dependencies

- N/A (it is to be noted that as this area currently is managed as a NAI site, the additional landowner engagement required when withdrawing maintenance does not apply here).

Stakeholders

- There are concerns from local residents and Kent County Council around impacts to flooding of the road. The KSL Area Team will coordinate with the Highways Department to review and agree the management of the road in the future.

Implementation Plan - BA4.6: Raspberry Hill

Year	No Active Intervention
2019	NAI implemented, health and safety surveys undertaken
2020	NAI implemented, health and safety surveys undertaken
2021	NAI implemented, health and safety surveys undertaken
2022	NAI implemented, health and safety surveys undertaken
2023	NAI implemented, health and safety surveys undertaken
2024	NAI implemented, health and safety surveys undertaken
2025	NAI implemented, health and safety surveys undertaken
2026	NAI implemented, health and safety surveys undertaken
2027	NAI implemented, health and safety surveys undertaken
2028	NAI implemented, health and safety surveys undertaken Mitigation & Action: Discussion with relevant Highways Authority
2029 – 2039	NAI implemented, health and safety surveys undertaken
2040 – 2069	NAI implemented, health and safety surveys undertaken
2070 – 2119	NAI implemented, health and safety surveys undertaken

A.4.8 BA4.7: Chetney Marshes

There are large lengths of defences in this section which are not sustainable to continue to maintain in the long term. Modelling of this site has shown that the current topography has the potential to provide an area for saltmarsh habitat to “rollback”, which avoid immediate adverse impacts on the freshwater designated sites. This suggests that this option may allow adaptation of the habitat rather than immediate loss of all the freshwater habitat (see Appendix C). However, it is less certain when the saltmarsh habitat in this area will develop, so although the option will be implemented within the first epoch, the intertidal habitat which develops will only be considered for compensatory habitat in the third epoch. Modelling will be undertaken to see whether a managed realignment site can be developed in the short term at Tailness Marshes.

Preferred Option	Ongoing maintenance until year 15 with Managed Realignment at Tailness in year 5, followed by Habitat Adaptation.		
Description of Preferred Option	Initial MR site by year 5 in the northeast corner at Tailness marshes, to provide compensation for coastal squeeze in the first epoch of the Strategy. For the rest of the frontage, maintenance (patch and repair) of the current defences (earth embankments) for the first 15 years. After year 15 the natural adaptation of the frontage will be allowed to occur through the 'MR – habitat adaptation' option. This option involves the natural adaptation of the frontage, by slowly reducing maintenance efforts and allowing inundation in particular areas, to help ensure a slower and more gradual adaptation of the designated habitat. There is a risk regarding the access to the electricity pylons during extreme events, but this risk is reduced compared to undertaking a MR site approach here, as it is envisaged only the fringes of the site will be regularly inundated. The whole of the BA will only be affected in extreme events, and this is similar to the impacts under a NAI option. If required localised adaptation of the access roads etc can be undertaken to allow access to the pylons in extreme events. See Appendix C for more details.		
Justification	Due to the limited assets at risk in the area, options to Hold the Line in the long term do not provide a BCR above one. The current defences have a 15-year median residual life. If patch and repair maintenance continues, the overall BCR is above one and the NPV is positive, enabling HTL policy in the short term. Once maintenance is withdrawn, there is a legal requirement to compensate or protect the freshwater designated habitat. The MR - habitat adaptation option will allow the freshwater habitat to adapt over time. This will result in a low-level impact over a longer period of time, which is more in line with Natural England's aspirations. This approach will help ensure continued functionality of the SPA in the Medway Estuary through providing new intertidal habitat close to the site of habitat loss. As such this is a more sustainable option and in line with the IPENs (Improvement Programme for England's Natura 2000 sites) guidance. The MR site in the first epoch will help contribute to coastal squeeze compensation in the short term, with the rest of the frontage contributing coastal squeeze compensation in the third epoch.		
Environmental	The aim of this option is to help improve the functionality of the Medway Estuary and Marshes SPA and Ramsar intertidal habitat, by allowing a more natural adaptation of the freshwater habitat. There will be adverse effects on the freshwater Medway Estuary and Marshes SPA and Ramsar habitat as there could be overtopping of the defences in extreme events, but this is the least damaging option as there will be the gradual natural adaptation of the habitat, and is a more sustainable approach to manage the environment in this BA.		
	2018-2038	2039-2068	2069-2118
Overall Policy	MR: Habitat Adaptation	MR: Habitat Adaptation	MR: Habitat Adaptation
Defence Crest Level Required	N/A	N/A	N/A

Whole Life Cost (PV)	£599k	BCR	1.3	PF%	8
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Key Risks and Mitigation - BA4.7: Chetney Marshes

Key Risk	Mitigation and Action	Owner
Electricity pylons run across the site and sub-station for the offshore cable landings.	Discussions will be had with the landowners and National Grid to determine the mitigation that would need to be implemented to protect the pylons. At Strategy level, some high level costs have been included to account for mitigation works that may be required. These discussions will be started as soon as possible.	KSL Area Team.
Provision of satisfactory compensatory freshwater habitat.	Based on the results of the freshwater surveys acceptable compensatory habitat will be found prior to the loss of the freshwater habitat in year 30. However, it is to be noted that the habitat could potentially not require compensation until much later depending on the natural adjustment of the shoreline with coastal processes.	KSL Area Team with support from NEAS and FBG.
Landowner buy-in to the creation of a MR site.	Conversations will be had with the landowner. These conversations will need provide the landowner with more detail e.g. year of construction, to confirm that they continue to provide support to the scheme.	KSL Area Team.
Impacts of soil conditions on design and environment for Managed Realignment site.	There is evidence to suggest former fields have an impermeable podzol layer which effects the drainage of newly forming saltmarsh and mudflat. Undertake a core during early GI to understand ground conditions. If poor, alternatives include ploughing, crop stripping etc.	KSL Area Team with support from design consultant and NEAS.
Rights of way.	The impacts on rights of way will be reviewed in more detail at the project level and mitigated by providing set back access if required.	NEAS.
Review opportunities to reduce carbon.	For MR site, consider sourcing embankment material from borrow pit within the site – GI works would be required to investigate this. Consider material sources and transportation during design phase and limit carbon footprint where possible.	Designer.

Impacts on freshwater designated (SPA and Ramsar) habitat assessment

Option for managing impacts	Freshwater habitat compensation	Maintaining and raising the defences in line with sea level rise	MR Habitat Adaptation
Cost (PV £k)	£14,511k	£20,893	£12,999k
Other comments	Significant area (385ha) of freshwater compensation required	Protection of the freshwater habitat (to the current SoP). Potential coastal squeeze implications	Will allow the natural adaptation of intertidal habitat. Potentially less adverse impacts on freshwater SPA as a gradual change. Also in line with IPENs guidance. More cost effective as freshwater compensatory habitat is not required till later in the scheme and can be phased, and reduces the length of embankments which need to maintained long term.
Ranking	2	3	1

Dependencies

- Strategy wide environmental reviews to assess the requirements for the freshwater habitat requirements.
- Finding a suitable freshwater compensation site.
- Landowner buy-in for the MR site.
- Licences and permits required for the MR scheme to include (but not be limited to): MMO licence, preliminary WFD Assessment, EIA Screening, EIA Scoping, Environmental Statement, HR01, Appropriate Assessment, and Flood Risk Activity Permit.

Stakeholders

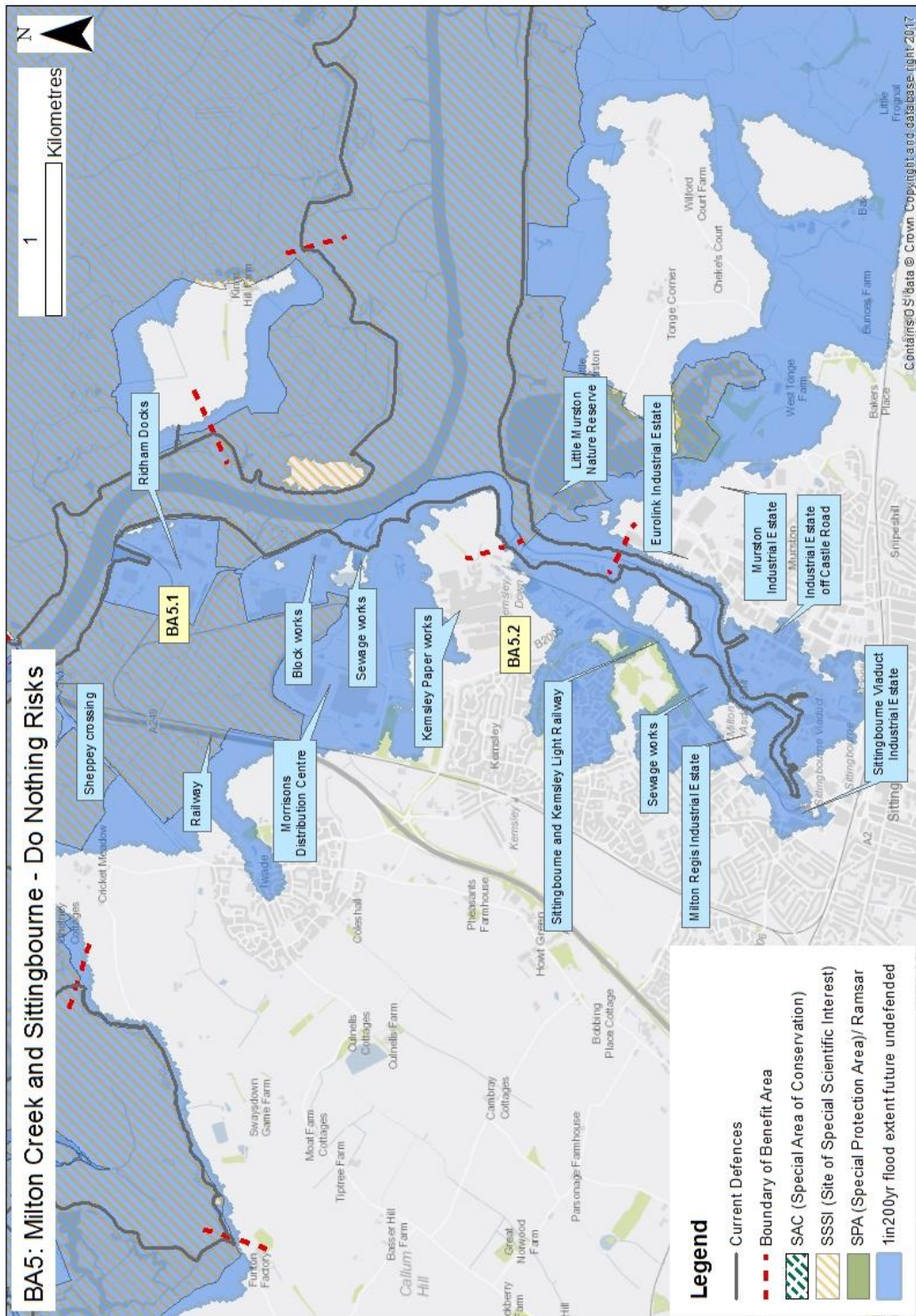
- National Grid need to be engaged early on when developing management plans to work out detailed requirements associated with the infrastructure.

Implementation Plan - BA4.7: Chetney Marshes

Year	Strategy Wide Activities	Capital MR Scheme	Freshwater Compensation	Ongoing Maintenance
2019	Update of HCP Report with detailed scope and programme for surveys. Surveys of the Priority 1 sites to determine freshwater habitat requirements	Assessment of survey requirements within HCP report NEAS screening and business case production for Tailness Mitigation & Action: Landowner consultation for Tailness Discussions with National Grid regarding mitigation required to protect critical infrastructure and possible third party funding Mitigation & Action: Archaeological desk study	Assessment of survey requirements within HCP report	Annual maintenance – mowing of embankments and patch and repair of embankments and seawalls
2020	Surveys of the SPA and Ramsar sites to determine the freshwater compensatory habitat requirement	Landowner consultation for Tailness MR site Business case for Tailness MR site Mitigation & Action: GI to include test on soil conditions		Annual maintenance – mowing of embankments and patch and repair of embankments and seawalls
2021	Mitigation & Action: Freshwater compensation sites reviewed and finalised National DEFRA review of HCP Report	Detailed design of Tailness MR site Environmental impact assessment of the MR site Mitigation & Action: Assess impacts on public right of way	Mitigation & Action: Determine potential locations of freshwater compensation sites and agree funding and timescales	Annual maintenance – mowing of embankments and patch and repair of embankments and seawalls
2022		Detailed design of Tailness MR site Application for permits and licenses	Landowner discussions in compensation sites	Annual maintenance – mowing of embankments and patch and repair of embankments and seawalls
2023	National DEFRA review of HCP Report	Construction of set-back embankments Construction of breach	Landowner discussions in compensation sites	Annual maintenance – mowing of embankments and patch and repair of embankments and seawalls
2024	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation	Surveys of MR site to determine the colonisation of the intertidal habitat		Annual maintenance – mowing of embankments and patch and repair of embankments and seawalls
2025	National DEFRA review of HCP Report			Annual maintenance – mowing of embankments and patch and repair of embankments and seawalls
2026				Annual maintenance – mowing of embankments and patch and repair of embankments and seawalls
2027	National DEFRA review of HCP Report			Annual maintenance – mowing of embankments and patch and repair of embankments and seawalls

Year	Strategy Wide Activities	Capital MR Scheme	Freshwater Compensation	Ongoing Maintenance
2028				Annual maintenance – mowing of embankments and patch and repair of embankments and seawalls
2029 – 2039	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation Every 2 years - National DEFRA review of HCP Report	Mitigation & Action: Landowner discussions regarding MR site 2039 – Provide compensation to landowners to allow site to be managed as habitat adaptation	2029-2039 - Review and implement freshwater compensation site	Annual maintenance until 2032 – mowing of embankments and patch and repair of and seawalls 2034, 2036 and 2038 – mowing of embankments and patch and repair of embankments and seawalls
2040 – 2069	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation Every 2 years - National DEFRA review of HCP Report	Manage deteriorating defences to allow progressive realignment	2040-2043 - Review and implement freshwater compensation site 2043 – Confirmation of required compensatory habitat creation	2040,2042, 2046, 2048, 2051, 2055, 2059, 2063 and 2067 – mowing of embankments and patch and repair of embankments and seawalls
2070 – 2119	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation Every 2 years - National DEFRA review of HCP Report	Manage progressive realignment and adaptation of habitat		

A.5 BA5: Milton Creek and Sittingbourne

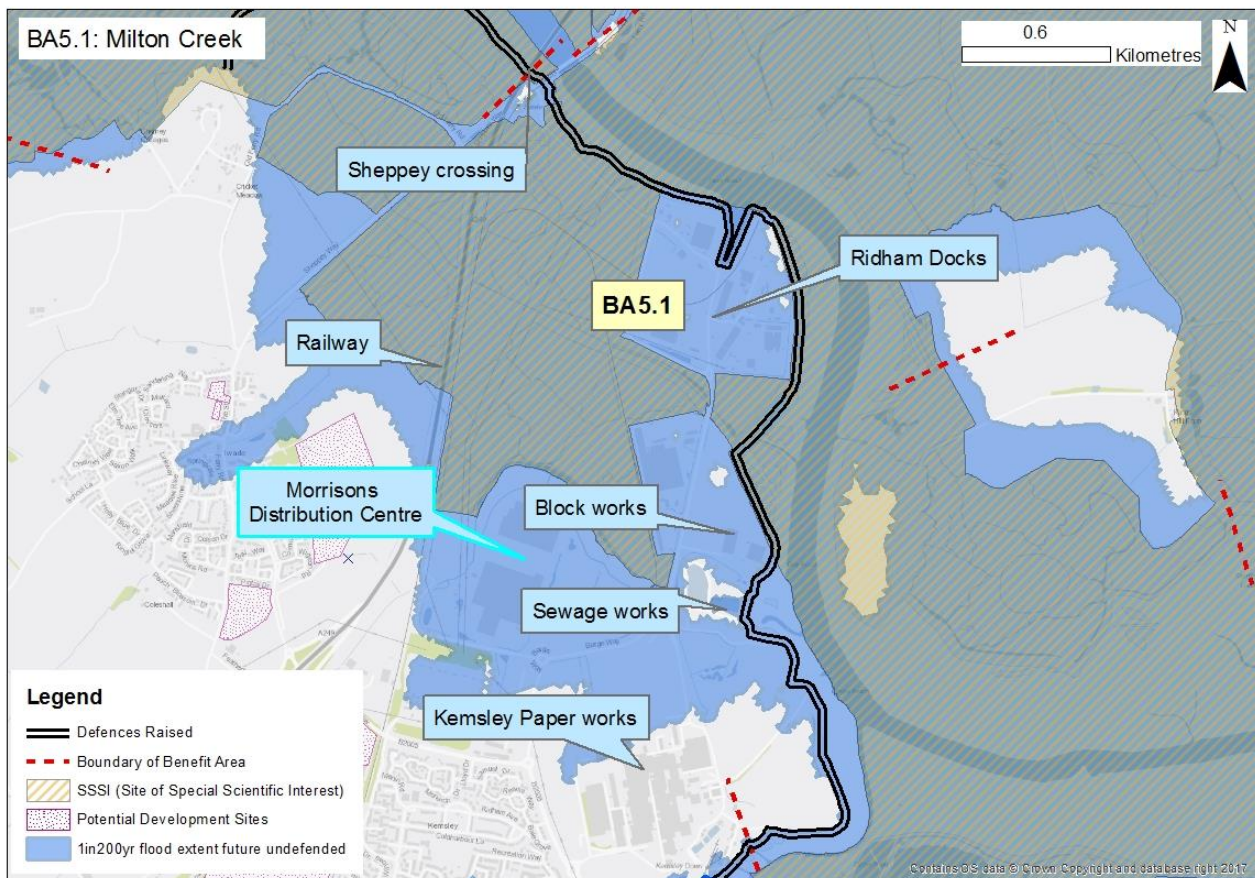


A.5.1 BA5.1: Milton Creek

Flood risk in this area means that the defences need to be maintained over the next 20 years and then raised in year 20 to increase the standard of protection to the area. It is to be noted that the assets at risk in this area are heavily weighted to commercial and industrial assets and therefore the PF score is relatively low. Part of the defences in BA4.7 (just west of the bridge) also need to be maintained and raised as they link into the same flood cell.

Preferred Option	Maintain defences until year 20. Raise (sustain) embankments and walls from year 20.		
Description of Preferred Option	Maintenance of the current defences (embankment, seawall and rock revetment) for the first 5 years to the current SoP offered. Following this the defences will be raised to 5.2m AOD and then raised again in year 50 to 6.5m AOD to provide protection to a 0.1% SoP with sea level rise.		
Justification	Delayed sustain option has highest BCR and better environmental scoring compared to the Maintain option. It is more cost effective to raise the defences in year 5 when the defences are near the end of their residual life, and then in year 50 to raise with sea level rather than raising all initially.		
Environmental	There are potential significant effects on the intertidal The Swale SPA and Ramsar and constituent qualifying features due to coastal squeeze. There are unlikely to be any adverse impacts on the freshwater habitat as the SoP provided by the defences is improved.		
	2018-2038	2039-2068	2069-2118
Overall Policy	HTL Maintain	HTL Sustain	HTL Sustain
Defence Crest Level Required	5.2m AOD	5.2m AOD	6.5m AOD

Whole Life Cost (PV)	£8,920k	BCR	7.6	PF%	42
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Key Risks and Mitigation - BA5.1: Milton Creek

Key Risk	Mitigation and Action	Owner
Visual effects and impacts upon landscape character of implementing capital works to sustain defences.	Design of flood defences (most likely earth banks) that minimise visual impacts and impacts on the landscape character. Use of materials, where hard engineering is present and will be enhanced, that reflect the cultural landscape and enhance local character.	KSL Area Team with support from NEAS and design consultants.
Loss of intertidal habitats due to coastal squeeze.	Strategy wide intertidal habitat compensation developed through MR sites. The feasibility of the MR sites will be undertaken to confirm that adequate habitat will be provided.	KSL Area Team with support from NEAS.
Third party contributions required.	Discussions will be had with key asset owners early when the business case is being developed. This should include the sewage works, block works, Ridham docks and Morrisons' distribution centre.	KSL Area Team.
Heritage impacts.	There are a number of key heritage assets, buildings and landscapes in this area which will be considered as part of the design development. A heritage assessment will be undertaken if required.	NEAS heritage specialist with support from appraisal consultants.
Rights of way.	The impacts on rights of way will be reviewed in more detail at the project level and mitigated by providing set back access if required.	NEAS.
Review opportunities to reduce carbon.	For seawall consider use of steel rather than concrete, however if concrete is required investigate possibility of using low carbon concrete. Consider material sources and transportation during design phase and limit carbon footprint where possible.	Designer.

Key Dependencies

- MR sites being approved to ensure that compensation is required for the loss of intertidal habitat due to coastal squeeze.
- Achieving third party funding contributions. This should include discussions with the sewage works, block works, Ridham docks and Morrisons' distribution centre.
- Maintain and raise defences just west of the bridge in BA4.7 to reduce flooding from adjacent sections (the OBC should cover this whole area).

