

Appendix E Policy Development and Appraisal

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E1 THE POLICY DEVELOPMENT AND APPRAISAL PROCESS

E1.1 Principles/Values and Objectives

The policy development and appraisal process was undertaken as part of Stage 3 of the SMP, following the definition of policy appraisal criteria as part of Stage 2. The objective setting process used a combination of the key values and principles, as developed as part of a preceding Stage 2 task. Details of the Objective setting process are provided in section E2.

E1.2 Define Policy Packages

The first Stage 3 task associated with the policy development and appraisal process was to define the policy packages, which are the options that go into the appraisal. This was effectively a streamlining process, firstly involving the identification of the obvious and unrealistic policy choices for certain frontages and epochs (Defining the Playing Field). Based on this, policy packages were identified that spanned the playing field and that were sufficiently distinct to represent the fundamental choices that the SMP has to make. Once these fundamental options were agreed with the CSG and EMF, the alignment of these policy packages was defined. These tasks were collectively undertaken under the Define Policy Packages task and are described in detail in section E3.

E1.3 Policy Package Appraisal

Once the policy packages were defined, the shoreline responses and interactions under each policy package for the three epochs were assessed. Based on that information, each policy package was assessed against the objectives (or policy appraisal criteria) as defined in Stage 2. The policy assessment methodology was developed and agreed with the CSG through the additional Test Baseline Scenarios task which was undertaken as an additional task at the beginning of Stage 3. A broad assessment of economic viability, based on existing strategies, and a consideration of the sensitivity of the policy packages was also carried out as part of this Policy Package Appraisal task. This ensured that the policy selection was robust, despite the uncertainties. The full Policy Scenario assessment is provided in section E4.

An iterative process of fine-tuning followed with the CSG, which saw a next cycle of the Define Policy Packages, Assess Coastal Processes and Test against Principles tasks, and the final policy decision was then made by the EMF. At this stage there were a number of key issues that needed resolving in order to translate from the Intent of Management to the policy package. This is discussed in section E5.

E1.4 Confirmation of Preferred Scenario

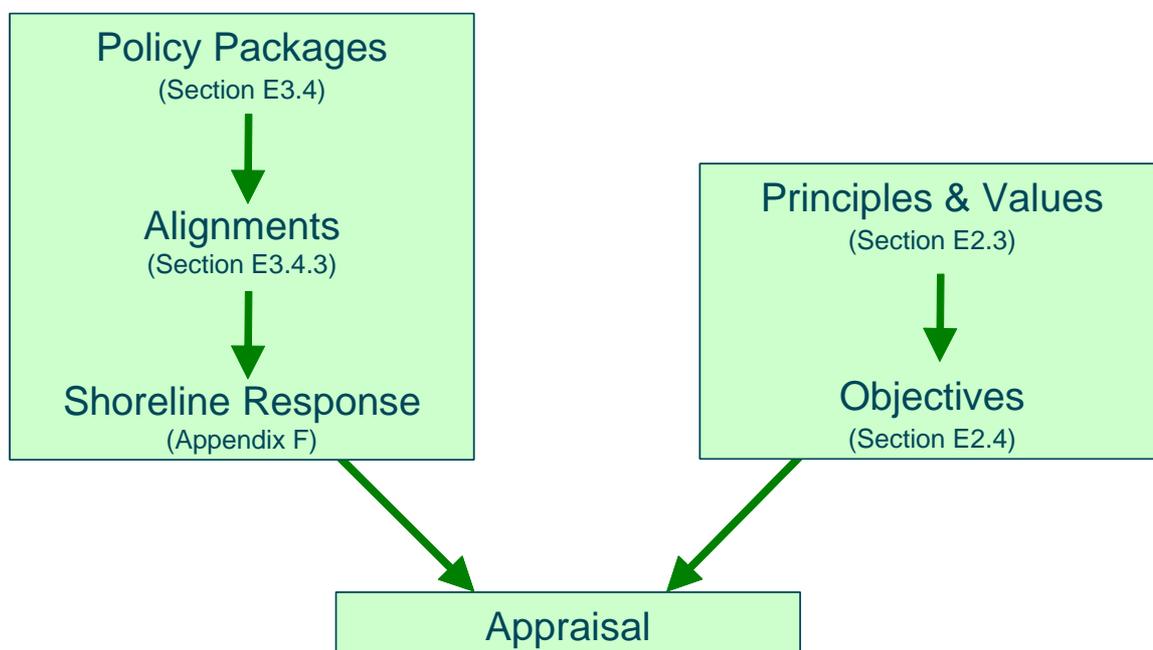
Following these additional assessments and investigation, the final preferred policy packages for the defined policy development zones were agreed. This is discussed briefly in section E4 and E5, and in full in appendix G.

