Appendix E
Policy development and appraisal

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Appendix E - Contents

E1 Introduction

This appendix describes the policy appraisal for the Essex and South Suffolk Shoreline Management Plan (SMP). The appraisal has been carried out through a number of steps, with strong involvement from the Client Steering Group and Elected Members' Forum and with significant input of local knowledge from the Key Stakeholders' Group.

Two processes were essential for carrying out an appraisal appropriate to the SMP: setting objectives and identifying options for appraisal. The approach and methodology for developing both processes is outlined in sections E2 and E3 respectively.

Section E4 outlines the outcome of the application of the objectives setting and options appraisal process at a management unit and policy development zone level.

E2 Setting principles and objectives

This chapter sets out the approach for establishing the policy appraisal objectives. This approach was presented to and confirmed by the Client Steering Group (CSG) on 15 October 2008.

E2.1 Objective setting in the SMP guidance

The Shoreline Management Plan (SMP) guidance indicates the following process for setting objectives:

- Develop objectives for each feature in the theme review (task 2.4).
- Prioritise objectives within themes - specific approach at the discretion of the CSG (task 2.6).
- Identify key policy drivers - features with associated objectives likely to have overriding influence (task 3.1a).

The theme review for Essex has led to the development of a set of objectives for all identified features. This information is used to feed into the development of the objectives for policy appraisal, using a method that is appropriate for this particular SMP. The SMP guidance does not present a fixed method for developing objectives, but allows the CSG to develop an appropriate approach.

E2.2 Agreed approach

Based on (ongoing) experience with the Wash SMP2, a different approach was devised for developing policy appraisal objectives, at a level appropriate to SMPs. The suggested approach is therefore to follow a logical process in four steps:

- Use the outcome of earlier tasks (theme review, baseline scenarios) to develop a characterisation of the shoreline.
- Determine a set of key values based on the characterisation.
- Identify the principles (on an appropriate geographic scale) that should govern shoreline management, based on the key values and on local and national ambitions.
- Combine the key values and the principles to identify the policy appraisal criteria.

In general, the nature of the values, principles and criteria determines their geographic scale, so there is no pre-defined unit size. However, for practical purposes, we will use units on an appropriate geographic scale.

E2.3 Typical elaboration of suggested approach

The approach of identifying key values, and the associated criteria and objectives, is carried out on a local level along the entire shoreline. This section sets out the typical outcomes for all four steps: characterisation, key values, principles and criteria for policy appraisal.

E2.3.1 Characterisation

The characterisation is based on earlier tasks in stage 2 of the SMP: the theme review (appendix D), the baseline scenarios task (appendix F) and the identification of flood and erosion risks (appendix F). This characterisation covers the whole area that could be affected by shoreline management, so this concerns the whole area at risk of flooding and erosion (up to the high ridge).

E2.3.2 Key values

Key values offer a clear definition of the key or core values that underpin the entire range of values that both communities and society attach to the Essex and South Suffolk coastal area (both coastline and hinterland). The key values provide a concise account of the key assets that support the range of activities in or around the shoreline of Essex and South Suffolk that are enjoyed or used by society. Ecological values (specific habitat for example) have an inherent value, but also contribute towards tourism, commercial activity and the overall experience of visiting specific coastal areas. These key values have been developed for each unit, based on the characterisation. Typical key values will be:

- Communities of people and associated range of economic activities (agriculture, tourism, etc.).
- Landscape.
- Freshwater, brackish and saline habitats.
- Recreation.
- Roads.

The key values have been visualised in cross-sections as the theme review graphics and have been presented in **appendix D**. Each cross-section represents a management unit of the SMP shoreline and covers the whole zone relevant to the SMP. The cross-sections provide a summary of the key values of each area of coast and provide clarity about how values 'sit together' and interact.

E2.3.3 Principles

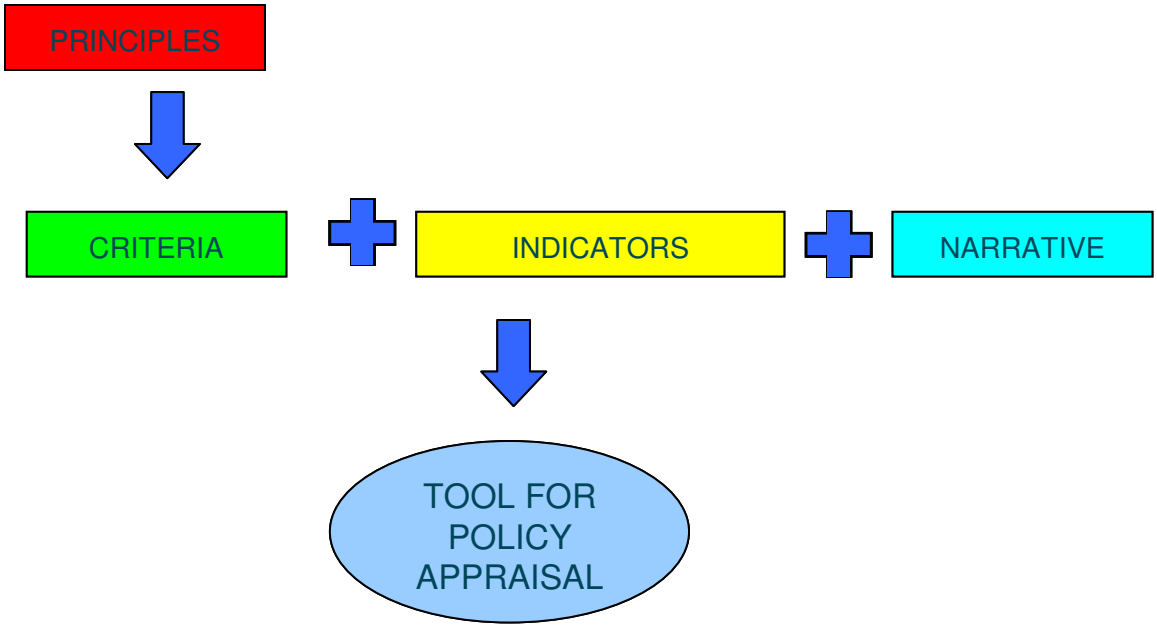
In the context of the SMP, principles are defined statements which provide a clear expression of position which will inform and guide the decision making process within the SMP.

These statements offer a concise account of the specific guidance that will focus the formulation of policy. Principles therefore provide an expression of the 'rules' within which appraisal criteria will be developed and policy formulated. Note that principles can be in competition. It is important to realise that the SMP will probably not be able to fulfil all principles, but will need to find the right balance between the principles ('balanced sustainability', as the SMP guidance calls it).

E2.3.4 Policy appraisal criteria and indicators

The principles set the framework, but the appraisal also requires a set of more specific criteria to measure how well each policy option performs against each principle. These criteria bring together the overall principles and the more locally-defined key values. They will therefore be location-specific, even though in practice particular criteria can be valid for more than one area. The criteria need to be accompanied by indicators, which if possible are quantifiable. However, the assessment of how well a policy option performs against the principles will always be based on judgement, supported by indicators and a narrative.

The actual performance of the policy against the principle ('Extent and quality of biodiversity') requires judgement, but this is supported by a calculated value for the indicator combined with a narrative that puts the outcome in perspective. Figure 1 below illustrates the approach.


PRINCIPLES
CRITERIA
INDICATORS
NARRATIVE
TOOL FOR POLICY APPRAISAL

E2.4 Principles

This set of principles for the Essex and South Suffolk SMP was developed with active involvement from the Client Steering Group and the Elected Members' Forum.

The set of principles as a whole represents the balance of values to which the SMP aspires. In other words, the SMP aims to develop the policies that achieve the best achievable balance between the principles ('balanced sustainability') in the short, medium and long term.

1. To develop policies appropriate to the diverse character of the Essex and South Suffolk coast and its dynamic interaction of land and sea.

2. To balance flood and erosion management with the assets and benefits that it protects.

3. To seek opportunities for managing the shoreline through natural coastal processes and take full account of longshore and cross-shore impacts.

4. To develop policies that are resilient against future changes and associated uncertainty.

5. To provide time and information for communities, individuals and partner organisations to adapt to any anticipated coastal change.

6. To support communities and sustainable development for the people living around the Essex and South Suffolk shoreline by managing the risk to community activities and infrastructure.

7. To support and promote the social and economic values of the Essex and South Suffolk coast to wider society.

8. To support conservation and enhancement of biodiversity and geodiversity.

9. To contribute to maintaining and enhancing the evolving character of the coastal landscape.

10. To support protection and promotion of the historic environment and its value for the heritage, culture and economy of the area.

11. To support and enhance people's enjoyment of the coast by maintaining and enhancing access.

E2.5 Objectives and criteria

This section describes the characterisation and key values along the frontage of the Essex and South Suffolk coastline and how they combine with the principles from section E2.4 to set policy appraisal criteria.

E2.5.1 Criteria

As described in section E2.3.4**,** the policy appraisal criteria are typically linked to one or more of the principles and to one or more of the key values. Each principle may have more than one criterion, or one criterion may serve a suite of principles. Most of the criteria are supported by quantifiable measurements but for all criteria, a level of judgement is needed to test to what extent each SMP policy fulfils the associated principles.

To make this transparent, each criterion is accompanied by indicators and their assessment is illustrated by a narrative that will further explain the decision-making process and which will inform judgement on overall policy scoring. Through this approach, the principles and criteria will be used explicitly for policy appraisal. Appendix G provides appraisal tables that demonstrate the application of this approach.

As many of the key values and characteristics of the Essex and South Suffolk coast are present throughout the SMP area, the general structure and content of the criteria is similar for all frontages. The first column of Table E 1 gives an overview. However, the indicators will be largely frontage-specific and relate to particular features. The second column of Table E 1 gives a general description. This table is repeated for each frontage in this chapter, but with the indicators made specific. There are cases where particular criteria are not relevant for a frontage; this is then also mentioned.

Table E 1 Principles, criteria and indicators

Principle / Criterion	Indicator
To develop policies appropriate to the diverse character of the Essex and South Suffolk coast and its dynamic interaction of land and sea	
Impact of policy package on the diverse character of the Essex coast	Qualitative judgement
Impact of policy package on dynamic interaction of land and sea	Qualitative judgement

Principle / Criterion	Indicator
To balance flood and erosion management with the assets and benefits that it protects	
Level of flood and erosion risk to people and properties	Number of properties within the tidal flood zone compared to the current number
Impact on future opportunities	Judgement based on input re. future opportunities
To seek opportunities for managing the shoreline through natural coastal processes and take full account of longshore and cross-shore impacts	
Use of natural processes (saltmarsh, longshore interaction)	Qualitative judgement
Longshore impact on neighbouring frontages	Qualitative judgement
Cross-shore impact on near shore activities	Qualitative judgement
To develop policies that are resilient against future changes and associated uncertainty	
Tested by the sensitivity check (task 3.4) as part of appraisal, so there is no need for explicit criteria	
To provide time and information for communities, individuals and partner organisations to adapt to any anticipated coastal change	
Adequacy of time available for adaptation for communities, individuals and partner organisations	Time (in epochs) available for each required process of adaptation, depending on the policy option
To support communities and sustainable development for the people living around the Essex and South Suffolk shoreline by managing the risk to community activities and infrastructure	
Impact on infrastructure	Type of roads and railways affected
Impact on socio-economic activities	• Impact on tourism and recreation features • Impact on fisheries • Impact on area and grade of agricultural land
Impact on public services	Type and number of services affected
Impact on communities	Number and size of communities (individual dwellings, hamlets, settlements)

Principle / Criterion	Indicator
To support and promote the social and economic values of the Essex and South Suffolk coast to wider society	
Impact on socio-economic features of regional, national or international significance	Impact as a percentage of regional / national / international availability
To support conservation and enhancement of biodiversity and geodiversity	
Impact on achieving management objectives for designated habitats and species, keeping them in favourable condition (including no significant loss of extent or populations)	• Area of designated land lost/gained for each epoch and scenario • Changes in condition of designated land for each epoch and scenario
Impact on achieving national and local Biodiversity Action Plan (BAP) targets within both designated sites and the wider coastal countryside	• Area of BAP habitats • Impact on BAP species
Impact on achieving management objectives for designated geological sites, keeping them in favourable condition	• Area of designated land lost/gained for each epoch and scenario • Changes in condition of designated land for each epoch and scenario
To contribute to maintaining and enhancing the evolving character of the coastal landscape	
Impact on the character of the coastal landscape, including consideration of geological, geomorphological, historic environment and cultural features and the role of settlements in the landscape	Qualitative judgement

Principle / Criterion	Indicator
To support protection and promotion of the historic environment and its value for the heritage, culture and economy of the area	
Impact on historic environment and its wider value	• Type and number of designated heritage assets (scheduled monuments, listed buildings, conservation areas, registered battlefields, protected wreck sites, registered parks and gardens) • Significant undesignated historic assets are assessed separately, due to the lack of a Rapid Coastal Zone Assessment Survey for the study area. See the policy appraisal results agreed with English Heritage in appendix G. The following factors were considered: the presence of significant historic assets, quality of preservation, archaeological potential, historic landscape and expected scale of mitigation. • Historic Grazing Marshes
To support and enhance people's enjoyment of the coast by maintaining and enhancing access	
Impact on access to the coast	Type and number of roads and paths affected

E3 Setting options for appraisal

This section outlines the approach and method for setting the options for appraisal.

The appraisal of options in this SMP is carried out for 10 management units (MUs). These have been defined based on the physical processes and they typically cover an estuary, a combined estuary or a coastal frontage. Within each management unit we have defined policy development zones. These are smaller units for which the issues are uniform and which are therefore likely to have one set of policies. Once the policies have been confirmed, the policy development zones will be translated to policy units. The SMP's appraisal has to take into account issues at a range of different geographical scales: local (PDZ), estuary/coastal frontage (MU), the SMP as a whole and even larger than that.

The appraisal of options process of the Essex and South Suffolk SMP has consisted of a number of iterations. This appendix aims to capture the essence of this process and so provide a framework for justifying the proposed policies. We can distinguish the following steps:

1. Defining the coastal policy context. This step, early on in the SMP process, identified which policies were sufficiently relevant to require appraisal. This is described in section E3.1.
2. Refinement of the coastal policy context based on more local information, identifying frontages where a change of management approach may be needed. For currently-defended frontages, this step identifies the frontages that are, or are expected to come, under pressure from defence deterioration and coastal processes. For currently undefended frontages, this step involves identifying sites where features are at risk of erosion. The outcome is a refined list of sites for which there is more than one option and that therefore need full appraisal.
3. Appraisal of realistic options against the principles. For PDZs with more than one realistic option, this step assesses and illustrates how each option performs against the principles. This needs to form the basis of the SMP's decision making.
4. For this SMP, steps one to three only concern the overall decision whether a change from the current policy is needed. For the PDZs where a change of policy is proposed, this step concerns the decision about which epoch (1, 2 or 3) this change would occur.
5. Analysis of economic viability. In line with the SMP guidance, this is carried out for the proposed policies only. This is reported in a separate note, which will constitute the economics appendix of the SMP document.

Each step is covered in a separate section, discussing first the approach and then summarising the results.

E3.1 Coastal policy context

E3.1.1 Approach

This section reports on Task 3.1a and 3.1b from the SMP guidance: identifying policy options that are sufficiently realistic and relevant to justify the effort of full appraisal. This streamlining process is needed because otherwise there would be an infinite number of policy options in both time (epochs) and space (frontages). So this task improves the efficiency of the SMP process. Key elements of this section were earlier included in the note 'Playing field for policies' of 5 January 2009, which was discussed with the Client Steering Group on 12 January 2009.

The essence of this task is to identify:

- Obvious policy choices for certain frontages and epochs – this will streamline the process by avoiding having to go through detailed appraisal for that frontage and epoch.
- Unrealistic policy choices for certain frontages and epochs – this will streamline the process by limiting the number of options that need appraisal.

All policies have drivers (reasons for) and constraints (reasons against). They are listed here (Table E 2) for the policies, as applied to the Essex and South Suffolk SMP.

Table E 2: Drivers and constraints for SMP policies

Policy	Drivers	Constraints
Hold the line	Existing land use: communities, infrastructure, agriculture, historic assets, freshwater habitats, tourism / amenity	Flood risk management budget Intertidal habitats (coastal squeeze) Coastal / estuary processes
Managed realignment	Intertidal habitats Flood risk management budget (in case of realignment to more cost effective location) Wider benefits (tourism, amenity, fisheries etc)	Existing land use: communities, infrastructure, agriculture, historic assets, freshwater habitats, tourism / amenity Flood risk management budget (in case of realignment to less cost effective location)

Advance the line	Reclamation to create agricultural land, freshwater habitats. To be determined whether these are realistic drivers	Intertidal habitats Existing use of foreshore Flood risk management budget
No active intervention	Flood risk management budget Technical feasibility Enhancement of intertidal habitats Coastal / estuary processes (increase in tidal prism, longshore effects)	Existing land use: communities, infrastructure, agriculture, designated historic assets, freshwater habitats

E3.1.2 Outcome

At this first stage of the appraisal, we need to look for drivers or constraints of such an absolute nature that they can rule out a policy or even determine policy selection without full appraisal. This means that a policy is only part of the coastal policy context if there is at least a driver and if there are no absolute constraints.

The decision whether a constraint is absolute or not is, of course, a matter of judgement. At this stage of the process, this requires a cautious approach. If it is uncertain whether a policy can be eliminated, then it is preferable to keep it within the coastal policy context and take it through appraisal. The results are as follows.

- Hold the line always has a driver for currently-defended frontages - to sustain current land use. There can be strong constraints (such as pressures from coastal processes or habitat loss due to coastal squeeze), but these are not sufficiently absolute to eliminate Hold the line for appraisal. This means that Hold the line is part of the coastal policy context for all currently-defended frontages. The only exceptions are Wallasea Island and Deveraux Farm (Hamford Water) where the decision has already been made outside the SMP to carry out Managed realignment in epoch 1.

- Managed realignment can be an option for frontages that currently have flood defences. The key drivers would be to reduce pressure on the defences (from channel movement or waves) by moving them further inland and to create intertidal habitat. Both drivers are particularly relevant where there is a loss of foreshore (either current or predicted). There can, of course, also be strong constraints for Managed realignment, because of its effect on existing land use. Section E3.2.1 looks in more

detail at these drivers and constraints, aiming to refine the coastal policy context by identifying frontages for which MR is or isn't a realistic option. There can also be cases where Managed realignment is a realistic option because the value of the protected features is limited and outweighed by the benefits of realignment. Section E3.2.3 identifies frontages where this is the case.

Note that in any case, MR is only realistic within certain constraints - the landward extent is limited where there are features (such as established settlements) that need continued protection. Furthermore, the timing of the realignment has to take into account the time needed for the people, businesses and organisations affected to adapt. These constraints are taken into account in developing the alignments for MR options (see section E4) and in the epochs (see section E5).

For undefended higher ground frontages, it can sometimes be a realistic management approach to limit or slow down erosion. This is neither Hold the line nor No active intervention, so it has to be labelled as managed realignment. For currently undefended frontages, this is only part of the coastal policy context if ongoing erosion is likely to threaten significant features. Section E3.2.2 looks in more detail at these frontages, aiming to refine the coastal policy context by identifying frontages for which MR is or isn't a realistic option.

Beyond the scope of the Essex and South Suffolk SMP Managed realignment may also be an option in locations that are not under pressure and we have not taken these forward as MR policies. Through the Environment Agency's Habitat Creation Programme, MR may take place in areas with willing landowners. Within the scope of the SMP, MR is still needed at vulnerable locations to reduce flood risk pressures.