Implementation Plan - BA5.1: Milton Creek

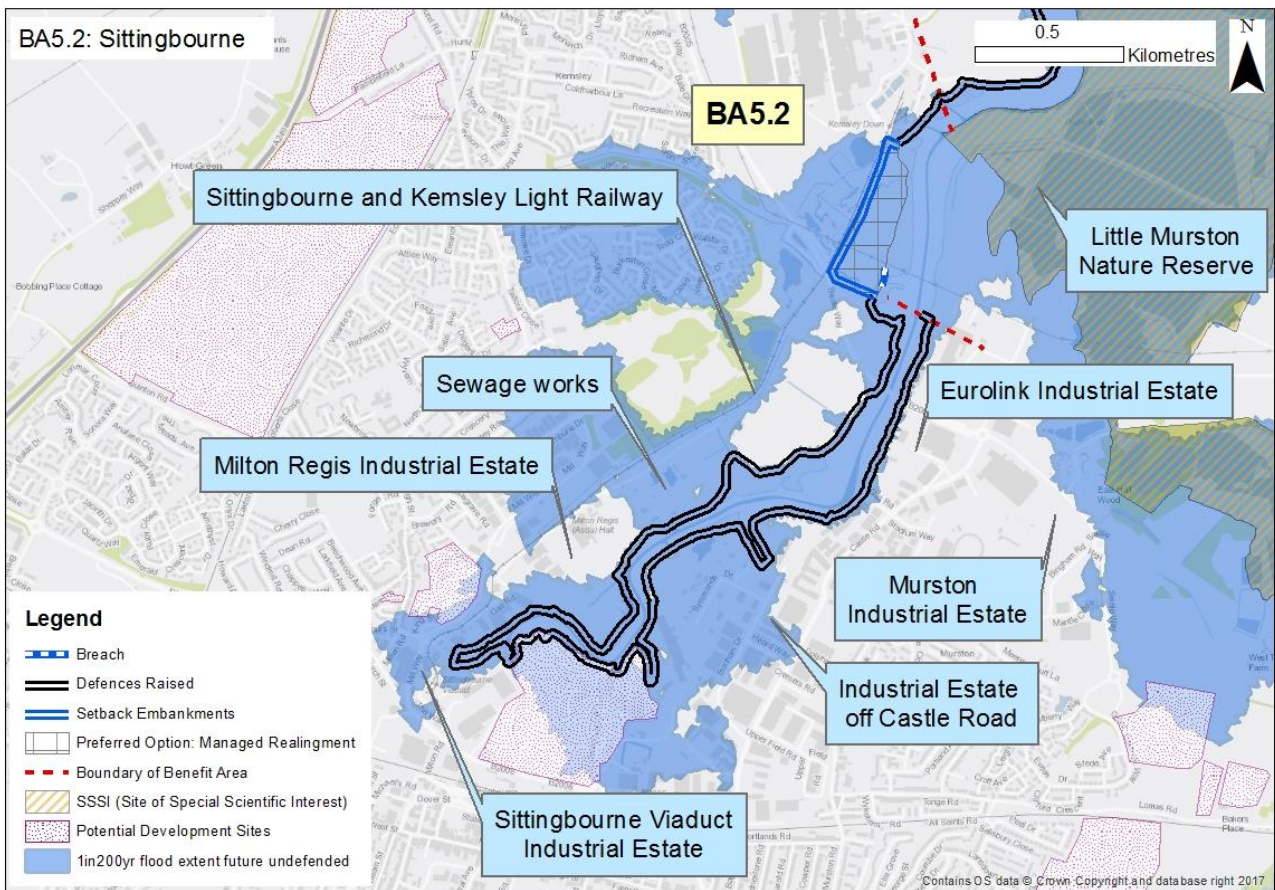
Year	Capital Scheme	Ongoing Maintenance
2019	Mitigation & Action: MR feasibility study	Annual maintenance – mowing and patch and repair of embankments Patch and repair maintenance of seawall
2020		Annual maintenance – mowing and patch and repair of embankments
2021		Annual maintenance – mowing and patch and repair of embankments
2022		Annual maintenance – mowing and patch and repair of embankments
2023		Annual maintenance – mowing and patch and repair of embankments
2024		Annual maintenance – mowing and patch and repair of embankments
2025		Annual maintenance – mowing and patch and repair of embankments
2026		Annual maintenance – mowing and patch and repair of embankments
2027		Annual maintenance – mowing and patch and repair of embankments
2028		Annual maintenance – mowing and patch and repair of embankments Patch and repair maintenance of seawall
2029 – 2039	<p>2035 – OBC procurement including NEAS screening</p> <p>Mitigation & Action: Discussion with key asset owners around third party funding</p> <p>2036 – Start to develop the OBC - detailed economic assessment – review options and develop outline design – stakeholder engagement – third party contributions – environmental assessment – licenses and permits discussions</p> <p>2037 – Finalise business case and undertake detailed design - early contractor involvement – refine option design – stakeholder engagement – obtain licenses and permits</p> <p>Mitigation & Action: Review designs impact on heritage assets</p> <p>Mitigation & Action: Review impacts on rights of way</p> <p>2038 – Construction of the first phase of HTL sustain works</p>	<p>Annual maintenance – mowing and patch and repair of embankments</p> <p>2034 – Patch and repair maintenance of seawall</p>
2040 – 2069	<p>2066 – Develop OBC for phase two of HTL sustain works</p> <p>2067 – Finalise business case and undertake detailed design for phase two</p> <p>2068 – Raise the embankment, seawall and rock revetment for phase two</p>	<p>Annual maintenance – mowing and patch and repair of embankments</p> <p>2046 and 2056 – Patch and repair maintenance of seawall</p>
2070 – 2119		<p>Annual maintenance – mowing and patch and repair of embankments</p> <p>2077, 2087, 2097 and 2107 – Patch and repair maintenance of seawall</p>

A.5.2 BA5.2: Sittingbourne

There are a number of residential properties at risk from flooding and the capital works should replace any failing assets as well as bring the crest level up to provide a standard of protection to 0.5% AEP. The small MR site at Kemsley will help compensate for coastal squeeze across the Strategy.

Preferred Option	Construct new setback embankments at identified managed realignment site at Kemsley. Raise (sustain) embankments and walls along the rest of the section.		
Description of Preferred Option	This option involves improving the SoP provided by the defences to improve the SoP to 0.5% AEP with sea level rise; in year 5 to 4.9m AOD and then in year 50 to 6.0m AOD to continue to provide protection in line with sea level rise. Additionally, construction of a MR site from year 5 at Kemsley to help compensate for the strategy wide coastal squeeze impacts. Setback embankments will be constructed to manage tidal water before a breach in the current defences is created.		
Justification	The sustain option has an incremental BCR of greater than 3 and it has one of the highest environmental ranking from the short list of options. There is a higher economic justification for raising the defences in the short term rather than waiting for defences to reach their residual life to provide increased flood risk protection in the short term. The MR site at Kemsley is required to help compensate for coastal squeeze across the Strategy in the first epoch. This site has a PF score over 100% and BCR over 1 and is not impacting on any designated sites.		
Environmental	These options are not likely to have adverse effects on The Swale SPA and Ramsar. The MR site provides compensatory habitat for coastal squeeze of The Swale SPA and Ramsar designated saltmarsh.		
	2018-2038	2039-2068	2069-2118
Overall Policy	HTL Sustain and MR	HTL Sustain and MR	HTL Sustain and MR
Defence Crest Level Required	4.9m AOD	4.9m AOD	6.0m AOD

Whole Life Cost (PV)	£8,751k	BCR	7.7	PF%	106
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Key Risks and Mitigation - BA5.2: Sittingbourne

Key Risk	Mitigation and Action	Owner
Visual effects and impacts upon landscape character of implementing capital works to sustain defences and constructing new setback embankments.	Design of flood defences (most likely earth banks) that minimise visual impacts and impacts on the landscape character. Use materials, where hard engineering is present and will be enhanced, that reflect the cultural landscape and enhance local character.	KSL Area Team with support from NEAS and design consultants.
Landowner buy-in to the creation of a MR site.	Conversations will be undertaken with the landowner and will provide more detail e.g. year of construction, to confirm that they continue to provide support to the scheme.	KSL Area Team.
Third party contributions required.	Discussions will be undertaken with key asset owners early on when the business case is being developed. This will include the various industrial estates in the area, the sewage works and the Sittingbourne and Kemsley Light Railway.	KSL Area Team.
Unknown archaeological risk from new embankments and Managed Realignment Site.	In-depth archaeological desk study will be carried out as one of the first activities in the design of the Managed Realignment site. Desk study will influence further investigations which may include trial pits, non-intrusive or geophysical surveys, ground investigations.	NEAS heritage specialists with support from appraisal consultants.
Impacts on the light railway heritage and landscape.	The set back embankments for the MR site will be located close to the light railway and design will mitigate visual/landscape impacts.	NEAS landscape specialists with support from appraisal consultants.
Rights of way.	The impacts on rights of way will be reviewed in more detail at the project level and mitigated by providing set back access if required.	NEAS.
Risk of breach and MR site causing increased scour and increased tidal prism.	More detailed modelling at design stage to be undertaken to confirm velocity and shear stress changes. Design will mitigate potential impacts and improve scour protection elsewhere if required.	KSL Area Team with support from design consultant.
Impacts of soil conditions on design and environment for Managed Realignment site.	There is evidence to suggest former fields have an impermeable podzol layer which effects the drainage of newly forming saltmarsh and mudflat. Undertake a core during early GI to understand ground conditions. If poor, alternatives include ploughing, crop stripping etc.	KSL Area Team with support from design consultant and NEAS.
Review opportunities to reduce carbon.	For MR site, consider sourcing embankment material from borrow pit within the site – GI works would be required to investigate this. For seawall consider use of steel rather than concrete, however if concrete is required investigate possibility of using low carbon concrete. Consider material sources and transportation during design phase and limit carbon footprint where possible.	Designer.

Key Dependencies

- Achieving third party funding contributions for the HTL scheme.
- Landowner buy-in on the MR site.
- Licences and permits required for the capital scheme to include (but not be limited to): MMO licence, EIA Screening, and Flood Risk Activity Permit. Depending on option design, potentially EIA Scoping and Environmental Statement required.
- Licences and permits required for the MR scheme to include (but not be limited to): MMO licence, preliminary WFD Assessment, footpath realignment, EIA Screening, EIA Scoping, HR01, Appropriate Assessment and Flood Risk Activity Permit. Depending on design option Environmental Statement might be required.

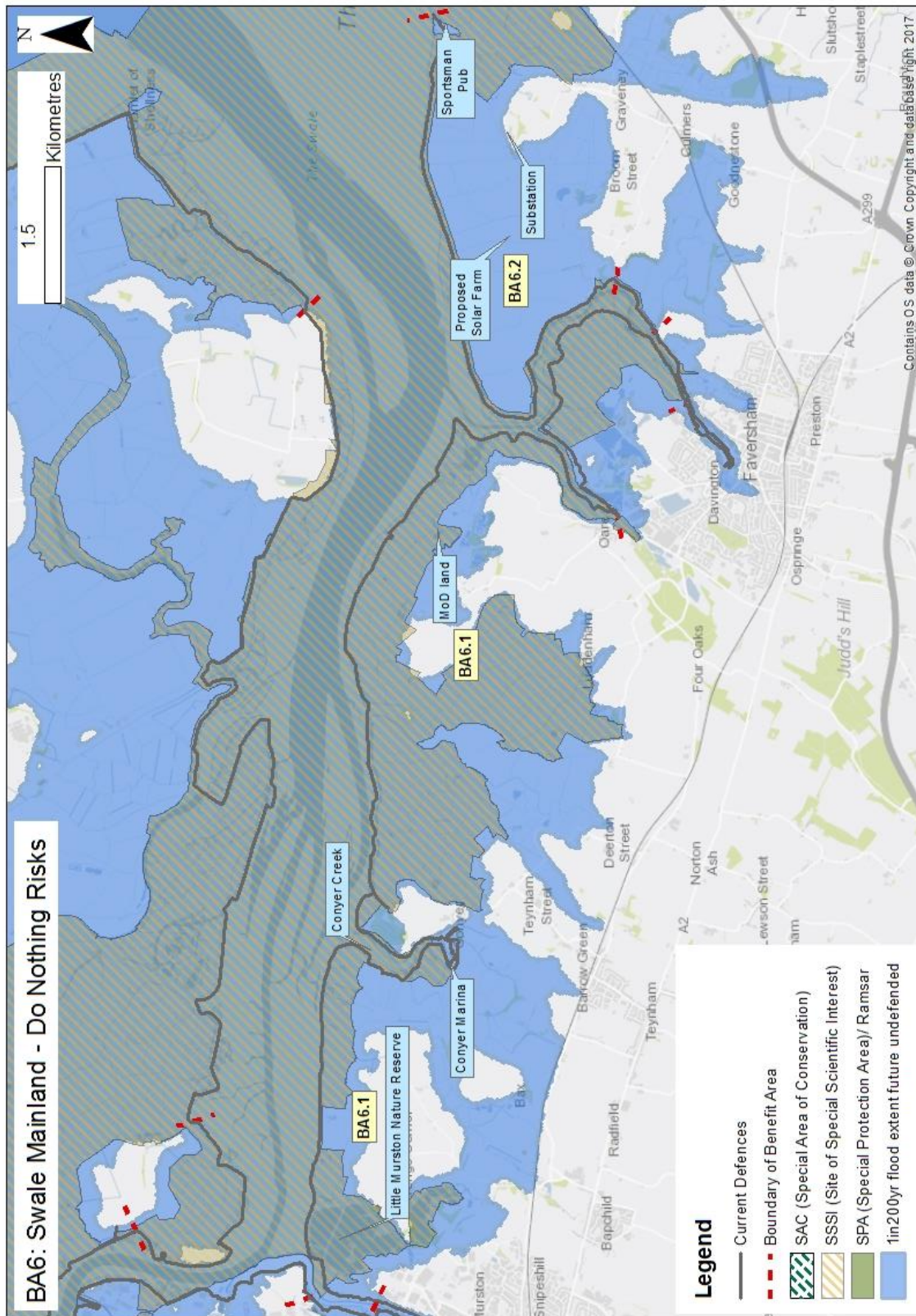
Stakeholders

- Early engagement with the owners of the Sittingbourne and Kemsley Light Railway on the MR site will be required.

Implementation Plan - BA5.2: Sittingbourne

Year	Capital Scheme	Capital MR Scheme	Ongoing Maintenance
2019		Assessment of survey requirements within HCP report NEAS screening and business case Mitigation & Action: Landowner consultation in MR site Mitigation & Action: Archaeological Desk Study	Annual maintenance – mowing of embankments and patch and repair Patch and repair maintenance of revetments
2020	OBC procurement and NEAS screening	Landowner consultation in MR site Business case for MR site Mitigation & Action: GI to include test on soil conditions	Annual maintenance – mowing of embankments and patch and repair
2021	Start to develop the OBC - detailed economic assessment – review options and develop outline design – stakeholder engagement – third party contributions – environmental assessment – licenses and permits discussions Mitigation & Action: Funding discussions with asset owners Mitigation & Action: Review impacts on right of way	Detailed design of MR site Environmental impact assessment of the site Mitigation & Action: Review impacts on rights of way Mitigation & Action: Modelling to assess risk of downstream scour	
2022	Finalise business case and undertake detailed design - early contractor involvement – refine option design – stakeholder engagement – obtain licenses and permits	Detailed design of MR site Application for permits and licenses	Annual maintenance – mowing of embankments and patch and repair
2023	Construction works to raise the embankments and seawall	Construction of set-back embankments Construction of breach	Annual maintenance – mowing of embankments and patch and repair
2024	Construction works to raise the embankments and seawall	Surveys of MR site to determine the colonisation of the intertidal habitat	Annual maintenance – mowing of embankments and patch and repair
2025		Surveys of MR site to determine the colonisation of the intertidal habitat	Annual maintenance – mowing of embankments and patch and repair
2026		Surveys of MR site to determine the colonisation of the intertidal habitat	Annual maintenance – mowing of embankments and patch and repair
2027		Surveys of MR site to determine the colonisation of the intertidal habitat	Annual maintenance – mowing of embankments and patch and repair
2028			Annual maintenance – mowing of embankments and patch and repair
2029 – 2039			Annual maintenance – mowing of embankments and patch and repair 2029 – Patch and repair maintenance of seawall
2040 – 2069	2066 – Business case for second phase of works 2067 – Finalise business case and undertake detailed design 2068 – Construction works to raise the embankment and seawall		Annual maintenance – mowing of embankments and patch and repair 2039, 2049 and 2059 - Patch and repair maintenance of seawall
2070 – 2119			Annual maintenance – mowing of embankments and patch and repair 2077, 2087, 2097 and 2107 – Patch and repair maintenance of seawall

A.6 BA6: Swale Mainland

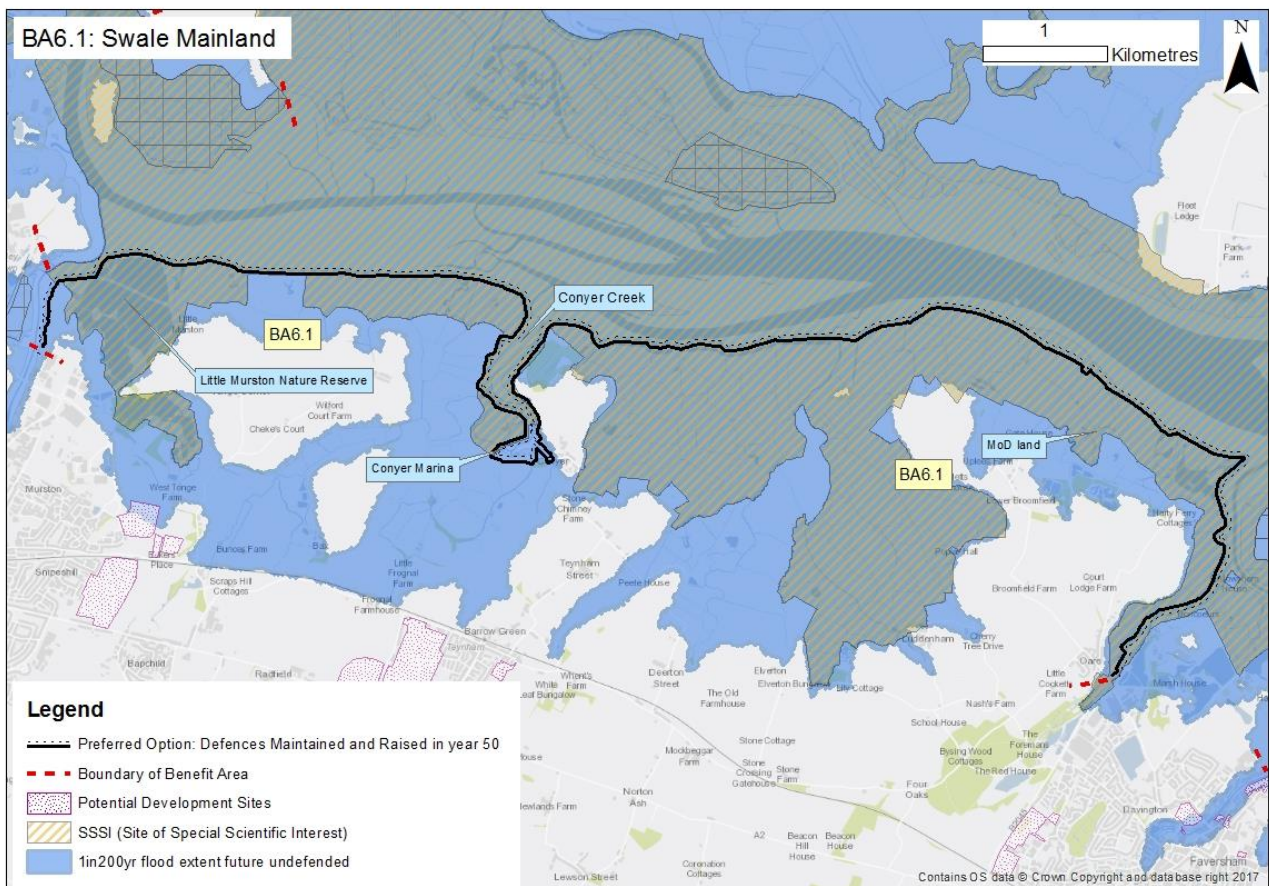


A.6.1 BA6.1: Swale Mainland

Although there is a benefit cost ratio below 1 here, the impacts on the designated freshwater habitat need to be mitigated through either compensatory habitat or maintenance of the embankments. A cost effectiveness analysis here shows that ongoing maintenance of the embankments is the most cost effective solution. This will not only provide protection to the freshwater habitat, but also to areas which have potential to be developed as designated freshwater compensation sites.

Preferred Option	Maintain embankments and upgrade SoP with sea level rise in year 50.		
Description of Preferred Option	Maintenance (with capital works) of the current defences, and raise in year 50, to maintain the current SoP offered.		
Justification	No short listed options were identified which would provide increased protection and with BCRs above one/positive NPVs. The preferred option is required as part of the legal obligations to cause no net loss of the designated freshwater habitat. The current defences have a 25-year residual life. Following this, the cost to compensate the large area of freshwater habitat is much greater than the cost to maintain the defences with sea level rise. Therefore, it is more cost-effective to maintain the defences and raise with sea level rise. Raising the defences to this level will prevent more frequent overtopping which would adversely affect the freshwater habitat and require compensation.		
Environmental	Adverse impacts on intertidal The Swale SPA and Ramsar and constituent qualifying features due to coastal squeeze. The current SoP of the defences will be maintained to ensure continued level of protection to The Swale SPA and Ramsar freshwater habitat.		
	2018-2038	2039-2068	2069-2118
Overall Policy	HTL Maintain	HTL Maintain	HTL Maintain but defences raised with SLR to ensure the same SOP provided
Defence Crest Level Required	Average of 4.34m AOD	Average of 4.34m AOD	Average of 4.34m AOD + sea level rise

Whole Life Cost (PV)	£0	BCR	N/A	PF%	N/A
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Key Risks and Mitigation - BA6.1: Swale Mainland

Key Risk	Mitigation and Action	Owner
Potential overtopping of the defences impacting on the designated freshwater habitat.	Although the defences are being maintained with sea level rise, there is still a risk that there will be overtopping of the defences in extreme events as the current standard of protection is relatively low. Following the freshwater surveys, the specific invertebrates supported by the site will be assessed to dictate the future raising of the defences.	KSL Area Team with support from NEAS and FBG.
The funding for the scheme is dependent upon approval of GiA to protect the freshwater habitat.	Early discussions are going to be had with LPRG around the funding mechanisms. The strategy has been developed based on the most recent guidance.	KSL Area Team.
Loss of intertidal habitats due to coastal squeeze.	Strategy wide intertidal habitat compensation developed through MR sites. The feasibility of the MR sites will be undertaken to confirm that adequate habitat will be provided.	KSL Area Team with support from NEAS.
Review opportunities to reduce carbon.	Consider material sources and transportation during design phase and limit carbon footprint where possible.	Designer.

Impacts on freshwater designated (SPA and Ramsar) habitat assessment

Option for managing impacts	Freshwater Habitat Compensation	Maintaining and Raising the defences in line with sea level rise
Cost (PV £k)	£20,228	£14,283
Other comments	Very significant area (837ha) of freshwater habitat compensation required. Potentially not technically viable to find the space within the Strategy.	Coastal squeeze of the intertidal SPA if the defences are held.
Ranking	2	1

Dependencies

- Funding to maintain the defences to protect the freshwater sites being available.
- MR sites being approved to ensure that compensation is required for the loss of intertidal habitat due to coastal squeeze.