Figure E1.1 provides an overview of the policy development and appraisal process as discussed above. This figure highlights the two main inputs to the appraisal process, namely the definition of policy package, alignments of these policy packages and assessment of shoreline response, and the development of principles, values and objectives. Figure E1.2 also provides an overview of the Stage 3 tasks and the order in which they were carried out. This figure also shows where the tasks are described within this document.

E1.5 Post-public consultation

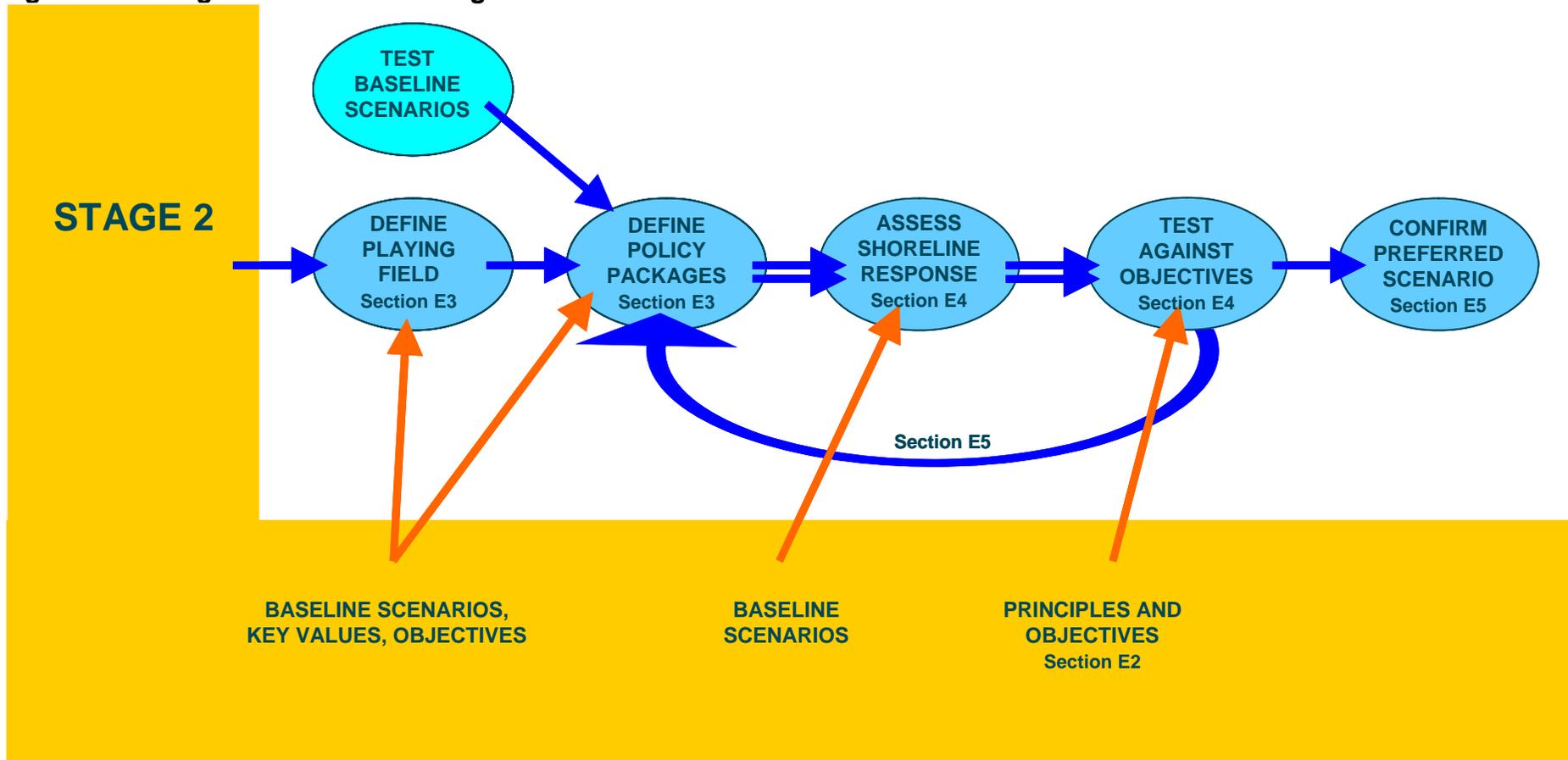
The responses to the public consultation have had a significant impact on the data used and on the resulting SMP policies. It has not changed the appraisal process however. Section E6 of this appendix summarises the key changes, with reference to the main document and other appendices for more detail.