- No active intervention is a realistic option for all currently undefended frontages. It is not an option for any flood defences that protect dwellings (permanent or temporary) as it could lead to failure of the defences in an uncontrolled manner. As mentioned under MR, there can be frontages where the value of the protected features is limited. For some of these, the available information suggests that continued maintenance will be difficult to justify. NAI could be a realistic option, although only after time for adaptation. Section E3.2.2 identifies frontages where this is the case.

- Advance the line will always have significant effects, so it is only realistic if there is a strong driver. Based on the understanding we have developed so far, there are only two PDZs where this may be the case: Felixstowe Port (PDZ A1), where an extension is underway, and Bathside Bay (PDZ A11a) where an extension is under consideration. For all other PDZs there are no strong drivers for advance the line. This means that advance the line can be eliminated at this stage for the whole SMP area except for these two PDZs.

These considerations lead to the following coastal policy context:

- Hold the line is part of the coastal policy context for all frontages that are currently defended, apart from Wallasea Island (H10) and Deveraux Farm (B4a).
- Advance the line is not part of the coastal policy context for any of the frontages apart from Felixstowe Port and Bathside Bay.
- Managed realignment could in principle be considered for all frontages with flood defences and for all currently undefended higher ground frontages, but this will be refined further in section E3.2.
- No active intervention is an option for all currently undefended frontages. It is not an option for most of the currently defended ones, but it could be an option (after time for adaptation) for flood defences that protect very limited features (see section E3.2.2).

E3.2 Refinement of coastal policy context

E3.2.1 Managed realignment for frontages with flood defences

As described in section E3.1 the 'coastal policy context' analysis results in the conclusion that for most frontages with flood defences, Hold the line and Managed realignment are in principle both realistic options. However, it is possible to refine the coastal policy context further by selecting those frontages for which there are practical and local drivers for Managed realignment. These are the frontages where the existing defences are under pressure from coastal or estuary processes. For the frontages where this is not the case, the constraints for Managed realignment (that is, sustaining existing land use) can be seen to outweigh the drivers.

At a high level, there are two key drivers for choosing a Managed realignment policy for frontages within this SMP - defence sustainability and compensation for loss of habitats. Both drivers are related to the estuary and coastal processes, which are leading to loss of saltmarsh in various locations throughout the area. In such frontages, continuing to hold the current alignment is unlikely to be sustainable. Also, there are frontages where continued defence could be unsustainable because the defences themselves or their foundations are of poor quality. Realigning these defences to a more inland position creates a buffer. For coastal frontages, the newly-created foreshore can dissipate wave energy, while for estuary frontages there would be more room for natural channel development before it undermines the defence. The frontages where the defences are under pressure largely coincide with the areas where intertidal habitats are being lost. There can also be other benefits of Managed realignment, such as for recreation and landscape value. These have been taken into account in the appraisal (see section E4).

The identification of defences under pressure has been carried out based on existing scientific and technical information combined with local knowledge from all those involved in the Essex and South Suffolk SMP. This has involved the Environment Agency's defence asset managers, the officers and elected members from all the SMP's partner organisations and also the local representatives from the Key Stakeholders' Group.

Our understanding of overall estuary behaviour has played an important role in this selection process, complementing local knowledge. This tells us that the estuaries are currently most constrained in their middle and outer reaches, which is typically where the shoreline is eroding and the defences are under pressure. Realigning the defences in those areas reduces this pressure and provides room for the natural processes. It is likely to reduce pressure on the defences across the estuary. In contrast, carrying out Managed realignments in the upper estuaries is likely to aggravate the problem. Doing this would increase the tidal prism of the estuaries, causing more water to flow in and out of the estuary with each tidal cycle. This water

has to pass through the already constrained profile of the middle and outer estuary, which would further increase the pressure on the shoreline there. Based on this, it will generally be more sustainable to carry out realignments in the middle and outer estuaries, than in the upper estuaries.

For some of the frontages under pressure as identified on the maps, there are constraints for Managed realignment that have been judged to be overriding. This is the case for PDZs where the land behind the defence is being used as military ranges: D8b (Fingringhoe and Langenhoe), I1a (Foulness) and H16 (Great Wakering); these have not been appraised further. For PDZ G1 (Bradwell-on-Sea), the partner authorities have indicated explicitly that realignment is not seen as a realistic option as there are overriding constraints at this time, concerning the value of the beach and historic features for recreation and tourism. Finally, there is a number of PDZs with refuse-filled defences or contaminated land behind the defences. PDZs with refuse-filled defences are: G3 (Dengie, Holliwell Point), H8a (South Fambridge), I1b (Potton Island). PDZ H14 (Barling Marsh) has contaminated land behind the defences; even though Managed realignment is not seen as realistic at this stage, these frontages have been appraised (see section E4) because the study into refuse filled walls identified in the Action plan may lead to a need to review these policies.

A special case is the Seawick, Jaywick and Osyth Marsh frontage, where Essex County Council and Tendring District Council are working with the Local Development Framework process to develop a sustainable long term solution. The SMP has not carried out its own appraisal, but has supported the LDF process, which is reflected in the policy statement (section 4.4 of the main SMP document).

The remaining list of frontages for which MR and HtL need to be appraised is included in Table E 1.

Table E 3: Frontages under pressure for which MR needs to be appraised

Management Unit (MU)	Policy Development Zone (PDZ)
A. Stour and Orwell	A2 (Trimley Marsh) A3 (Loompit Lake and Levington Creek) A8a (Shotley Marshes west) A8b (Shotley Marshes east)
B. Hamford Water	B2 (Little Oakley) B3a (Horsey Island) B4a (Kirby-le-Soken to Coles Creek) B5 (Walton Channel)

Management Unit (MU)	Policy Development Zone (PDZ)
C. Tendring	C2 (Holland-Haven) C4 (Seawick, Jaywick and St Osyth Marsh)*
D. Colne estuary	D1b (Point Clear to St Osyth Creek) D2 (Along the southern bank of Flag Creek) D3 (Flag Creek to northern bank to Brightlingsea) D5 (Westmarsh Point to where the frontage meets the B1029)
E. Mersea Island	E1 (Landward frontage) E2 (seaward frontage between North Barn and West Mersea) E4a (Strood Channel)
F. Blackwater	F3 (South bank of the Salcott Channel to Tollesbury Fleet) F5 (Tollesbury Wick Marshes to Goldhanger) F12 (Steeple) F14 (St. Lawrence to Bradwell-on-Sea)
G. Dengie peninsula	G3 (Dengie marshes)
H. Crouch and Roach	H2a (From Burnham on Crouch to Bridgemarsh) H2b (Bridgemarsh to North Fambridge) H8a (South Fambridge) H8b (Canewdon) H10 (Wallasea) H11a (Paglesham Churchend) H11b (Paglesham Eastend)
	H14 (Barling Marsh)
I. Foulness	I1b (Potton)
	I1c (Rushley)

*Appraisal outside SMP through LDF process - see policy statement in section 4.4 of main SMP document

E3.2.2 Managed realignment for currently undefended higher ground frontages

As described in section E3.1, continuing No active intervention is always a realistic option for currently undefended higher ground frontages. However, for frontages where ongoing erosion could affect features, it could be a realistic option to start defending against erosion. Within the context of the Essex and South Suffolk SMP, holding the shoreline where it is now (Hold the line) is unlikely to be a realistic option for these PDZs. It would have an unacceptable effect on natural processes and the costs are unlikely to be

justified by the features to be protected. However, it may be realistic to allow the implementation of local small-scale measures to slow down or limit erosion in order to protect particular features. This last option can't be described as either Hold the line or No active intervention so it has to be labelled as Managed realignment. If there are no drivers (that is, features at risk of erosion), then No active intervention is the obvious policy and there is no need to appraise other options. This section identifies the frontages for which other options do need to be appraised.

The technical background is described in the note ' Identification of erosion risk' (first draft of 22 September 2009, only distributed to EA, CSG members from Suffolk local authorities, Natural England and English Heritage for verification - to be distributed more widely). The availability of monitored erosion rates to predict future erosion is limited and needs to be complemented by judgement and by local knowledge. Part of this local knowledge is provided in the 'Coastal processes and defence assessment overview' maps, which highlight frontages where erosion is taking place. The identification of key features at risk has been informed by the SMP graphics. For frontages with features at risk of erosion but lack of erosion rate information, the SMP's action plan will highlight the need for monitoring.

The analysis in this section is summarised in Table E 4. The conclusion is based on the following logical steps:

1. If there is no erosion, there is no reason to change from NAI.
2. If there is erosion but there are no features at risk, there is no reason to change from NAI. This assessment is done conservatively at this stage (using high estimates of erosion rates and including all features). A more detailed assessment can be carried out in appraisal.

Table E 4: Currently undefended frontages – refining coastal policy context

PDZ	Location of undefended shoreline	Erosion	Features at risk	Policies
A3a Loompit Lake	Thorpe Common – marina (southern part of A3a)	No	--	Southern part of A3a: NAI
A4 Orwell northern bank	All	Orwell Park eastward **(A4a)**	Parks and footpaths	**A4a**: appraise A4b: NAI
A6 The Strand	All	Locally	B1456 (also flood risk)	Appraise

PDZ	Location of undefended shoreline	Erosion	Features at risk	Policies
A7 Orwell southern bank	All	Pin Mill	Marina and park	A7a: NAI **A7b**: appraise
A8 Shotley	Shotley Gate (A8c)	Yes	Seafront, dwellings	**A8c**: appraise
A9 Northern Stour	Seven sections throughout	A9c and A9e	Footpaths	**A9c**/**e**: appraise Other sections: NAI
A10 Southern Stour	Four sections throughout	A10d and A10f	Roads, footpaths, beach huts, dwellings, railway line	**A10d**/**f**: appraise Other sections: NAI
B3 Oakley Creek to Kirby-le-Soken	Small sections	No	--	NAI
B3a Horsey Island	Small section north shore	No	--	NAI
B6 Naze Cliffs	All (geological designation)	Yes	Mainly southern tip (Naze tower, car park, facilities), footpath throughout	NAI for northern section (B6a), appraise for southern section (**B6b**)
D1a Stone Point	Point Clear	No	--	NAI
D8b Fingringhoe and Langenhoe	Small sections	No	--	NAI
F1 Strood to Salcott-cum Virley	Abbot's Hall	No	--	NAI
F8 Maldon inner estuary	Marina	No	--	NAI
F9b Northey Island		No	--	NAI
Osea Island		No	--	NAI
F11b Mayland Creek		No	--	NAI

PDZ	Location of undefended shoreline	Erosion	Features at risk	Policies
F14 St. Lawrence to Bradwell-on-Sea	Orplands	No	--	NAI
H2a From Burnham-on-Crouch to Bridgemarsh	The Cliff (geological designation)	Yes	No	NAI
H5 Eastwards of Brandy Hole	Sections	No	--	NAI
H9 Paglesham Creek	All	No	--	NAI
H13 Rochford	Purdeys	No	--	NAI

Table E 4 shows that appraisal is needed for nine frontages; these will be defined as separate PDZs (refining the list used so far and using the numbers identified in bold in the table). This will ensure that each PDZ has only one set of policies.

E3.2.3 Managed realignment or No active intervention for potentially 'uneconomical' flood defences

There are a few areas where the flood defences are not necessarily under pressure, but for which there is still a need to appraise alternative options. This is because the economic assessment of the SMP (in this case based on available estuary strategies) indicates that continued Hold the line is not likely to be viable (see appendix H). The two PDZs are PDZ D6b (B1029 to Wivenhoe) and PDZ D8a (Inner Colne west bank).

E4 Appraisal against the principles

E4.1 Introduction

In the preceding sections we have identified which policy options need to be appraised for which of the PDZs. For those PDZs that have more than one realistic option, the appraisal against the principles and related criteria is described in this section.

Note that this step in the appraisal does not include the decision about the epoch in which the policy would change. This is covered in section E5.

Section E4.2 summarises the approach. Section E4.3 describes in general terms the appraisal results for the two most common policy decisions in the Essex and South Suffolk SMP. The appraisal is then described by management unit, starting with MU A Stour and Orwell in section E4.4.

E4.2 Approach

E4.2.1 Appraisal against the principles and criteria

For this part of the task, each option is assessed against all the principles via the agreed set of criteria. The results are indicated by a combination of a number/colour. Table E 5 shows the scoring system.

Table E 5 Assessment for each criterion

Decreasing fulfilment of criteria ↓	Score	Description	Associated colour
	9	**Good** performance of the policy against the criterion	
	8		
	7		
	6	**Average** performance of the policy against the criterion	
	5		
	4		
	3	**Poor** performance of the policy against the criterion	
	2		
	1		

A narrative is included for each criterion for further explanation of the effect of the policy on the specific criterion. This narrative describes the judgement behind the score, based on the indicators (quantifiable as far as possible). The results for each criterion are then aggregated to assess the performance of each policy against each principle. The score for each criterion (within a PDZ) is averaged, giving an overall score and associated colour for each principle. All policy appraisal tables will be posted on the extranet.

The aggregate assessment is the tabulated end product of the appraisal and is visualised schematically. These figures provide an overview for each PDZ for each policy option and use a symbol to represent each principle. The symbol is then shaded in green, amber, or red to visualise how the policy option scores against each principle. The graphics are intended to provide decision makers with a transparent overview of the advantages and disadvantages of each of the policy options, to support them in their decision to choose the policy that will deliver the best balance of values.

E4.2.2 Defence alignments for Managed realignment options

For the appraisal of Managed realignment options against the principles, we need to have some indication of the new alignment. This determines which features do and don't remain protected, how much intertidal habitat is created and how long the new defence length is. We have developed indicative alignments, based on the following principles:

- Continued protection of all dwellings, key infrastructure and specific local features.
- Within that constraint, minimise the length of the new defences and aim to follow existing defence lines.

Note that these alignments are by no means final and have only been developed for the purpose of the appraisal. If Managed realignment is chosen as the policy, then there will be a full process of project appraisal and scheme development, including local consultation.

E4.3 General description of appraisal

E4.3.1 PDZs with flood defences - Hold the line versus Managed realignment

This section describes the general appraisal of the PDZs with flood defences that have been identified as being under pressure (see section E3.1). For these PDZs, there is a need to appraise two policies: Hold the line and Managed realignment.

Overall, the key difference between these two options concerns the following four principles:

- managing the shoreline through natural coastal processes
- supporting communities and sustainable development
- enhancing biodiversity
- historic environment
- access.

Whilst sustaining the defences allows for protection of agricultural land and historic features inland of the defence, it can be detrimental for the natural development of coastal processes. The defences remain under pressure and work against coastal processes. In estuaries and creeks, holding the line

aggravates the undermining and pressure on defences of frontages on the opposite side of the channel as tidal volumes increase. In addition, holding the line does not provide compensation for the loss of designated intertidal habitats due to continued erosion.

On the other hand, Managed realignment allows the development of natural processes, creation of intertidal habitats and relocation of the defence line to a more sustainable position, but this can come at the expense of agricultural land and historic assets and areas. In particular cases, realignment also comes at the expense of designated or undesignated freshwater habitats and would convert these into intertidal habitats.

Under both Hold the line and managed realignment the shoreline will remain accessible along the existing defences, path or tracks or through the creation of new routes. However, for managed realignment there will be temporary disturbance and additional costs.

E4.3.2 Currently undefended PDZs - No active intervention versus Managed realignment / Hold the line

This section describes the general appraisal of the currently undefended PDZs where features could be at risk of erosion (see section E3.2). For these PDZs, there is a need to appraise two policies: No active intervention and an option that provides erosion protection.

Overall, the key difference between these two options concerns the following five principles:

- managing the shoreline through natural coastal processes
- supporting communities and sustainable development
- enhancing biodiversity
- historic environment
- access.

Whilst starting to defend the shoreline against erosion allows for protection of features on the shoreline (especially footpaths but also agricultural land, parks and historic assets), it can be detrimental for the natural development of coastal processes. The new defences are likely to come under pressure and work against coastal processes. On the other hand, continuing the current No active intervention approach allows for the development of natural processes, but this can come at the expense of features.

Under Managed realignment the shoreline will remain accessible along the existing defences, path or tracks or through the creation of new routes. In areas under No active intervention erosion and/or flood risk is not likely to affect paths and tracks.

A more detailed description of the appraisal of the impacts on the historic environment is provided for each management unit or PDZ in the following sections.

E4.4 Management Unit A: Stour and Orwell

E4.4.1 Characterisation and summary of options

Characterisation

The Stour and Orwell estuary system is confined by geology and/or flood defences that limit the landward development of intertidal areas and the waves and tidal flows promote erosion of the seaward edge of the intertidal areas. The hydrodynamic pressures and erosion are particularly prominent at the mouth of the estuary which is highly exposed to the north-easterly waves and waves generated by shipping activity.

Most of the land surrounding the estuaries falls outside the 1 in 1000 year tidal flood zone. Notable exceptions are the ports of Harwich and Felixstowe with their ferry services, cargo shipping and the Petrochem Carless refinery. In addition, there are properties along the estuaries that also fall within the tidal flood zone. Other communities include those of Shotley Gate, Brantham, Lawford, Manningtree and Mistley on the Stour. On the Orwell there is Levington, Nacton, Freston, Woolverstone and Chelmondiston. The railway line on the southern side of the Stour is at risk at several locations. Most of the flood zone, however, is characterised by agricultural land. There are sewerage treatment works on both the Stour and Orwell that discharge waste water into the rivers. The industry at Ipswich and Cattawade is also in the tidal flood zone. There are numerous marinas along the Orwell, golf courses and camping and caravan sites that are also at risk. In addition, there is the Royal Hospital School near Holbrook and the HMS Ganges museum at Shotley Marina.

The Stour and Orwell estuaries are of international importance. They provide habitats for an important assemblage of wetland birds and internationally important numbers of wintering and passage wildfowl and waders. The site also holds several nationally scarce plants and British Red Data Book invertebrates. In the Stour estuary horizontal erosion of saltmarsh is occurring at a rate of four hectares a year, while the Orwell estuary has vertical erosion of mudflats in the lower reaches and saltmarsh erosion at a rate of one hectare a year.

The Cattawade Marshes SSSI lies at the head of the Stour estuary and is situated between the freshwater and tidal channels of the River Stour. These grazing marshes with associated their open water and fen habitats are of major importance for the diversity of their breeding bird community, which includes species that have become uncommon throughout lowland Britain as a result of habitat loss. These marshes are also an important example of

historic coastal grazing marsh and have the potential for well-preserved palaeo-environmental deposits.

The Harwich Foreshore SSSI yields the only fossil flora attributable to the lowest division of the Eocene London clay. Its composition is typical of the formation and specimens are abundant. Association of the plants with ash bands within the clay may aid correlations elsewhere in the basin since they form useful marker horizons. This is a recently discovered site with great research potential.

In the Stour and Orwell estuaries a range of finds, from worked flints to hulks and at least one Saxon timber fish-trap, which highlight the long history of human exploitation of the estuary, have been recorded within the intertidal area of the Stour estuary. Quays, landing places and wrecks survive clustered around the historic ports of Manningtree and Mistley. Jetties and other timber structures can be anticipated along the length of the estuary.