Implementation Plan - BA6.1: Swale Mainland

Year	Strategy Wide Activities	Capital Scheme	Ongoing Maintenance
2019	Update of HCP Report with detailed scope and programme for surveys. Surveys of the Priority 1 sites to determine freshwater habitat requirements	Mitigation & Action: MR Feasibility Study	Annual maintenance – mowing and patch and repair of embankments Patch and repair maintenance of seawalls
2020	Surveys of the SPA and Ramsar sites to determine the freshwater compensatory habitat requirement		Annual maintenance – mowing and patch and repair of embankments
2021	Mitigation & Action: Freshwater compensation sites reviewed and finalised National DEFRA review of HCP Report		Annual maintenance – mowing and patch and repair of embankments
2022			Annual maintenance – mowing and patch and repair of embankments
2023	National DEFRA review of HCP Report		Annual maintenance – mowing and patch and repair of embankments
2024	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation		Annual maintenance – mowing and patch and repair of embankments
2025	National DEFRA review of HCP Report		Annual maintenance – mowing and patch and repair of embankments
2026			Annual maintenance – mowing and patch and repair of embankments
2027	National DEFRA review of HCP Report		Annual maintenance – mowing and patch and repair of embankments
2028			Annual maintenance – mowing and patch and repair of embankments Patch and repair maintenance of seawalls
2029 – 2039	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation Every 2 years - National DEFRA review of HCP Report	2032 – Procurement of OBC and NEAS screening 2032 - Mitigation & Action: Early conversations with LPRG 2033 – Start to develop the OBC - detailed economic assessment – review options and develop outline design – stakeholder engagement – third party contributions – environmental assessment – licenses and permits discussions 2033 - Mitigation & Action: Review impacts on rights of way 2034 – Finalise business case and undertake detailed design - early contractor involvement – refine option design – stakeholder engagement – obtain licenses and permits 2035 - 2036 – Construction on the embankments, seawalls and flood gates	Annual maintenance – mowing and patch and repair of embankments 2038 – Patch and repair maintenance of seawalls

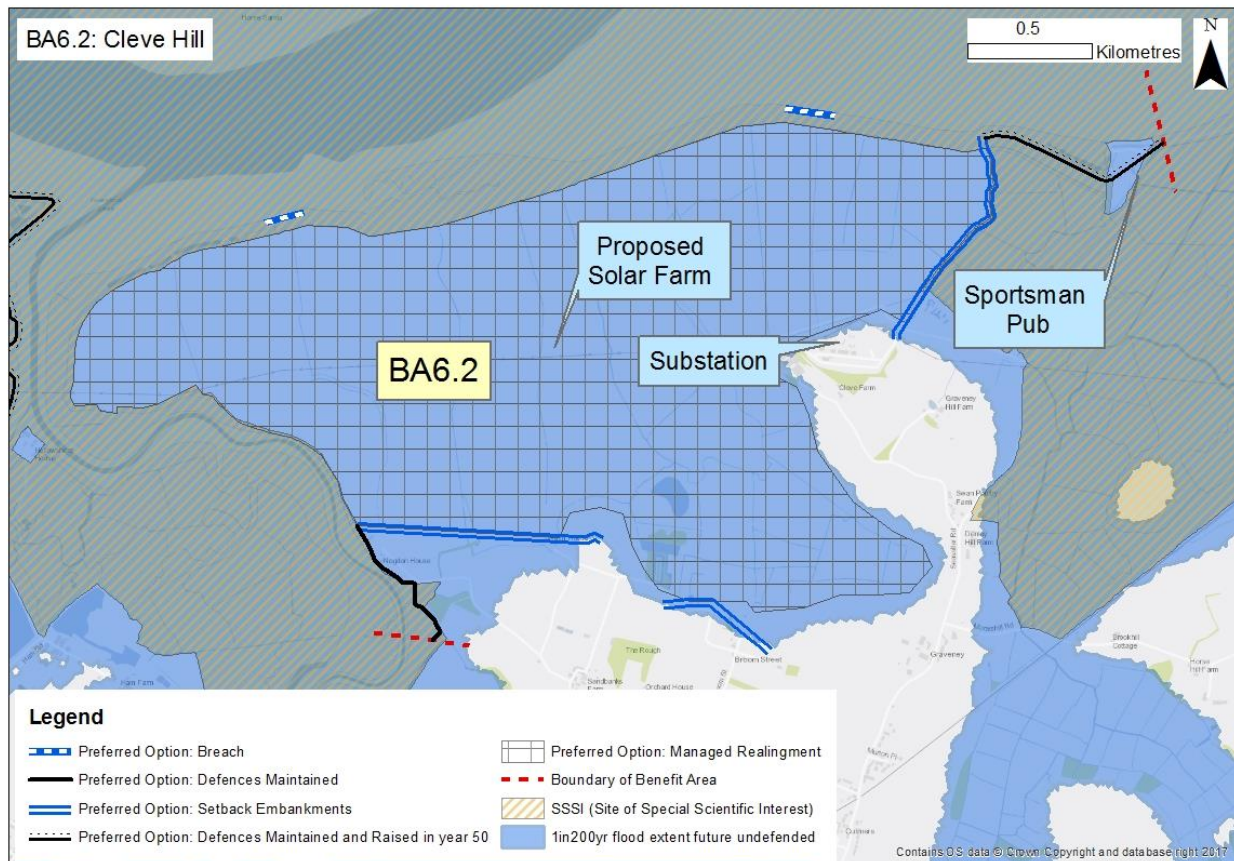
Year	Strategy Wide Activities	Capital Scheme	Ongoing Maintenance
2040 – 2069	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation Every 2 years - National DEFRA review of HCP Report	2066 – Develop OBC for phase two of works 2067 – Finalise business case and undertake detailed design for phase two 2068 – Raise the embankment and seawalls	Annual maintenance – mowing and patch and repair of embankments 2048 and 2058 – Patch and repair maintenance of seawalls
2070 – 2119	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation Every 2 years - National DEFRA review of HCP Report		Annual maintenance – mowing and patch and repair of embankments 2077, 2087, 2097 and 2107 – Patch and repair maintenance

A.6.2 BA6.2: Cleve Hill

This site has been identified as a managed realignment site, planned for construction in the second epoch due to a number of risks. This includes interactions with key infrastructure and the potential use of the site for a solar farm. A 'plan B' will provide an alternative option for providing compensatory habitat and managing flood risks depending on the outcome of these risks.

Preferred Option	Ongoing maintenance until year 20. Then construct new setback embankments at Cleve Hill managed realignment site. Maintain embankments and walls either side and at the Sportsman Pub.		
Description of Preferred Option	Maintenance (patch and repair) of the current defences (embankments) until year 20. After this the Cleve Hill MR site will be developed to mitigate against the strategy wide impacts of coastal squeeze in the second epoch. The defences either side of the MR site will be maintained (capital), apart from the section of defences fronting the freshwater SPA and Ramsar habitat at the Sportsman Pub, where the defences will be raised in year 50 to continue to provide the same SoP with sea level rise to the freshwater designated habitat. There are potential risks associated with the interaction with the electricity pylons and overhead lines for the MR site and this will need careful consideration during the design stage.		
Justification	Ongoing maintenance is the only short listed option with a BCR above 1 and a positive NPV. MR site at Cleve Hill is required to help compensate for coastal squeeze across the Strategy in the second epoch. The cost of the MR site reduces the overall BCR below one, but is generally justified from the wider Strategy assessment. The defences will be raised in line with sea level rise near the Sportsman Pub as the cost to compensate the freshwater habitat is much greater than the cost to maintain the defences with sea level rise.		
Environmental	The development of the MR site will allow the creation of new areas of intertidal habitat, helping reduce the strategy wide coastal squeeze impacts. The freshwater The Swale SPA and Ramsar habitat will be protected to the same SoP as the defences will be maintained with sea level rise.		
	2018-2038	2039-2068	2069-2118
Overall Policy	HTL Maintain	HTL Maintain and MR	HTL Maintain and MR
Defence Crest Level Required	As now -average 5.68m AOD	Minimum of 5.4m AOD	6.4m AOD

Whole Life Cost (PV)	781k	BCR	4.3	PF%	34
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Key Risks and Mitigation - BA6.2: Cleve Hill

Key Risk	Mitigation and Action	Owner
Visual effects and impacts upon landscape character of implementing capital works to construct new setback embankments.	Design flood defences (most likely earth banks) that minimise visual impacts and impacts on the landscape character. Use materials, where hard engineering is present and will be enhanced, that reflect the cultural landscape and enhance the local character.	KSL Area Team with support from NEAS and the design consultant.
Electricity pylons run across the site and sub-station for the offshore cable landings.	Discussions will be undertaken with the landowners and National Grid to determine the mitigation that would need to be implemented to protect the pylons. At Strategy level high level costs have been included to account for mitigation works that may be required. These discussions will be started as soon as possible.	KSL Area Team.
Landowner buy-in to the creation of a MR site.	Conversations will be had with the landowner providing them with more detail e.g. year of construction to confirm that they continue to provide support to the scheme.	KSL Area Team.
Unknown archaeological risk from new embankments and Managed Realignment Site.	In-depth archaeological desk study will be carried out as one of the first activities in the design of the Managed Realignment site. Desk study to influence further investigations which may include trial pits, non-intrusive or geophysical surveys, ground investigations.	NEAS heritage specialist with support from appraisal consultant.
Planning application for the development of a solar farm on the site.	The planning application is currently being submitted, therefore the results of the outcome will need to be reviewed to determine the suitability of the site for Managed Realignment. This will need to be reviewed when the outcome of the planning application is known.	KSL Area Team.
Rights of way.	The impacts on rights of way will be reviewed in more detail at the project level and mitigated by providing set back access if required.	NEAS.
Risk of breach and MR site causing increased scour and increased tidal prism.	More detailed modelling at design stage to be undertaken to confirm velocity and shear stress changes. Design will mitigate potential impacts and improve scour protection elsewhere if required.	KSL Area Team with support from design consultant.
Impacts of soil conditions on design and environment for Managed Realignment site.	There is evidence to suggest former fields have an impermeable podzol layer which effects the drainage of newly forming saltmarsh and mudflat. Undertake a core during early GI to understand ground conditions. If poor, alternatives include ploughing, crop stripping etc.	KSL Area Team with support from design consultant and NEAS.
Review opportunities to reduce carbon.	For MR site, consider sourcing embankment material from borrow pit within the site – GI works would be required to investigate this. For seawall consider use of steel rather than concrete, however if concrete is required investigate possibility of using low carbon concrete. Consider material sources and transportation during design phase and limit carbon footprint where possible.	Designer.

Impacts on freshwater designated (SPA and Ramsar) habitat assessment

Option for managing impacts	Freshwater Habitat Compensation	Maintaining and Raising the defences in line with sea level rise
Cost (PV £k)	£1,444	£913
Other comments	35ha of freshwater habitat compensation required	Coastal squeeze of the intertidal SPA and Ramsar if the defences are held
Ranking	2	1

Dependencies

- Determination of the planning application and plans for the solar farm on the site.
- Mitigation of the risks associated with the electricity pylons on the site.
- Landowner buy-in to the scheme.

- Licences and permits required for the capital scheme to include (but not be limited to): MMO Licence, EIA Screening, and Flood Risk Activity Permit.
- Licences and permits required for the MR scheme to include (but not be limited to): MMO Licence, preliminary WFD Assessment, footpath relocation, EIA Screening, EIA Scoping, Environmental Statement, HR01, Appropriate Assessment and Flood Risk Activity Permit.

Stakeholders - BA6.2: Cleve Hill

- There are key stakeholders to be engaged regarding the Solar Farm proposals and interaction with the infrastructure existing. This includes (but is not limited to): National Grid, Cleve Hill Solar Park Ltd, and Blue Transmission London Array Ltd.
- RSPB and KWT have a key interest in this potential MR site.

'Plan B'

Should the plans for the solar farm at Cleve Hill be approved and this moves forward to construction, the following will replace the current policy:

- The Environment Agency will not take responsibility for continued maintenance of the defences in this area.
- A managed realignment site would be proposed in the longer term following the lifetime of the solar farm.
- Managed realignment in other parts of the Strategy would be brought forward to provide second epoch rather than third epoch habitat. Chetney marshes (BA4.7) adaptation policy could be accelerated with additional management/breaches to create intertidal habitat earlier. This would require some additional works, however the impacts on the current landowner would be similar as initial overtopping is expected from Year 15. Freshwater compensation for BA4.7 would be required earlier than currently programmed.

Implementation Plan - BA6.2: Cleve Hill

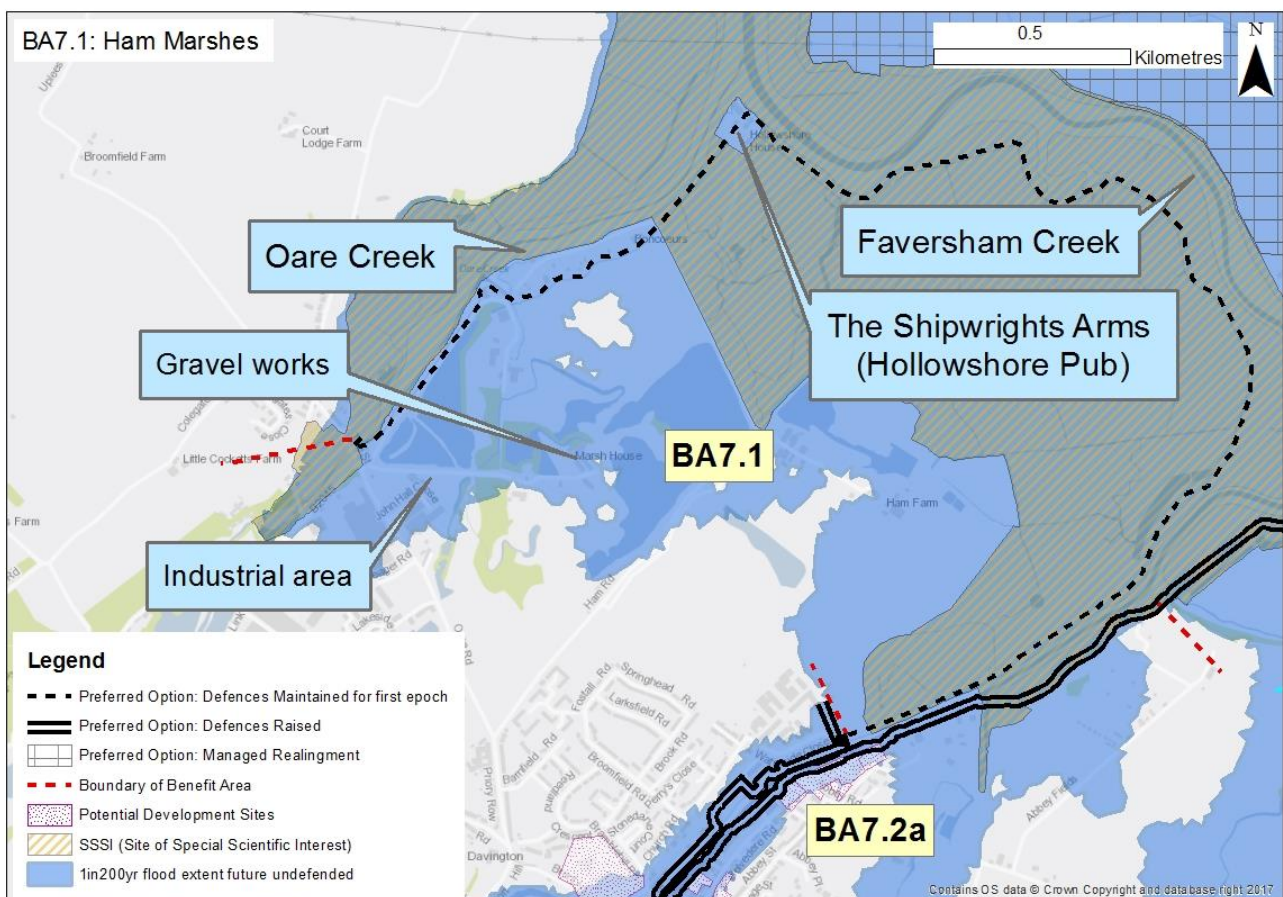
Year	Capital Scheme	Capital MR Scheme	Ongoing Maintenance
2019		Assessment of survey requirements within HCP report Mitigation & Action: Discussions with landowners, National Grid, and other key stakeholders	Annual maintenance – mowing of embankments and patch and repair
2020		Feasibility study for MR site Landowner consultation in MR site	Annual maintenance – mowing of embankments and patch and repair
2021		Feasibility study for MR site Landowner consultation in MR site	Annual maintenance – mowing of embankments and patch and repair
2022		Feasibility study for MR site Landowner consultation in MR site	Annual maintenance – mowing of embankments and patch and repair
2023		Mitigation & Action: Review developments in Solar Farm proposals and review requirement for Plan B	Annual maintenance – mowing of embankments and patch and repair
2024			Annual maintenance – mowing of embankments and patch and repair
2025			Annual maintenance – mowing of embankments and patch and repair
2026			Annual maintenance – mowing of embankments and patch and repair
2027			Annual maintenance – mowing of embankments and patch and repair
2028			Annual maintenance – mowing of embankments and patch and repair Patch and repair maintenance of seawalls
2029 – 2039	2036 – OBC to upgrade defences outside of MR site 2037 – Finalise business case and detailed design 2038 – Construction works outside of MR site	Mitigation & Action: Archaeological Desk Study Mitigation & Action: Review impacts on rights of way Mitigation & Action: GI to include test on soil conditions 2036 and 2037 – Detailed design of MR site, environmental assessment and application for permits and licenses Mitigation & Action: Modelling to assess risk of downstream scour 2038 – Construction of set-back embankments and breach 2038 - 2039 – Surveys if the MR site to determine colonisation	Annual maintenance – mowing of embankments and patch and repair
2040 – 2069		2040 – 2043 – Annual surveys of MR site to determine colonisation	Annual maintenance – mowing of embankments and patch and repair 2047, 2057 and 2067 - Patch and repair maintenance of seawall
2070 – 2119			Annual maintenance – mowing of embankments and patch and repair

A.7.1 BA7.1: Ham Marshes

The area around Ham Marshes is used for a variety of activities, and with defences with a residual life around 30 years, ongoing maintenance is required in the first epoch. However, from year 30 maintenance will be withdrawn and moved towards a NAI phase. Compensatory freshwater habitat will be required. There are potential areas in BA6.1 that could be used to provide this.

Preferred Option	Ongoing maintenance until year 30, followed by No Active Intervention (NAI). Freshwater compensation required by year 30 (capital works in year 25).		
Description of Preferred Option	Maintenance (patch and repair) of the current defences (earth embankments) for the first 30 years to the current SoP offered. After this all maintenance will be ceased which will increase the risk of failure of the defences which would result in the inundation of the designated freshwater habitat. Therefore, compensatory freshwater habitat will need to be developed by year 25 to allow it to be in place prior to failure of the defences from year 30.		
Justification	Due to the limited assets at risk in the area, options to Hold the Line in the long term do not provide a BCR above one. The current defences have a 30-year median residual life. If patch and repair maintenance continues, the overall BCR is above one and the NPV is positive, enabling HTL policy in the short term.		
Environmental	There are potential significant effects on the intertidal The Swale SPA and Ramsar and constituent qualifying features due to coastal squeeze Once the defences fail there will be degradation and loss of existing The Swale SPA and Ramsar freshwater grazing marsh. The freshwater habitat across the Ham Marshes is good breeding and overwintering habitat for a variety of waders and wildfowl.		
	2018-2038	2039-2068	2069-2118
Overall Policy	HTL Maintain	HTL Maintain until year 30, then NAI with freshwater compensation	NAI with freshwater habitat compensation
Defence Crest Level Required	Average 4m AOD	N/A - NAI Policy	N/A - NAI Policy

Whole Life Cost (PV)	£165k	BCR	9.1	PF%	56
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Key Risks and Mitigation - BA7.1: Ham Marshes

Key Risk	Mitigation and Action	Owner
Potential release of contaminants from landfill site	The potential impacts due to inundation after the NAI policy is implemented will be reviewed and assessed in more detail.	KSL Area Team.
Provision of satisfactory compensatory freshwater habitat.	Based on the results of the freshwater surveys acceptable compensatory habitat will be constructed prior to the loss of the freshwater habitat in year 30.	KSL Area Team with support from NEAS.
Landowner buy-in to the creation of the freshwater compensation site.	Conversations will be undertaken with landowners to confirm that there is buy-in for the creation of the compensatory freshwater habitat. This habitat will be delivered by 2048.	KSL Area Team.
Potential impacts of increased overtopping on infrastructure.	Prior to implementation of the NAI policy, further engagement with the landowners, and in particular the industrial areas and gravel works along Oare Creek and the Hollowshore Pub will be undertaken. This will be undertaken in 2046, 2 years prior to implementation of the policy.	KSL Area Team.

Impacts on freshwater designated (SPA and Ramsar) habitat assessment

Option for managing impacts	Freshwater Habitat Compensation	Maintaining and Raising the defences in line with sea level rise
Cost (PV £k)	£2,335k	£4,159k
Other comments	Significant area (111ha) of freshwater habitat compensation required	Coastal squeeze of the intertidal Spa if the defences are held
Ranking	1	2

Dependencies

- Ongoing maintenance over the first epoch requires coastal squeeze mitigation through Managed Realignment sites elsewhere in the Strategy.
- Strategy wide environmental reviews to assess the requirements for the freshwater habitat compensation.
- Suitable freshwater compensation to be established prior to implementing the NAI policy.
- Engagement with landowners to be undertaken two years prior to implementing the NAI policy.
- Ongoing review of the defences and whether the landowner continues to maintain the defences. Should the defences be continued to be maintained, freshwater compensation may not be required.

Stakeholders

Stakeholders also have concern regarding potential risks of overtopping and flooding to Graveny marshes which should be discussed during scheme development.

This is an area where the public have lots of ideas around the best way to provide flood protection and early stakeholder engagement should be undertaken to capture this.

Implementation Plan - BA7.1: Ham Marshes

Year	Strategy Wide Activities	Freshwater Compensation	Ongoing Maintenance	No Active Intervention
2019	Update of HCP Report with detailed scope and programme for surveys. Surveys of the Priority 1 sites to determine freshwater habitat requirements	Assessment of survey requirements within HCP report	Maintenance – mowing of embankments and patch and repair	
2020	Surveys of the SPA and Ramsar sites to determine the freshwater compensatory habitat requirement			
2021	Mitigation & Action: Freshwater compensation sites reviewed and finalised National DEFRA review of HCP Report	Mitigation & Action: Determine potential locations of freshwater compensation sites and agree funding and timescales	Maintenance – mowing of embankments and patch and repair	
2022		Landowner engagement in compensation site		
2023	National DEFRA review of HCP Report	Landowner engagement in compensation site Mitigation & Action: Landowner engagement	Maintenance – mowing of embankments and patch and repair	
2024	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation			
2025	National DEFRA review of HCP Report	Review and implement freshwater compensation site	Maintenance – mowing of embankments and patch and repair	
2026		Review and implement freshwater compensation site		
2027	National DEFRA review of HCP Report	Review and implement freshwater compensation site	Maintenance – mowing of embankments and patch and repair	
2028		Review and implement freshwater compensation site		
2029 – 2039	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation Every 2 years - National DEFRA review of HCP Report	2029-2036 - Review and implement freshwater compensation site 2035 – Compensation site design 2036 – Funding application for compensation site 2037 – Compensatory habitat creation	Years 2028, 2030, 2032, 2034, 2037 and 2038 maintenance – mowing of embankments and patch and repair	2036 – Landowner engagement regarding withdrawal of maintenance
2040 – 2069	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation Every 2 years - National DEFRA review of HCP Report		2040 – Maintenance mowing of embankments and patch and repair 2042 – 2047 – Annual maintenance – mowing of embankments and patch and repair	Mitigation and Action: 2046 – Landowner engagement regarding maintenance withdrawal 2048 – Maintenance ceases and NAI implemented

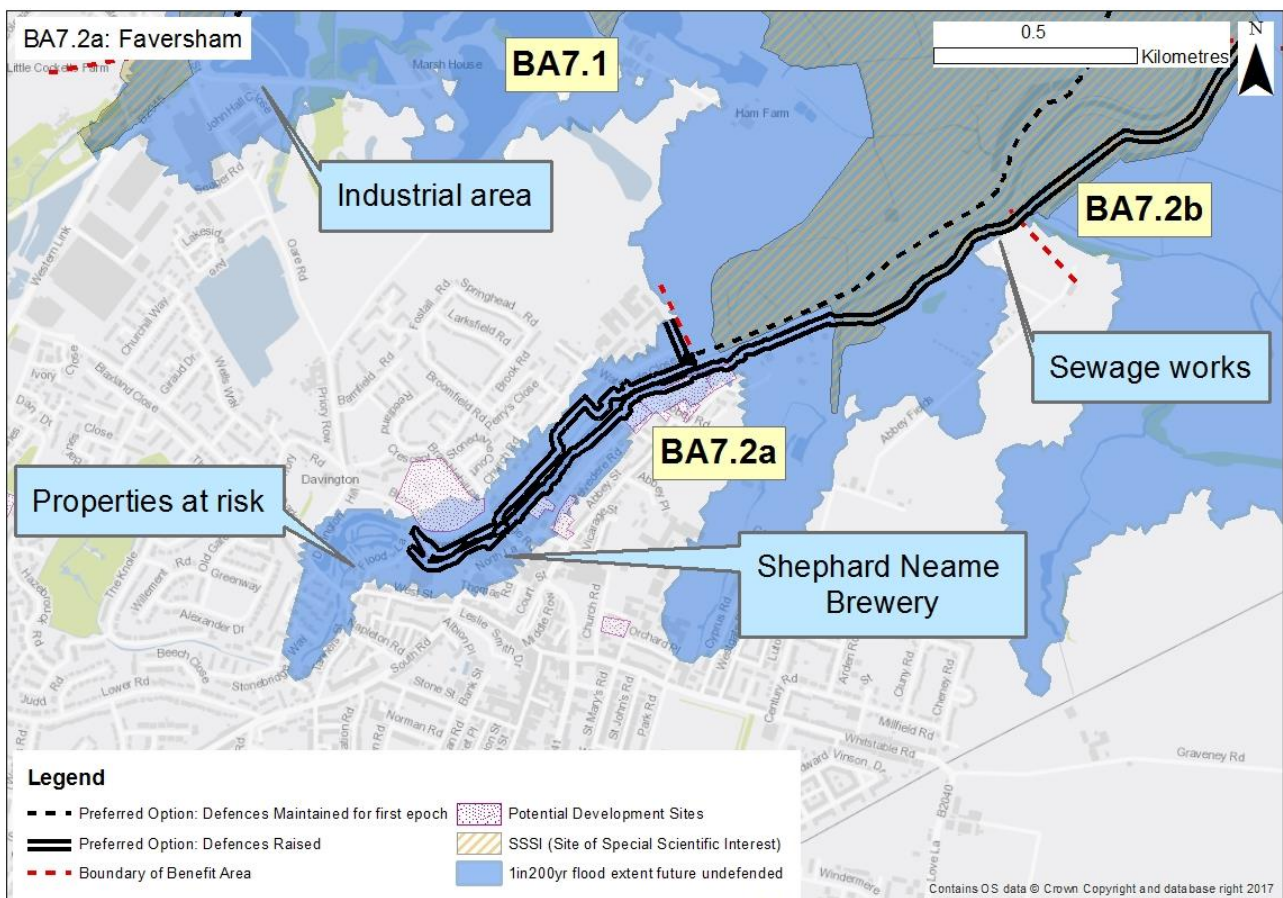
Year	Strategy Wide Activities	Freshwater Compensation	Ongoing Maintenance	No Active Intervention
				Mitigation and Action: Assess risk to landfill sites
2070 – 2119	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation Every 2 years - National DEFRA review of HCP Report			Maintenance ceased and NAI implemented

A.7.2 BA7.2a: Faversham

Faversham has a number of residential and commercial properties at risk of flooding, as well as an important heritage landscape. Protection of this area is important, however raising the current standard of protection will be difficult. The design will need to carefully consider interactions with historic buildings and quay walls. Potential sources for third party funding needs to be investigated early on in the process.