Figure E1.1 Overall Approach to Policy Appraisal



It is important to note that this appendix contains a full record of the assessments undertaken and decisions made along the route to concluding draft SMP policies for The Wash. All of this information has been used within the decision making process, but it may not have necessarily been taken forward and reported on within the main SMP document or non-technical summary. In some instances insights have changed in the course of the SMP process, so it is possible that the text in the appendices seems to contradict the content of the main SMP document or non-technical summary. In such cases, this is highlighted in the introduction to the appendix section. The main SMP document and the non-technical summary contain the agreed draft SMP policies.

Figure E1.2 Stage 3 Tasks and Timings



Glossary:

In addition to the Glossary provided as part of the main SMP document, the Glossary below provides a more in depth description of the specific terms that are used in this Appendix (specific to policy appraisal).

Policy

This describes the way in which a shoreline is managed. In line with SMP guidance, four policies are available:

- No active intervention (NAI)
- Active intervention:
 - Hold The Line (HTL): keep the existing line (even if changing the standard of protection);
 - Advance the line (AtL): build new defences on the seaward side of the existing defences;
 - Managed realignment (MR): allowing the shoreline to move backwards or forwards, with management to control or limit movement. In practice, and for clarity, we suggest to only use this policy for landward movement of the defence; any seaward movement can be defined as AtL.

Policy Scenario/Package

These are scenarios defined in the SMP guidance as a full set of policies for the whole SMP frontage and for the three epochs. We have developed Baseline scenarios that use only one policy for the whole area and all epochs, but a scenario can consist of any combination of policies in space and time. Note that this use of the word scenarios does not relate to possible future developments of external factors such as climate change or economic development. To avoid confusion, this SMP uses the word 'policy package' instead of policy scenario.

Intent of Management

This is a vision for the future of shoreline management in a certain frontage, for all epochs. We have introduced this concept because there is a risk that policy development and appraisal is too strongly focused on, and therefore restricted by, the defined policies and that it is developed at the level of (sub) frontages. The SMP needs to make decisions that take into account all longshore interactions. This is not possible at the level of sub frontages. In addition, we feel that decision making should have a basis in a spatial and integrated vision, which can then be translated to the specific policies for the purpose of management.

E2 OBJECTIVES

E2.1 Introduction

The approach for objective setting was agreed with the Client Steering Group, and subsequently a set of principles for the SMP policies was agreed with the Elected Members Forum. This section builds both on the approach (section E2.2) and on the principles (E2.3) to develop the Objectives. Section E2.4 contains a characterisation of the coastal zone along the frontage; the key values derived from this characterisation are illustrated in a set of cross sections, see figure E2.1 to figure E2.10. For each area, the key values and the principles have been combined to develop a set of policy appraisal objectives.

E2.2 Approach

E2.2.1 Introduction

This section sets out the approach for developing policy appraisal objectives on the basis of the detailed feature-level objectives that were developed as part of the Theme Review (see appendix D).

E2.2.2 Objective setting in the SMP guidance

The 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 The Wash has led to a set of objectives for all identified features; in discussion with the Client Steering Group, this was limited to the area within the ring of A-roads surrounding the Wash: it would be impractical and not very useful to do this detailed analysis for all features in the whole floodzone. The Theme Review does include a narrative description of the key features in the whole area in the floodzone.

This information has 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 but leaves it to the Client Steering Group to develop an appropriate approach.

E2.2.3 Agreed approach

Compared to other coastal areas, the Wash is a very large area and has a very large number of features which could be influenced by shoreline policy

decisions in the Wash SMP. It is impractical to identify all separate features at risk of tidal flooding and develop feature-level issues, values and objectives – even when limiting the feature-level Theme Review to a roughly 5km (roughly 3 miles) band around the shoreline, the table runs into almost 150 pages. At the same time, it is vital that the SMP process for the Wash does take appropriate account of the whole tidal floodzone.