Criteria and indicators to appraise against options

Principle / criterion	**Indicator**
To develop policies appropriate to the diverse character of the Essex and South Suffolk coast and its dynamic interaction of land and sea	
Impact of policy package on the diverse character of the Essex and South Suffolk coast	Qualitative judgement
Impact of policy package on dynamic interaction of land and sea	Qualitative judgement
To balance flood and erosion management with the assets and benefits that it protects	
Level of flood and erosion risk to people and property.	Number of properties within the tidal flood zone per epoch compared to the current number (about 13,600 in epoch 1, 13,780 in epoch 2 and 14,630 in epoch 3)
Impact on future opportunities	Judgement based on input about future opportunities
This principle has also been tested by the check of economic viability (see Appendix H) as part of appraisal, so there is no need for explicit criteria.	

Principle / criterion	Indicator
To seek opportunities for managing the shoreline through natural coastal processes and take full account of longshore and cross-shore impacts	
Use of natural processes (saltmarsh, longshore interaction)	Qualitative judgement
Longshore impact on neighbouring frontages	Qualitative judgement: • Impact on Hamford Water and The Naze • Impact on the Felixstowe frontage (Suffolk SMP2)
Cross-shore impact on near shore activities	Qualitative judgement: • Dredging of the channel at Harwich
To develop policies that are resilient against future changes and associated uncertainty	
Tested by the sensitivity check (task 3.4) as part of appraisal, so there is no need for explicit criteria.	
To provide time and information for communities, individuals and partner organisations to adapt to any anticipated coastal change	
Adequacy of time available for adaptation for communities, individuals and partner organisations	Time (in epochs) available for each required process of adaptation, depending on the policy option
To support communities and sustainable development for the people living around the Essex and South Suffolk shoreline by managing the risk to community activities and infrastructure	
Impact on infrastructure	Type and length of roads, railways and services affected: • Railway line between Harwich and Manningtree and mainline railway link to Ipswich • A136 at Parkeston, A120 from Harwich, A137 between Manningtree station and Cattawade, A154 in Felixstowe and A1455 in Felixstowe Type and number of utilities affected: • Sewage treatment works at Dovercourt and Harwich, Chantry (Ipswich) and Cliff Quay (Ipswich).
Impact on socio-economic activities	• Impact on grade 1, 2, 3 and 4 agricultural land Impact on tourism and recreation

Principle / criterion	Indicator
	assets including: • Marinas within the estuaries • Campsites and caravan parks • Harwich and Dovercourt golf club • Orwell country park • Historic features at Harwich.
Impact on public services	Type and number of services affected: • Rail services to Harwich and Ipswich • Passenger ferry services from Harwich and Felixstowe • RNLI operation from Harwich
Impact on communities	Number and size of communities (individual dwellings, hamlets, settlements): • Ports of Harwich and Felixstowe • Smaller communities of Shotley Gate, Brantham, Lawford, Manningtree, Mistley, Nacton, Freston, Woolverstone and Chelmondiston.
To harness the social and economic values of the Essex and South Suffolk coast to wider society	
Impact on socio-economic features of regional, national or international significance	Impact as a percentage of regional / national / international availability: • Railway links • Orwell country park • Harwich ferry terminal and international port • Felixstowe port • Ipswich port
To support conservation and enhancement of biodiversity and geodiversity	
Impact on achieving management objectives for designated habitats and species, keeping them in favourable condition (including no significant loss of extent or populations)	For each of the designations (Stour and Orwell Estuaries Ramsar site and SPA, Stour Estuary SSSI and Cattawade Marshes SSSI): • Area of designated land lost/gained for each epoch and scenario • Changes in condition of designated land for each epoch and scenario.

Principle / criterion	Indicator
Impact on achieving national and local Biodiversity Action Plan (BAP) targets within both designated sites and the wider coastal countryside	• Area of BAP habitats for each epoch and scenario (BAP habitats present are maritime cliffs and slopes, mudflats, coastal and flood plain grazing marsh, reed beds, lowland mixed deciduous forest, lowland meadow, wet woodland and fens)
Impact on achieving management objectives for designated geological sites, keeping them in favourable condition	For each of the geological designations (Harwich Foreshore SSSI and Little Oakley Channel Deposits SSSI): • Area of designated land lost/gained for each epoch and scenario • Changes in condition of designated land for each epoch and scenario
To contribute to maintaining and enhancing the evolving character of the coastal landscape	
Impact on the character of the coastal landscape, including consideration of geological, geomorphological, historic environment and cultural features, and the role of settlements in the landscape	Qualitative judgement: • Suffolk Coast and Heaths Area of Outstanding Natural Beauty

Principle / criterion	Indicator
To support protection and promotion of the historic environment and its value for the heritage, culture and economy of the area	
Impact on historic environment and its wider value	Impact on designated heritage assets • 11 scheduled monuments • 27 grade I and II* listed buildings • 207 grade II listed buildings • five conservation areas • No protected wreck sites, registered battlefields, registered parks and gardens • 3 areas of undesignated historic grazing marsh • presence of significant historic assets, quality of preservation, archaeological potential, historic landscape and expected scale of mitigation were also considered.

Principle / criterion	Indicator
To support and enhance people's enjoyment of the coast by maintaining and enhancing access	
Impact on access to the coast	Type and number of roads and paths affected • footpaths along part of the shoreline (including Suffolk coast and heaths path) • numerous footpaths, tracks and roads leading to the shoreline • eight car parks in tidal flood zone

Summary of PDZs and options

The analysis of the coastal policy context has led to the following list of PDZs and options for this management unit.

PDZ	Options	Appraisal needed?
A1 (Felixstowe port)	AtL in epoch 1, HtL in epochs 2 and 3	No
A2 (Trimley Marsh)	HtL or MR2	Yes
A3a (Loom Pit Lake) (apart from southernmost NAI part)	HtL or MR2	Yes
A3b (Levington Creek)	HtL	No
A4a (Northern Orwell east)	NAI or MR1	Yes
A4b (Northern Orwell west)	NAI	No
A5 (Ipswich)	HtL	No
A6 (The Strand)	NAI or MR1	Yes
A7a (Southern Orwell west)	NAI	No
A7b (Southern Orwell east)	NAI or MR1	Yes
A8a (Shotley Marshes west)	HtL or MR2	Yes
A8b (Shotley Marshes east)	HtL or MR 2	Yes
A8c (Shotley Gate)	NAI or MR1	Yes
A9a,d,f (Northern Stour – flood defence)	HtL	No
A9b (Northern Stour – not erosional)	NAI	No

PDZ	Options	Appraisal needed?
A9c,e (Northern Stour – erosional)	NAI or MR1	Yes
A10a,c,e (Southern Stour – flood defence)	HtL	No
A10b,g (Southern Stour – not erosional)	NAI	No
A10a,f (Southern Stour – erosional)	NAI or MR1	Yes
A11a (Harwich harbour)	AtL	No (outside SMP scope)
A11b (Harwich town)	HtL	No

MR1 Allow local and limited intervention to limit the risks, as long as negative impacts are minimised

MR2 Breach of the frontline defence after building a new landward defence line

E4.4.2 PDZ A2: Trimley Marsh

Description of the options

With MR the current line of natural defence will be realigned. However, the Felixstowe port south of the realignment areas will remain protected by the bund currently positioned between PDZ A1 and A2. Reinforcement of the bund may be required. Apart from the Felixstowe port, no other features will require protection. In the HtL option the current line of defence will be sustained.

Comparison

Unlike HtL, MR will lead to loss of around 65 hectares of designated freshwater habitats. However, there will be a significant net gain in habitats, with a total intertidal area of around 200 hectares. MR will require the re-routing of the Stour and Orwell Walk path which may also create opportunities for improvement. Most of agricultural land lost through realignment is of grade 3. MR would have limited adverse effect on the historic environment as the historic marshes have been severely damaged by agriculture and there is moderate archaeological potential. MR would relieve pressure on the currently-constrained sections of the estuary, which is likely to reduce pressure across the river at Shotley Marshes. New wetland areas, currently managed by Suffolk Wildlife Trust may be of benefit to local communities in terms of recreation and education.

Recommended option

The policy for this frontage is for Managed realignment as described above. The combined realignments in the Orwell Estuary could have a significant impact on the AONB by changing freshwater habitats to intertidal habitats; this will be mitigated by aiming to recreate freshwater habitats within the AONB area.

E4.4.3 PDZ A3a: Loom Pit Lake

Description of the options

With MR the current line of natural defence will breached at the relevant epoch. Breaching of the defences is not likely to affect any features so no new defences lines are required. In the HtL option the current line of defence will be sustained.

Comparison

Unlike HtL, MR will lead to conversion of around 15 hectares of designated freshwater habitats into intertidal habitats. MR will require the re-routing of the Stour and Orwell Walk path which may also create opportunities for improvement. MR would have limited adverse effect on the historic environment as there is low archaeological potential due to the quarry pits. MR would relieve pressure on the currently-constrained sections of the estuary, which is likely to reduce pressure across the river at Shotley Marshes. The defences are privately owned and the ongoing maintenance is the responsibility of this landowner.

Recommended option

The policy for this frontage is for Managed realignment as described above. The combined realignments in the Orwell Estuary could have a significant impact on the AONB by changing freshwater habitats to intertidal habitats; this will be mitigated by aiming to recreate freshwater habitats within the AONB area.

E4.4.4 PDZ A4a: Northern Orwell east

Description of the options

As an alternative to continuing the current No active intervention policy, there is a need to appraise a Managed realignment option that limits the erosion in order to protect the Stour and Orwell Walk footpath and Orwell Park from erosion. This MR option would consist of limited small-scale local flexible measures such as gabions and geo-textiles.

Comparison

Continuing the No active intervention policy supports the natural state of the estuary, including the role of bank erosion as a source of sediment elsewhere in the estuary. The MR policy as described would have an effect (although limited) on these aspects, but it would sustain the full area of the parks and could prevent the need to realign the footpaths along the estuary bank.

Recommended option

The policy for this frontage is for Managed realignment as described above. All small scale local interventions would require permission or consents. This is when any geological, environmental and social issues or impacts would be considered and addressed.

E4.4.5 PDZ A6: The Strand

Description of the options

As an alternative to continuing the current No active intervention policy, there is a need to appraise an option that protects the B1456 road on the shoreline from flooding and potentially from erosion. This option could consist of building a low embankment. An alternative solution could be to realign the B1456 to higher ground, but this is outside the remit of the SMP.

Comparison

Continuing the current No active intervention approach is likely to lead to an increased flooding frequency of the road, which affects the accessibility of Shotley peninsula (there is a second access route (via the B1080) for emergency situations). Continuing No active intervention would not have significant negative effects on other features or values. Construction of a defence or raising the level of the road would solve this problem. The costs of a new defence are unlikely to be justified, but this would be assessed separately, after the appraisal. Further discussion will be required with partners regarding other alternatives such as raising the road.

Recommended option

The policy for this frontage is for Managed realignment as described above.

The SMP's intent is to establish a process of cooperation between the partner organisations and all people and businesses with an interest in the area to develop a sustainable long-term solution, including funding opportunities. This solution may include limited local defences, but it is also likely to include adaptation or other measures.

All small scale local interventions would require permission or consents. This is when any geological, environmental and social issues or impacts would be considered and addressed.

E4.4.6 PDZ A7b: Southern Orwell east

Description of the options

As an alternative to continuing the current No active intervention policy, there is a need to appraise a Managed realignment option that limits the erosion in order to protect the Pin Mill marina, including a grade II listed public house, and the Stour and Orwell Walk footpath from erosion. This MR option would consist of limited local flexible measures such as gabions or geo-textiles.

Comparison

Continuing the No active intervention policy supports the natural state of the estuary, including the role of bank erosion as a source of sediment elsewhere in the estuary. The MR policy as described would have an effect (although

limited) on these aspects, but it would reduce erosion risk to the marina and could prevent the need to realign the footpaths along the estuary bank.

Recommended option
The policy for this frontage is for Managed realignment as described above.

The SMP's intent is to establish a process of cooperation between the partner organisations and all people and businesses with an interest in the area to develop a sustainable long-term solution, including funding opportunities. This solution may include limited local defences, but it is also likely to include adaptation or other measures.

All small scale local interventions would require permission or consents. This is when any geological, environmental and social issues or impacts would be considered and addressed.

E4.4.7 PDZ A8a: Shotley Marshes west

Description of the options
With MR the current line of defence will be realigned with continued flood protection to dwellings at the Clamp. This will require a new line of defence around 100 metres long. With HtL the current line of defence will be sustained.

Comparison
MR leads to loss of around 50 hectares of designated freshwater habitats in the Shotley Marshes. The intertidal habitat created is around 75 hectares so there will be a marginal net gain. Most of the agricultural land lost through realignment is of grade 3. MR will require the re-routing of the Stour and Orwell Walk path which may also create opportunities for improvement. Furthermore, MR will have a moderate adverse effect on the historic environment due to the anticipated high archaeological potential of the area. MR would relieve pressure on the currently-constrained sections of the estuary, which is likely to reduce pressure across the river at Trimley Marshes.

Recommended option
The policy for this frontage is for Managed realignment as described above. This project – Hill House farm- is being taken forward with a willing landowner under the Regional Habitat Creation programme.

The combined realignments in the Orwell Estuary could have a significant impact on the AONB by changing freshwater habitats to intertidal habitats; this will be mitigated by aiming to recreate freshwater habitats within the AONB area.

E4.4.8 PDZ A8b: Shotley Marshes east

Description of the options

Under MR the current defence will be realigned while continuing to provide protection to the Shotley marina, dwellings and roads. This will require new defences around Shotley marina, Church End and Old Hall Cottage (near the Oldhall Road), with a total length of about 430 metres. With HtL the current line of defence will be sustained.

Comparison

Managed realignment leads to loss of around 65 hectares of designated freshwater habitats in the Shotley Marshes. The area of intertidal habitats created is around 100 hectares, so there would be some net gain in habitats. Most of the agricultural land lost through realignment is of grade 3. MR will require the re-routing of the Stour and Orwell Walk path which may also create opportunities for improvement. Furthermore, MR will have a high adverse effect on the historic environment due to archaeological potential and tracts of historic landscape that will need extensive mitigation. MR would relieve pressure on the currently-constrained sections of the estuary, which is likely to reduce pressure across the river at Trimley Marshes.

Recommended option

The policy for this frontage is for Managed realignment as described above. The combined realignments in the Orwell Estuary could have a significant impact on the AONB by changing freshwater habitats to intertidal habitats; this will be mitigated by aiming to recreate freshwater habitats within the AONB area.

E4.4.9 PDZ A8c: Shotley Gate

Description of the options

As an alternative to continuing the current No active intervention policy, there is a need to appraise a Managed realignment option that limits the erosion in order to protect the sea front, dwellings and historic assets (notably, HMS Ganges) at Shotley Gate and the footpaths (which have already been realigned recently). The stability of the cliffs in this section is also under threat from local drainage issues.

There are a number of privately owned toe protection structures along this frontage. However, these structures are currently not recognised in legislation as coast protection structures and neither the Environment Agency nor the Local Authority has legal responsibility or funding to maintain them.

There is a lack of information on the erosion rates. This is particularly relevant for this PDZ given the proximity of dwellings and the sea front to the shoreline. The SMP's action plan will flag up the need for monitoring to inform firmer policy decisions in the next review of the SMP.

Comparison

Continuing the No active intervention policy supports the natural state of the estuary, including the role of bank erosion as a source of sediment elsewhere in the estuary. The MR policy as described would have an effect (although limited) on these aspects, but it could reduce erosion risk to the dwellings, the recreational area and footpaths of Shotley Woods and to the sea front (although it needs to be noted that coastal erosion is not the only cause of cliff instability). It could also prevent the need to carry out further realignment of the footpaths along the estuary bank.

Recommended option

The policy for this frontage is for Managed realignment as described above.

The SMP's intent is to establish a process of cooperation between the partner organisations and all people and businesses with an interest in the area to develop a sustainable long-term solution, including funding opportunities. This solution may include limited local defences, but it is also likely to include adaptation or other measures.

All small scale local interventions would require permission or consents. This is when any geological, environmental and social issues or impacts would be considered and addressed.

E4.4.10 PDZ A9c, e Northern Stour – undefended, erosional

Description of the options

As an alternative to continuing the current No active intervention policy, there is a need to appraise a Managed realignment option that limits the erosion in order to protect the footpaths (partly part of the Stour and Orwell Walk) from erosion. This MR option would consist of limited local flexible measures such as gabions.

Comparison

Continuing the No active intervention policy supports the natural state of the estuary, including the role of bank erosion as a source of sediment elsewhere in the estuary. The MR policy as described would have an effect (although limited) on these aspects, but it could prevent the need to realign the footpaths along the estuary bank.

Recommended option

The policy for this frontage is for Managed realignment as described above. All small scale local interventions would require permission or consents. This is when any geological, environmental and social issues or impacts would be considered and addressed.

E4.4.11 PDZ A10d, f Southern Stour – erosional

Description of the options

As an alternative to continuing the current No active intervention policy, there is a need to appraise a Managed realignment option that limits the erosion in order to protect the features at Wrabness beach (beach with facilities) and at Strandlands (dwellings, footpaths) from erosion. In the long term, there may also be an erosion risk to the railway line at this location. This MR option would consist of limited local flexible measures such as gabions.

Comparison

Continuing the No active intervention policy supports the natural state of the estuary, including the role of bank erosion as a source of sediment elsewhere in the estuary. The MR policy as described would have an effect (although limited) on these aspects, but it would reduce erosion risk to the beach and its facilities at Wrabness and to the other properties along this frontage. It could also prevent the need to realign the footpaths along the estuary bank. Finally, in the long term it would protect the railway line if the erosion extends that far.

Recommended option

The policy for this frontage is for Managed realignment as described above. All small scale local interventions would require permission or consents. This is when any geological, environmental and social issues or impacts would be considered and addressed.

E4.5 Management Unit B Hamford Water

E4.5.1 Characterisation and summary of options

Characterisation

Hamford Water coastal processes are largely driven by north-easterly waves and winds leading to erosion along the frontages at the entrance of the estuary. Little Oakley is particularly exposed, leading to the undermining of the defences. In the Walton channel undercutting of defences takes place due to hydrodynamic pressures (tidal flow and waves). The Naze constitutes an intermittent and decreasing sediment source. Erosion of intertidal areas takes place at the mouth of the estuary with accretion at inner creeks.

In Hamford Water, there are no significant settlements in the tidal flood zone. However, some properties do lie within the zone around the periphery of Hamford Water. Most of the area is agricultural land, with some exceptions including the Exchem industrial area, at Bramble Island. The B1414 crosses the tidal flood zone at Beaumont Key and the B1043 is at risk near Kirby-le-Soken. Titchmarsh marina is also in the tidal flood zone.

Hamford Water has been designated a National Nature Reserve, Ramsar site and SSSI. It is a large, shallow estuarine basin comprising tidal creeks

and islands, intertidal mud and sandflats and saltmarsh supporting rare plants and internationally important species/populations of migratory waterfowl. The site is of international importance for breeding little terns and wintering nark-bellied Brent geese, wildfowl and waders and of national importance for many other bird species. It also supports communities of coastal plants that are rare or extremely local in Britain, including hog's fennel, *Peucedanum officinale* which is found elsewhere only in Kent.

The historic environment of the unit has numerous earthworks including current and former sea walls, enclosures, decoy ponds and the surviving historic structures of the explosives factory on Bramble Island. Other industrial works include the scheduled lime kiln and quay at the end of Beaumont Cut and the tidal mill pond of Walton mere. Jetties, quays and trackways highlight the importance of access to and from the sea and the relationship with adjacent dryland areas. The tower of Trinity House is a prominent historic landmark at Walton-on-the Naze. Earlier exploitation of the area is marked by ancient buried land surfaces, particularly on the foreshore between the Naze and Stone Point and to the south of Dovercourt. These have produced much evidence for prehistoric occupation and numerous red hills (salt-making sites). Important areas of historic grazing marsh also survive, as on Horsey Island.