Preferred Option	Raise (sustain) embankments and walls.		
Description of Preferred Option	This option involves improving the current SoP provided by the defences to 0.5% AEP with sea level rise; in year 8 to 4.8m AOD and then in year 50 to 6.0m AOD to continue to provide protection in line with sea level rise.		
Justification	The sustain option has the highest BCR and NPV value and second highest environmental ranking.		
Environmental	These options are not likely to have significant effects on any designated sites and their constituent qualifying features.		
	2018-2038	2039-2068	2069-2118
Overall Policy	HTL Sustain	HTL Sustain	HTL Sustain
Defence Crest Level Required	4.8m AOD	4.8m AOD	6.0m AOD

Whole Life Cost (PV)	£5,877k	BCR	2.1	PF%	18
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Key Risks and Mitigation - BA7.2a: Faversham

Key Risk	Mitigation and Action	Owner
Visual effects and impacts upon landscape character of implementing capital works to sustain defences.	Design flood defences that minimise visual impacts and impacts on the landscape character. Use materials, where hard engineering is present and will be enhanced, that reflect the cultural landscape and enhance local character.	KSL Area Team with support from NEAS landscape specialists and design consultants.
Heritage and landscape impacts from the capital works.	Part of the outline design scope will be to work with the heritage landscape, limited space and historic buildings. The area is of high heritage sensitivity, the creek is a conservation area and there are heritage assets vulnerable to flood damage. A detailed heritage assessment will be undertaken early in the scheme, with Kent County Council being consulted from the beginning of the OBC process.	NEAS heritage specialists with support from appraisal consultants.
Third party contributions required.	Discussions will be held with key asset owners early on when the business case is being developed. This will include the sewage works and Shephard Neame Brewery.	KSL Area Team.
Review opportunities to reduce carbon.	For seawall consider use of steel rather than concrete, however if concrete is required investigate possibility of using low carbon concrete. Consider material sources and transportation during design phase and limit carbon footprint where possible.	Designer.

Key Dependencies

- Achieving third party funding contributions. This should include the sewage works and Shephard Neame Brewery.
- Licences and permits required for the capital scheme to include (but not be limited to): MMO Licence, preliminary WFD Assessment, EIA Screening, HR01 and Flood Risk Activity Permit.

Business Case for Capital Scheme

Case	Summary
Strategic case	<ul style="list-style-type: none"> • Residential properties at risk from overtopping and flooding. • Heritage properties at risk from flooding. • Areas with potential for development in Faversham which will be supported by the scheme.
Economic case	<ul style="list-style-type: none"> • The Benefit Cost Ratio is above 1. • Large number of OM2s associated with this Scheme.
Commercial case	<ul style="list-style-type: none"> • Procurement route likely to follow the Environment Agency framework and standard procurement practices.
Financial case	<ul style="list-style-type: none"> • The PF score is low and third-party funding will be required.
Management case	<ul style="list-style-type: none"> • The key risks and required mitigations are highlighted above and will be considered and actioned throughout the business case activities. • Early public engagement is important in this business case.

Stakeholders

This is an important part of the heritage landscape and Historic England and Kent County Council will be key stakeholders in developing a scheme here.

Implementation Plan - BA7.2a: Faversham

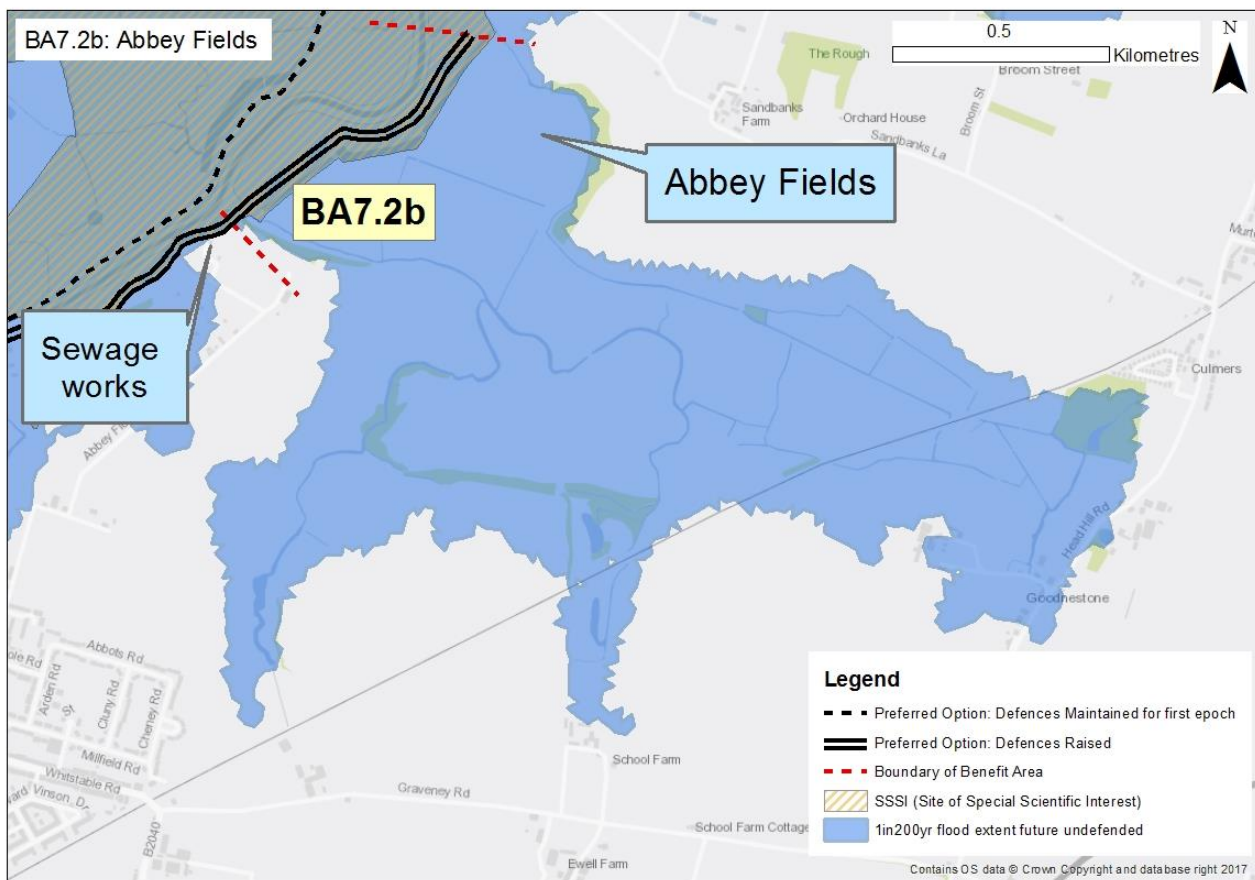
Year	Capital Scheme	Ongoing Maintenance
2019		Annual maintenance – mowing and patch and repair of embankments Maintenance of seawall Maintenance of sheet piling
2020		Annual maintenance – mowing and patch and repair of embankments
2021		Annual maintenance – mowing and patch and repair of embankments
2022		Annual maintenance – mowing and patch and repair of embankments
2023	OBC procurement and NEAS screening Mitigation & Action: OBC scope will highlight requirement to work alongside heritage landscape, limited space and historic buildings Mitigation & Action: Discussions with key asset owners regarding third party funding	Annual maintenance – mowing and patch and repair of embankments
2024	Start to develop the OBC - detailed economic assessment – review options and develop outline design – stakeholder engagement – third party contributions – environmental assessment – licenses and permits discussions	Annual maintenance – mowing and patch and repair of embankments
2025	Finalise business case and undertake detailed design - early contractor involvement – refine option design – stakeholder engagement – obtain licenses and permits	Annual maintenance – mowing and patch and repair of embankments
2026	Construction works to raise the embankment, seawall and sheet piling	Annual maintenance – mowing and patch and repair of embankments
2027		Annual maintenance – mowing and patch and repair of embankments
2028		Annual maintenance – mowing and patch and repair of embankments
2029 – 2039		Annual maintenance – mowing and patch and repair of embankments 2029 – Localised patch and repair maintenance of seawalls
2040 – 2069	2066 – Develop OBC for phase two of capital works 2067 – Finalise business case and undertake detailed design for phase two 2068 – Raise the embankment, seawall and sheet piling for phase two	Annual maintenance – mowing and patch and repair of embankments 2039, 2049 and 2059 – Maintenance of seawall 2049 – Maintenance of sheet piling
2070 – 2119		Annual maintenance – mowing and patch and repair of embankments 2077, 2087, 2097 and 2107 – Maintenance of seawall 2079 and 2109 – Maintenance of sheet piling

A.7.3 BA7.2b: Abbey Fields

Although there are limited assets immediately landwards of the embankment defences, the low lying land means that flood waters can reach residential properties further inland. The height of the embankments and walls should be raised in year 20 to improve the standard of protection offered.

Preferred Option	Maintain defences until year 20. Raise (sustain) embankments and walls from year 20.		
Description of Preferred Option	Maintenance of the current defences for the first 20 years to the current SoP offered. Following this the defences will be raised to 5.7m AOD and then raised again in year 50 to 6.4m AOD to provide a 0.1% SoP with sea level rise.		
Justification	Although the Maintain option has the highest BCR and NPV, there are wider benefits associated with the delayed sustain which will justify the additional partnership funding requirements. It is more cost effective to raise the defences in year 20 when the defences are near the end of their residual life, and then in year 50 to raise with sea level rather than raising all initially.		
Environmental	There are potential significant effects on the intertidal The Swale SPA and Ramsar and constituent qualifying features due to coastal squeeze. There are no adverse impacts on designated freshwater habitat.		
	2018-2038	2039-2068	2069-2118
Overall Policy	HTL Maintain	HTL Sustain	HTL Sustain
Defence Crest Level Required	Current levels – average 5.22m AOD	5.7m AOD	6.4m AOD

Whole Life Cost (PV)	£1,236k	BCR	1.2	PF%	12
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Key Risks and Mitigation - BA7.2b: Abbey Fields

Key Risk	Mitigation and Action	Owner
Visual effects and impacts upon landscape character of implementing capital works to sustain defences	Design flood defences that minimise visual impacts and impacts on the landscape character. Use materials, where hard engineering is present and will be enhanced, that reflect the cultural landscape and enhance local character.	KSL Area Team with support from NEAS and design consultants.
Loss of intertidal habitats due to coastal squeeze.	Strategy wide intertidal habitat compensation developed through MR sites. The feasibility of the MR sites will be undertaken to confirm that adequate habitat will be provided.	KSL Area Team with support from NEAS.
Third party contributions required.	Discussions will be held with key asset owners early on in 2034 when the business case is being developed.	KSL Area Team.
Review opportunities to reduce carbon.	For seawall consider use of steel rather than concrete, however if concrete is required investigate possibility of using low carbon concrete. Consider material sources and transportation during design phase and limit carbon footprint where possible.	Designer.

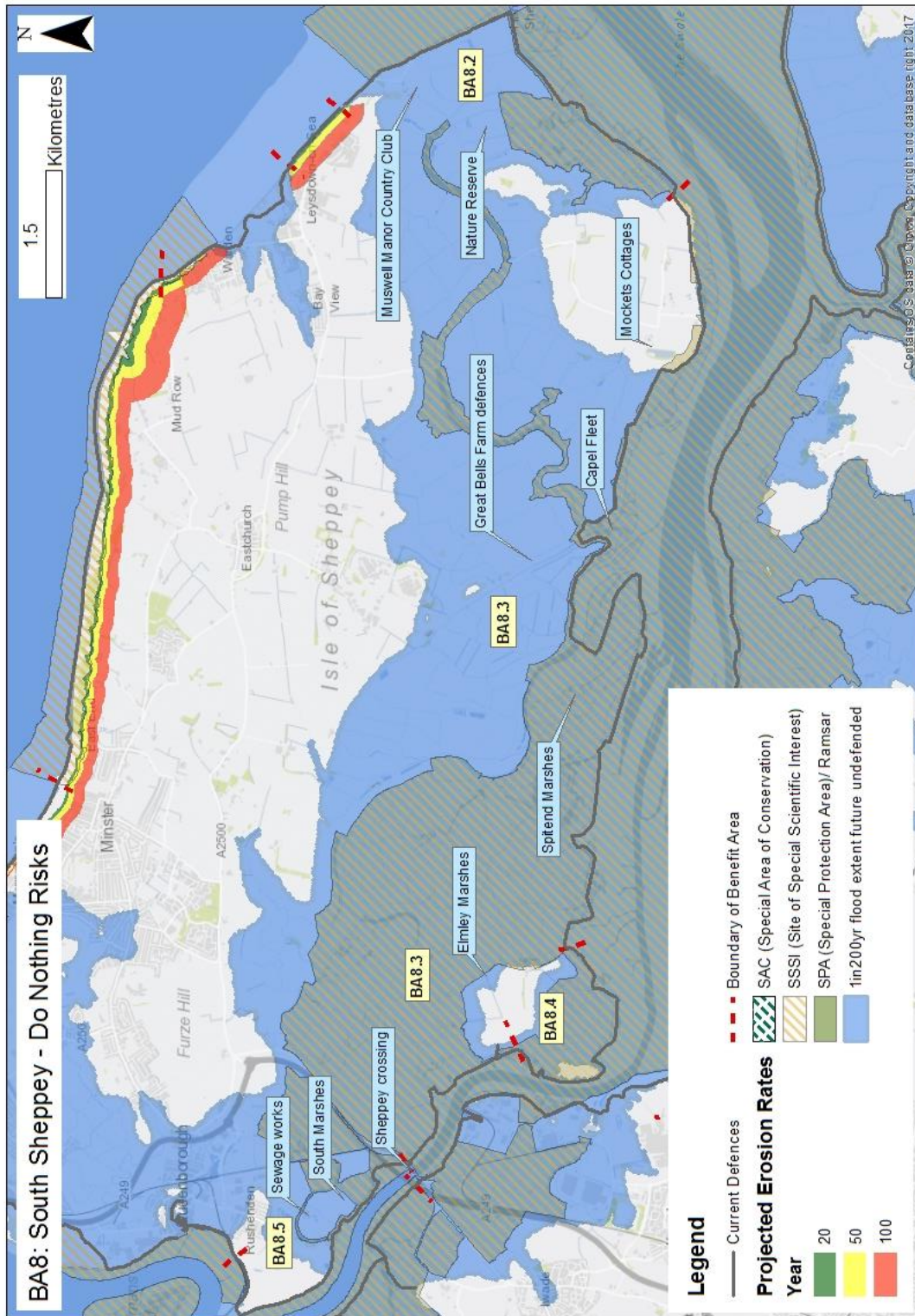
Key Dependencies

- MR sites being approved to ensure that compensation is required for the loss of intertidal habitat due to coastal squeeze.
- Achieving third party funding contributions.
- Some of the defences in this section tie into defences in BA7.2a. The works are being planned earlier in the Strategy implementation for 7.2a and it should be considered whether there are efficiencies to be gained from doing the works together.
- Licences and permits required for the capital scheme to include (but not be limited to): MMO Licence, preliminary WFD Assessment, EIA Screening, HR01 and Flood Risk Activity Permit.

Implementation Plan - BA7.2b: Abbey Fields

Year	Capital Scheme	Ongoing Maintenance
2019	Mitigation & Action: MR Feasibility Study	Annual maintenance – mowing and patch and repair of embankments Patch and repair maintenance of seawall
2020		Annual maintenance – mowing and patch and repair of embankments
2021		Annual maintenance – mowing and patch and repair of embankments
2022		Annual maintenance – mowing and patch and repair of embankments
2023		Annual maintenance – mowing and patch and repair of embankments
2024		Annual maintenance – mowing and patch and repair of embankments
2025		Annual maintenance – mowing and patch and repair of embankments
2026		Annual maintenance – mowing and patch and repair of embankments
2027		Annual maintenance – mowing and patch and repair of embankments
2028		Annual maintenance – mowing and patch and repair of embankments Patch and repair maintenance of seawall
2029 – 2039	<p>2035 – OBC procurement and NEAS screening</p> <p>Mitigation & Action: Discussions with key asset owners regarding third party funding</p> <p>2036 – Start to develop the OBC - detailed economic assessment – review options and develop outline design – stakeholder engagement – third party contributions – environmental assessment – licenses and permits discussions</p> <p>2037 – Finalise business case and undertake detailed design - early contractor involvement – refine option design – stakeholder engagement – obtain licenses and permits</p> <p>2038 – Construction work to raise the embankments and sea walls</p>	Annual maintenance – mowing and patch and repair of embankments
2040 – 2069	<p>2066 – Develop OBC for phase two of capital works</p> <p>2067 – Finalise business case and undertake detailed design for phase two</p> <p>2068 – Raise the embankments and seawalls</p>	Annual maintenance – mowing and patch and repair of embankments 2046 and 2056 – Patch and repair maintenance of seawall
2070 – 2119		Annual maintenance – mowing and patch and repair of embankments 2077, 2087, 2097 and 2107 – Patch and repair maintenance of seawall

A.8 BA8: South Sheppey

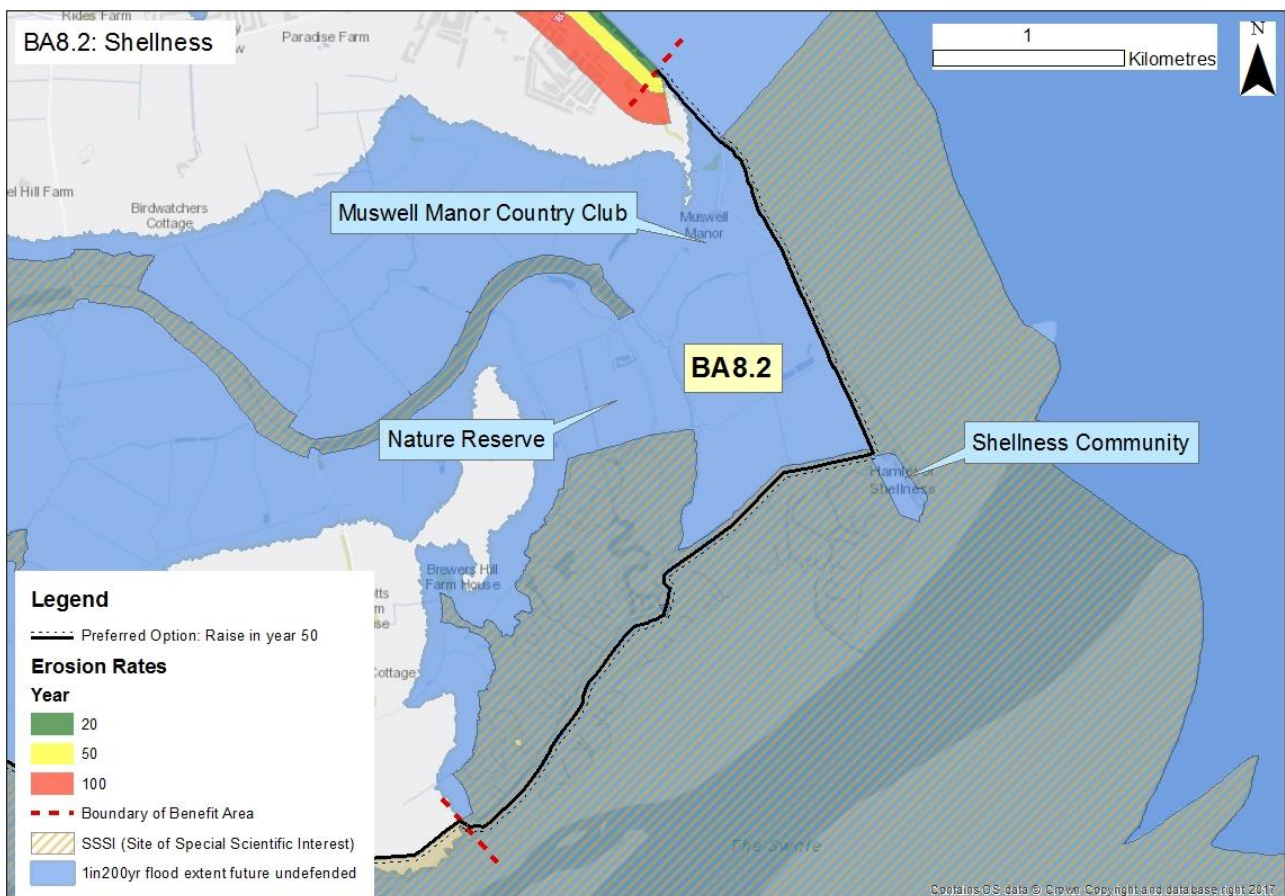


A.8.1 BA8.2: Shellness

Although there is a benefit cost ratio below 1 here, the impacts on the designated freshwater habitat need to be mitigated through either compensatory habitat or maintenance of the embankments. A cost effectiveness analysis here shows that ongoing maintenance of the embankments is the most cost effective solution. This will not only provide protection to the freshwater habitat, but also to areas which have potential to be developed as designated freshwater compensation sites such as Great Bells Farm. It is important to note that the flood cell linked to BA8.2 also covers BA8.3 and therefore the management of the south of Sheppey should be undertaken in a coordinated way.