Based on good practice developed in other SMP2s, the agreed approach leads to objectives at a level appropriate to SMPs, following 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;
- Identify the *policy appraisal objectives*, combining the principles with locally defined key values.

The approach of identifying key values and principles and combining them to develop objectives will be carried out on a local level. This section explains the process for each of the four steps: characterisation, key values, principles and objectives.

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) which incorporates coastal processes and coastal defences, 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 (up to about OD6.5m, the expected 0.1% flooding probability level in 2100 in a No active intervention scenario).

Key values

Key values offer a clear definition of the key or core values which underpin the overall range of values which communities and society as a whole attach to the Wash. The key values provide a succinct account of the key assets that support the range of activities in or around the Wash, enjoyed or utilised 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 have been developed for each unit, based on the characterisation. The key values have been visualised in cross sections, which are included in section E2.4. Each cross section is representative of a certain part of the SMP shoreline and covers the whole zone that is relevant for the SMP. The

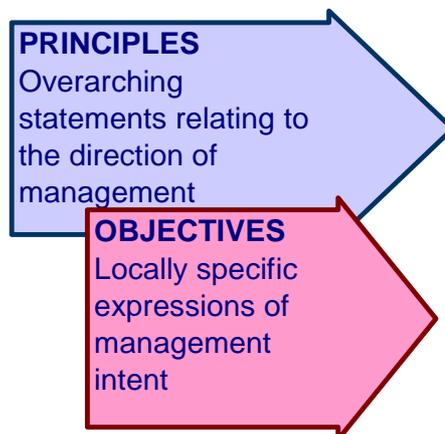
cross sections provide a summary of the key values of each area of coast and provide clarity in regard to how values 'sit together' and interact. The coast is a complex socio-economic environment and the cross sections intend to show an intelligent and insightful representation of the structure of each coastal area. They are not intended to be exhaustive; rather they show the main values and relationships in an area specific manner. Since the cross sections are a stylised account, they are not to scale; the images are sometimes deliberately distorted to illustrate features and relationships rather than spatial or topographic accuracy. The cross-sections should be readily understandable by all stakeholder groups.

Principles and Objectives

In the context of the SMP, principles and objectives have been defined as follows.

Principles are defined statements which provide a clear expression of position which will inform and guide the decision making process within the SMP. Equally, principles can provide an indication of the direction of management.

Principles provide an expression of the 'rules' within which objectives will be developed and policy formulated. A full, SMP wide set of principles has been agreed with the Elected Members Forum, see section 3.



Objectives relate to specific targets for management and should wherever possible provide a means for the monitoring and assessment of their effectiveness. This approach enables policy development in a simple hierarchy of principles-objectives-policy.

E2.3 Principles

The following set of 11 principles was discussed and agreed with the Client Steering Group and the Elected Members Forum. Together with the location specific key values they form the basis for setting policy appraisal objectives.

1. To balance flood and erosion risk management with the value of the features that it protects
2. To ensure that shoreline management takes into account longer term adaptation options
3. To develop policies for flood and erosion risk management that will enable appropriate future development
4. To ensure that localised decisions do not affect the natural balance of the coastline and shoreline management elsewhere
5. To ensure that shoreline management supports the continuation of sustainable patterns of development and considers possible effects on communities and their welfare
6. To ensure that shoreline management informs the land use planning system
7. To ensure that shoreline management supports the sustainable provision of the social and economic values of the area to the wider society
8. To ensure that shoreline management supports conservation and enhancement of biodiversity
9. To ensure that shoreline management takes into consideration the management objectives of environmentally designated sites and species
10. To ensure that shoreline management recognises the character of the coastal landscape
11. To ensure that shoreline management has regard to the historic environment

E2.4 Objective setting

E2.4.1 Introduction

This section describes the characterisation and key values along the frontage of the Wash, and how they combine with the principles from section E2.3 to set policy appraisal objectives. The section distinguishes eight areas. As mentioned before, these areas are convenient for the characterisation and for setting objectives, but they are not necessarily policy units.

Characterisation

The characterisation is generally described from the shoreline in a landward direction. The text for most areas distinguishes the coastal strip and the hinterland, divided by a belt of established settlements that runs around the Wash. These established settlements are established communities with a strategic importance to the surrounding area. In the text we refer to these settlements as established settlements.

It is important to note that the majority of the frontages throughout the Wash SMP area are designated due to their international importance. These designations will not be mentioned explicitly for each frontage, so are instead listed here:

- The Wash and North Norfolk Coast SAC;
- The Wash SPA, Ramsar Site, SSSI, NNR and LBAP;
- Norfolk Coast AONB;
- Moulton Marsh LNR;
- Frampton Marsh LNR;
- Various SAMs.