Criteria and indicators to appraise against options

Principle / Criterion	**Indicator**
To develop policies appropriate to the diverse character of the Essex and South Suffolk coast and its dynamic interaction of land and sea	
Impact of policy package on the diverse character of the Essex and South Suffolk coast	Qualitative judgement
Impact of policy package on dynamic interaction of land and sea	Qualitative judgement
To balance flood and erosion management with the assets and benefits that it protects	
Level of flood and erosion risk to people and property.	Number of properties within the tidal flood zone compared to the current number (about 890 in epoch 1, 1,000 in epoch 2 and 1,570 in epoch 3)
Impact on future opportunities	Judgement based on input re. future opportunities
This principle has also been tested by the check of economic viability (see Appendix H) as part of appraisal, so there is no need for explicit criteria.	

Principle / Criterion	Indicator
To seek opportunities for managing the shoreline through natural coastal processes and take full account of longshore and cross-shore impacts	
Use of natural processes (saltmarsh, longshore interaction)	Qualitative judgement
Longshore impact on neighbouring frontages	Qualitative judgement: • Impact on the Stour and Orwell estuaries • Impact on the Tendring peninsula
Cross-shore impact on near-shore activities	Qualitative judgement
To develop policies that are resilient against future changes and associated uncertainty	
Tested by the sensitivity check (task 3.4) as part of appraisal, so there is no need for explicit criteria.	
To provide time and information for communities, individuals and partner organisations to adapt to any anticipated coastal change	
Adequacy of time available for communities, individuals and partner organisations to adapt	Time (in epochs) available for each required process of adaptation, depending on the policy option
To support communities and sustainable development for the people living around the Essex and South Suffolk shoreline by managing the risk to community activities and infrastructure	
Impact on infrastructure	• Type and length of roads, railways and services affected. • Impact on the sewage treatment works at The Naze
Impact on socio-economic activities	• Impact on grade 2, 3 and 4 agricultural land Impact on tourism and recreation assets including: • Titchmarsh marina • Campsite and caravan park at Walton-on-the-Naze
Impact on public services	No services affected
Impact on communities	Number and size of communities (individual dwellings, hamlets, settlements): • Individual dwellings only

Principle / Criterion	Indicator
To harness the social and economic values of the Essex and South Suffolk coast to wider society	
Impact on socio-economic features of regional, national or international significance	No specific features
To support conservation and enhancement of biodiversity and geodiversity	
Impact on the achievement of management objectives for designated habitats and species, keeping them in favourable condition (including no significant loss of extent or populations)	For each of the designations (Hamford Water SPA, SSSI and NNR): • Area of designated land lost/gained for each epoch and scenario • Changes in condition of designated land for each epoch and scenario. Area of designated land lost/gained
Impact on the achievement of national and local Biodiversity Action Plan (BAP) targets, both within designated sites and within the wider coastal countryside	• Area of BAP habitats per epoch and scenario (BAP habitats present are mudflats, coastal and flood plain grazing marsh and reed beds)
Impact on the achievement of management objectives for designated geological sites, keeping them in favourable condition	For each of the geological designations (The Naze SSSI): • Area of designated land lost/gained for each epoch and scenario • Changes in condition of designated land for each epoch and scenario. Area of designated land lost/gained.
To contribute to maintaining and enhancing the evolving character of the coastal landscape	
Impact on the character of the coastal landscape, including consideration of geological, geomorphological, historic environment and cultural features and the role of settlements in the landscape	Qualitative judgement

Principle / Criterion	Indicator
To support protection and promotion of the historic environment and its value for the heritage, culture and economy of the area	
Impact on historic environment and its wider value	Impact on designated heritage assets: • two scheduled monuments • one grade II* listed building • 18 grade II listed buildings • one conservation area • no protected wreck sites, registered battlefields, registered parks and gardens • 2 areas of undesignated historic grazing marsh. • presence of significant historic assets, quality of preservation, archaeological potential, historic landscape and expected scale of mitigation were also considered
To support and enhance people's enjoyment of the coast by maintaining and enhancing access	
Impact on access to the coast	Type and number of roads and paths affected • Footpaths and tracks to and along shoreline of Hamford Water and the Naze • No car parks affected

Summary of PDZs and options

The analysis of the coastal policy context has led to the following list of PDZs and options for this management unit.

PDZ	Options	Appraisal needed?
B1 (South Dovercourt)	HtL	No
B2 (Little Oakley)	HtL or MR2	Yes
B3 (Oakley Creek to Kirby-le-Soken)	HtL	No
B3a (Horsey Island)	HtL or MR2	Yes
B4a (Kirby-le-Soken to Coles Creek)	MR2	No
B4b (Kirby-le-Soken to the Martello tower)	HtL	No
B5 (Walton Channel)	HtL or MR2	Yes
B6a (Naze Cliffs – north)	NAI	No
B6b (Naze Cliffs – south)	NAI or MR1	Yes

MR1	Allow local and limited intervention to limit the risks, as long as negative impacts are minimised
MR2	Breach of the frontline defence after building a new landward defence line

E4.5.2 PDZ B2: Little Oakley

Description of the options

With MR the current line of defence will be realigned while continuing to protect the dwellings, communities, roads and infrastructure south of Dovercourt and the sewage works at Bramble Island with new counterwalls (defence lines) of 640 metres and 170 metres respectively. Note that Little Oakley is currently proposed as a realignment site for habitat compensation under the Harbour Empowerment Order should the Bathside Bay port development go ahead. The realignment that the SMP proposes for PDZ B2 includes the Bathside Bay compensation plus additional area. With HtL the current line of defence will be sustained.

Comparison

With MR there will be a considerable increase in intertidal habitats (about 370 hectares) with no loss of designated freshwater habitats. Most of the agricultural land lost through realignment is of grade 4 and some grade 2. MR will require the re-routing of the Essex Way and Long Bank paths which may also create opportunities for improvement. MR is likely to have a high effect on the historic environment due to the expected quality of preservation and high archaeological potential of the area, including tracts of historic landscape.

Recommended option

The policy for this frontage is for Managed realignment as described above. Potential to expand this site from the Bathside Bay compensation works would be considered with willing local landowners into the rest of B2. If

Bathside Bay does not go ahead Managed realignment in this PDZ would be considered in the medium or long term.

E4.5.3 PDZ B3a: Horsey Island

Description of the options

MR would consist of realigning the defences which would turn the eastern end of the island into intertidal area. A new defence line of about 400 metres would be required to protect the dwellings at the western end of the island. With HtL the current line of defence will be sustained.

Comparison

The key difference between the two options is that HtL would keep protecting all the designated freshwater grazing marsh, while MR would turn about 45 hectares into intertidal habitats. MR requires the building of a new defence, but this would be much shorter and under much less pressure than the existing alignment. In addition, MR could have high adverse effect the historic environment, due to large tracts of historic landscape and associated archaeological potential. Mitigation by design should be explored at an early stage.

Recommended option

The policy for this frontage is for Managed realignment as described above.

E4.5.4 PDZ B5: Walton Channel

Description of the options

With MR the defence will be realigned over the Walton Hall marshes. New defence lines of about 1.5 kilometres in total would be required to protect the sewage works to the north and the Willows caravan park, dwellings and communities to the south. With HtL the current line of defence will be sustained, possibly including foreshore recharge as has happened in the past, subject to sediment availability.

Comparison

Whilst HtL sustains the Walton marshes, the nature reserve (30 hectares of designated grazing marsh) and grade 4 agricultural land, MR would convert those areas into intertidal habitat and create an additional 90 hectares. Paths and tracks along the defences would have to be realigned which may also create opportunities for improvement. In addition, MR would have a high adverse effect on the historic environment, due to tracts of historic landscape with associated archaeological potential. In addition, MR may have a positive effect on tourism and access to the backwaters under future regeneration plans for Walton.

Recommended option

The policy for this frontage is for Managed realignment as described above. The intent is to continue dialogue and explore the possibility of using sands

and shingles from dredging activities for foreshore recharge. However it is understood that sediment availability from those activities may be limited.

E4.5.5 PDZ B6b Naze Cliffs south

Description of the options
As an alternative to continuing the current No active intervention policy, there is a need to appraise a Managed realignment option that limits the erosion in order to protect the Naze tower and possibly also the features around it (car park, facilities) from erosion.

This Managed realignment option has been developed as a scheme that is currently being proposed by Tendring District Council under the Coast Protection Act (CPA) 1949. The preferred option set out by the Naze Coastal Protection Scheme-Crag Walk Project Appraisal Report (Royal Haskoning 2009) is for a rock revetment at the base of the cliffs including an access road for maintenance and providing access to the cliff face for geological interpretation. The cliffs will slump, vegetate and stabilise as the erosion of the toe is prevented, although small-scale vegetation clearance will be required to maintain the geological exposure.

Comparison
Continuing the No active intervention policy supports the natural state of the estuary, including the role of bank erosion as a source of sediment elsewhere on the frontage. The MR policy as described would have an effect (although limited) on these aspects, but it would significantly extend the life of the characteristic Naze tower, a grade II* listed building, while maintaining the geological interest and improving the amenity value.

Recommended option
The policy for this frontage is for Managed realignment as described above. All small scale local interventions would require permission or consents. This is when any geological, environmental and social issues or impacts would be considered and addressed.

E4.6 Management Unit C Tendring peninsula

E4.6.1 Characterisation and summary of options

Characterisation
Tendring is a beach frontage with a mixture of shingle and/or sand and muddy shores. Here the main process is loss of beach material due to its vulnerability to wave pressures (seawards) and landward constraints imposed by coastal and flood defences, set mainly at the low water mark (including Clacton-on-Sea and Holland) as well as the general orientation of the coast. Effectively, the defences are being undermined. The sediment drifts in a north-south direction. However, there is lack of sediment supply

from the north. There is some accretion at Seawick and Leewick due to a change in alignment of the coast.

There is less low-lying land within this frontage than most of the other frontages, with the exceptions being St Osyth Marsh, Seawick, Holland Haven Marshes and part of Walton-on-the-Naze. St Osyth Marsh comprises drained agricultural land with the settlements of Seawick and Jaywick to the east including a substantial caravan park and Jaywick golf club.

The sea front at Clacton-on-Sea has important recreational and tourism value with attractions including the beach and pier. Walton-on-the-Naze is another important tourist destination with its frontage and pier. Although most of these settlements are outside the tidal flood zone, they are at risk from coastal erosion that is an issue throughout the frontage.

The foreshore and cliff exposures, and excavations in the Clacton district (Clacton Cliffs and Foreshore SSSI), have provided opportunities for the study of one of the most important Pleistocene interglacial deposits in Britain, while the Holland-on-Sea Cliffs SSSI represents a stratigraphic site of considerable importance. These sites can be precisely attributed to the Anglian glaciation, providing a fixed dating point within the terrace sequence of the eastern London Basin and a means of correlation with sequences where the Anglian is represented elsewhere in southern Britain and on the continent.

Holland Haven Marshes SSSI represents an outstanding example of a freshwater to brackish water transition and includes a number of nationally and locally scarce species. Holland Haven country park situated in the flood plain of Holland Brook is important both for conservation and recreational value. Part of Walton-on-the-Naze is also within the flood zone, with several buildings and a caravan site at risk. The Clacton and Holland-on-Sea Strategy, which will be reviewed in 2010, will provide further details about the interaction between the frontages of Clacton and Holland-on-Sea.

Structures associated with the coastal resorts at Walton and Clacton are a feature of the area's historic built environment as are defences including distinctive Napoleonic Martello towers and World War two pill boxes. The reclaimed Holland Haven marshes are likely to contain well-preserved palaeo-environmental deposits and internationally important palaeolithic remains are known from the Clacton Cliffs and Foreshore SSSI. Areas of well-preserved prehistoric land surfaces may survive in places and a number of finds of red hills (salt-making sites) have been recorded on the coast which date from the late iron age/Roman period. Post-medieval oyster pits, industrial features, duck decoys and existing and relict sea defences reflect the strong coastal/maritime nature of the historic environment of the area and fragments of historic grazing marsh survive in places.

Criteria and indicators to appraise against options

Principle / criterion	Indicator
To develop policies appropriate to the diverse character of the Essex and South Suffolk coast and its dynamic interaction of land and sea	
Impact of policy package on the diverse character of the Essex and South Suffolk coast	Qualitative judgement
Impact of policy package on dynamic interaction of land and sea	Qualitative judgement
To balance flood and erosion management with the assets and benefits that it protects	
Level of flood and erosion risk to people and property.	Number of properties in the tidal flood zone compared to the current number (about 7,100 in epoch 1, 7,510 in epoch 2 and 8,390 in epoch 3)
Impact on future opportunities	Judgement based on input about future opportunities
This principle has also been tested by the check of economic viability (see Appendix H) as part of appraisal, so there is no need for explicit criteria.	
To seek opportunities for managing the shoreline through natural coastal processes and take full account of longshore and cross-shore impacts	
Use of natural processes (saltmarsh, longshore interaction)	Qualitative judgement
Longshore impact on neighbouring frontages	Qualitative judgement: • Impact on Hamford Water and The Naze • Impacts on the Colne estuary, Blackwater estuary and Mersea Island
Cross-shore impact on near shore activities	Qualitative judgement
To develop policies that are resilient against future changes and associated uncertainty	
Tested by the sensitivity check (task 3.4) as part of appraisal, so there is no need for explicit criteria.	
To provide time and information for communities, individuals and partner organisations to adapt to any anticipated coastal change	
Adequacy of time available for communities, individuals and partner organisations to adapt	Time (in epochs) available for each required process of adaptation, depending on the policy option

Principle / criterion	Indicator
To support communities and sustainable development for the people living around the Essex shoreline by managing the risk to community activities and infrastructure	
Impact on infrastructure	Type and length of roads, railways and services affected: • A133 Type and number of utilities affected: • sewage treatment works at Jaywick, Clacton-on-Sea and St Osyth • Electricity transmission lines at Holland-on-Sea
Impact on socio-economic activities	• Impact on grade 2, 3 and 4 agricultural land Impact on tourism and recreation assets including: • caravan park at Seawick • Clacton-on-Sea and Frinton-on-Sea golf clubs • St Osyth beach • Holland Haven country park • piers at Clacton-on-Sea and Walton-on-the-Naze
Impact on public services	Public services affected: • coastguard look-out station at Clacton-on-Sea and Walton-on-the-Naze • RNLI stations at Clacton-on-Sea and Walton-on-the-Naze
Impact on communities	Number and size of communities (individual dwellings, hamlets, settlements): • towns of Walton-on-the-Naze, Frinton-on-Sea and Clacton-on-Sea • smaller communities of Seawick and Jaywick
To harness the social and economic values of the Essex and South Suffolk coast to wider society	
Impact on socio-economic features of regional, national or international significance	Impact as a percentage of regional / national / international availability: • St Osyth beach

Principle / criterion	Indicator
To support conservation and enhancement of biodiversity and geodiversity	
Impact on the achievement of management objectives for designated habitats and species, keeping them in favourable condition (including no significant loss of extent or populations)	For each of the designations (Colne Estuary Ramsar site, SPA and SSSI): • Area of designated land lost/gained for each epoch and scenario • Changes in condition of designated land for each epoch and scenario
Impact on the achievement of national and local Biodiversity Action Plan (BAP) targets, both within designated sites and within the wider coastal countryside	• Area of BAP habitats per epoch and scenario (BAP habitats present are maritime cliffs and slopes, mudflats, coastal and flood plain grazing marsh, reed beds, lowland heathland and lowland acid dry grassland)
Impact on the achievement of management objectives for designated geological sites, keeping them in favourable condition	For each of the geological designations (Clacton Cliffs and Foreshore SSSI and Holland-on-Sea Cliffs SSSI): • Area of designated land lost/gained for each epoch and scenario • Changes in condition of designated land for each epoch and scenario
To contribute to maintaining and enhancing the evolving character of the coastal landscape	
Impact on the character of the coastal landscape, including consideration of geological, geomorphological, historic environment and cultural features, and the role of settlements in the landscape	Qualitative judgement

Principle / criterion	Indicator
To support protection and promotion of the historic environment and its value for the heritage, culture and economy of the area	
Impact on historic environment and its wider value	Impact on designated heritage assets: • five scheduled monuments • no grade I and II* listed buildings • four grade II listed buildings. • two conservation areas. • no protected wreck sites, registered battlefields, registered parks and gardens. • 2 areas of historic grazing marsh. • presence of significant historic assets, quality of preservation, archaeological potential, historic landscape and expected scale of mitigation were also considered
To support and enhance people's enjoyment of the coast by maintaining and enhancing access	
Impact on access to the coast	Type and number of roads and paths affected: • footpaths to and along shoreline • tracks across St Osyth Marsh • three car parks in tidal flood zone

Summary of PDZs and options

The analysis of the coastal policy context has led to the following list of PDZs and options for this management unit.

PDZ	Options	Appraisal needed?
C1 (Walton-on-the-Naze and Frinton-on-Sea)	HtL	No
C2 (Holland Haven)	HtL or MR2	Yes
C3 (Clacton-on-Sea)	HtL	No
C4 (Seawick, Jaywick and St Osyth Marsh)	HtL – MR2	No (see policy statement in section 4.4 of main SMP)

MR1	Allow local and limited intervention to limit the risks, as long as negative impacts are minimised
MR2	Breach of the frontline defence after building a new landward defence line

E4.6.2 PDZ C2: Holland-on-Sea

Description of the options

With MR the current line would be realigned over the Holland Haven country park and the golf course. Around 640 metres of new defences would be required to protect properties in Frinton and 1.6 kilometres to protect the B1032 road, the pumping station and properties in Holland-on-Sea. With HtL the current line of defence will be held.

Comparison

The situation is complex and sensitive. MR would lead to creation of 190 hectares of intertidal habitats at the expense of coastal vegetated shingle, about 55 hectares of designated coastal grazing marsh and grade 4 agricultural land, plus a potential negative impact on the Holland Haven Country Park and the Frinton-on-Sea Golf Course. The MR option would also allow the release of some sediment down-drift, which may improve the beach level of the beaches in Clacton-on-Sea. The new defence lines constructed would be under less pressure than the existing alignment as the intertidal area would act as a buffer for the north-easterly wave action. Realignment of tracks and footpaths would be required which may also create opportunities for improvement. In addition, MR would have a moderate to high adverse effect on the historic environment, affecting the historic landscape in an area with very high archaeological potential. HtL would sustain the recreational activities in Holland country park and the golf course. This could be counter-balanced by opportunities for new water-based recreational activities within the new wetland area. The sluice has recently been upgraded and MR will therefore be a possible option for epoch 3.

Recommended option

The draft policy for this frontage was Managed realignment in the long term as described above. However, following public consultation the partner organisations decided to change this to a dual policy of either Hold the line or Managed realignment, to be confirmed in future SMP reviews.

The SMP's intent of management for Holland-on-Sea is to support a long term sustainable solution and adaptation. The current line will be held in the short and medium term. Whether the policy in Epoch 3 is Hold the line or Managed realignment, all dwellings and infrastructure will remain protected, which will require moving some of the defences to a more sustainable sheltered position but this would need to be explored more fully in the future with full community consultation before finalising a policy option. The importance of protecting Holland Sewerage Treatment Works was recognised by the Elected Members Forum and this was seen as a priority for protection for the next 100 years.