Preferred Option	Maintain embankments and upgrade SoP with sea level rise in year 50.		
Description of Preferred Option	Maintenance (with capital works) of the current defences, and raise in year 50, to maintain a minimum SoP of 4%AEP with sea level rise.		
Justification	This option is the only option with BCR greater than one and a positive NPV score. However the option is the lowest ranked environmentally and further environmental mitigation would be required. Following this, the cost to compensate the large area of freshwater habitat is much greater than the cost to maintain the defences with sea level rise. Therefore, it is more cost-effective to maintain the defences and raise with sea level rise. The defences are required to be raised with sea level rise to confirm that in 100 years the freshwater habitat is protected to the same Standard of Protection as is currently provided.		
Environmental	Adverse impacts on the intertidal The Swale SPA and Ramsar and constituent qualifying features due to coastal squeeze.		
	2018-2038	2039-2068	2069-2118
Overall Policy	HTL Maintain	HTL Maintain	HTL Maintain but defences raised with SLR to ensure the same SOP provided
Defence Crest Level Required	Average of 5.25m AOD	Average of 5.25m AOD	Average of 5.25m AOD + sea level rise

Whole Life Cost (PV)	£0	BCR	N/A	PF%	N/A
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Key Risks and Mitigation - BA8.2: Shellness

Key Risk	Mitigation and Action	Owner
Potential overtopping of the defences impacting on the designated freshwater habitat.	Although the defences are being maintained with sea level rise, there is still a risk that there will be overtopping of the defences in extreme events as the current standard of protection is relatively low. Following the freshwater surveys, the specific invertebrates supported by the site will be assessed to dictate the future raising of the defences.	KSL Area Team with support from NEAS and FBG.
The funding for the scheme is dependent upon approval of GiA to protect the freshwater habitat.	Early discussions are going to be undertaken with LPRG around the funding mechanisms. The strategy has been developed based on the most recent guidance.	KSL Area Team.
Loss of intertidal habitats due to coastal squeeze.	Strategy wide intertidal habitat compensation will be developed through MR sites. The feasibility of the MR sites will be undertaken to ensure that adequate habitat will be provided.	KSL Area Team with support from NEAS.
Review opportunities to reduce carbon.	Consider material sources and transportation during design phase and limit carbon footprint where possible.	Designer.

Impacts on freshwater designated (SPA and Ramsar) habitat assessment

NB: The assessment has been undertaken based on a combination of both BA8.2 and BA8.3, as the flood cells are independent.

Option for managing impacts	Freshwater Habitat Compensation	Maintaining and raising the defences in line with sea level rise
Cost (PV £k)	£52,210k	£28,048
Other comments	Very significant area (1,492ha) of freshwater habitat compensation required. This is not technically feasible.	Coastal squeeze of the intertidal SPA if the defences are held.
Ranking	2	1

Dependencies

- Funding to maintain the defences to protect the freshwater sites being available.
- MR sites being approved to ensure that compensation is required for the loss of intertidal habitat due to coastal squeeze.
- The flood plain for this area is closely linked to BA8.3 and the future maintenance of the embankments will only have the positive impacts on flood risk if the same is undertaken for BA8.3.
- Licences and permits required for the capital scheme to include (but not be limited to): MMO Licence, preliminary WFD Assessment, EIA Screening, EIA scoping, Environmental Statement, Protect Species Licences, HR01, Appropriate Assessment and Flood Risk Activity Permit.

Implementation Plan - BA8.2: Shellness

Year	Strategy Wide Activities	Capital Scheme	Ongoing Maintenance
2019	Update of HCP Report with detailed scope and programme for surveys. Surveys of the Priority 1 sites to determine freshwater habitat requirements	Mitigation & Action: MR Feasibility Study	Annual maintenance – mowing and patch and repair of embankments Patch and repair maintenance of seawalls
2020	Surveys of the SPA and Ramsar sites to determine the freshwater compensatory habitat requirement		Annual maintenance – mowing and patch and repair of embankments
2021	Mitigation & Action: Freshwater compensation sites reviewed and finalised National DEFRA review of HCP Report		Annual maintenance – mowing and patch and repair of embankments
2022			Annual maintenance – mowing and patch and repair of embankments
2023	National DEFRA review of HCP Report		Annual maintenance – mowing and patch and repair of embankments
2024	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation		Annual maintenance – mowing and patch and repair of embankments
2025	National DEFRA review of HCP Report		Annual maintenance – mowing and patch and repair of embankments
2026			Annual maintenance – mowing and patch and repair of embankments
2027	National DEFRA review of HCP Report		Annual maintenance – mowing and patch and repair of embankments
2028			Annual maintenance – mowing and patch and repair of embankments Patch and repair maintenance of seawalls
2029 – 2039	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation Every 2 years - National DEFRA review of HCP Report	Mitigation & Action: Discussions with LPRG 2035 – Procurement of OBC and NEAS screening 2036 – Start to develop the OBC - detailed economic assessment – review options and develop outline design – stakeholder engagement – third party contributions – environmental assessment – licenses and permits discussions 2037 – Finalise business case and undertake detailed design - early contractor involvement – refine option design – stakeholder engagement – obtain licenses and permits 2038 – Construction on the embankments, seawalls and flood gates	Annual maintenance – mowing and patch and repair of embankments 2029 – Patch and repair maintenance of seawalls

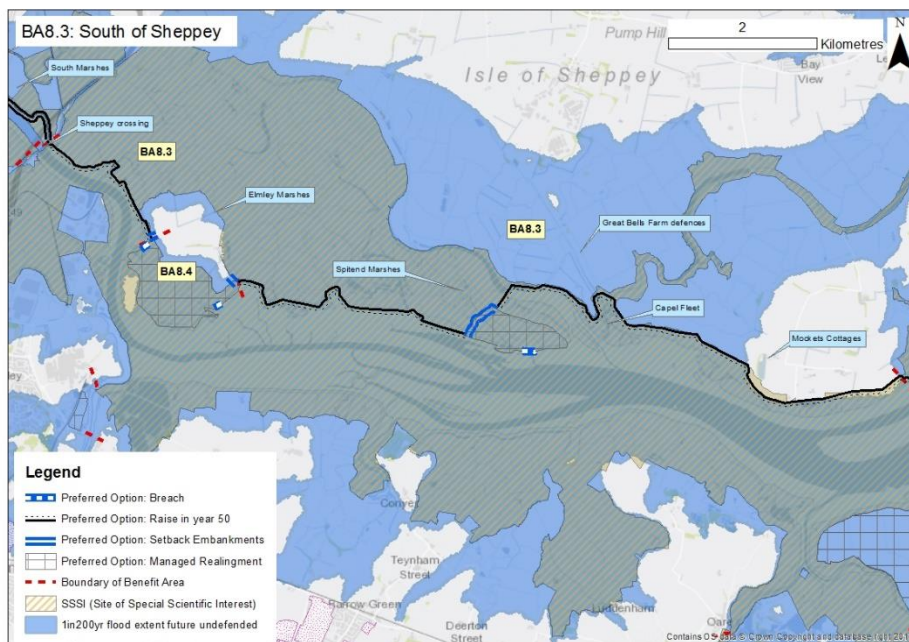
Year	Strategy Wide Activities	Capital Scheme	Ongoing Maintenance
2040 – 2069	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation Every 2 years - National DEFRA review of HCP Report	2066 – Develop OBC for phase two of works 2067 – Finalise business case and undertake detailed design for phase two 2068 – Raise the embankment and seawalls	Annual maintenance – mowing and patch and repair of embankments 2046 and 2056 – Patch and repair maintenance of seawalls
2070 – 2119	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation Every 2 years - National DEFRA review of HCP Report		Annual maintenance – mowing and patch and repair of embankments 2077, 2087, 2097 and 2107 – Patch and repair maintenance of seawalls

A.8.2 BA8.3: South of Sheppey

Although there is a benefit cost ratio below 1 here, the impacts on the designated freshwater habitat need to be mitigated through either compensatory habitat or maintenance of the embankments. A cost effectiveness analysis here shows that ongoing maintenance of the embankments is the most cost effective solution. This will not only provide protection to the freshwater habitat, but also to areas which have potential to be developed as designated freshwater compensation sites such as Great Bells Farm. It is important to note that the flood cell linked to BA8.3 also covers BA8.2 and therefore the management of the south of Sheppey should be undertaken in a coordinated way. A managed realignment site is proposed at Spitend marshes to provide compensatory saltmarsh habitat for the strategy. Freshwater compensation for this site will be provided at Great Bells Farm.

Preferred Option	Maintain embankments and upgrade SoP with sea level rise in year 50. No Active Intervention (NAI) at Isle of Harty.		
Description of Preferred Option	Maintenance (with capital works) of the current defences, and raise in year 50, to maintain a minimum SoP of 4% AEP with sea level rise. A MR site to be developed at Spitend Marshes. Setback embankments will be constructed before a breach in the current defences is created.		
Justification	Due to the limited assets at risk in the area, options to Hold the Line in the long term do not provide a BCR above one. The current defences have a 25-year median residual life. If patch and repair maintenance continues, the overall BCR is above one and the NPV is positive, enabling HTL policy in the short term. The option is required as part of the legal obligations to cause no net loss of the designated freshwater habitat. Following this, the cost to compensate the large area of freshwater habitat is much greater than the cost to maintain the defences with sea level rise. Therefore, it is more cost-effective to maintain the defences and raise with sea level rise. The defences are required to be raised with sea level rise as otherwise the frequency of inundation to the freshwater habitat would increase with sea level rise and compensation for this would be required in year 50. The justification for the MR site is related to the Strategy wide requirement for coastal squeeze compensation.		
Environmental	Adverse impacts on the intertidal the Swale SPA and Ramsar and constituent qualifying features due to coastal squeeze. MR site will help compensate for some of this loss but will require The Swale SPA and Ramsar freshwater habitat compensation.		
	2018-2038	2039-2068	2069-2118
Overall Policy	HTL Maintain	HTL Maintain	HTL Maintain but defences raised with SLR to ensure the same SOP provided
Defence Crest Level Required	Average of 5m AOD	Average of 5m AOD	Average of 5m AOD + sea level rise

Whole Life Cost (PV)	£0	BCR	N/A	PF%	N/A
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Key Risks and Mitigation - BA8.3: South of Sheppey

Key Risk	Mitigation and Action	Owner
Potential overtopping of the defences impacting on the designated freshwater habitat.	Although the defences are being maintained with sea level rise, there is still a risk that there will be overtopping of the defences in extreme events as the current standard of protection is relatively low. Following the freshwater surveys, the specific invertebrates supported by the site should be assessed to dictate the future raising of the defences.	KSL Area Team with support from NEAS and FBG.
The funding for the scheme is dependent upon approval of GiA to protect the freshwater habitat.	Early discussions are going to be had with LPRG around the funding mechanisms. The strategy has been developed based on the most recent guidance.	KSL Area Team.
Loss of intertidal habitats due to coastal squeeze.	Strategy wide intertidal habitat compensation developed through MR sites. The feasibility of the MR sites will be undertaken to ensure that adequate habitat will be provided.	KSL Area Team with support from NEAS.
Visual effects and impacts upon landscape character of new setback embankments.	Design flood defences (most likely earth banks) that minimise visual impacts and impacts on the landscape character. Use materials, where hard engineering is present and will be enhanced, that reflect the cultural landscape and enhance local character.	KSL Area Team with support from NEAS and FBG.
Provision of satisfactory compensatory freshwater habitat.	It has been proposed that Great Bells Farm can be used as compensatory habitat for freshwater compensation in the first 10 years. Surveys of the habitat that will be lost will inform the management of Great Bells to provide habitat of the same type. Discussions will be held with NE, RSPB and the EA to confirm that the habitat is of sufficient quality. Great Bells farm can then be classed as compensatory habitat and designated accordingly. Should Great Bells Farm not be suitable, and further works cannot be undertaken to improve the suitability of Great Bells Farm, additional compensation sites will be required.	KSL Area Team with support from NEAS.
Location of breach sites to minimise impact on existing saltmarsh.	The design will include detailed modelling of breach sizes and locations to optimise the flooding of the site and minimise impacts on the saltmarsh and mudflat adjacent to the site.	KSL Area Team with support from appraisal consultant.
Landowner buy-in to the creation of a MR site.	Conversations have already been had with the landowner and they are open to MR on their site. These conversations will be continued providing more detail e.g. year of construction to ensure that they continue to provide support to the scheme.	KSL Area Team.
Unknown archaeological risk from new embankments and Managed Realignment Site.	In-depth archaeological desk study will be carried out as one of the first activities in the design of the Managed Realignment site. Desk study will influence further investigations which may include trial pits, non-intrusive or geophysical surveys, ground investigations.	NEAS heritage specialist with support from appraisal consultant.
Rights of way.	The impacts on rights of way will be reviewed in more detail at the project level and mitigated by providing set back access if required.	NEAS.
Risk of breach and MR site causing increased scour and increased tidal prism.	More detailed modelling at design stage to be undertaken to confirm velocity and shear stress changes. Design will mitigate potential impacts and improve scour protection elsewhere if required.	KSL Area Team with support from design consultant.
Impacts of soil conditions on design and environment for Managed Realignment site.	There is evidence to suggest former fields have an impermeable podzol layer which effects the drainage of newly forming saltmarsh and mudflat. Undertake a core during early GI to understand ground conditions. If poor, alternatives include ploughing, crop stripping etc.	KSL Area Team with support from design consultant and NEAS.
Review opportunities to reduce carbon.	Consider material sources and transportation during design phase and limit carbon footprint where possible.	Designer.

Impacts on freshwater designated (SPA and Ramsar) habitat assessment

NB: The assessment has been undertaken based on a combination of both BA8.2 and BA8.3, as the flood cells are independent.

Option for managing impacts	Freshwater Habitat Compensation	Maintaining and raising the defences in line with sea level rise
Cost (PV £k)	£52,210k	£28,048k
Other comments	Very significant area (1,492ha) of freshwater habitat compensation required. This is not technically feasible.	Coastal squeeze of the intertidal SPA if the defences are held
Ranking	2	1

Dependencies - BA8.3: South of Sheppey

- Funding to maintain the defences to protect the freshwater sites being available.
- MR sites being approved to ensure that compensation is required for the loss of intertidal habitat due to coastal squeeze.
- The flood plain for this area is closely linked to BA8.3 and the future maintenance of the embankments will only have the positive impacts on flood risk if the same is undertaken for BA8.3.
- The same landowner as BA8.4 Elmley MR site owns this site and therefore landowner consultation and negotiation on both sites should be coordinated.
- Freshwater Habitat being available and confirmed suitable at Great Bells Farm following freshwater surveys as freshwater compensatory habitat which is required for the construction on the MR site.
- Licences and permits required for the capital scheme to include (but not be limited to): MMO Licence, preliminary WFD Assessment, EIA Screening, EIA scoping, Environmental Statement, Protect Species Licences, HR01, Appropriate Assessment and Flood Risk Activity Permit.
- Licences and permits required for the MR scheme to include (but not be limited to): MMO Licence, footpath relocation, EIA Screening, EIA Scoping, Environmental Statement, Protected Species, preliminary WFD Assessment, HR01, Appropriate Assessment and Flood Risk Activity Permit.

Implementation Plan - BA8.3: South of Sheppey

Year	Strategy Wide Activities	Capital Scheme	Capital MR Scheme	Ongoing Maintenance
2019	Update of HCP Report with detailed scope and programme for surveys. Surveys of the Priority 1 sites to determine freshwater habitat requirements	Mitigation & Action: MR Feasibility Study	Assessment of survey requirements within HCP report NEAS screening and business case production for MR site Mitigation and Action: Landowner discussions in MR site Mitigation & Action: Archaeological Desk Study	Annual maintenance – mowing and patch and repair of embankments
2020	Surveys of the SPA and Ramsar sites to determine the freshwater compensatory habitat requirement	Mitigation & Action: Discussions with LPRG	Business case for MR site Landowner discussions in MR site Mitigation & Action: GI to include test on soil conditions	Annual maintenance – mowing and patch and repair of embankments
2021	Mitigation & Action: Freshwater compensation sites reviewed and finalised National DEFRA review of HCP Report		Detailed design of the MR site Mitigation & Action: Agree required compensation Mitigation & Action: Modelling of breach sizes and locations and assessment of downstream scour Mitigation & Action: Review impacts on rights of way Environmental impact assessment of the MR site	Annual maintenance – mowing and patch and repair of embankments
2022			Detailed design of the MR site Applications for permits and licenses	Annual maintenance – mowing and patch and repair of embankments
2023	National DEFRA review of HCP Report		Construction of set-back embankments Construction of breach	Annual maintenance – mowing and patch and repair of embankments
2024	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation		Surveys of MR site to determine colonisation of habitat	Annual maintenance – mowing and patch and repair of embankments
2025	National DEFRA review of HCP Report		Surveys of MR site to determine colonisation of habitat	Annual maintenance – mowing and patch and repair of embankments
2026		OBC procurement and NEAS screening	Surveys of MR site to determine colonisation of habitat	Annual maintenance – mowing and patch and repair of embankments
2027	National DEFRA review of HCP Report	Start to develop the OBC - detailed economic assessment – review options and develop outline design – stakeholder engagement –	Surveys of MR site to determine colonisation of habitat	Annual maintenance – mowing and patch and repair of embankments

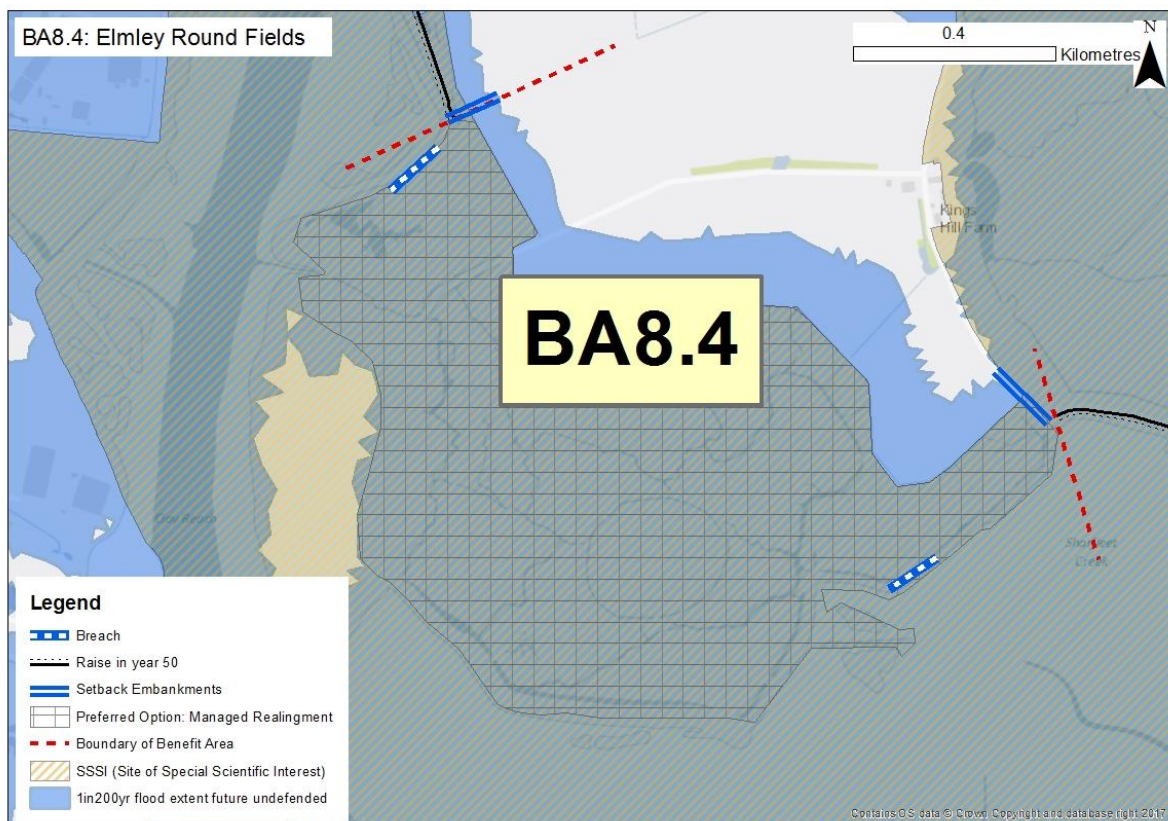
Year	Strategy Wide Activities	Capital Scheme	Capital MR Scheme	Ongoing Maintenance
		third party contributions – environmental assessment – licenses and permits discussions		
2028		Finalise business case and undertake detailed design - early contractor involvement – refine option design – stakeholder engagement – obtain licenses and permits	Surveys of MR site to determine colonisation of habitat	Annual maintenance – mowing and patch and repair of embankments
2029 – 2039	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation Every 2 years - National DEFRA review of HCP Report	2029-2030 - Construction works on the embankments		Annual maintenance – mowing and patch and repair of embankments
2040 – 2069	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation Every 2 years - National DEFRA review of HCP Report	2066 – Develop OBC for phase two of capital works 2067 – Finalise business case and undertake detailed design for phase two 2068 – Raise the embankment for phase two		Annual maintenance – mowing and patch and repair of embankments
2070 – 2119	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation Every 2 years - National DEFRA review of HCP Report			Annual maintenance – mowing and patch and repair of embankments

A.8.3 BA8.4: Elmley Round Fields

Elmley Round Fields site is identified as a Managed Realignment site, to be constructed in the first 5 years of the Strategy. The current freshwater habitat on the site will be compensated at Great Bells Farm. The site will use the natural high ground, with just limited set back embankments at both edges to ensure there is no flood risk to adjacent sections. An archaeological study of the site as well as freshwater habitat surveys are required to inform the design of the site.