Key Value Graphics

The cross sections (figure E2.1 to figure E2.10) illustrate the key values for each of the areas. Note that the graphics do not represent specific real cross sections: they are intended to represent the whole area, from offshore all through the low lying area up to the ridge of high ground that surrounds the Wash. The cross sections of the area typically consist of up to 5 zones:

- A: intertidal zone, seaward of the defences
- B: zone among existing defence lines (including defacto defences)
- C: zone between most landward existing defence line and belt of established settlements
- D: belt of established settlements
- E: zone landward of belt of established settlements, up to high ground

Objectives

As described in section E2.2.2, the policy appraisal objectives are typically linked to one or more of the Principles and to one or more of the Key values.

It is worthwhile noting here that there is considerable 'pressure' between a number of the objectives, and as a result they are often acting to work against each other. The final policies for this SMP area will need to find a solution which represents a balance between these competing objectives.

E2.4.2 Gibraltar Point to River Witham including Boston

Characterisation

Coastal processes and flood risk

Wide intertidal flats extend seaward from the shoreline and areas of saltmarsh exist in the upper intertidal zone. The intertidal flat width ranges from up to 6 kilometres (3.7 miles) in the north to less than 1 kilometre (0.6 miles) in the south. Gibraltar Point forms the northern limit and provides some shelter against wave attack. There are large sand banks parallel with this frontage, closely linked to the development of the Gibraltar point spit system, which shelter the coastline from wave attack. This shelter enables the existence of the intertidal flats, and together the two reduce wave attack on the defences. The deep water channel, Boston Deep, that also runs parallel with the coastline, controls the seaward limit of the flats. Due to continued land reclamation, the saltmarshes are generally in an immature state: they are low in height and not colonised by the usual wide range of salt-tolerant plant species, which limits absorption of wave energy. At the southern limit, the outfall of the River Witham (Haven) joins with the outfall of the River Welland at Clay Hole and then links with Boston Deep. This combined outfall of two major rivers and the deep water channel has a significant control on the seaward limit of the flats.

Future shoreline behaviour is expected to be influenced by sea level rise. The expectation is that saltmarsh will initially increase both vertically and horizontally while the width of the mudflats will decrease, reflecting a continued trend of coastal squeeze. However, as the rate of sea level rise increases after 2055, the uncertainty about foreshore development increases. The current accretional trend may continue, but there could also be a change to a more erosional future. See appendix F for further details.

The backshore, behind the flood defences, there is extensive coastal lowland of reclaimed intertidal flats that is now protected from large-scale flooding by a series of grassed earth embankments. The zone below the 0.5% extreme flood level is about 25km (about 15 miles) wide and bordered by high ground to the North; the River Witham has been chosen as the boundary to the South and West. Upstream from Tattershall the low lying area stretches about 30km (about 19 miles) further up through the narrow left bank floodplain of River Witham, almost up to Lincoln. Two narrow higher ridges cross the area from north to south: South of Wainfleet (about 5km or 3 miles from the shoreline) and at Stickney (about 15 km or 9 miles from the shoreline). Both ridges stretch roughly down to about halfway into the unit. Seaward of the Wainfleet ridge, the elevation is approximately 3 mAOD;

further landward, the elevation is lower, down to around OD between the two ridges. The progressive reclamation of coastline which has occurred is reflected in the extensive array of flood defences: there are up to three lines of flood banks within 3 km (2 miles) of the shoreline. The majority of these secondary and tertiary lines of flood banks are not publicly owned or maintained as formal lines of defence.

Land use and environment

Coastal strip

Much of the offshore zone in this area is of significant military importance as a weapons training range for the Ministry of Defence. Behind the frontline defences, there is little settlement seaward of the Wainfleet – Wrangle ridge, with only occasional isolated properties and few surfaced roads. From Wrangle southward, the coastal strip is narrower but also more populated, with a number of small settlements such as Leverton Lucasgate and Freiston Shore, as well as other more disparate housing. The North Sea Camp open Category D prison is also located immediately to the south of Scrane End.

Land in this area is of high arable agricultural value, this being the dominant land use in the area (the sole land use alongside the ridge). Except for certain identified local wildlife sites South of Wrangle and the nationally recognised RSPB site at Freiston Shore, the area is of low conservation value, which contrasts with the area seaward of the primary flood defence. This comprises designated saltmarsh and mudflats, and is of international importance for its high conservation value.