E4.7 Management Unit D: Colne estuary

E4.7.1 Characterisation and summary of options

Characterisation

The Colne estuary system is confined by geology and/or flood defences which limit the landward development of intertidal areas. The hydrodynamic pressures (tidal flows and waves) and erosion are particularly prominent at the mid-section of the estuary where the channel is widening. Hence the defences are under pressure. There is erosion throughout the main sections of the River Colne, Brightlingsea creek and Pyefleet Channel and accretion at the inner sections, including Geedon creek.

Most of the land within the 1 in 1000 year flood zone lies within the river flood plain and agricultural areas. There are the communities of Point Clear, Brightlingsea, Thorrington, Wivenhoe and Rowhedge. The Wick Marsh - Langenhoe Marsh - Fingringhoe Marsh area has military importance as a Ministry of Defence firing range and is also within the flood risk zone. At Point Clear, a large caravan site lies within the 1 in 1000 year flood zone as well as another Martello tower, an associated battery and a museum. The camping and caravan site at Brightlingsea also provides amenity and tourist value.

The Colne Estuary Ramsar site, SAC, SPA, SSSI and NNR is of international importance for wintering Brent geese and black-tailed godwit and of national importance for breeding little terns and five other species of wintering waders and wildfowl. The variety of habitats which include mudflat, saltmarsh, grazing marsh, sand and shingle spits, disused gravel pits and reedbeds, support outstanding assemblages of invertebrates and plants. Recently, saltmarsh erosion has accelerated reflecting the ebb tidal dominance within the estuary. The Colne barrier is important for regulating tidal exchange and upstream issues.

The historic landscape of this unit is characterised by areas of important historic reclaimed coastal grazing marsh, such as Howlands Marsh. Relict and existing sea walls are a dominant feature of the area, as is The Strood causeway which links Mersea Island to the main land and is of Saxon origin. Other earthworks relate to the medieval and post-medieval exploitation of the marshes, including raised trackways and enclosures. The unit is also characterised by post-medieval oyster beds, industrial and transport structures such as timber jetties, hulks and the dismantled railway from Wivenhoe to Arlesford quarry. Earlier archaeological remains include finds of flint artefacts retrieved from possible habitation sites along the foreshore, indicating the possibility that well-preserved land surfaces may be present in places. The potential for palaeo-environmental remains and deposits in the unit is high and there are significant possibilities of archaeological remains directly related to these deposits including timber structures. A large number of red hills (salt-making sites) survive, with notable concentrations along the Strood Channel.

Criteria and indicators to appraise against options

Principle / criterion	Indicator
To develop policies appropriate to the diverse character of the Essex and South Suffolk coast and its dynamic interaction of land and sea	
Impact of policy package on the diverse character of the Essex and South Suffolk coast	Qualitative judgement
Impact of policy package on dynamic interaction of land and sea	Qualitative judgement
To balance flood and erosion management with the assets and benefits that it protects	
Level of flood and erosion risk to people and properties	Number of properties in the tidal flood zone compared to the current number (about 4,520 in epoch 1, 5,100 in epoch 2 and 5,860 in epoch 3)
Impact on future opportunities	Judgement based on input about future opportunities
This principle has also been tested by the check of economic viability (see Appendix H) as part of appraisal, so there is no need for explicit criteria.	
To seek opportunities for managing the shoreline through natural coastal processes and take full account of longshore and cross-shore impacts	
Use of natural processes (saltmarsh, longshore interaction)	Qualitative judgement
Longshore impact on neighbouring frontages	Qualitative judgement: • impact on the Tendring peninsula • impact on Mersea Island • impact on the Blackwater estuary
Cross-shore impact on near shore activities	Qualitative judgement
To develop policies that are resilient against future changes and associated uncertainty	
Tested by the sensitivity check (task 3.4) as part of appraisal, so there is no need for explicit criteria.	
To provide time and information for communities, individuals and partner organisations to adapt to any anticipated coastal change	
Adequacy of time available for communities, individuals and partner organisations to adapt	Time (in epochs) available for each required process of adaptation, depending on the policy option

Principle / criterion	Indicator
To support communities and sustainable development for the people living around the Essex shoreline by managing the risk to community activities and infrastructure	
Impact on infrastructure	• Type and length of roads, railways and services affected • Type and number of utilities affected • Railway line at Wivenhoe
Impact on socio-economic activities	• Impact on grade 2, 3, 4 and 5 agricultural land. Impact on tourism and recreation assets including: • Wivenhoe quay, Brightlingsea Moorings, Rowhedge quay • campsites and caravan parks at Point Clear and Brightlingsea • museum at Stone Point
Impact on public services	Public services affected • rail services to Clacton-on-Sea and Walton-on-the-Naze
Impact on communities	Number and size of communities (individual dwellings, hamlets, settlements): • Point Clear, Brightlingsea, Thorrington, Wivenhoe and Rowhedge
To harness the social and economic values of the Essex and South Suffolk coast to wider society	
Impact on socio-economic features of regional, national or international significance	No specific features

Principle / criterion	Indicator
To support conservation and enhancement of biodiversity and geodiversity	
Impact on the achievement of management objectives for designated habitats and species, keeping them in favourable condition (including no significant loss of extent or populations)	For each of the designations (Colne Estuary Ramsar site, SPA and SSSI): • area of designated land lost/gained for each epoch and scenario • changes in condition of designated land for each epoch and scenario
Impact on the achievement of national and local Biodiversity Action Plan (BAP) targets, both within designated sites and within the wider coastal countryside	• Area of BAP habitats for each epoch and scenario (BAP habitats present are mudflats, coastal and flood plain grazing marsh, reed beds, lowland mixed deciduous forest, lowland heathland and lowland acid dry grassland)
Impact on the achievement of management objectives for designated geological sites, keeping them in favourable condition	For each of the geological designations (Colne Estuary SSSI): • area of designated land lost/gained for each epoch and scenario • changes in condition of designated land for each epoch and scenario
To contribute to maintaining and enhancing the evolving character of the coastal landscape	
Impact on the character of the coastal landscape, including consideration of geological, geomorphological, historic environment and cultural features, and the role of settlements in the landscape	Qualitative judgement

Principle / criterion	Indicator
To support protection and promotion of the historic environment and its value for the heritage, culture and economy of the area	
Impact on historic environment and its wider value	Impact on designated heritage assets: • one scheduled monument • two grade I and II* listed buildings • 77 grade II listed buildings • four conservation areas • one registered park and garden • no protected wreck sites or registered battlefields • 4 areas of historic grazing marsh. • presence of significant historic assets, quality of preservation, archaeological potential, historic landscape and expected scale of mitigation were also considered
To support and enhance people's enjoyment of the coast by maintaining and enhancing access	
Impact on access to the coast	Type and number of roads and paths affected: • footpaths to and along estuary shoreline • tracks to estuary shoreline • two car parks in tidal flood zone

Summary of PDZs and options

The analysis of the coastal policy context has led to the following list of PDZs and options for this management unit.

PDZ	Options	Appraisal needed?
D1(Point Clear to St Osyth Creek)	HtL or MR2	Yes
D2 (Along the southern bank of Flag Creek)	HtL or MR2	Yes
D3 (Flag Creek to northern bank to Brightlingsea)	HtL or MR2	Yes
D4 (Brightlingsea)	HtL	No
D5 (Westmarsh Point to where the frontage meets the B1029)	HtL or MR2	No

PDZ	Options	Appraisal needed?
D6a (South of Wivenhoe)	HtL	No
D6b (B1029 to Wivenhoe)	HtL & MR2	Yes
D7 (Colne barrier)	HtL	No
D8a (Inner Colne west bank)	HtL & MR2	Yes
D8b (Fingringhoe and Langenhoe)	HtL	No
D8c (Langenhoehall Marsh)	HtL	No

MR1 Allow local and limited intervention to limit the risks, as long as negative impacts are minimised

MR2 Breach of the frontline defence after building a new landward defence line

E4.7.2 PDZ D1b: Point Clear to St Osyth Creek

Description of the options

MR will mean building one kilometre of new defences to the west and east of the realignment area for flood protection of the caravan park, dwellings at Point Clear and roads.

Comparison

MR allows the creation of 34 hectares of intertidal habitats at the expense of the golf course and grade 3 agricultural land. MR would relieve the pressure on defences along Brightlingsea Creek and the new defence alignment would be under less pressure than the existing alignment. Realignment of footpaths would be required which would have a limited adverse effect on the historic environment.

Recommended option

The policy for this frontage is for Managed realignment in a phased approach as described above.

E4.7.3 PDZ D2: Along the southern bank of Flag Creek

Description of the options

MR will require the building of about 900 metres of new defences to the south and north of the realignment area to protect dwellings and roads including the B1027. Under HtL the defences will be remain where they are now.

Comparison

MR allows the creation of about 75 hectares intertidal habitats in the expense of 60 hectares of designated freshwater habitats and grade 4 agricultural land. MR would relieve the pressure on defences along Brightlingsea Creek and the new defence alignment would be under less pressure than the

existing alignment. Realignment of footpaths would be required which may also create opportunities for improvement. In addition, MR would have high adverse effect on many aspects of the historic environment due to the rich historic landscape in this area. There will be a need for mitigation by design and recording as part of implementation of the Plan, which could take significant time and may influence the timing and even the feasibility of a realignment. The effect of MR on oyster fisheries is difficult to quantify as realignments can affect local shellfisheries in terms of increased flows but can also provide new oyster-laying areas and food sources for existing shellfisheries as in the case of Abbott's Hall in the Blackwater. Further modelling at scheme level would be undertaken to manage effects and maximise opportunities.

Recommended option

The policy for this frontage is for Managed realignment as described above. However, it is acknowledged that the negative effect on the historic grazing marsh is difficult to mitigate. This should influence the timing of this realignment, and it could mean that the policy reverts to Hold the line in future reviews of the SMP.

E4.7.4 PDZ D3: Flag Creek to northern bank to Brightlingsea

Description of the options

Under MR the new realignment would require about 200 metres of defence line for flood protection of dwellings and roads including the B1029. With HtL the defences will remain where they are now.

Comparison

MR would lead to the creation of 70 hectares of intertidal habitat with no loss of designated freshwater habitats. However, there would be loss of grade 3 and grade 4 agricultural land. MR would relieve the pressure on defences along Brightlingsea Creek and Flag Creek and the new defence alignment would be under less pressure than the existing alignment. In addition, MR would have a high adverse effect on the historic environment of the area. There are tracts of historic landscape with associated high archaeological potential. Under HtL all agricultural land would remain protected. The effect of MR on oyster fisheries is difficult to quantify as realignments can affect local shellfisheries in terms of increased flows but can also provide new oyster-laying areas and food sources for existing shellfisheries as in the case of Abbott's Hall in the Blackwater. Further modelling at scheme level would be undertaken to manage impacts and maximise opportunities.

Recommended option

The policy for this frontage is for Managed realignment as described above.

E4.7.5 PDZ D5: Westmarsh Point to where the frontage meets the B1029

Description of the options

Under HTL the current line of defence will remain. With MR new defences will be needed at Thicks Wood (180 metres) and the current Brightlingsea counter wall. The new defences would be required to keep protecting Brightlingsea, isolated dwellings and roads including the B1029. With HtL the defences will be remain where they are now.

Comparison

With MR about 125 hectares of intertidal habitats would be created at expense of grade 3 agricultural land and 20 hectares of designated freshwater grazing marsh landwards of the defences at Alresford Creek. In addition, realignment would relieve the pressure on defences and allow the widening of the River Colne at the mid-section. Realignment of footpaths would be required which may also create opportunities for improvement. In addition, MR would have a high adverse effect on the historic environment, due to archaeological potential and the expected scale of mitigation. Under HtL all agricultural land and present day footpaths would remain protected.

Recommended option

The policy for this frontage is for Managed realignment as described above.

E4.7.6 PDZ D6b: B1029 to Wivenhoe

Description of the options

Under HTL the current line of defence will remain. With MR 700 metres of new defences will be needed to protect the railway line, the properties near the Colne barrier, properties near the Alresford Creek bank and associated road and the B1027. With HtL the defences will remain where they are now. Under NAI the defences are likely to fail in epoch 2. Although the railway is not expected to flood, its embankment will suffer increased pressure as it becomes more exposed. In later epochs with sea level rise properties near the Alresford Creek bank and the B1027 road may be affected.

Comparison

With both MR and NAI about 40 of intertidal habitats would be created at the expense of grade 2 agricultural land. In addition, both MR and NAI are likely to reduce the ongoing erosion southwards of the Colne barrier. With MR, these processes would take place in a managed way, but the costs would be higher. Realignment of footpaths would be required which may also create opportunities for improvement. MR and NAI would have an adverse effect on the historic environment as there is well-preserved grazing marsh and high archaeological potential. Under HtL all agricultural land and present day footpaths would remain protected, but this is unlikely to be economically viable.

Recommended option

The policy for this frontage is for Managed realignment as described above.

E4.7.7 PDZ D8a: Inner Colne west bank

Description of the options
Under HtL the current line of defence will remain. With MR, 30 metres of new defences will be needed to protect the Fingringhoe quay. Under NAI the defences are likely to fail in epoch 2 and allow flooding of the areas behind the defences (no properties are expected to flood).

Comparison
With both MR and NAI about 30 hectares of intertidal habitats would be created at the expense of the currently operational quarry and grade 3 agricultural land. Both MR and NAI are likely to reduce the ongoing erosion southwards of the Colne barrier. With MR, these processes would take place in a managed way, but the costs would be higher. Realignment of footpaths would be required which may also create opportunities for improvement. MR and NAI would have a moderate adverse effect on the historic environment, due largely to the archaeological potential of the area. Under HtL all agricultural land and present day footpaths would remain protected, but this is unlikely to be economically viable beyond the functional lifetime of the quarry.

Recommended option
The policy for this frontage is for Managed realignment (breach of defences) followed by NAI, as described above. A more thorough assessment of the long term economic value of the quarry will need to be completed before the next review of the SMP to help confirm the most viable shoreline policy option for PDZ D8a.

E4.8 Management Unit E: Mersea Island

E4.8.1 Characterisation and summary of options

Characterisation
The Colne estuary system is confined by geology and/or flood defences which limit the landward development of intertidal areas. The hydrodynamic pressures (tidal flows and waves) and erosion are particularly prominent mid-section of the estuary where the channel is widening so the defences are under pressure. There is erosion throughout the main sections of the River Colne, Brightlingsea Creek and Pyefleet Channel and accretion at the inner sections, including Geedon creek.

This frontage covers Mersea Island. Most of the properties are outside the flood risk zone but there are several camping and caravan sites that are at risk. The landward side of the island is comprised of drained agricultural land behind the flood defences with a small area of saltmarsh. The area is particularly important for its shellfisheries.

Two areas of foreshore at East Mersea are of geological importance. Cudmore Grove country park and Mersea Stone Local Nature Reserve have local conservation and recreational value.

The beach at Cudmore Grove, East Mersea, overlies a peaty deposit containing the faunal remains of species dating to 300,000 before present. Flint artefact finds retrieved from possible habitation sites along the foreshore suggest that prehistoric land surfaces may survive in places. A number of red hills (salt-making sites) have been identified along the north side of the island. The Strood causeway linking Mersea to the mainland has been dated to the 7th century. Two massive timber fish-traps of Anglo-Saxon date have been recorded in the intertidal zone off West Mersea flats. Military defences include the Tudor blockhouse at East Mersea and World War two defensive structures such as pillboxes located along the sea walls.

Criteria and indicators to appraise against options

Principle / criterion	**Indicator**
To develop policies appropriate to the diverse character of the Essex and South Suffolk coast and its dynamic interaction of land and sea	
Impact of policy package on the diverse character of the Essex and South Suffolk coast	Qualitative judgement
Impact of policy package on dynamic interaction of land and sea	Qualitative judgement
To balance flood and erosion management with the assets and benefits that it protects	
Level of flood and erosion risk to people and property.	Number of properties in the tidal flood zone compared to the current number (about 90 in epoch 1, 120 in epoch 2 and 300 in epoch 3)
Impact on future opportunities	Judgement based on input about future opportunities
This principle has also been tested by the check of economic viability (see Appendix H) as part of appraisal, so there is no need for explicit criteria.	
To seek opportunities for managing the shoreline through natural coastal processes and take full account of longshore and cross-shore impacts	
Use of natural processes (saltmarsh, longshore interaction)	Qualitative judgement
Longshore impact on neighbouring frontages	Qualitative judgement
Cross-shore impact on near shore activities	Qualitative judgement

Principle / criterion	Indicator
To develop policies that are resilient against future changes and associated uncertainty	
Tested by the sensitivity check (task 3.4) as part of appraisal, so there is no need for explicit criteria	
To provide time and information for communities, individuals and partner organisations to adapt to any anticipated coastal change	
Adequacy of time available for communities, individuals and partner organisations to adapt	Time (in epochs) available for each required process of adaptation, depending on the policy option
To support communities and sustainable development for the people living around the Essex shoreline by managing the risk to community activities and infrastructure	
Impact on infrastructure	• Type and length of roads and services affected • No utilities affected
Impact on socio-economic activities	• Impact on grade 2, 3, 4 and 5 agricultural land Impact on tourism and recreation assets including: • caravan parks and campsites • Cudmore Grove country park • Mersea Stone nature reserve
Impact on public services	Public services affected: • RNLI station at West Mersea
Impact on communities	Number and size of communities (individual dwellings, hamlets, settlements): • West Mersea and East Mersea
To harness the social and economic values of the Essex and South Suffolk coast to wider society	
Impact on socio-economic features of regional, national or international significance	No specific features
To support conservation and enhancement of biodiversity and geodiversity	
Impact on the achievement of management objectives for designated habitats and species, keeping them in favourable condition (including no significant loss of extent or populations)	For each of the designations (Colne Estuary Ramsar site, SPA and SSSI and Blackwater Estuary Ramsar site, SPA, SSSI and NNR): • area of designated land lost/gained for each epoch and scenario • changes in condition of

Principle / criterion	Indicator
	designated land for each epoch and scenario. Area of designated land lost/gained.
Impact on the achievement of national and local Biodiversity Action Plan (BAP) targets, both within designated sites and within the wider coastal countryside	• Area of BAP habitats for each epoch and scenario (BAP habitats present are mudflats, coastal and flood plain grazing marsh and reed beds)
Impact on the achievement of management objectives for designated geological sites, keeping them in favourable condition	For each of the designations (Colne Estuary SSSI and Blackwater Estuary SSSI): • area of designated land lost/gained for each epoch and scenario • changes in condition of designated land for each epoch and scenario. Area of designated land lost/gained
To contribute to maintaining and enhancing the evolving character of the coastal landscape	
Impact on the character of the coastal landscape, including consideration of geological, geomorphological, historic environment and cultural features, and the role of settlements in the landscape	Qualitative judgement
To support protection and promotion of the historic environment and its value for the heritage, culture and economy of the area	
Impact on historic environment and its wider value	Impact on designated heritage assets: • four scheduled monuments • no grade I and II* listed buildings • 68 grade II listed buildings • one conservation area • no protected wreck sites, registered battlefields, registered parks and gardens

Principle / criterion	Indicator
To support and enhance people's enjoyment of the coast by maintaining and enhancing access	
Impact on access to the coast	Type and number of roads and paths affected • footpaths to and along shoreline of Mersea Island • tracks to shoreline of Mersea Island • five car parks in tidal flood zone. • 1 area of historic grazing marsh. • presence of significant historic assets, quality of preservation, archaeological potential, historic landscape and expected scale of mitigation were also considered

Summary of PDZs and options

The analysis of the coastal policy context has led to the following list of PDZs and options for this management unit.