Preferred Option	Construct setback defences to form Managed Realignment site in year 5 at Elmley Round Field.		
Description of Preferred Option	Development of a MR site from year 5 to compensate against the strategy wide impacts of coastal squeeze. Most of the MR site will tie into high ground, but some new set-back embankments will need to be constructed near the shoreline to fully tie the site into high ground. These defences will provide a 5%AEP SoP.		
Justification	<p>No short listed options were identified which would provide increased protection and with BCRs above one/positive NPVs.</p> <p>Managed realignment is justified because although designated freshwater habitat is present, it is not sustainable or economically justifiable to maintain and improve the defences. The MR option will allow intertidal habitat to be created, which will contribute towards the strategy wide coastal squeeze compensation for the first epoch.</p> <p>The costs for compensating the freshwater designated habitat have been added to the option costs. It is not economically justified to implement the MR site as a standalone scheme. However, as the creation of intertidal habitat will allow HTL policy in other areas of the Strategy, it can be justified when taking a high level review.</p>		
Environmental	<p>Creation of the Managed Realignment site will contribute towards the strategy wide compensatory requirements for coastal squeeze.</p> <p>There will be an impact on up to 89 ha of designated freshwater habitats which are part of The Swale SPA and Ramsar.</p>		
	2018-2038	2039-2068	2069-2118
Overall Policy	MR	MR	MR
Defence Crest Level Required	5.6m AOD	5.6m AOD	5.6m AOD

Whole Life Cost (PV)	£0	BCR	N/A	PF%	N/A
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Key Risks and Mitigation - BA8.4: Elmley Round Fields

Key Risk	Mitigation and Action	Owner
Visual effects and impacts upon landscape character of new setback embankments.	Design flood defences (most likely earth banks) that minimise visual impacts and impacts on the landscape character. Use materials, where hard engineering is present and will be enhanced, that reflect the cultural landscape and enhance local character.	KSL Area Team with support from NEAS and FBG.
Provision of satisfactory compensatory freshwater habitat.	It has been proposed that Great Bells Farm can be used as compensatory habitat for freshwater compensation in the first 10 years. Surveys of the habitat that will be lost will inform the management of Great Bells to provide habitat of the same type. Discussions will be held with NE, RSPB and the EA to confirm that the habitat is of sufficient quality. Great Bells farm can then be classed as compensatory habitat and designated accordingly. Should Great Bells Farm not be suitable, and further works cannot be undertaken to improve the suitability of Great Bells Farm, additional compensation sites will be required.	KSL Area Team with support from NEAS.
Location of breach sites to minimise impact on existing saltmarsh.	The design will include detailed modelling of breach sizes and locations to optimise the flooding of the site and development of new intertidal habitat whilst minimising impacts on the existing saltmarsh and mudflat adjacent to the site.	KSL Area Team with support from appraisal consultant.
Landowner buy-in to the creation of a MR site.	Conversations have already been had with the landowner and they are open to MR on their site. These conversations will be continued providing more detail e.g. year of construction to ensure that they continue to provide support to the scheme.	KSL Area Team.
Unknown archaeological risk from new embankments and Managed Realignment Site.	In-depth archaeological desk study will be carried out as one of the first activities in the design of the Managed Realignment site. Desk study will influence further investigations which may include trial pits, non-intrusive or geophysical surveys, ground investigations.	NEAS heritage specialist with support from appraisal consultant.
Rights of way.	The impacts on rights of way will be reviewed in more detail at the project level and mitigated by providing set back access if required.	NEAS.
Risk of breach and MR site causing increased scour and increased tidal prism.	More detailed modelling at design stage to be undertaken to confirm velocity and shear stress changes. Design will mitigate potential impacts and improve scour protection elsewhere if required.	KSL Area Team with support from design consultant.
Impacts of soil conditions on design and environment for Managed Realignment site.	There is evidence to suggest former fields have an impermeable podzol layer which effects the drainage of newly forming saltmarsh and mudflat. Undertake a core during early GI to understand ground conditions. If poor, alternatives include ploughing, crop stripping etc.	KSL Area Team with support from design consultant and NEAS.
Review opportunities to reduce carbon.	For MR site, consider sourcing embankment material from borrow pit within the site – GI works would be required to investigate this. Consider material sources and transportation during design phase and limit carbon footprint where possible.	Designer.

Dependencies

- Strategy wide environmental reviews to assess the requirements for the freshwater habitat requirements.
- The suitability of Great Bells Farm for a freshwater compensation site.
- The same landowner as BA8.3 Spitend Marshes MR site owns this site and therefore landowner consultation and negotiation on both sites should be coordinated.
- Licences and permits required for the MR scheme to include (but not be limited to): MMO Licence, footpath relocation, EIA Screening, EIA Scoping, Environmental Statement, Protected Species, preliminary WFD Assessment, HR01, Appropriate Assessment and Flood Risk Activity Permit.

Implementation Plan - BA8.4: Elmley Round Fields

Year	Strategy Wide Activities	Capital MR Scheme	Freshwater Compensation	Ongoing Maintenance
2019	Update of HCP Report with detailed scope and programme for surveys. Surveys of the Priority 1 sites to determine freshwater habitat requirements	Assessment of survey requirements within HCP report NEAS screening and business case production for MR site Mitigation and Action: Landowner discussions in MR site Mitigation & Action: Archaeological Desk Study	Determine suitability of Great Bells Farm as compensation site	Annual maintenance – mowing and patch and repair of embankments
2020	Surveys of the SPA and Ramsar sites to determine the freshwater compensatory habitat requirement	Business case for MR site Landowner discussions in MR site Mitigation & Action: GI to include test on soil conditions	Determine suitability of Great Bells Farm as compensation site Mitigation and Action: Confirm GBF as compensatory freshwater site	Annual maintenance – mowing and patch and repair of embankments
2021	Mitigation & Action: Freshwater compensation sites reviewed and finalised National DEFRA review of HCP Report	Detailed design of the MR site Mitigation & Action: Modelling of breach sizes and locations and assessment of downstream scour Mitigation & Action: Review impacts on rights of way Environmental impact assessment of the MR site		Annual maintenance – mowing and patch and repair of embankments
2022		Detailed design of the MR site Applications for permits and licenses		Annual maintenance – mowing and patch and repair of embankments
2023	National DEFRA review of HCP Report	Construction of set-back embankments Construction of breach		
2024	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation	Surveys of MR site to determine colonisation of habitat		Annual maintenance – mowing and patch and repair of embankments
2025	National DEFRA review of HCP Report	Surveys of MR site to determine colonisation of habitat		Annual maintenance – mowing and patch and repair of embankments
2026		Surveys of MR site to determine colonisation of habitat		Annual maintenance – mowing and patch and repair of embankments
2027	National DEFRA review of HCP Report	Surveys of MR site to determine colonisation of habitat		Annual maintenance – mowing and patch and repair of embankments
2028		Surveys of MR site to determine colonisation of habitat		Annual maintenance – mowing and patch and repair of embankments
2029 – 2039	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation Every 2 years - National DEFRA review of HCP Report			Annual maintenance – mowing and patch and repair of embankments

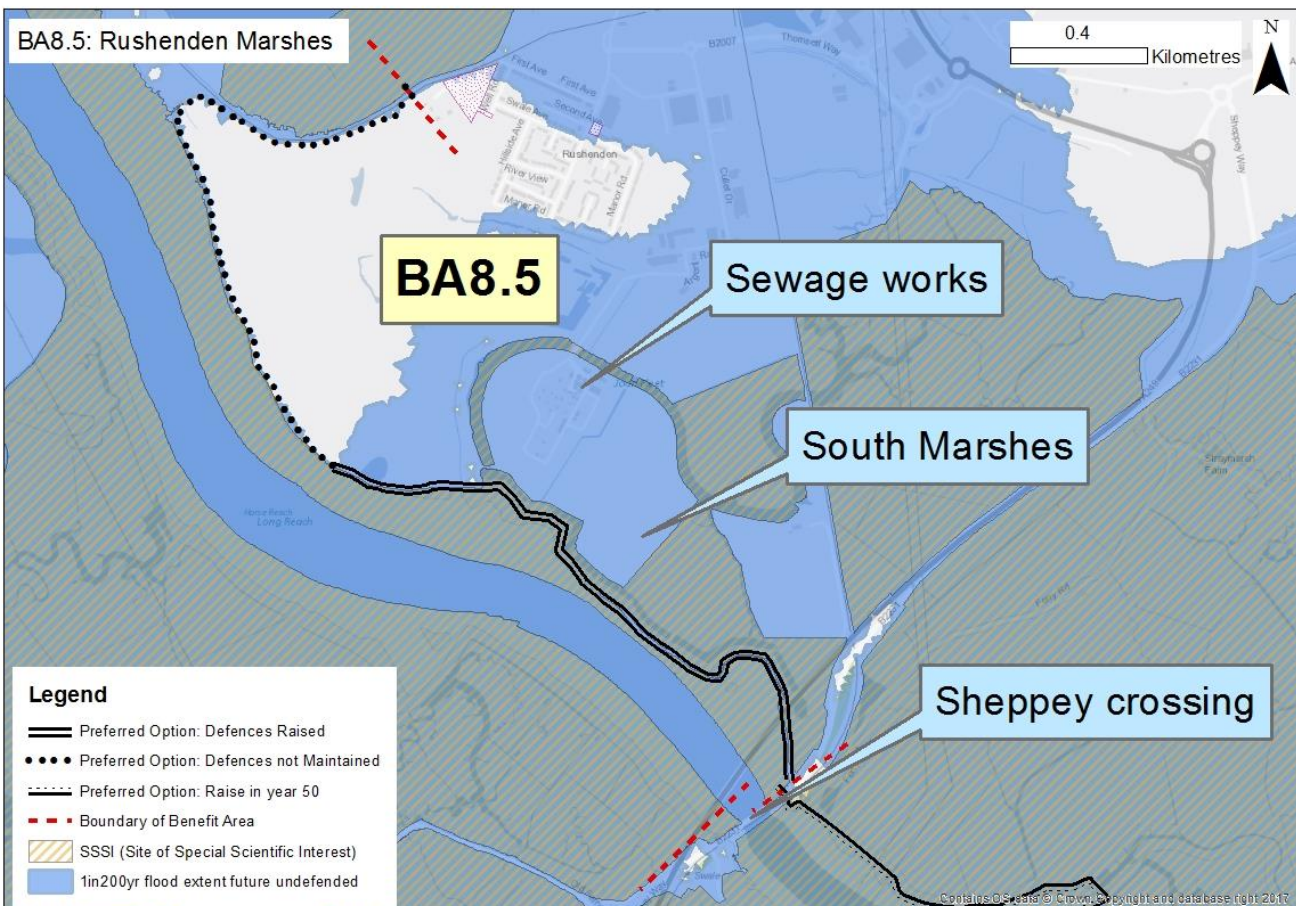
Year	Strategy Wide Activities	Capital MR Scheme	Freshwater Compensation	Ongoing Maintenance
2040 – 2069	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation Every 2 years - National DEFRA review of HCP Report			Annual maintenance – mowing and patch and repair of embankments
2070 – 2119	Surveys of the freshwater compensation site every 5 years to ensure site is adequate compensation Every 2 years - National DEFRA review of HCP Report			Annual maintenance – mowing and patch and repair of embankments

A.8.4 BA8.5: Rushenden Marshes

Although this section is NAI, the eastern part of this section will have new defences with increased crest levels due to the flood pathway that connects up with BA11.2 (Sheerness and Queenborough). The rest ties into high ground and therefore there is little flood risk to assets or land here.

Preferred Option	No Active Intervention (NAI)		
Description of Preferred Option	All maintenance will be ceased and the current defences will not be maintained. <i>Note: there will need to be some localised defences within this section to provide protection from flooding to BA11.2 which will also ensure no flooding of designated areas. These defences have been assessed as part of 11.2.</i>		
Justification	No short listed options were identified which would provide increased protection and with BCRs above one/positive NPVs.		
Environmental	There are potential significant effects on the Medway Estuary and Marshes SPA and Ramsar and constituent qualifying features due to coastal squeeze. The defences associated with the BA11.2 works will also ensure no impact to the freshwater designations following failure of the defences.		
	2018-2038	2039-2068	2069-2118
Overall Policy	NAI	NAI	NAI
Defence Crest Level Required	N/A (but 5.8m AOD in eastern section)	N/A (but 6.5m AOD in eastern section)	N/A (but 6.5m AOD in eastern section)

Whole Life Cost (PV)	£0	BCR	N/A	PF%	N/A
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Key Risks and Mitigation - BA8.5: Rushenden Marshes

Key Risk	Mitigation and Action	Owner
Potential release of contaminants from landfill site. The landfill site is not in the flood plain, but due to NAI approach there may be scour of the site and subsequent release of contaminant.	The potential impacts will be reviewed and assessed in more detail in year 20 as defences reach towards the end of their residual life.	KSL Area Team.
Rights of way.	The impacts on rights of way will be reviewed in more detail at the project level and mitigated by providing set back access if required.	NEAS.

Key Dependencies

- The works being undertaken in BA11.2 which will ensure that a section of the defences is maintained and the freshwater habitat is protected.
- Engagement with landowners to be undertaken two years prior to implementing the NAI policy along the rest of the BA.

Implementation Plan - BA8.5: Rushenden Marshes

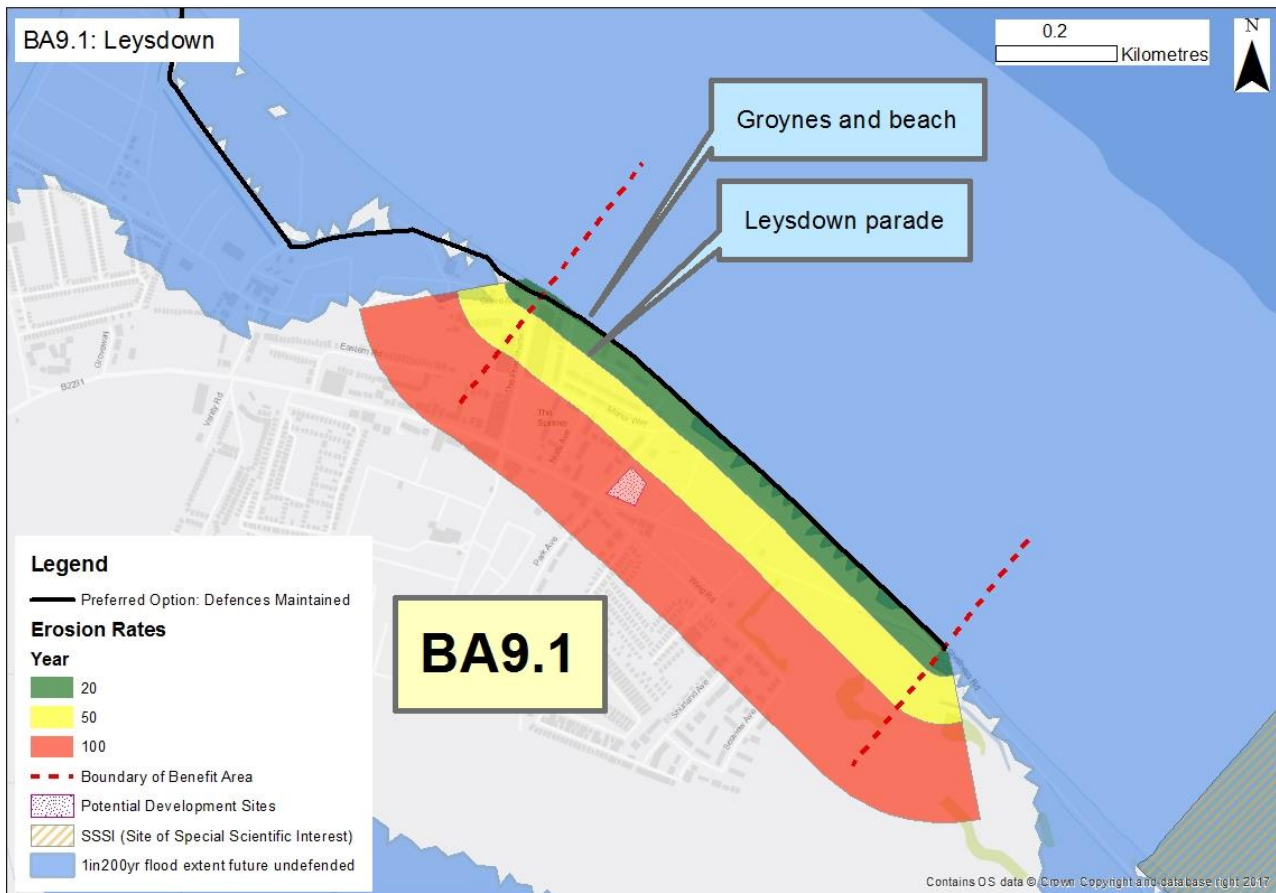
Year	No Active Intervention
2019	Landowner engagement regarding withdrawal of maintenance
2020	Landowner engagement regarding withdrawal of maintenance
2021	NAI implemented, health and safety surveys undertaken
2022	NAI implemented, health and safety surveys undertaken
2023	NAI implemented, health and safety surveys undertaken
2024	NAI implemented, health and safety surveys undertaken
2025	NAI implemented, health and safety surveys undertaken
2026	NAI implemented, health and safety surveys undertaken
2027	NAI implemented, health and safety surveys undertaken
2028	NAI implemented, health and safety surveys undertaken
2029 – 2039	NAI implemented, health and safety surveys undertaken Mitigation & Action: Review impacts of NAI Policy on landfill site risk Mitigation & Action: Review impacts on rights of way
2040 – 2069	NAI implemented, health and safety surveys undertaken
2070 – 2119	NAI implemented, health and safety surveys undertaken

A.9.1 BA9.1: Leysdown

This area is at risk from coastal erosion and the defences are in poor condition. Therefore, a business case to undertake capital works is recommended over the first three years of the Strategy. The benefit period for the business case should be 100 years. Third party funding will be required to support the business case. The defences on the beach tie into the beach and groynes throughout both BAs 9.1 and 9.2 and therefore efficiencies to either undertake the groyne and beach work required in 9.1 later or bring 9.2 forward so the beach is all undertaken at the same time should be considered. However, if schemes are split, double counting/future use of benefits should be carefully considered.

Preferred Option	Maintain (with capital works) walls, groynes and beach.		
Description of Preferred Option	Capital works will be undertaken on the current defences to ensure that they remain in place to protect the higher ground from erosion.		
Justification	This option has the highest BCR and highest NPV value.		
Environmental	This option is not likely to have significant effects on any designated sites and their constituent qualifying features.		
	2018-2038	2039-2068	2069-2118
Overall Policy	HTL Maintain	HTL Maintain	HTL Maintain
Defence Crest Level Required	N/A – erosional frontage	N/A – erosional frontage	N/A – erosional frontage

Whole Life Cost (PV)	£5,612k	BCR	2.4	PF%	55
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Key Risks and Mitigation - BA9.1: Leysdown

Key Risk	Mitigation and Action	Owner
The poor condition of the current defences	The works will be undertaken in year 3, as the business case and the design will be undertaken prior to construction. However, works will be undertaken as soon as possible and therefore if they can be accelerated this will be done.	Swale Borough Council and appraisal consultants.
Third party contributions required.	Discussions will be had with key asset owners early on when the business case is being developed.	Swale Borough Council.
Requirement of Heritage Assessment	If groundworks are required as part of the wall, beach or groyne maintenance than a heritage assessment will be undertaken.	Swale Borough Council.
Review opportunities to reduce carbon.	For seawall consider use of steel rather than concrete, however if concrete is required investigate possibility of using low carbon concrete. Consider material sources and transportation during design phase and limit carbon footprint where possible.	Designer.

Key Dependencies

- Achieving third party funding contributions.
- If groyne/beach work is undertaken with BA9.2, splitting of benefits so that future works can also be funding needs to be considered in the business case.
- Licences and permits required for the capital scheme to include (but not be limited to): MMO Licence, preliminary WFD Assessment, EIA Screening, and Flood Risk Activity Permit.

Business Case for Capital Scheme

Case	Summary
Strategic case	<ul style="list-style-type: none"> • Residential properties at risk from coastal erosion. • Defences at the end of residual life. • Amenity value of the beach at Leysdown.
Economic case	<ul style="list-style-type: none"> • The Benefit Cost Ratio is above 1.
Commercial case	<ul style="list-style-type: none"> • Procurement route likely to follow the Environment Agency framework and standard procurement practices.
Financial case	<ul style="list-style-type: none"> • The PF score is low and third-party funding will be required.
Management case	<ul style="list-style-type: none"> • The key risks and required mitigations are highlighted above in the risks and mitigation table and need to be implemented throughout the business case activities. • Carefully considered public engagement is important in this business case due to close proximity to the undefended cliff sections in BAs 9.2 and 10.1.

Stakeholders

It is important that the public are involved in scheme development as the frontage is very important for recreation and tourism.

Implementation Plan - BA9.1: Leysdown

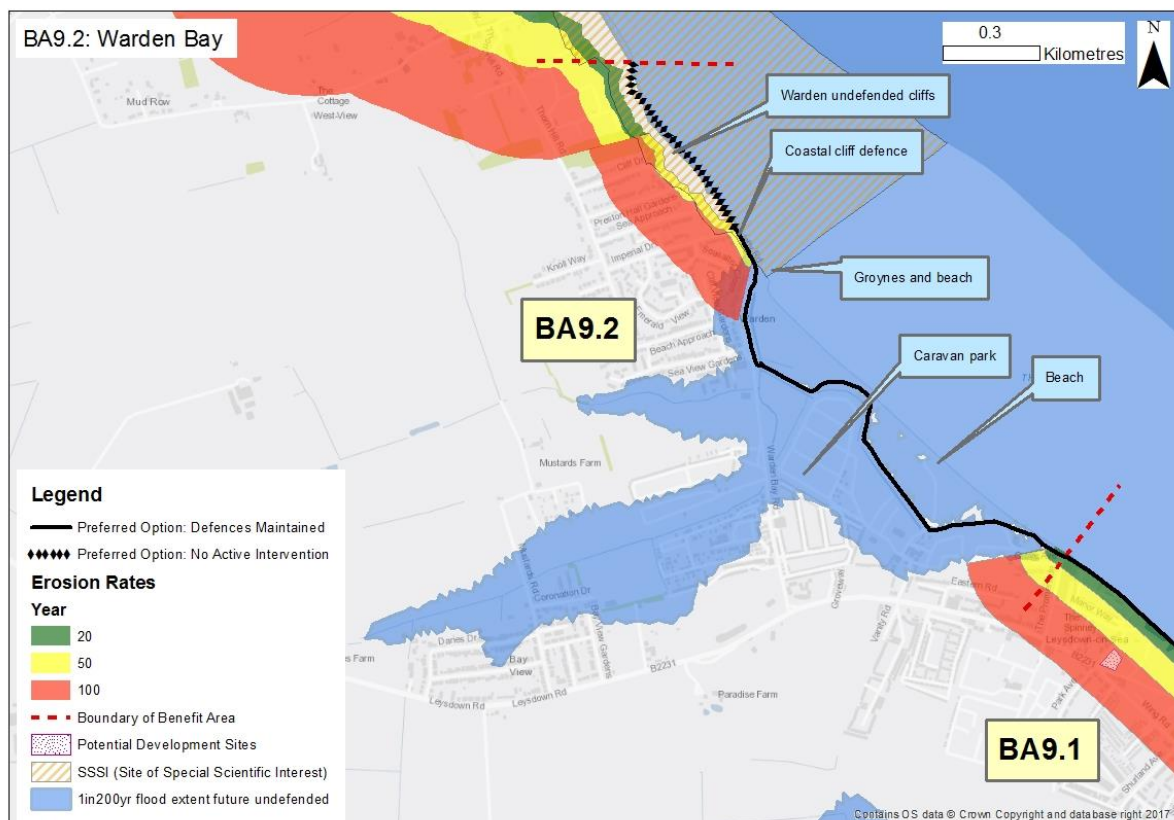
Year	Capital Scheme	Ongoing Maintenance
2019	<p>Mitigation & Action: OBC to commence with condition survey Mitigation & Action: Discussions with key asset owners regarding third party funding Procurement of OBC Start to develop the OBC - detailed economic assessment – review options and develop outline design – stakeholder engagement – third party contributions – environmental assessment – licenses and permits discussions Mitigation & Action: Heritage assessment to be undertaken</p>	
2020	<p>Finalise business case and undertake detailed design - early contractor involvement – refine option design – stakeholder engagement – obtain licenses and permits</p>	
2021	<p>Construction works to raise the embankment, seawall and sheet piling</p>	
2022		
2023		
2024		
2025		
2026		
2027		
2028		Maintenance of seawalls
2029 – 2039		2037 – Maintenance of seawalls
2040 – 2069		2047, 2057 and 2067 – Maintenance of seawalls
2070 – 2119		2077, 2087, 2097 and 2107 – Maintenance of seawalls

A.9.2 BA9.2: Warden Bay

This section has both erosion and flood considerations and as such the business case should look to assess both flood and erosion risk in one scheme. There is not a business case to raise the standard of protection due to the small number of properties at risk. Due to the residual life of the defences, works are not required until 2036. The section of SSSI protected cliffs at the western section of 9.2 have a NAI policy (which is in line with the SMP policy and the Coastal Change Management Study by Swale Borough Council). Potential adaptation options to relocate or compensate properties should be considered here.