PDZ	Options	Appraisal needed?
E1 (Landward frontage)	HtL	No
E2 (Seaward frontage between North Barn and West Mersea)	HtL or MR2	Yes
E3 (West Mersea)	HtL	No
E4a (North Mersea (Strood Channel))	HtL or MR2	Yes
E4b (Pyefleet Inner Channel)	HtL	No

MR1	Allow local and limited intervention to limit the risks, as long as negative impacts are minimised
MR2	Breach of the frontline defence after building a new landward defence line

E4.8.2 PDZ E2: Seaward frontage between North Barn and West Mersea

Description of the options

Under HTL the current line of defence will remain. With MR there would be construction of about 800 metres of new defences to the east and west of the realignment area for protection roads, sewage works, dwellings and properties in West Mersea. The currently undefended sections will remain undefended.

Comparison

MR would convert 30 hectares of undesignated freshwater grazing marsh into intertidal habitat with a net gain of 10 hectares of habitat. Grade 3 agricultural land would also be lost. Realignment would relieve the pressure on defences caused by the north easterly waves and the new defence alignment would be under less pressure than the existing alignment. Realignment of footpaths would be required which may also create opportunities for improvement. In addition, MR would have moderate adverse effect on the historic environment. Under HtL the current defence alignment would be maintained and protect agricultural land, present day footpaths and historic environment.

Recommended option

The policy for this frontage is for Managed realignment as described above.

E4.8.3 PDZ E4a: North Mersea (Strood Channel)

Description of the options

Under MR the new realignment would require about 230 metres of defences for flood protection of the B1025 and properties in West Mersea. With HtL the defences will remain where they are now.

Comparison

MR would lead to the creation of 45 hectares of intertidal habitat at the expense of 10 hectares of undesignated freshwater grazing marsh and grade 4 agricultural land. MR would relieve the pressure on defences along the Strood Channel and the new defence alignment would be under less pressure than the existing alignment. Realignment of footpaths would be required which may also create opportunities for improvement. In addition, MR would have moderate adverse effect on the historic environment of the area. The effect of MR on oyster fisheries is difficult to quantify as realignments can affect local shellfisheries in terms of increased flows but can also provide new oyster-laying areas and food sources for existing shellfisheries as in the case of Abbott's Hall in the Blackwater. Further modelling at scheme level would be undertaken to manage negative effects and maximise positive effects. Under HtL the current defence alignment would be maintained to protect agricultural land, present day footpaths and historic environment.

Recommended option

The policy for this frontage is for Managed realignment as described above.

E4.9 Management Unit F: Blackwater estuary

E4.9.1 Characterisation and summary of options

Characterisation

The mouth of estuary is under significant pressure from north-easterly waves and estuary processes. Effectively, the estuary at this section is trying to widen. The widening of the estuary is constrained by the flood defences. The north bank is the section of the estuary most affected by waves while at the mid-estuary the south bank is pressurised by estuary processes. Overall there is erosion of saltmarsh at the outer and mid-sections of the estuary and siltation at inner creeks and inner estuary. Jet ski and boat wash may encourage further erosion. At some locations overtopping is an issue. Foreshore recharge to prevent overtopping has taken place in the past at the seaward face of the Old Marshes. At Mundon Creek and Mayland Creek there is hydrodynamic pressure on the defences due to widening of meanders.

This unit covers the low-lying land surrounding the Blackwater estuary extending inland to Maldon. The area within the 1 in 1000 year tidal flood zone is for the most part agricultural land with scattered farm buildings. There are, however, several settlements within this zone: St Lawrence, Mayland, Maylandsea, parts of Maldon and Goldhanger. Sections of several B-roads along with numerous minor roads are also in the tidal flood zone. The campsites at St Lawrence, Mayland Creek and Vaulty Manor provide amenity value. There are several marinas in the estuary that have recreational, amenity and economic value. The site of the Battle of Maldon and National Trust Property is a valuable tourist attraction.

Blackwater Estuary NNR and SSSI is the largest estuary in Essex north of the Thames and is one of the largest estuarine complexes in East Anglia. The mudflats are fringed by saltmarsh on the upper shores and support internationally and nationally important numbers of over wintering waterfowl. Shingle and shell banks and offshore islands are also a feature of the tidal flats. The surrounding terrestrial habitats - the sea wall, ancient grazing marsh and its associated fleet and ditch systems, plus semi-improved grassland - are also of high conservation interest. This rich mosaic of habitats supports an outstanding assemblage of nationally scarce plants and a nationally important assemblage of rare invertebrates.

Northey Island Nature Reserve (National Trust), Ray Island Nature Reserve (National Trust) and several other local nature reserves further highlight the conservation value of much of the tidal flood zone.

The area includes extensive settled neolithic land surface preserved within the intertidal zone. There are also many large timber fish weirs of Saxon date. There are numerous red hills (salt-making sites) and duck-decoy ponds on the present and former marshes and the estuary is fringed by extensive

crop mark landscapes dating to the prehistoric and Roman periods. A range of archaeological deposits and features, including prehistoric relict land surfaces, peats and 'submerged forests' survive well within and beneath the alluvium and in the intertidal zone There are also numerous red hills, relict sea walls, oyster pits, timber structures and military remains. The existing grazing marshes are complex and significant historic landscapes. There are important areas of surviving historic grazing marsh as at Blue House and Morris Farms. In view of its complex and important historic environment, the upper Crouch estuary has been included on the English Heritage list of nationally-significant wetland sites as part of the Heritage Management of England's Wetlands initiative.

Criteria and indicators to appraise against options

Principle / criterion	**Indicator**
To develop policies appropriate to the diverse character of the Essex and South Suffolk coast and its dynamic interaction of land and sea	
Impact of policy package on the diverse character of the Essex and South Suffolk coast	Qualitative judgement
Impact of policy package on dynamic interaction of land and sea	Qualitative judgement
To balance flood and erosion management with the assets and benefits that it protects	
Level of flood and erosion risk to people and property.	Number of properties in the tidal flood zone compared to the current number (about 3,110 in epoch 1, 3,500 in epoch 2 and 4,430 in epoch 3)
Impact on future opportunities	Judgement based on input about future opportunities
This principle has also been tested by the check of economic viability (see Appendix H) as part of appraisal, so there is no need for explicit criteria.	
To seek opportunities for managing the shoreline through natural coastal processes and take full account of longshore and cross-shore impacts	
Use of natural processes (saltmarsh, longshore interaction)	Qualitative judgement
Longshore impact on neighbouring frontages	Qualitative judgement
Cross-shore impact on near shore activities	Qualitative judgement

Principle / criterion	Indicator
To develop policies that are resilient against future changes and associated uncertainty	
Tested by the sensitivity check (task 3.4) as part of appraisal, so there is no need for explicit criteria.	
To provide time and information for communities, individuals and partner organisations to adapt to any anticipated coastal change	
Adequacy of time available for communities, individuals and partner organisations to adapt	Time (in epochs) available for each required process of adaptation, depending on the policy option
To support communities and sustainable development for the people living around the Essex and South Suffolk shoreline by managing the risk to community activities and infrastructure	
Impact on infrastructure	Type and length of roads, railways and services affected Impact on utilities including: • electricity transmission lines at Bradwell Marshes • Maldon sewage treatment works • Bradwell nuclear power station
Impact on socio-economic activities	• Impact on grade 2, 3, 4 and 5 agricultural land Impact on tourism and recreation assets including: • campsites and caravan parks at St Lawrence, Mayland Creek and Vaulty Manor • marinas at Bradwell Waterside, Maylandsea and Tollesbury • museum at Maldon
Impact on public services	• Provision of electricity
Impact on communities	Number and size of communities (individual dwellings, hamlets, settlements): • St Lawrence, Mayland, Maylandsea, Tollesbury, Ramsey Island, Maldon and Goldhanger
To harness the social and economic values of the Essex and South Suffolk coast to wider society	
Impact on socio-economic features of regional, national or international significance	No specific features

Principle / criterion	Indicator
To support conservation and enhancement of biodiversity and geodiversity	
Impact on the achievement of management objectives for designated habitats and species, keeping them in favourable condition (including no significant loss of extent or populations)	For each of the designations (Blackwater Estuary Ramsar site, SPA, SSSI and NNR and Dengie Ramsar site, SPA, SSSI and NNR): • area of designated land lost/gained for each epoch and scenario • changes in condition of designated land for each epoch and scenario. Area of designated land lost/gained
Impact on the achievement of national and local Biodiversity Action Plan (BAP) targets, both within designated sites and within the wider coastal countryside	• Area of BAP habitats for each epoch and scenario (BAP habitats present are mudflats, coastal and flood plain grazing marsh, reed beds, and purple moorgrass and rush pasture)
Impact on the achievement of management objectives for designated geological sites, keeping them in favourable condition	For each of the designations (Blackwater Estuary SSSI and Dengie SSSI): • area of designated land lost/gained for each epoch and scenario • changes in condition of designated land for each epoch and scenario. Area of designated land lost/gained
To contribute to maintaining and enhancing the evolving character of the coastal landscape	
Impact on the character of the coastal landscape, including consideration of geological, geomorphological, historic environment and cultural features, and the role of settlements in the landscape	Qualitative judgement

Principle / criterion	Indicator
To support protection and promotion of the historic environment and its value for the heritage, culture and economy of the area	
Impact on historic environment and its wider value	Impact on designated heritage assets: • six scheduled monuments • four grade I and II* listed buildings • 99 grade II listed buildings • three conservation areas • one registered battlefield • no protected wreck sites or registered parks and gardens • 3 areas of historic grazing marsh • presence of significant historic assets, quality of preservation, archaeological potential, historic landscape and expected scale of mitigation were also considered
To support and enhance people's enjoyment of the coast by maintaining and enhancing access	
Impact on access to the coast	Type and number of roads and paths affected • footpaths to and along estuary shoreline • tracks to estuary shoreline • three car parks in tidal flood zone

Summary of PDZs and options

The analysis of the coastal policy context has led to the following list of PDZs and options for this management unit.

PDZ	Options	Appraisal needed?
F1 (Strood to Salcott-cum-Virley)	HtL	No
F2 (Salcott Creek)	HtL	No
F3 (South bank of the Salcott Channel to Tollesbury Fleet)	HtL or MR2	Yes
F4 (Tollesbury)	HtL	No
F5 (Tollesbury Wick Marshes to Goldhanger)	HtL or MR2	Yes
F6 (Goldhanger to Heybridge)	HtL	No
F7 (Heybridge Basin)	HtL	No

PDZ	Options	Appraisal needed?
F8 (Maldon Inner estuary)	HtL	No
F9a (South Maldon)	HtL	No
F9b (Northey Island)	HtL	No
F10 (Maylandsea)	HtL	No
F11a (Mayland Creek west)	HtL	No
F11b (Mayland Creek)	NAI	No
F11c (Mayland Creek wast)	HtL	No
F12 (Steeple)	HtL or MR2	Yes
F13 (St. Lawrence)	HtL	No
F14 (St. Lawrenceto Bradwell-on-Sea)	HtL or MR2	Yes
F15 (Bradwell Creek)	HtL	No

MR1	Allow local and limited intervention to limit the risks, as long as negative impacts are minimised
MR2	Breach of the frontline defence after building a new landward defence line

E4.9.2 PDZ F3: South bank of the Salcott Channel to Tollesbury Fleet

Description of the options

Under HtL the current line of defence will remain. With MR there would be construction of about 950 metres of new defences for protection of the properties at Salcott, the B1026 and other roads, sewage works and isolated dwellings.

Comparison

MR would convert 390 hectares of designated freshwater habitat in Old Hall Marshes into intertidal habitat. The majority of agricultural land lost would be grade 4 and realignment of footpaths would be required which may also create opportunities for improvement. Realignment would relieve the pressure on defences caused by the north-easterly waves and tidal flows along the Salcott Channel and the Tollesbury network of creeks. The new defence alignment would be under less pressure than the existing alignment. The effect of MR on oyster fisheries is difficult to quantify, as realignments can affect local shellfisheries in terms of increased flows but can also provide new oyster-laying areas and food sources for existing shellfisheries as in the case of Abbott's Hall in the Blackwater. Further modelling at scheme level would be undertaken to manage negative effects and maximise positive effects. In addition, MR would have a particularly high adverse effect on the historic environment, which includes two decoy ponds (both scheduled monuments), a rich historic landscape and high archaeological potential. There will be a need for mitigation by design and recording as part of implementation of the Plan, which could take significant time and may

influence the timing and even the feasibility of a realignment. Under HtL the current defence alignment would be maintained and protect the designated freshwater habitats, agricultural land and present day alignment of footpaths.

Recommended option
The policy for this frontage is for Managed realignment as described above. However, it is acknowledged that the negative effect on the historic grazing marsh is difficult to mitigate. This should influence the timing of this realignment, and it could mean that the policy reverts to Hold the line in future reviews of the SMP.

E4.9.3 PDZ F5: Tollesbury Wick Marshes to Goldhanger

Description of the options
MR of the Tollesbury Wick Marshes area (at the eastern extent of this PDZ) would require about 860 metres of new defences for flood protection of the properties at Salcott, the B1026 and other roads, sewage works and isolated dwellings. With HtL the defences will remain where they are now.

Comparison
MR would convert 200 hectares of designated freshwater habitat in Tollesbury Wick Marshes into intertidal habitat. There would also be loss of grade 3 and grade 4 agricultural land and various footpaths would need to be realigned which may also create opportunities for improvement. The new defence alignment would be under less pressure from the north-easterly waves than the existing alignment. In addition, MR would have a particularly high adverse effect on the historic environment, which comprises a rich historic landscape with associated high archaeological potential. There will be a need for mitigation by design and recording as part of implementation of the Plan, which could take significant time and may influence the timing and even the feasibility of a realignment. Under HtL the current defence alignment would be maintained and continue to protect the designated freshwater habitats, agricultural land and present day alignment of footpaths.

Recommended option
The policy for this frontage is for Managed realignment as described above. However, it is acknowledged that the negative effect on the historic grazing marsh is difficult to mitigate. This should influence the timing of this realignment, and it could mean that the policy reverts to Hold the line in future reviews of the SMP.

E4.9.4 PDZ F12: Steeple

Description of the options
MR would require 220 metres of new defences for flood protection of the properties at Steeple and Ramsey Island, sewage works, roads and isolated dwellings. With HtL the defences will remain where they are now.

Comparison
MR would lead to the creation of 160 hectares of intertidal habitat at the expense of 40 hectares of undesignated freshwater grazing marsh and grade 3 agricultural land. MR would relieve the pressure on defences and the new defence alignment would be under less pressure than the existing alignment. Realignment of footpaths would be required which may also create opportunities for improvement. In addition, MR would have a moderate adverse effect on the historic environment, due largely to the archaeological potential of the area. HtL would keep protecting the agricultural land and present day alignment of footpaths.

Recommended option
The policy for this frontage is for Managed realignment as described above.

E4.9.5 PDZ F14: St. Lawrence to Bradwell-on-Sea

Description of the options
MR would require about 400 metres of new defence line for flood protection of the properties at Ramsey Island, Beacon Hill leisure park, roads and dwellings. With HtL the defences would remain where they are now.

Comparison
MR would create around 50 hectares of intertidal habitat at the expense of grade 3 agricultural land and realignment of footpaths which may also create opportunities for improvement. Realignment would relieve the pressure on defences and the new defence alignment would be under less pressure than the existing alignment. In addition, MR would have a moderate adverse effect on the historic environment, due largely to the archaeological potential of the area. With HtL the defences would be kept where they are now allowing for protection of agricultural land and present day alignment of footpaths. This site is adjacent to a successful Managed realignment at Orplands which was completed in 1999 and is currently managed by the local wildfowling group. Further realignment of this frontage would complement existing intertidal habitat and create opportunities for similar local recreational activities.

Recommended option
The policy for this frontage is for Managed realignment as described above, As for all realignments, this is conditional on landowner agreement and support.

E4.10 Management Unit G: Dengie peninsula

E4.10.1 Characterisation and summary of options

Characterisation
The Dengie peninsula comprises extensive low-lying areas of intertidal flats. The Dengie Flats and Ray Sands are currently undergoing accretion of the foreshore with vulnerable parts at Sales Point and Holliwell Point. Most of the

defences are under pressure by coastal processes apart from the pressure point mentioned, where the extent of foreshore is also limited.

Within this frontage the tidal flood zone is almost exclusively drained agricultural land with scattered farm buildings and some minor roads. The area is one of the largest coastal hinterlands in the Anglian region with good freshwater supply and consequently supports very productive grade 1 and 2 agricultural land.

Othona Roman fort, a Saxon shore fort and St Peters chapel have important value historically and as tourist attractions. Earlier occupation of the marshes is marked by the survival of numerous red hills (salt-making sites), duck-decoy ponds, former sea-walls and World War two defensive sites. Former cheniers (beach ridges) are also buried within the marsh and these may well have served as foci for occupation and activity in the past. Bradwell nuclear power station is currently being decommissioned but there are plans for a new development on the site. Inundation or undermining of this site would cause numerous issues.

The Dengie NNR, Ramsar site, SPA and SSSI saltmarsh is the largest continuous example of its type in Essex. The foreshore, saltmarsh and beaches support an outstanding assemblage of rare coastal flora and internationally and nationally important wintering populations of wildfowl and waders, as well as supporting a range of breeding coastal birds in summer. Bradwell Cockle Spit Nature Reserve consists of saltmarsh and shell bank habitats that support numerous species of breeding bird species.

Criteria and indicators to appraise against options

Principle / criterion	**Indicator**
To develop policies appropriate to the diverse character of the Essex and South Suffolk coast and its dynamic interaction of land and sea	
Impact of policy package on the diverse character of the Essex and South Suffolk coast	Qualitative judgement
Impact of policy package on dynamic interaction of land and sea	Qualitative judgement

Principle / criterion	Indicator
To balance flood and erosion management with the assets and benefits that it protects	
Level of flood and erosion risk to people and property.	Number of properties in the tidal flood zone compared to the current number (13 in epoch 1, 16 in epoch 2 and 19 in epoch 3)
Impact on future opportunities	Judgement based on input about future opportunities
This principle has also been tested by the check of economic viability (see Appendix H) as part of appraisal, so there is no need for explicit criteria.	
To seek opportunities for managing the shoreline through natural coastal processes and take full account of longshore and cross-shore impacts	
Use of natural processes (saltmarsh, longshore interaction)	Qualitative judgement
Longshore impact on neighbouring frontages	Qualitative judgement
Cross-shore impact on near shore activities	Qualitative judgement
To develop policies that are resilient against future changes and associated uncertainty	
Tested by the sensitivity check (task 3.4) as part of appraisal, so there is no need for explicit criteria.	
To provide time and information for communities, individuals and partner organisations to adapt to any anticipated coastal change	
Adequacy of time available for communities, individuals and partner organisations to adapt	Time (in epochs) available for each required process of adaptation, depending on the policy option
To support communities and sustainable development for the people living around the Essex and South Suffolk shoreline by managing the risk to community activities and infrastructure	
Impact on infrastructure	Type and length of roads, railways and services affected: • electricity transmission lines at Bradwell Marshes
Impact on socio-economic activities	• Impact on grade 1, 2, 3 and 5 agricultural land. Impact on tourism and recreation assets including: • Bradwell Cockle Spit Nature Reserve • St Peter's Way path • St Peter's chapel and Othona

Principle / criterion	Indicator
	Roman fort
Impact on public services	• Provision of electricity
Impact on communities	Number and size of communities (individual dwellings, hamlets, settlements): • Tillingham and individual dwellings on the Dengie peninsula
To harness the social and economic values of the Essex and South Suffolk coast to wider society	
Impact on socio-economic features of regional, national or international significance	No specific features
To support conservation and enhancement of biodiversity and geodiversity	
Impact on the achievement of management objectives for designated habitats and species, keeping them in favourable condition (including no significant loss of extent or populations)	For each of the designations (Dengie Ramsar site, SPA, SSSI and NNR and the Sand Beach Meadows SSSI): • area of designated land lost/gained for each epoch and scenario • changes in condition of designated land for each epoch and scenario. Area of designated land lost/gained
Impact on the achievement of national and local Biodiversity Action Plan (BAP) targets, both within designated sites and within the wider coastal countryside	• Area of BAP habitats for each epoch and scenario (BAP habitats present are maritime cliffs and slopes, mudflats, coastal and flood plain grazing marsh and reed beds)
Impact on the achievement of management objectives for designated geological sites, keeping them in favourable condition	For each of the geological designations (Dengie SSSI): • area of designated land lost/gained for each epoch and scenario • changes in condition of designated land for each epoch and scenario. Area of designated land lost/gained

Principle / criterion	Indicator
To contribute to maintaining and enhancing the evolving character of the coastal landscape	
Impact on the character of the coastal landscape, including consideration of geological, geomorphological, historic environment and cultural features, and the role of settlements in the landscape	Qualitative judgement
To support protection and promotion of the historic environment and its value for the heritage, culture and economy of the area	
Impact on historic environment and its wider value	Impact on designated heritage assets: • four scheduled monuments • one grade I and II* listed buildings • 33 grade II listed buildings • no conservation areas, registered parks and gardens, protected wreck sites or registered battlefields • 2 areas of historic grazing marsh • presence of significant historic assets, quality of preservation, archaeological potential, historic landscape and expected scale of mitigation were also considered
To support and enhance people's enjoyment of the coast by maintaining and enhancing access	
Impact on access to the coast	Type and number of roads and paths affected: • footpaths to and along shoreline of the Dengie peninsula • tracks to shoreline of the Dengie peninsula • No car parks affected

Summary of PDZs and options

The analysis of the coastal policy context has led to the following list of PDZs and options for this management unit.

PDZ	Options	Appraisal needed?
G1 (Bradwell-on-Sea)	HtL	No

PDZ	Options	Appraisal needed?
G2 (Bradwell Marshes)	HtL	No
G3 (Dengie Marshes)	HtL	Yes

E4.10.2 PDZ G3: Dengie Marshes

Description of the options

MR would require around three kilometres of new defence line, largely through upgrading an existing relic defence line. This would continue to provide flood protection to isolated dwellings at Burnham-on-Crouch, Southminster and Dengie. The new defences would also provide protection to roads and agricultural land. With HtL the defences would remain where they are now.

Comparison

MR would create around 130 hectares of intertidal habitat at the expense of grade 2 agricultural land and realignment of footpaths which may also create opportunities for improvement. Realignment would relieve the pressure on defences along the mouth of the Crouch and the new defence alignment would be under less pressure than the existing alignment. However, MR as the potential to release contaminants into the water bodies as the defences around the location are refuse-filled. Further work to establish the extent of waste issues within defences will be required. MR would also have a very limited adverse effect on the historic environment. With HtL the defences would be kept at the existing position, providing continued protection of agricultural land and present day alignment of footpaths.

Recommended option

The policy for this frontage is for HtL as described above. It should be noted that as further studies and investigations are undertaken and the SMP is reviewed, frontages along the Dengie Peninsula may be put forward for managed realignment. In particular issues of future freshwater drainage will need to be considered because additional pumping may be needed in the future as sea levels rise. The economic viability of Hold the line policies coupled with freshwater pumping will need further appraisal in the future.

E4.11 Management Unit H: Crouch and Roach

E4.11.1 Characterisation and summary of options

Characterisation

The Crouch and Roach is a very canalised and constrained system, perhaps the most constrained system in Essex. Due to this confined character of the estuary there is very little room for development of intertidal areas in the estuary and the defences are being strongly undermined as the tidal volumes increase. The mid-section of the Crouch estuary (Bridgemarsh and Cliff Reach) is particularly under hydrodynamic pressure. There will be increased

strain if there are no changes to the mid-section of the Crouch. At both the Crouch and Roach there is an overall loss of saltmarsh, with some accretion at inner estuaries and creeks. At the Roach, boat wash may encourage further erosion at H2, H5 and H8.

The settlements within the tidal flood zone include parts of Rochford, South Woodham Ferrers and Burnham-on-Crouch. Infrastructure located within the flood zone includes several minor roads and the railway line between Woodham Ferrers and Burnham-on-Crouch, along with the station at Althorne.

The marinas at Burnham-on-Crouch, Althorne and North Fambridge provide recreational and economic value, along with the campsites around Burnham-on-Crouch. Foulness and Potton islands have significant military importance as firing ranges for the Ministry of Defence

The Crouch and Roach Estuaries Ramsar site, SPA and SSSI is of international importance for bird species, with additional interest being provided by the aquatic and terrestrial invertebrates and an outstanding assemblage of nationally scarce plants.

A range of archaeological deposits and features, including prehistoric relict land surfaces, peats and 'submerged forests' survive well within and beneath the alluvium and in the intertidal zone There are also numerous red hills, relict seawalls, oyster pits, timber structures and military remains. The existing grazing marshes are complex and significant historic landscapes. There are important areas of surviving historic grazing marsh as at Blue House and Morris Farms. In view of its complex and important historic environment, the upper Crouch estuary has been included on the English Heritage list of nationally-significant wetland sites as part of the Heritage Management of England's Wetlands initiative.

Criteria and indicators to appraise against options

Principle / criterion	**Indicator**
To develop policies appropriate to the diverse character of the Essex and South Suffolk coast and its dynamic interaction of land and sea	
Impact of policy package on the diverse character of the Essex and South Suffolk coast	Qualitative judgement
Impact of policy package on dynamic interaction of land and sea	Qualitative judgement

Principle / criterion	Indicator
To balance flood and erosion management with the assets and benefits that it protects	
Level of flood and erosion risk to people and property.	Number of properties in the tidal flood zone compared to the current number (about 6,190 in epoch 1, 6,660 in epoch 2 and 10,120 in epoch 3)
Impact on future opportunities	Judgement based on input about future opportunities
This principle has also been tested by the check of economic viability (see Appendix H) as part of appraisal, so there is no need for explicit criteria.	
To seek opportunities for managing the shoreline through natural coastal processes and take full account of longshore and cross-shore impacts	
Use of natural processes (saltmarsh, longshore interaction)	Qualitative judgement
Longshore impact on neighbouring frontages	Qualitative judgement
Cross-shore impact on near shore activities	Qualitative judgement
To develop policies that are resilient against future changes and associated uncertainty	
Tested by the sensitivity check (task 3.4) as part of appraisal, so there is no need for explicit criteria.	
To provide time and information for communities, individuals and partner organisations to adapt to any anticipated coastal change	
Adequacy of time available for communities, individuals and partner organisations to adapt	Time (in epochs) available for each required process of adaptation, depending on the policy option

Principle / criterion	Indicator
To support communities and sustainable development for the people living around the Essex and South Suffolk shoreline by managing the risk to community activities and infrastructure	
Impact on infrastructure	Type and length of roads, railways and services affected: • A130, A1245 and A129 • railway line to Southend-on-Sea and Southminster Type and number of utilities affected: • electricity transmission lines • Rochford sewage treatment works
Impact on socio-economic activities	• Impact on grade 1, 2, 3, 4 and 5 agricultural land. Impact on tourism and recreation assets including: • caravan parks and campsites at Wallasea Island and Burnham-on-Crouch • Marinas at Wallasea Island, North Fambridge and Burnham-on-Crouch
Impact on public services	Type and number of services affected: • rail services • RNLI station at Burnham-on-Crouch • electricity provision • police station at South Woodham Ferrers •
Impact on communities	Number and size of communities (individual dwellings, hamlets, settlements): • South Woodham Ferrers, Burnham-on-Crouch, Rochford, Hullbridge, Battlesbridge, Paglesham East and Churchend
To harness the social and economic values of the Essex and South Suffolk coast to wider society	
Impact on socio-economic features of regional, national or international significance	No specific features

Principle / criterion	Indicator
To support conservation and enhancement of biodiversity and geodiversity	
Impact on the achievement of management objectives for designated habitats and species, keeping them in favourable condition (including no significant loss of extent or populations)	For each of the designations (Crouch and Roach Estuaries Ramsar site, SPA and SSSI, Foulness Ramsar site, SPA and SSSI and Dengie Ramsar site, SPA, SSSI and NNR): • area of designated land lost/gained for each epoch and scenario • changes in condition of designated land for each epoch and scenario
Impact on the achievement of national and local Biodiversity Action Plan (BAP) targets, both within designated sites and within the wider coastal countryside	• Area of BAP habitats for each epoch and scenario (BAP habitats present are maritime cliffs and slopes, mudflats, coastal and flood plain grazing marsh, reed beds, lowland meadows and purple moor grass and rush pasture)
Impact on the achievement of management objectives for designated geological sites, keeping them in favourable condition	For each of the geological designations (The Cliff, Burnham-on-Crouch SSSI and Dengie SSSI): • area of designated land lost/gained for each epoch and scenario • changes in condition of designated land for each epoch and scenario
To contribute to maintaining and enhancing the evolving character of the coastal landscape	
Impact on the character of the coastal landscape, including consideration of geological, geomorphological, historic environment and cultural features, and the role of settlements in the landscape	Qualitative judgement

Principle / criterion	Indicator
To support protection and promotion of the historic environment and its value for the heritage, culture and economy of the area	
Impact on historic environment and its wider value	Impact on designated heritage assets: • one scheduled monument • three grade I and II* listed buildings • 70 grade II listed buildings • six conservation areas • no registered parks and gardens, protected wreck sites or registered battlefields • 3 areas of historic grazing marsh • presence of significant historic assets, quality of preservation, archaeological potential, historical landscape and expected scale of mitigation were also considered
To support and enhance people's enjoyment of the coast by maintaining and enhancing access	
Impact on access to the coast	Type and number of roads and paths affected: • footpaths to and along shoreline of the estuaries • tracks to the shoreline of the estuaries • two car parks in tidal flood zone

Summary of PDZs and options

The analysis of the coastal policy context has led to the following list of PDZs and options for this management unit.

PDZ	Options	Appraisal needed?
H1 (Burnham-on-Crouch)	HtL	No
H2a (From Burnham-on-Crouch to Bridgemarsh)	HtL or MR2	Yes
H2b (Bridgemarsh to North Fambridge)	HtL or MR2	Yes
H3 (North Fambridge and South Woodham Ferrers)	HtL	No

PDZ	Options	Appraisal needed?
H4 (South Woodham Ferrers, Battlesbridge and Hullbridge)	HtL	No
H5 (Eastwards of Brandy Hole)	HtL	No
H6 (Landward of Brandy Hole Reach)	HtL	No
H7 (South Fambridge)	HtL	No
H8a (South bank of Longpole, Shortpole and Raypitts Reaches (Canewdon West))	HtL or MR2	Yes
H8b (Canewdon)	HtL or MR2	Yes
H9 (Paglesham Creek)	NAI	No
H10 (Wallasea)	MR2	No
H11a (Paglesham Churchend)	HtL or MR2	Yes
H11b (Paglesham Eastend)	HtL or MR2	Yes
H12 (Stambridge)	HtL	No
H13 (Rochford)	HtL	No
H14 (Barling Marsh)	HtL or MR2	Yes
H15 (Little Wakering)	HtL	No
H16 (Great Wakering)	HtL	No

MR1	Allow local and limited intervention to limit the risks, as long as negative impacts are minimised
MR2	Breach of the frontline defence after building a new landward defence line

E4.11.2 PDZ H2a: From Burnham on Crouch to Bridgemarsh

Description of the options

MR will require the construction of 220 metres of new defences to the west and east of the realignment area for flood protection of properties at Creeksea, Althorne and North Fambridge. In addition, there may have to be some reinforcement of 800 metres of railway embankment that would be exposed to the tides. With HtL the defences will remain where they are now.

Comparison

MR allows the creation of 40 hectares of intertidal habitats at the expense of grade 3 agricultural land. MR would relieve the pressure on defences along Cliff Reach and Easter Reach and the new defence alignment would be under less pressure than the existing alignment. Realignment of footpaths would be required which may also create opportunities for improvement. In addition, MR would have a high adverse effect on the historic environment, due largely to the archaeological potential of the area. HtL would sustain the agricultural land and present day alignment of footpaths.

Recommended option
The policy for this frontage is for Managed realignment as described above. Note that realignment at PDZ H2 and H8 need to be considered together.

E4.11.3 PDZ H2b: Bridgemarsh to North Fambridge

Description of the options
MR would require 3.2 kilometres of new defence line, including reinforcement of the railway embankment, to provide flood protection to the railway line, properties at Althorne and North Fambridge. Under HtL the defences will remain where they are now.

Comparison
MR allows the creation of about 310 hectares intertidal habitats at the expense of 200 hectares of designated freshwater habitats and grade 3 and grade 4 agricultural land. MR would relieve the pressure on defences along the mid-section of the Crouch and the new defence alignment would be under less pressure than the existing one. Realignment of footpaths would be required which may also create opportunities for improvement. In addition, MR would have a very high adverse effect on the historic environment as there are tracts of historic landscape with associated high archaeological potential. Mitigation by design would be desirable from an early stage. Note that the current alignment area is under discussion. HtL would sustain the agricultural land and present day alignment of footpaths.

Recommended option
The policy for this frontage is for Managed realignment as described above. Note that realignment at PDZ H2 and H8 need to be considered together: the presence of refuse filled walls in PDZ H8a has contributed to the decision to propose realignments across the river in order to reduce the pressure on the shoreline. If further study changes the decision on PDZ H8a, then this may change the proposed policy for PDZ H2b given the high quality of preservation of its historic grazing marshes.

E4.11.4 PDZ H8a: South bank of Longpole, Shortpole and Raypitts Reaches

Description of the options
Under MR the new realignment would require about 200 metres of defences for flood protection of dwellings and roads including the B1029. With HtL the defences will remain where they are now.

Comparison
MR would lead to the creation of 360 hectares of intertidal habitat with no loss of designated freshwater habitats. However, there would be loss of grade 3 and grade 4 agricultural land. MR would relieve the pressure on defences along the mid section of Crouch and the new defence alignment would be under less pressure than the existing one. Realignment of footpaths

would be required which may also create opportunities for improvement. MR has the potential to release contaminants into the water bodies as the defences around the location are refuse-filled. Further work to establish the extent of waste issues within defences will be required. In addition, MR would have a high adverse effect on the historic environment due to the archaeological potential of the area. HtL would sustain the agricultural land and present day alignment of footpaths.

Recommended option

The policy for this frontage is for Hold the line as described above. As noted above, if further study changes the decision on PDZ H8a, then this may change the proposed policy for PDZ H2b given the high quality of preservation of its historic grazing marshes.

E4.11.5 PDZ H8b: Canewdon

Description of the options

Under HtL the current line of defence will remain. With MR new defences will be constructed to east (300 metres) and west (one kilometre) of the realignment area to protect properties at Ashingdon, roads and isolated dwellings.

Comparison

MR would lead to the creation of 300 hectares of intertidal habitat at the expense of 50 hectares of designated freshwater habitats. Most of the agricultural land lost would be grade 3. MR would relieve the pressure on defences along the mid-section of the Crouch and the new defence alignment would be under less pressure than the existing one. Realignment of footpaths would be required which may also create opportunities for improvement. In addition, MR would have a very high adverse effect on the historic environment as there are tracts of historic landscape with associated high archaeological potential. Mitigation by design would be desirable from an early stage. HtL would sustain the agricultural land and present day alignment of footpaths.

Recommended option

The policy for this frontage is for Managed realignment as described above. Note that realignment at PDZ H2 and H8 need to be considered together.

E4.11.6 PDZ H11a: Paglesham Churchend

Description of the options

MR will require the construction of four kilometres of new defences for flood protection of roads and properties at Paglesham, Great Stambridge and Rochford. As for all Managed realignments where defences protect significant features, these new defences will be put in place before breaching the current ones and will effectively be new frontline flood defences, so

dwellings and infrastructure will remain protected throughout. With HtL the defences will remain where they are now.

Comparison
MR allows the creation of 270 hectares of intertidal habitats at the expense of grade 1, grade 2 and grade 3 agricultural land. MR would relieve the pressure on defences along a limited section of the Paglesham Pool, the Paglesham Reach and the Roach estuary. The new defence alignment would be under less pressure than the existing alignment. Realignment of footpaths would be required which may also create opportunities for improvement. In addition, MR would have a high adverse effect on the historic environment due to tracts of historic landscape and associated high archaeological potential, but it would continue to defend the settlements and their Conservation Areas. HtL would sustain the agricultural land and present day alignment of footpaths.

Recommended option
The policy for this frontage is for Managed realignment as described above.

E4.11.7 PDZ H11b: Paglesham Reach north bank

Description of the options
MR will require two kilometres of new defences to provide flood protection to the power lines, roads and properties at Paglesham, as well as roads and properties at Great Stambridge and Rochford. As for all Managed realignments where defences protect significant features, these new defences will be put in place before breaching the current ones and will effectively be new frontline flood defences, so dwellings and infrastructure will remain protected throughout. With HtL the defences remain where they are now.

Comparison
MR allows the creation of about 70 hectares of intertidal habitats at the expense of grade 3 agricultural land. MR would relieve the pressure on defences along the Paglesham Reach and the Roach estuary. The new defence alignment would be under less pressure than the existing one. Realignment of footpaths would be required which may also create opportunities for improvement. In addition, MR would have a high adverse effect on the historic environment, due to tracts of historic landscape and associated high archaeological potential, but it would continue to defend the settlements and their Conservation Areas. HtL would sustain the agricultural land and present day alignment of footpaths.

Recommended option
The policy for this frontage is for Managed realignment as described above.

E4.11.8 PDZ H14: Barling Marsh

Description of the options
With HtL the defences will remain where they are now. However, under MR 1.3 kilometres of new defence line would be required to protect properties, roads and infrastructure at Barling, Little Wakering and Great Wakering as well as isolated dwellings and a pumping station.

Comparison
MR would lead to the creation of 130 hectares of intertidal habitat at the expense of 12 hectares of undesignated designated freshwater habitats and grade 3 agricultural land. MR would relieve the pressure on defences along the River Roach and the new defence alignment would be under less pressure than the existing one. Realignment of footpaths would be required which may also create opportunities for improvement. MR has the potential to release contaminants into the water bodies as the defences around the location are refuse-filled. Further work to establish the extent of waste issues within defences will be required. In addition, MR would have a moderate adverse effect on the historic environment, due largely to the archaeological potential of the area. HtL would sustain the agricultural land and present day alignment of footpaths.

Recommended option
The policy for this frontage is HtL as described above.

E4.12 Management Unit I: Foulness, Potton and Rushley islands

E4.12.1 Characterisation and summary of options

Characterisation
The Foulness eastern frontages comprise of tidal flats with extensive areas of mudflat. This frontage is very exposed and under pressure due to waves and processes. The northern and the western frontages of Foulness are governed by the Crouch and Roach estuarine processes detailed above. A considerable length of the Foulness defence line within those estuaries is being strongly undermined due to the increase in tidal volumes. Potton and Rushley Island, considered as PDZs of this management unit, are also within the Crouch and Roach system and the defences are also being undermined.