Preferred Option	Maintain (with capital works) embankments, walls, groynes and beach. No Active Intervention (NAI) and localised property adaptation along Warden Cliffs (potentially not GiA funded).		
Description of Preferred Option	Capital works will be undertaken on the defences to ensure that they remain in place, however the SoP will not be improved with sea level rise, so the current SoP will decline over time. There will be a NAI policy on the SSSI designated cliffs at Warden, but costs have been included for relocating property away from the cliff top.		
Justification	This option has the highest BCR and NPV score. Other options do not have a high enough incremental benefit cost ratio to justify protecting to a higher standard of protection. Property relocation allows for management of the risk to residents whilst maintaining the integrity of the SSSI cliffs.		
Environmental	This option is not likely to have significant effects on any designated sites and their constituent qualifying features as the cliffs are left naturally to erode which support the Sheppey Cliffs and Foreshore SSSI designation for the geology. The eroding cliffs are thought to supply a significant amount of sediment to the Thames estuary, supplying mudflat and saltmarsh growth (or limiting erosion).		
	2018-2038	2039-2068	2069-2118
Overall Policy	HTL Maintain, and NAI on the cliffs (with localised property relocation/compensation)	HTL Maintain, and NAI on the cliffs (with localised property relocation/compensation)	HTL Maintain, and NAI on the cliffs (with localised property relocation/compensation)
Defence Crest Level Required	As now – average crest of 5.7m AOD	As now – average crest of 5.7m AOD	As now – average crest of 5.7m AOD

Whole Life Cost (PV)	£2,771k	BCR	3.3	PF%	23
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Key Risks and Mitigation - BA9.2: Warden Bay

Key Risk	Mitigation and Action	Owner
Third party contributions required.	Discussions will be had with key asset owners early on when the business case is being developed.	KSL Area Team/ Swale Borough Council.
Localised property relocation/compensation.	The localised property relocation/compensation scheme is quite an innovative scheme and as such there are limited examples of where this has been undertaken in the UK. The Strategy has referenced small scale projects on the North Norfolk coast, but the feasibility study will be undertaken in 2019/2020 to determine if the schemes will be eligible for GiA.	Swale Borough Council.
Stakeholder concerns around NAI section.	Key concerns from the public are concentrated on the area of Warden Cliffs SSSI where the cliffs are undefended and future erosion will put properties at risk. Early and effective stakeholder engagement and communication is critical here.	Swale Borough Council.
Review opportunities to reduce carbon.	For seawall consider use of steel rather than concrete, however if concrete is required investigate possibility of using low carbon concrete. Consider material sources and transportation during design phase and limit carbon footprint where possible.	Designer.

Key Dependencies

- Achieving third party funding contributions.
- The defences on the beach tie into the beach and groynes throughout both BAs 9.1 and 9.2 and therefore efficiencies to either undertake the groyne and beach work required in 9.1 later or bring 9.2 forward so the beach is all undertaken at the same time should be considered.
- Licences and permits required for the capital scheme to include (but not be limited to): MMO Licence, preliminary WFD Assessment, EIA Screening, and Flood Risk Activity Permit.

Stakeholders

Key concerns from the public are concentrated on the area of Warden Cliffs SSSI where the cliffs are undefended and future erosion will put properties at risk. Early and effective stakeholder engagement and communication is critical here.

Implementation Plan - BA9.2: Warden Bay

Year	Capital Scheme	Ongoing Maintenance
2019	Mitigation & Action: MR Feasibility Study	Annual maintenance – mowing and patch and repair of embankments, maintain culverts Patch and repair maintenance of seawall
2020		Annual maintenance – mowing and patch and repair of embankments, maintain culverts
2021		Annual maintenance – mowing and patch and repair of embankments, maintain culverts
2022		Annual maintenance – mowing and patch and repair of embankments, maintain culverts
2023		Annual maintenance – mowing and patch and repair of embankments, maintain culverts
2024		Annual maintenance – mowing and patch and repair of embankments, maintain culverts
2025		Annual maintenance – mowing and patch and repair of embankments, maintain culverts
2026		Annual maintenance – mowing and patch and repair of embankments, maintain culverts
2027		Annual maintenance – mowing and patch and repair of embankments, maintain culverts
2028		Annual maintenance – mowing and patch and repair of embankments, maintain culverts Patch and repair maintenance of seawall
2029 – 2039	<p>2036 – Start to develop the OBC - detailed economic assessment – review options and develop outline design – stakeholder engagement – third party contributions – environmental assessment – licenses and permits discussions</p> <p>Mitigation & Action: Discussions with key asset owners</p> <p>2037 – Finalise business case and undertake detailed design - early contractor involvement – refine option design – stakeholder engagement – obtain licenses and permits</p> <p>2038 – Construction work to undertake capital maintenance of the culverts, embankments, flood gates and seawalls</p>	Annual maintenance – mowing and patch and repair of embankments, maintain culverts
2040 – 2069		Annual maintenance – mowing and patch and repair of embankments, maintain culverts 2046, 2056 and 2066 – Patch and repair maintenance of seawall 2066 – Maintenance of flood gate
2070 – 2119	<p>2086 – Develop business case for capital maintenance of flood gates</p> <p>2087 – Finalise business case and undertake detailed design</p> <p>2088 – Construction works to undertake capital maintenance of the flood gates</p>	Annual maintenance – mowing and patch and repair of embankments, maintain culverts 2976, 2087, 2096 and 2106 – Patch and repair maintenance of seawall 2117 – Maintenance of flood gate

A.10 BA10: Minster Cliffs

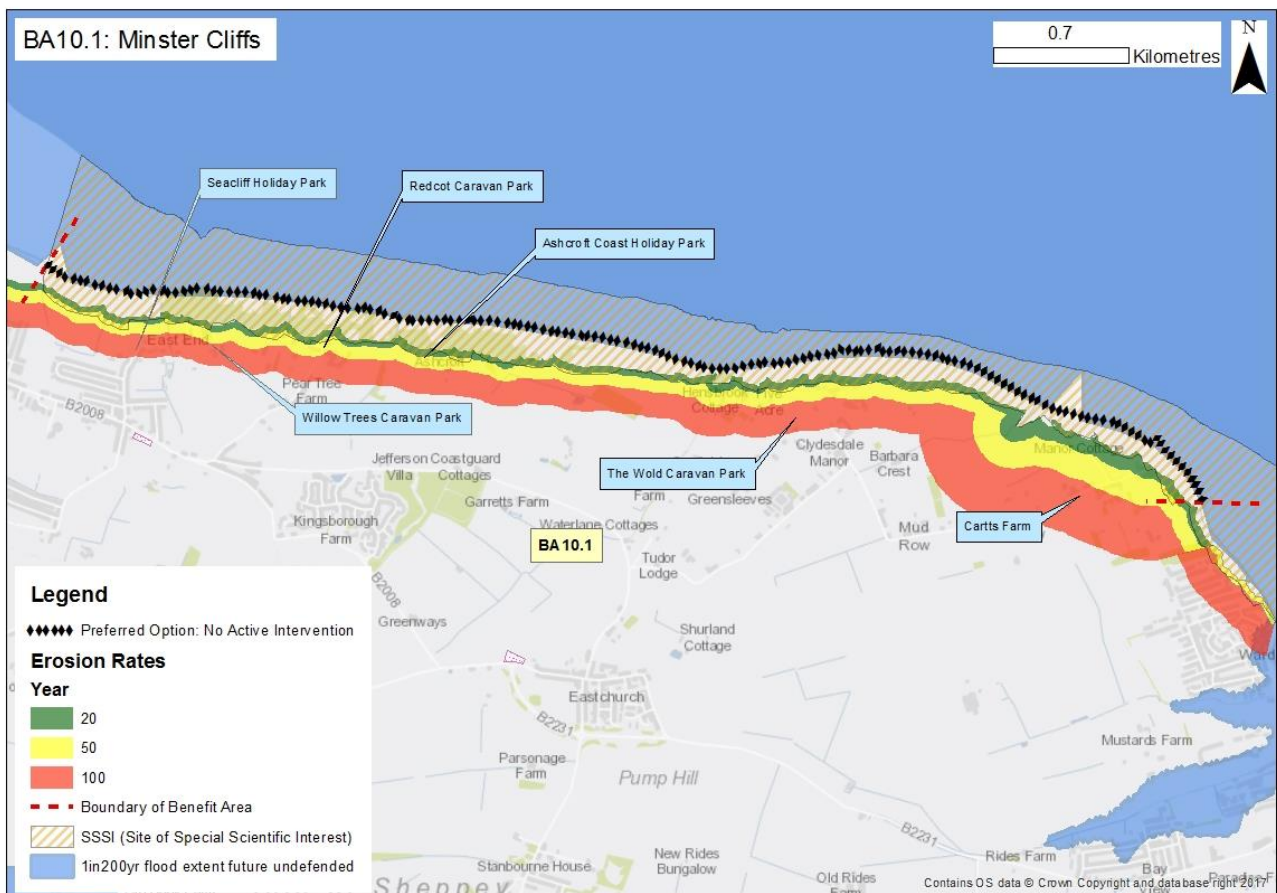


A.10.1 BA10.1: Minster Cliffs

These cliffs are SSSI protected and currently have no coastal defences to protect from erosion. Due to the SSSI protection, the long term policy here is to continue the NAI policy (which is in line with the SMP policy and the Coastal Change Management Study by Swale Borough Council). There are a number of stakeholders campaigning against this policy and stakeholder engagement here is important. Furthermore, this section is an important part of the World War 1 heritage landscape and has several important historical assets which will become at risk from erosion. Potential adaptation options to relocate or compensate properties should be considered here.

Preferred Option	No Active Intervention (NAI) with localised property adaptation (potentially not GiA funded).		
Description of Preferred Option	This option will continue to ensure that there is no active management of the cliffs, in line with the SSSI designation. However, to help reduce the risk to people and property, costs have been included for the relocation of property away from the cliff top.		
Justification	This option the only option with a BCR greater than 1, however there are a significant amount of contributions required. It also supports the implementation of Swale Borough Council's coastal change management plan.		
Environmental	This option is not likely to have significant effects on any designated sites and their constituent qualifying features as the cliffs are left naturally to erode which support the Sheppey Cliffs and Foreshore SSSI designation for the geology. The eroding cliffs are thought to supply a significant amount of sediment to the Thames estuary, supplying mudflat and saltmarsh growth (or limiting erosion).		
	2018-2038	2039-2068	2069-2118
Overall Policy	NAI, with localised property relocation/compensation	NAI, with localised property relocation/compensation	NAI, with localised property relocation/compensation
Defence Crest Level Required	N/A – NAI policy	N/A – NAI policy	N/A – NAI policy

Whole Life Cost (PV)	£5,956k	BCR	1.3	PF%	20
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Key Risks and Mitigation - BA10.1: Minster Cliffs

Key Risk	Mitigation and Action	Owner
Localised property relocation/compensation.	The localised property relocation/compensation scheme is quite an innovative scheme and as such there are limited examples of where this has been undertaken in the UK. The Strategy has referenced small scale projects on the North Norfolk coast, but the feasibility study will be undertaken in 2019/2020 to determine if the schemes will be eligible for GiA.	Swale Borough Council.
World War 1 heritage landscape.	Potential erosion risk to heritage assets that form part of the important WW1 heritage landscape. There will be further detailed erosion mapping and discussions with Kent County Council and English Heritage.	Swale Borough Council.
Rights of way.	The impacts on rights of way will be reviewed in more detail at the project level and mitigated by providing set back access if required.	Swale Borough Council.
Requirement for a setting assessment.	Historic England may require a setting assessment to better understand the implications for the preferred options. Historic England will be consulted early to identify if there is a requirement.	Swale Borough Council.

Key Dependencies

- Viability of the localised property relocation/compensation following the feasibility studies.
- It is to be noted that as this area currently is managed as a NAI site, the additional landowner engagement required when withdrawing maintenance does not apply here.
- The policy taken forward here should also align with the western section of BA9.2.

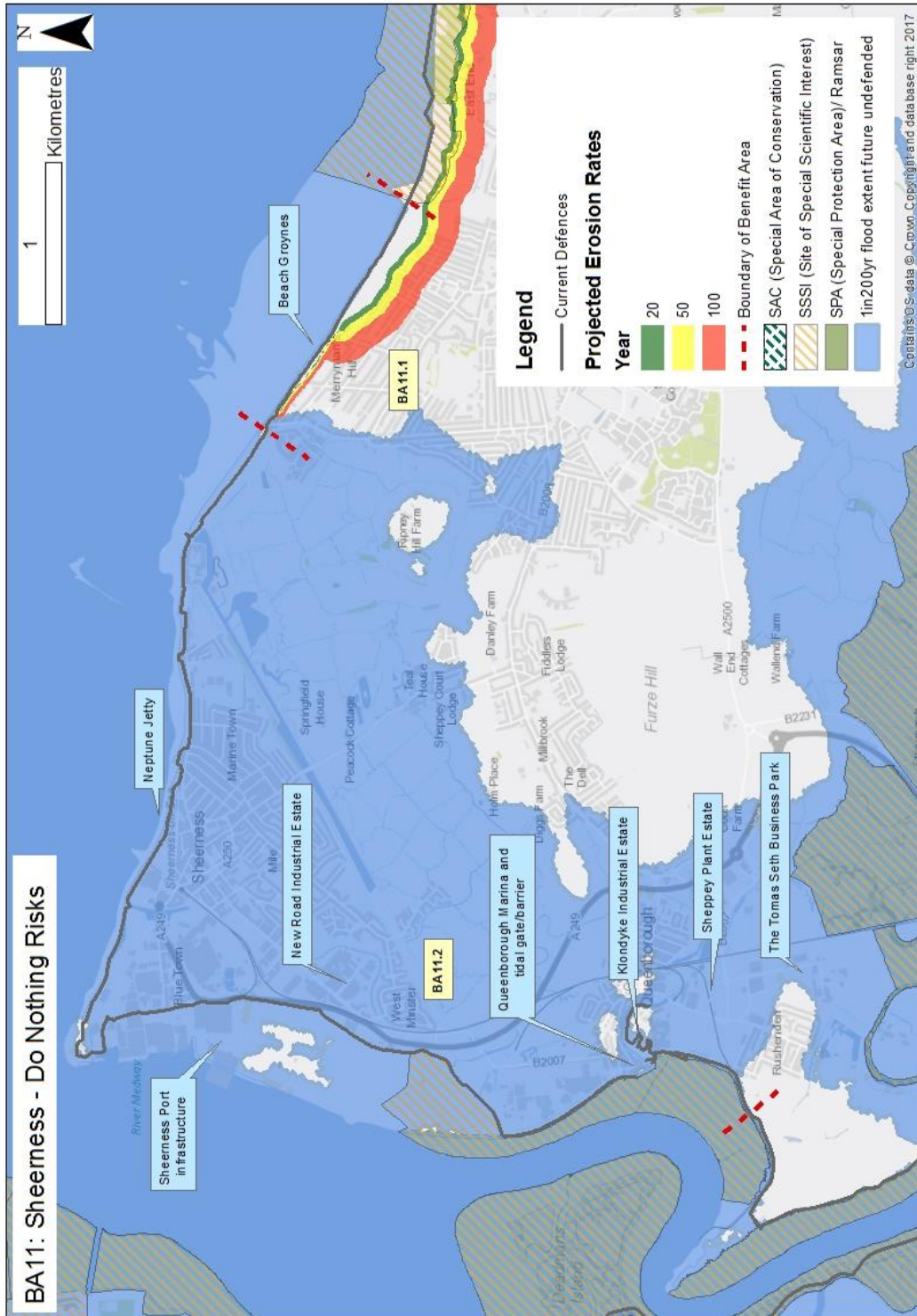
Stakeholders

Key concerns from the public are concentrated on the area of Warden Cliffs SSSI where the cliffs are undefended and future erosion will put properties at risk. Early and effective stakeholder engagement and communication is critical here.

Implementation Plan - BA10.1: Minster Cliffs

Year	Capital Scheme	No Active Intervention
2019	<p>Start to develop the Feasibility Study or Business Case for localised property adaptation - detailed economic assessment – review options and develop outline design – stakeholder engagement – third party contributions – environmental assessment – licenses and permits discussions</p> <p>Mitigation & Action: Detailed further erosion mapping and discussions with Kent County Council and English Heritage</p> <p>Mitigation & Action: Review impacts on rights of way</p>	NAI implemented, health and safety surveys undertaken
2020	<p>Finalise business case and undertake detailed design for localised property adaptation - early contractor involvement – refine option design – stakeholder engagement – obtain licenses and permits</p>	NAI implemented, health and safety surveys undertaken
2021	Localised property adaptation	NAI implemented, health and safety surveys undertaken
2022		NAI implemented, health and safety surveys undertaken
2023		NAI implemented, health and safety surveys undertaken
2024	Localised property adaptation	NAI implemented, health and safety surveys undertaken
2025		NAI implemented, health and safety surveys undertaken
2026		NAI implemented, health and safety surveys undertaken
2027		NAI implemented, health and safety surveys undertaken
2028		NAI implemented, health and safety surveys undertaken
2029 – 2039	2029, 2034 and 2038 - Localised property adaptation	NAI implemented, health and safety surveys undertaken
2040 – 2069	2044, 2049, 2054, 2059, 2064 and 2068 - Localised property adaptation	NAI implemented, health and safety surveys undertaken
2070 – 2119	2074, 2079, 2084, 2089, 2094, 2099, 2104, and 2109 - Localised property adaptation	NAI implemented, health and safety surveys undertaken

A.11 BA11: Sheerness

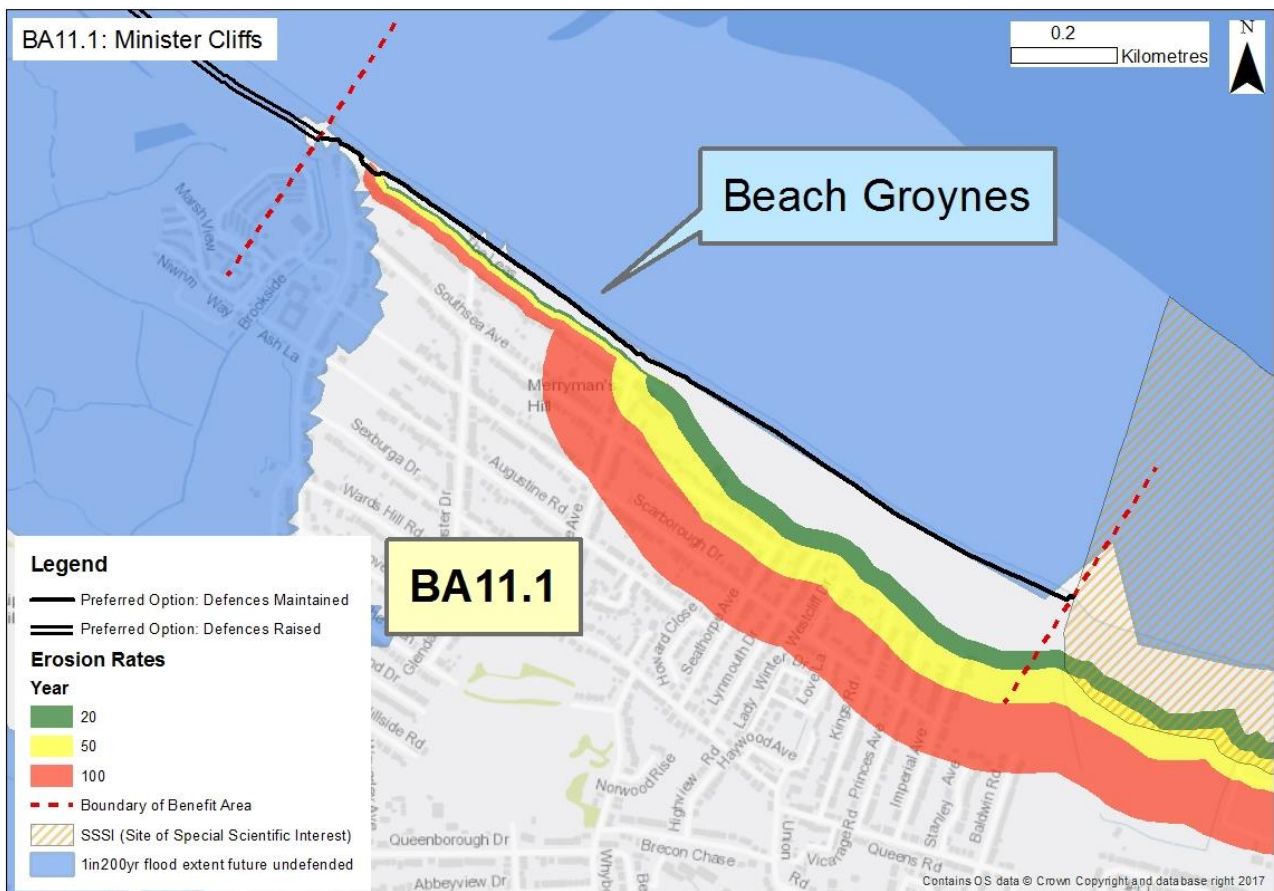


A.11.1 BA11.1: Minster Cliffs at Sheerness

A section at risk of coastal erosion more than overtopping/flooding, this benefit area protects several residential and commercial properties and therefore should continue to be maintained. The amenity value of the section should be assessed further, and it is important to consider the heritage links with the World War 1 landscape.

Preferred Option	Maintain embankments, walls, flood gates, groynes and beach.		
Description of Preferred Option	Capital works will be undertaken on the current defences to ensure that they remain in place to protect the toe of the cliff and assets behind the shoreline from erosion.		
Justification	This option has the highest NPV and BCR. However, the option is ranked the lowest environmentally and mitigation will be required. As the risk is from erosion, the assessment of the increase in SoP provided by other options are not applicable because the main risk is from the erosion of the toe of the cliff and not from overtopping.		
Environmental	This option is not likely to have significant effects on any designated sites and their constituent qualifying features.		
	2018-2038	2039-2068	2069-2118
Overall Policy	HTL Maintain	HTL Maintain	HTL Maintain
Defence Crest Level Required	N/A – erosional frontage	N/A – erosional frontage	N/A – erosional frontage

Whole Life Cost (PV)	£1,409k	BCR	9.9	PF%	116
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Key Risks and Mitigation - BA11.1: Minster Cliffs at Sheerness

Key Risk	Mitigation and Action	Owner
Third party contributions required.	Discussions will be had with key asset owners when the business case is being developed.	Swale Borough Council.
Heritage impacts on the WW1 landscape.	Design of defences will ensure they do not have impact any important historical assets or reduce the wider heritage landscape.	Swale Borough Council.
Requirement for a setting assessment.	Historic England may require a setting assessment to better understand the implications of the preferred options. Historic England will be consulted early to identify if there is a requirement.	Swale Borough Council.
Review opportunities to reduce carbon.	For seawall consider use of steel rather than concrete, however if concrete is required investigate possibility of using low carbon concrete. Consider material sources and transportation during design phase and limit carbon footprint where possible.	Designer.

Key Dependencies

- Achieving third party funding contributions.
- Licences and permits required for the capital scheme to include (but not be limited to): MMO Licence, preliminary WFD Assessment, EIA Screening, Flood Risk Activity Permit.

Stakeholders

- English Heritage and Kent County Council have particular interests in this area.

Implementation Plan - BA11.1: Minster Cliffs at Sheerness

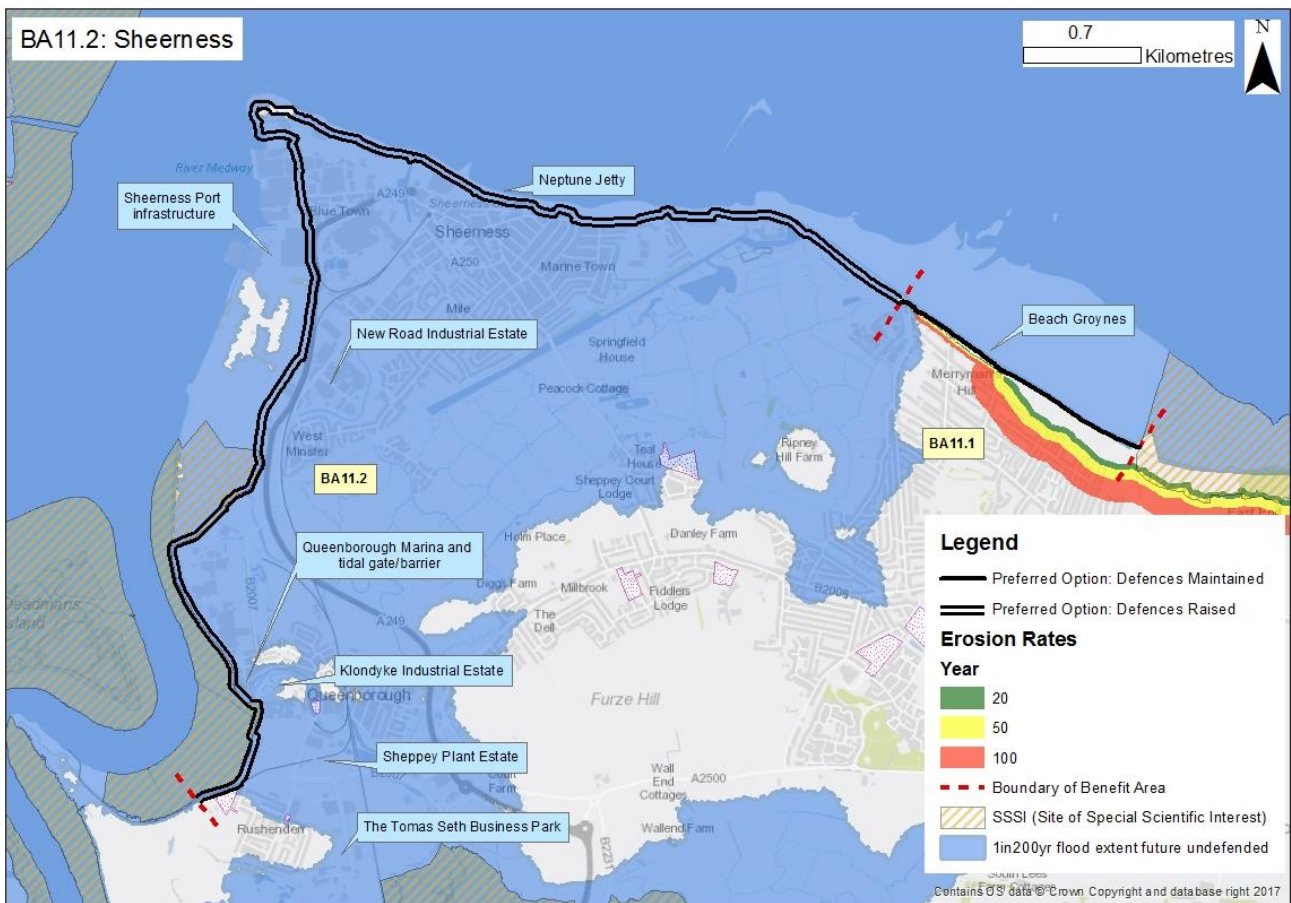
Year	Capital Scheme	Ongoing Maintenance
2019		Maintenance of the seawalls and beach recharge
2020		
2021		
2022		
2023		
2024		
2025		
2026		
2027		
2028		Maintenance of the seawalls and beach recharge
2029 – 2039	<p>2030 – Start to develop the OBC - detailed economic assessment – review options and develop outline design – stakeholder engagement – third party contributions – environmental assessment – licenses and permits discussions</p> <p>Mitigation & Action: Discussions with key asset owners</p> <p>2031 – Finalise business case and undertake detailed design - early contractor involvement – refine option design – stakeholder engagement – obtain licenses and permits</p> <p>Mitigation & Action: Review impact of design on heritage landscape</p> <p>2032 – Construction work to undertake capital maintenance on the seawalls</p>	2037 – Beach recharge
2040 – 2069		2042, 2052 and 2062 - Maintenance of the seawalls 2042, 2047, 2052, 2057, 2062 and 2067 – Beach recharge
2070 – 2119		2072, 2082, 2092, 2102 and 2112 – Maintenance of the seawalls 2072, 2077, 2082, 2087, 2092, 2097, 2102, 2107 and 2112 – Beach recharge

A.11.2 BA11.2: Sheerness

This BA has a large number of residential and commercial properties at risk from flooding and therefore has a high benefit cost ratio. Works to improve the standard of protection and residual life of defences should be undertaken as soon as possible to allow the benefits of the works to be realised. There are key heritage risks along here including potential works required around WW1 defences as well as important listed buildings (some of which are currently located seaward of the flood defences). The design should be developed with careful consideration to mitigate the risk in these areas.

Preferred Option	Raise (sustain) embankments, walls, flood gates, groynes and beach.		
Description of Preferred Option	This option involves improving the SoP provided by the defences to SoP of 0.1% AEP with sea level rise; in year 3 to 5.4m AOD and then in year 50 to 6.9m AOD to continue to provide protection in line with sea level rise.		
Justification	This option has the highest NPV although the incremental BCR is below 3. It has one of the highest environmental ranking from the short list of options.		
Environmental	There are potential adverse effects on the intertidal Medway Estuary and Marshes SPA and constituent qualifying features due to coastal squeeze. Areas of mudflat around West Swale to the west of Queenborough and Rushenden, are likely to be reduced in size.		
	2018-2038	2039-2068	2069-2118
Overall Policy	HTL Sustain	HTL Sustain	HTL Sustain
Defence Crest Level Required	5.4m AOD	5.4m AOD	6.9m AOD

Whole Life Cost (PV)	£36,060k	BCR	16.8	PF%	354
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Key Risks and Mitigation - BA11.2: Sheerness

Key Risk	Mitigation and Action	Owner
Visual effects and impacts upon landscape character of implementing capital works to sustain defences.	Design flood defences (most likely earth banks) that minimise visual impacts and impacts on the landscape character. Use materials, where hard engineering is present and will be enhanced, that reflect the cultural landscape and enhance local character.	KSL Area Team and design consultants.
Area of landfill in front of the defences at Sheerness Port. This will not be protected against sea level rise and there may be the potential release of contaminants	The Port Authority will be made aware of the risks and the potential environmental impacts that may occur.	KSL Area Team.
Loss of intertidal habitats due to coastal squeeze.	Strategy wide intertidal habitat compensation developed through MR sites. The feasibility of the MR sites will be undertaken to ensure that adequate habitat will be provided.	KSL Area Team with support from NEAS.
Impacts on heritage assets and WW1 defences.	There are key heritage risks along here including potential works required around WW1 defences as well as important listed buildings (some of which are currently located seaward of the flood defences). The design will be developed with careful consideration to mitigate the risk in these areas.	NEAS heritage specialist with support from appraisal consultant.
Listed buildings.	There are nationally important Listed Buildings on the water side of the defences. Historic England are keen to see this relocated as part of the works therefore there may be significant cost implications associated with this. Historic England and Kent County Council will be consulted early in the OBC development.	NEAS heritage specialist with support from appraisal consultant.
Changes to crest levels from updated modelling.	Modelling of this area is currently being undertaken by Thames Estuary 2100 team and may suggest increased wave heights here. Therefore the modelling will be assessed at OBC stage to confirm crest level height requirements of the defences.	KSL Area Team.
Review opportunities to reduce carbon.	For seawall consider use of steel rather than concrete, however if concrete is required investigate possibility of using low carbon concrete. Consider material sources and transportation during design phase and limit carbon footprint where possible.	Designer.

Key Dependencies

- MR sites being approved to ensure that compensation is required for the loss of intertidal habitat due to coastal squeeze.
- It is to be noted that included in the costs are the requirements for defence improvements in BA8.5 to prevent flooding from the south.

Business Case for Capital Scheme

Case	Summary
Strategic case	<ul style="list-style-type: none"> • Large number of commercial and residential properties at risk from coastal erosion. • Importance of industry in the area. • Important part of historic landscape.
Economic case	<ul style="list-style-type: none"> • The Benefit Cost Ratio is large and has a high PF score. • High number of OM2s.
Commercial case	<ul style="list-style-type: none"> • Procurement route likely to follow the Environment Agency framework and standard procurement practices.
Financial case	<ul style="list-style-type: none"> • A high PF score but wider outcomes and benefits and third part collaboration should be considered.
Management case	<ul style="list-style-type: none"> • The key risks and required mitigations are highlighted above in the risks and mitigation table and need to be implemented throughout the business case activities. • Large number of stakeholders to interact with, specifically Peel Ports and Historic England.

Stakeholders

- English Heritage and Kent County Council have particular interests in this area.

Implementation Plan - BA11.2: Sheerness

Year	Capital Scheme	Ongoing Maintenance
2019	<p>Mitigation & Action: MR Feasibility Study Start to develop the OBC - detailed economic assessment – review options and develop outline design – stakeholder engagement – third party contributions – environmental assessment – licenses and permits discussions</p> <p>Mitigation & Action: Discussions with Port Authority Mitigation & Action: Review impact of design on heritage landscape and listed buildings Mitigation & Action: Review any updated modelling from TE2100</p>	Annual maintenance – mowing or embankments and patch and repair of embankments, culverts and demountable Maintenance of seawall, sheet piling and flood gate
2020	Finalise business case and undertake detailed design - early contractor involvement – refine option design – stakeholder engagement – obtain licenses and permits	Annual maintenance – mowing or embankments and patch and repair of embankments, culverts and demountable
2021	Construction works to raise the culverts, demountables, embankments, seawalls and sheet piling	
2022	Construction works to raise the culverts, demountables, embankments, seawalls and sheet piling	
2023		Annual maintenance – mowing or embankments and patch and repair of embankments, culverts and demountable
2024		Annual maintenance – mowing or embankments and patch and repair of embankments, culverts and demountable
2025		Annual maintenance – mowing or embankments and patch and repair of embankments, culverts and demountable
2026		Annual maintenance – mowing or embankments and patch and repair of embankments, culverts and demountable
2027		Annual maintenance – mowing or embankments and patch and repair of embankments, culverts and demountable
2028		Annual maintenance – mowing or embankments and patch and repair of embankments, culverts and demountable
2029 – 2039	2030 – Develop OBC to undertake works on the flood gates 2031 – Finalise business case and undertake detailed design 2032 – Construction works on the flood gate	Annual maintenance – mowing or embankments and patch and repair of embankments, culverts and demountable 2029 – Maintenance of seawall, sheet piling and flood gate
2040 – 2069	2065 – Develop OBC for phase two of capital works 2066 – Finalise business case and undertake detailed design for phase two 2067 – Raise the culverts, demountables, embankments, seawalls and sheet piling	Annual maintenance – mowing or embankments and patch and repair of embankments, culverts and demountable 2039, 2049 and 2059 – Maintenance of seawall 2049 – Maintenance of sheet piling 2062 – Maintenance of flood gates
2070 – 2119		Annual maintenance – mowing or embankments and patch and repair of embankments, culverts and demountable 2077, 2087, 2097 and 2107 – Maintenance of seawall 2079 and 2109 – Maintenance of sheet piling 2097 – Maintenance of flood gates





B. Defence Crest Level Increase Requirements

MEASS Epoch 1 Defence Changes



0 2.5 5 10 Kilometers

Legend

-  NAI
-  MR
-  Defence Maintained but not Raised
-  Defence Raised

MEASS Epoch 2 Defence Changes



Legend

- NAI
- MR
- Defence Maintained but not Raised
- Defence Raised

0 2.5 5 10 Kilometers

MEASS Epoch 3 Defence Changes



Legend

- NAI
- MR
- Defence Maintained but not Raised
- Defence Raised

0 2.5 5 10 Kilometers

C. Technical note on Managed Realignment at Chetney Marshes - BA4.7

A number of specific elements have been considered for this option, and are presented in more detail below:

- Overall option design
- Interaction with landowners
- Interaction with infrastructure
- Potential for saltmarsh habitat roll back
 - Height of defences and overtopping
 - Residual life/condition of defences
- Impacts on freshwater habitat

C.1 Overall Option Design

The option description is as described below:

- Ongoing maintenance for the first 15 years. During this time habitat surveys will be undertaken to better understand the habitat there and access requirements to electricity pylons with required SOP to road access etc discussed with the electricity provider.
- Following year 15 maintenance is reduced in frequency until Year 50 where it is completely stopped.
- In year 20, it is considered there could be a risk of failure in parts of defences, and in year 20 land compensation will be provided to landowners so that the land can become owned and surveyed/maintained by the Environment Agency (or a partner such as Kent Wildlife Trust, RSPB or Natural England).
- From year 20, should there be a breach in defences due to failure of defences, the size and location would be considered alongside the additional surveys collected and would only be repaired or partially repaired if an adverse impact was predicted over a large spatial area.
- Currently, from Year 30, costs have included for freshwater habitat compensation as the increased risk of failure of defences, and increased overtopping from sea level rise under extreme events may cause adverse impact on the freshwater habitat. Ongoing survey of this area and option over the next 30 years may be able to reduce the amount of compensation required, however a worst case scenario has been used.

C.2 Interaction with Landowners

The landowner's agent in BA 4.7 (Mr Plumtree), was previously invited to a meeting on the 12th December 2017, to discuss the short-list of options in BA4.7 that were currently being assessed. His comments were:

- The site is currently being managed as freshwater habitat under HLS; it is 'effectively a nature reserve'.
- Much of the undesignated land is now actively managed freshwater habitat.
- NE own the undesignated land in the NW.
- The Landowner does not want or agree to MR on any part of the marshes, designated or non-designated for environmental reasons; unless he is compensated for loss of land, and will only consider if business model makes sense.

Although the Landowner is unlikely to be in full agreement with this option, he is more open to compensation that in other locations.

C.3 Interaction with Infrastructure

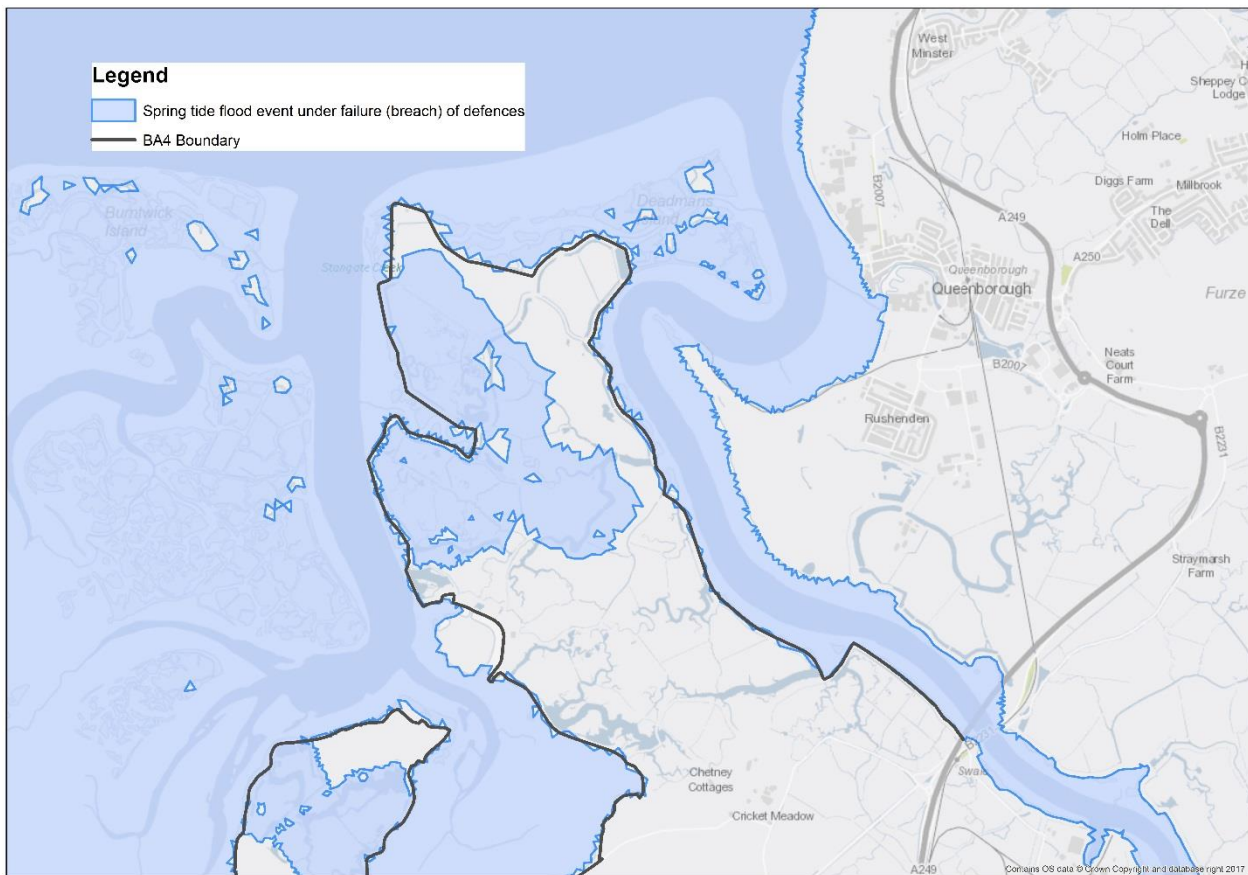
From work on other areas of the Strategy, it is known that 24 hour access to the pylons is required. However, as this would not be specifically breached, and the access only flooded under extreme events, this is more likely to be manageable. This area is currently at risk of flooding from low return period flood events and discussions in the future would be required with the infrastructure providers around the specific requirements of access. However, it is considered that this is a risk that could be managed in the future, compared to if a formal Managed Realignment site was created.

C.4 Potential for Saltmarsh Habitat Rollback

C.4.1 Height of defences and overtopping

Modelling has been undertaken to look at what areas would be effectively under water under tidal conditions in 100 years time taking into account sea level rise. This shows the potential of the current topography of the site for adapting to provide areas for saltmarsh habitat to “rollback”. Figure 4 presents the flood extents from the modelling. This shows that the natural topographic areas which are most suitable for saltmarsh habitat creation in the long term are areas which broadly avoid the freshwater designated sites, which provides positive indication that this option may allow adaptation and not loss of all of the freshwater habitat, whilst providing some compensation for the saltmarsh habitat experiencing coastal squeeze.

Figure 4: Areas of BA4.7 at risk in 100 years under normal tidal conditions if defences fail.

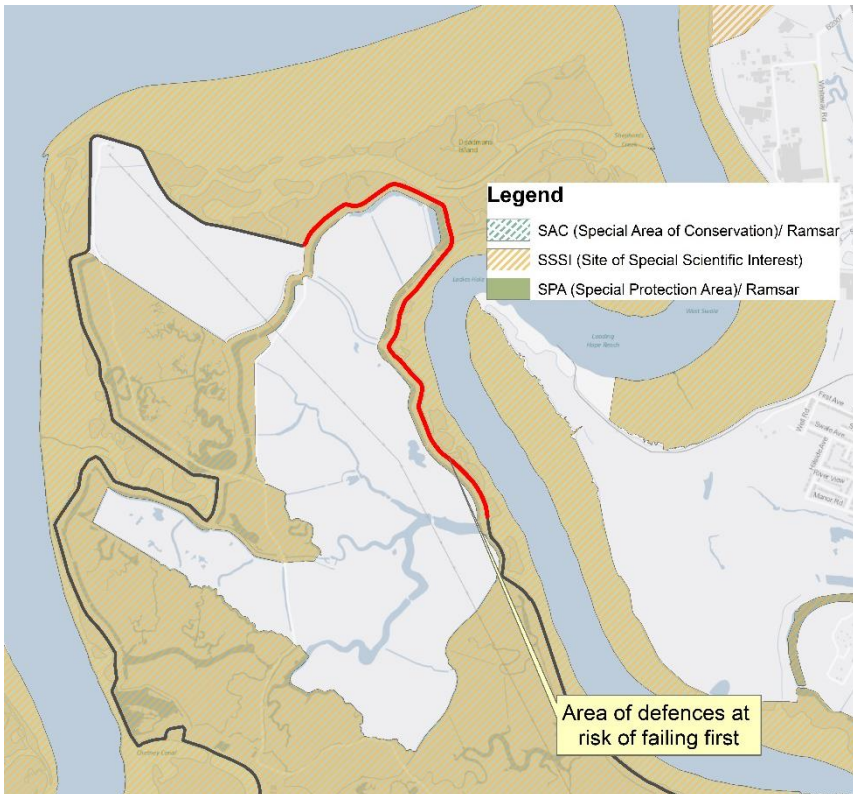


Source: Mott MacDonald Hydrodynamic Modelling, 2017

C.4.2 Residual life of defences

The defences that are likely to first fail are those in the north east of the site as these are the defences which are currently in the worst condition. Figure 5 presents the areas of defences which are more likely to fail first. From this it can be seen that it is the area of land which is owned by Natural England, and this could lend itself to being a good area to allow the progressive failure of the defences and roll back of saltmarsh.

Figure 5: Map highlighting the areas of defences at increased risk of failure in BA4.7



Source: AIMS data base, Environment Agency 2015

C.5 Impacts on freshwater habitat

From a comparison of Figures 4 and 5, it can be seen that a section of freshwater habitat to the west would be at risk of regular inundation in the future under this option, however, the majority of the freshwater habitat to the south of this BA would only be at risk from overtopping and flooding in extreme events.

This area is currently at risk from overtopping under events from a 2%AEP, with some areas at risk under a 5%AEP. Although this would increase in the future, it may be that the slow increase of the overtopping, with some ongoing management of the area and ongoing surveys, that the impacts is reduced if not mitigated through this option.

The implementation plan for the Strategy will recommend compensation for this area of designated freshwater habitat by Year 30, but with a specific review in Year 20 to update the implementation plan and required assessment following the surveys which will have been carried out and an update review of the defence conditions.