This land in this unit is low-lying and overlaps with the 1 in 1000 year flood zone of frontage H. Most of the tidal flood zone includes the Ministry of Defence controlled firing ranges on Havengore and Foulness islands that extend offshore onto Maplin Sands. The area numerous associated buildings including the hamlets of Churchend and Courtsend which are below the 1 in 1000 year flood level. The Broomway pubic right of way across Maplin Sands has amenity value

Foulness Ramsar site, SPA and SSSI is part of an open coast estuarine system comprising grazing marsh, saltmarsh, intertidal mudflats and sand flats that support nationally rare and nationally scarce plants and nationally and internationally important populations of breeding, migratory and wintering waterfowl.

A range of archaeological deposits and features, including prehistoric relict land surfaces, peats and 'submerged forests' survive well within and beneath the alluvium and in the intertidal zone There are also numerous red hills, relict sea walls, oyster pits, timber structures and military remains. The existing grazing marshes are complex and significant historic landscapes.

Criteria and indicators to appraise against options

Principle / criterion	**Indicator**
To develop policies appropriate to the diverse character of the Essex and South Suffolk coast and its dynamic interaction of land and sea	
Impact of policy package on the diverse character of the Essex and South Suffolk coast	Qualitative judgement
Impact of policy package on dynamic interaction of land and sea	Qualitative judgement
To balance flood and erosion management with the assets and benefits that it protects	
Level of flood and erosion risk to people and property	Number of properties in the tidal flood zone compared to the current number (about 2,160 in epoch 1, 2,340 in epoch 2 and 4,200 in epoch 3)
Impact on future opportunities	Judgement based on input about future opportunities
This principle has also been tested by the check of economic viability (see Appendix H) as part of appraisal, so there is no need for explicit criteria.	
To seek opportunities for managing the shoreline through natural coastal processes and take full account of longshore and cross-shore impacts	
Use of natural processes (saltmarsh, longshore interaction)	Qualitative judgement
Longshore impact on neighbouring frontages	Qualitative judgement
Cross-shore impact on near shore activities	Qualitative judgement

Principle / criterion	Indicator
To develop policies that are resilient against future changes and associated uncertainty	
Tested by the sensitivity check (task 3.4) as part of appraisal, so there is no need for explicit criteria.	
To provide time and information for communities, individuals and partner organisations to adapt to any anticipated coastal change	
Adequacy of time available for communities, individuals and partner organisations to adapt	Time (in epochs) available for each required process of adaptation, depending on the policy option
To support communities and sustainable development for the people living around the Essex and South Suffolk shoreline by managing the risk to community activities and infrastructure	
Impact on infrastructure	• Type and length of roads, railways and services affected • No specific utilities affected
Impact on socio-economic activities	• Impact on grade 1, 2, 3, 4 and 5 agricultural land Impact on tourism and recreation assets including: • campsite and caravan park at Shoeburyness • Broomway bye way
Impact on public services	• Type and number of services affected
Impact on communities	Number and size of communities (individual dwellings, hamlets, settlements): • Great Wakering
To harness the social and economic values of the Essex and South Suffolk coast to wider society	
Impact on socio-economic features of regional, national or international significance	No specific features
To support conservation and enhancement of biodiversity and geodiversity	
Impact on the achievement of management objectives for designated habitats and species, keeping them in favourable condition (including no significant loss of extent or populations)	For each of the designations (Foulness Ramsar site, SPA and SSSI, Benfleet and Southend Marshes Ramsar site, SPA and SSSI): • area of designated land lost/gained for each epoch and

Principle / criterion	Indicator
	scenario • changes in condition of designated land for each epoch and scenario. Area of designated land lost/gained
Impact on the achievement of national and local Biodiversity Action Plan (BAP) targets, both within designated sites and within the wider coastal countryside	• Area of BAP habitats for each epoch and scenario (BAP habitats present are maritime cliffs and slopes, mudflats, coastal and flood plain grazing marsh, lowland meadows and purple moorgrass and rush pasture)
Impact on the achievement of management objectives for designated geological sites, keeping them in favourable condition	No geological designations
To contribute to maintaining and enhancing the evolving character of the coastal landscape	
Impact on the character of the coastal landscape, including consideration of geological, geomorphological, historic environment and cultural features, and the role of settlements in the landscape	Qualitative judgement
To support protection and promotion of the historic environment and its value for the heritage, culture and economy of the area	
Impact on historic environment and its wider value	Impact on designated heritage assets: • one scheduled monument • no grade I and II* listed buildings • 17 grade II listed buildings • one conservation area • no registered parks and gardens, protected wreck sites or registered battlefields • 2 areas of historic grazing marsh • presence of significant historic assets, quality of preservation, archaeological potential, historic landscape and expected scale of mitigation were also considered

Principle / criterion	Indicator
To support and enhance people's enjoyment of the coast by maintaining and enhancing access	
Impact on access to the coast	Type and number of roads and paths affected • Footpaths on the Foulness Peninsula and along shoreline by Great Wakering. • Tracks across the Foulness Peninsula and along shoreline by Great Wakering. • 1 car park in flood zone

Summary of PDZs and Options

The analysis of the coastal policy context has led to the following list of PDZs and options for this Management Unit.

PDZ	Options	Appraisal needed?
I1a (Foulness)	HtL	No
I1b (Potton)	HtL	No
I1c (Rushley)	HtL or MR2	Yes

MR1	Allow local and limited intervention to limit the risks, as long as negative impacts are minimised
MR2	Breach of the frontline defence after building a new landward defence line

E4.12.2 PDZ I1b: Potton

Description of the options

MR would lead to flooding of the entire Island. It would require no new defences. Under HtL the defences will remain at the current alignment.

Comparison

MR would lead to the creation of 360ha of intertidal habitat at the expense of 44ha of designated freshwater grazing marsh; grade 3 agricultural land, MOD facilities and properties. MR would relieve the pressure on defences along the Roach and it would have a high adverse impact on historic environment, due to tracts of historic landscape and associated high archaeological potential. In addition, MR has the potential to release contaminants into the water bodies as the defences around the location are refuse-filled. Further work to establish the extent of waste issues within defences will be required. Under HtL the current alignment of the defences would remain unchanged; hence the MOD facilities, the properties, the agricultural land and the freshwater habitats would remain protected.

Recommended option

The policy for this frontage is HtL as described above. It needs to be noted that the management of the defences will remain challenging, and that holding the existing defence line restricts the natural evolution of the Roach estuary. The SMP's Action Plan includes a study to assess the economic feasibility of the removal of any contaminated materials from affected areas in the island and the opportunity for setting back the defences, particularly in the northern area of the island, to relieve pressures on the Roach, for input into the next SMP review. These constraints have contributed to decisions to propose realignments across the river in order to reduce the pressure on the shoreline (in this case at PDZ H11). If further study changes the decision for Potton Island, then this may change the proposed policy for PDZ H11.

E4.12.3 PDZ I1c: Rushley

Description of the options

MR would lead to flooding of the entire Island. It would require no new defences. Under HtL the defences will remain at the current alignment.

Comparison

MR would create approximately 55ha of intertidal habitat at the expense of grade 4 agricultural land. Realignment would relieve the pressure on defences along the Roach. With HtL the defences would be kept at the existing position allowing for protection of the agricultural land. MR would have a high adverse impact on historic environment, due largely to high archaeological potential. A realignment could have an impact on sailing; which is difficult to quantify, and realignments can have both positive and negative impacts.

Recommended option

The policy for this frontage is Managed realignment as described above.

E4.13 Management Unit J: Southend-on-Sea

E4.13.1 Characterisation and summary of options

Characterisation

Southend is a narrow beach frontage with a mixture of shingle, sand and muddy shores. Here the predominant process is loss of beach material due to tidal pressures and lack of sediment availability, partly due to cliff protection. Regular beach recharge is required.

The land in the 1 in 1000 year flood zone in this area is fairly limited comprising small sections of the seafront at Southend-On-Sea. Some properties lie within the 1 in 1000 year flood zone at Shoeburyness, South church and small areas of the seafront at Southend. Sections of the B1016 and the railway line at Leigh-on-Sea are within the flood zone. The golf

course at Southchurch provides recreational value. The seafront at Southend-On-Sea has important recreational and tourism value with its attractions including the beach, pier, aquarium and museum, while Shoeburyness has military importance as a Ministry of Defence firing range.

Benfleet and Southend Marshes Ramsar, SPA and SSSI comprise an extensive series of salt marshes, mudflats, scrub and grassland which support a diverse flora and fauna. The south-facing slopes of the downs, composed of London Clay capped by sand, represent the line of former river cliffs with several re-entrant valleys.

Criteria and indicators to appraise against options

Principle / Criterion	Indicator
To develop policies appropriate to the diverse character of the Essex coast and its dynamic interaction of land and sea	
Impact of policy package on the diverse character of the Essex coast	Qualitative judgement
Impact of policy package on dynamic interaction of land and sea	Qualitative judgement
To balance flood and erosion management with the assets and benefits that it protects	
Level of flood and erosion risk to people and property.	Number of properties within the tidal flood zone compared to the current number (about 6370 in Epoch 1, 6990 in Epoch 2 and 8620 in Epoch 3).
Impact on future opportunities	Judgement based on input re. future opportunities
This principle has also been tested by the check of economic viability (see Appendix H) as part of appraisal, so there is no need for explicit criteria.	
To seek opportunities for managing the shoreline through natural coastal processes and take full account of longshore and cross-shore impacts	
Use of natural processes (saltmarsh, longshore interaction)	Qualitative judgement
Longshore impact on neighbouring frontages	Qualitative judgement
Cross-shore impact on near shore activities	Qualitative judgement
To develop policies that are resilient against future changes and associated uncertainty	
Tested by the sensitivity check (task 3.4) as part of appraisal, so there is no need for explicit criteria.	

Principle / Criterion	Indicator
To provide time and information for communities, individuals and partner organisations to adapt to any anticipated coastal change	
Adequacy of time available for adaptation for communities, individuals and partner organisations	Time (in epochs) available for each required process of adaptation, depending on the policy option
To support communities and sustainable development for the people living around the Essex shoreline by managing the risk to community activities and infrastructure	
Impact on infrastructure	Type and length of roads, railways and services affected: • A13 at Bournes Green • Railway line east of Southchurch and along Southend-on-Sea seafront • No specific utilities affected
Impact on socio-economic activities	• Impact on grade 1 and 4 agricultural land. Impact on tourism and recreation assets including: • Aquarium, museum and pier at Southend-on-Sea • Thorpe Hall Golf Club • Waterside Farm Sports Centre.
Impact on public services	Type and number of services affected: • RNLI station at Southend-on-Sea • Rail services
To harness the social and economic values of the Essex coast to wider society	
Impact on socio-economic features of regional, national or international significance	No specific features
Impact on communities	Number and size of communities (individual dwellings, hamlets, settlements): • Southend-on-Sea and associated communities.

Principle / Criterion	Indicator
To support conservation and enhancement of biodiversity and geodiversity	
Impact on the achievement of management objectives for designated habitats and species, keeping them in favourable condition (including no significant loss of extent or populations)	For each of the designations (Benfleet and Southend Marshes SPA and SSSI, Pitsea Marsh SSSI, Vange and Fobbing Marshes SSSI, Holehaven Creek SSSI and Canvey Wick SSSI): • Area of designated land lost/gained per epoch and scenario. • Changes in condition of designated land per epoch and scenario. Area of designated land lost/gained.
Impact on the achievement of national and local Biodiversity Action Plan (BAP) targets, both within designated sites and within the wider coastal countryside	• Area of BAP habitats per epoch and scenario (BAP habitats present are mudflats and coastal and floodplain grazing marsh)
Impact on the achievement of management objectives for designated geological sites, keeping them in favourable condition	No geological designations.
To contribute to maintaining and enhancing the evolving character of the coastal landscape	
Impact on the character of the coastal landscape, including consideration of geological, geomorphological, historical environment and cultural features, and the role of settlements in the landscape	Qualitative judgement

Principle / Criterion	Indicator
To support protection and promotion of the historic environment and its value for the heritage, culture and economy of the area	
Impact on historic environment and its wider value	Impact on designated heritage assets: • 1 Scheduled Monument • No Grade I and II* Listed Buildings • 13 Grade II Listed Buildings • 4 Conservation Areas • No Registered Parks or Gardens, Protected Wreck Sites, Registered Battlefields • The presence of significant heritage assets, quality of preservation, archaeological potential, historical landscape and expected scale of mitigation were also considered.
To support and enhance people's enjoyment of the coast by maintaining and enhancing access	
Impact on access to the coast	Type and number of roads and paths affected • Footpaths along shoreline behind Two Tree Island and at Leigh-on-Sea. • 2 car parks in flood zone.

Summary of PDZs and Options

The analysis of the coastal policy context has led to the following list of PDZs and options for this Management Unit.

PDZ	Options	Appraisal needed?
J1 (Southend-on-Sea)	HtL	No

E5 EPOCHS

E5.1 Approach

In order to prioritise the Policy Development Zones where managed realignment was a potential policy option and subsequently assign the relevant epoch, a prioritisation exercise was undertaken by key SMP officers from Natural England, English Heritage and Environment Agency on August 13th 2009.

The Managed realignment sites have been selected at 'vulnerable' coastal locations due to the estimated unmaintained life of the defence being low and the impacts of coastal processes on the defences increasing flood and erosion risk, as described in section E3.2.1. A decision had already been taken by CSG and EMF that managed realignment policies should only be used in epoch 1 if there was a willing landowner. Following significant engagement of land owners at all vulnerable locations only a few managed realignment options were proposed for epoch 1, leaving the majority of remaining sites to go forward in epoch 2 and 3.

The premise was that MR would be proposed in epoch 2 unless there were significant impacts associated with the site either landward or seaward of the current defences. Three simple criteria were used to assess the likely impacts of a managed realignment at each vulnerable coastal location:

1) Is a managed realignment policy likely to have very significant impacts on assets landward of the defences?
2) Is a managed realignment policy likely to have very significant impacts on assets seaward of the defences?
3) Is a managed realignment policy likely to have very significant impacts on designated sites landward of the defences?

Each of the PDZs where Managed realignment was the proposed policy was given scores by the group: a score of 1 if impacts were marginal, a score of 2 if impacts are expected to be considerable, and a score of 3 if impacts are considered to be significant. Assigning the policy option of the PDZ to an epoch is done as follows: if the total score is 1 to 3 the policy option is assigned to epoch 1. If the total score is 4 to 6 the policy option is assigned to epoch 2, and if the total score is 7 to 9 the policy option is assigned to epoch 3.

E5.2 Resulting epochs for managed realignment

Table E6 summarises the assignment of the policy option to the Epochs of each Policy Development Zones.

Table E6: Results of the prioritisation exercise.

PDZ	Score	Epoch
A2	6/9	2
A3a	6/9	2
A8a	5/9	1/2
A8b	4/9	2
B2	4/9	2
B3a	7/9	3
B5	9/9	3
C2	9/9	3
D1b	5/9	2
D2	6/9	2
D4	4/9	2
D5	4/9	2
E1	7/9	3
E2	5/9	2
E4a	5/9	2
F3	7/9	3
F5	7/9	3
F12	7/9	3
F14	4/9	1/2
H2a	4/9	2
H2b	7/9	3
H8b	5/9	2
H11a	4/9	2
H11b	3/9	3
D6	n/a	2
D8a	n/a	2
I1c - Rushley	n/a	3
B4a - Devereux Farm	n/a	1
H10 - Wallasea	n/a	1
B2 - Bathside Bay	n/a	1

The scoring process helped to identify where there were likely to be significant impacts and this moved some MR options into epoch 3. Good examples of Epoch 3 sites include areas of outstanding heritage and landscape value or the very best of the nationally and internationally recognised freshwater designated sites such as Old Hall and Tollesbury. These will be hard to replace and therefore need to be protected for as long as possible compared to other sites. In addition hydrodynamics were considered and some sites are in sensitive locations such as heads of estuaries or close to locally important oyster fisheries where MR options could have significant impacts on the wider estuary function, increase erosion

of adjacent marsh and therefore affect flood defences or impact on important local economies.

Further engagement with landowners at all MR sites as well as with landowners with HTL policy is underway and is recommended in the action plan. Epoch 3 sites will still be considered for development and be brought forward if new information comes to light or if landowners are willing.

The epochs for realignment listed in Table E6 were proposed in the draft SMP. Following public consultation a small number of changes were made, reflecting additional information and understanding. These are:

- D2: from epoch 2 to epoch 3
- F14: confirmed for epoch 2
- H11b: from epoch 3 to epoch 2

In addition, as explained in section E4.6.2, the policy for PDZ C2 has been changed to a dual policy of Hold the line or Managed realignment in epoch 3.

E6 CONFIRMATION OF POLICIES

E6.1 Economic viability

The economic assessment is discussed in detail in **Appendix H**.

E6.2 Sensitivity analysis

This section discusses some of the main uncertainties that are likely to have an impact on policy selection: what is the uncertainty, what is the potential impact on the performance of policy options against the principles, and how could this uncertainty be managed in the SMP process.

Climate change

Sea level will certainly continue to rise, but the rates are uncertain, especially for Epoch 3. The rate of sea level rise could strongly influence the speed of morphological developments; in the case of saltmarsh development, it could even determine locally whether there is accretion or erosion. The morphological developments, and particularly the development of saltmarsh, are an important factor in policy development because they determine whether defences are under pressure and they have an impact on the habitats.

Both factors have played an important role in the selection of PDZs where Managed realignment of flood defences is the proposed policy. For the short term (Epoch 1), this source of uncertainty is limited, but for the medium and long term it is possible that different rates of sea level rise will cause more, less or other PDZs to come under pressure; they may also cause different developments of designated habitats. This will need to be taken into account in future reviews of the SMP.

Behaviour of coastal processes

Coastal geomorphology is a complex science that typically deals with large uncertainties. The main ones for Essex and South Suffolk SMP are:

- Our general understanding of the estuaries' behaviour has played an important role in policy development, primarily by focusing on the middle and outer estuaries for Managed realignment of flood defences. At the level of individual channels, particularly in the more complex estuaries, further work as part of scheme development is needed to confirm the estuaries' response to realignment.
- Development of intertidal areas in response to sea level rise: it is likely that the various current trends will continue into Epoch 1. The predicted developments in the later Epochs, in response to the speeding up of sea level rise and other changes, are much less certain. SMP policy development is not very sensitive to the speed of these developments, but it is very sensitive to the direction of change.
- Influence of Managed realignment on foreshore, neighbouring frontages and wider area: this has played a part in the identification of MR PDZs,

but further study and confirmation is needed in the development of Managed realignment projects after the SMP. Monitoring from existing realignments will lead to increased understanding in the coming years.

Saltmarsh development following realignment

Habitat creation is one of the drivers for realignment, in addition to wave dissipation. Both drivers will benefit from accretion in the newly created intertidal areas and subsequent saltmarsh development. The SMP policies are not very sensitive to the rate of saltmarsh development, but they can be sensitive to whether saltmarsh will develop at all. To some extent, this is also a locally specific issue, which can be influenced by design of realignment strategies and schemes (which places it beyond the scope of the SMP).

Future land use / future habitat needs

The future wider need for (high grade) agricultural land and habitat needs are important uncertainties which can change the balance between these values and will therefore have significant impacts on policy appraisal. The SMP guidance suggests that it is not appropriate to speculate regarding changes in social attitudes or policy. Still, this uncertainty is a fact that the SMP has to deal with. Some further insights will be provided through ongoing developments such as Foresight projects and other policy studies. In the meantime, it has to be acknowledged that the policies for the medium and long term are relatively uncertain.