There is also a port at Boston, which is economically important, both on a local, regional and national scale. The port is owned by the Victoria Group and handled a total tonnage of 834,000 in 2006. It has a live rail connection and container handling facilities. The main commodities handled by the port consist of steel, timber, grain and paper, in addition to smaller volumes of containers, scrap, and some bulk cargos such as soya meal and salt. There is also a very large commercial fishing fleet (mainly shellfish) operating out of the port.

Belt of settlements and hinterland

The belt of settlements and hinterland is on and just landward of the Wainfleet – Wrangle ridge and around the A52, and includes Wainfleet All Saints, Friskney, Wrangle, Old Leake, Leverton, Benington, Butterwick, Freiston and Fishtoft. The belt also contains associated smaller settlements and isolated properties, which are served by a network of minor roads. Boston is the major urban settlement within the area and represents not only a major residential concentration, but a regional centre. It also contains a number of historically and architecturally important buildings.

Moving inland from the belt of settlements, the density of settlement decreases, and primarily comprises disparate properties plus two substantial settlements along the A16, Sibsey and Stickney. This pattern remains as

such throughout the remainder of the 1 in 1,000 year flood zone. Other than the network of minor roads and B-roads present in this area, the infrastructure comprises the Skegness to Boston Railway, the A16, and power lines and pylons running from north east to south west. The landscape of the hinterland is Fenland landscape, characterised by arable agriculture and few natural, heritage or landscape features other than River Witham, Hobhole Drain, Cowbridge Drain, some isolated patches of woodland, and a number of windmills.

The key values of this area are visualised separately for Wainfleet to Wrangle and for Wrangle – Boston, see figure E2.1 and figure E2.2.

Objectives

The SMP will need to select the policies that provide the best balance between the key values for each stretch of the shoreline, taking account of the established principles. The objectives have been set up to reflect the values and the principles. For this area, the SMP will need to find the right balance between the following potentially competing objectives:

- Communities;
- Area of grade 1 and 2 agriculture;
- Habitats;
- Port of Boston; and
- Need for flood and erosion risk management,

Whilst taking account of other values such as regional transport routes, MoD use of the foreshore, drainage and recreation.

Flood and erosion risk

- Minimise flood risk to people, property and the environment.
- Have as little flood and erosion risk management throughout the plan period as possible.
- Maximise the use of existing man-made or natural defences (e.g. saltmarsh): the inland lines of (historical) defences and the ridge of high ground between Wainfleet and Wrangle.

Communities

- Protect as many settlements as possible.
- Protect as a minimum, throughout the plan period, to an appropriate standard of protection, all established communities in the unit:
 - Wainfleet All Saints, Wainfleet St Mary, Friskney, Wrangle, Old Leake, Leverton, Benington, Butterwick, Freiston, Fishtoft, Boston;
 - and the area landward from these settlements.
- Note that for smaller settlements seaward from the established settlements, such as Scrane End and Leverton Outgate, even though

there is no guarantee within the objectives that they will remain protected, their value will be taken fully into account in policy appraisal.

Habitats

- Maintain natural processes relating to mudflats, saltmarsh, sand dunes and saline lagoons.
- Maintain and if possible increase the area of mudflats, saltmarsh, sand dunes and saline lagoons.
- Ensure that the impact on the UK's area of intertidal habitat is acceptable.

Agriculture

- Protect as much grade 1 and grade 2 lands as possible.
- Ensure that the impact on the UK's area of grade 1 and grade 2 lands is acceptable.

Infrastructure

- Avoid interruption of the functioning of Boston Port throughout the plan period.
- Avoid interruption of the drainage function of River Witham throughout the plan period.
- Avoid interruption of transport connections and utility supply throughout the plan period.

Timing of policies

Provide sufficient time, if required, for:

- Community adaptation;
- Change of flood risk management practices;
- Relocation of regional infrastructure, ensuring continued A-road and rail transport links between Boston and Skegness;
- Relocation / adaptation of MoD use of the foreshore, prison facilities and sewage works;
- Research of archaeological features and ecological surveys.

E2.4.3 River Witham to River Welland

Characterisation

Coastal processes and flood risk

This frontage is characterised by a long history of sediment accretion, as the majority of sediment entering the Wash embayment is preferentially deposited in this area. Black Buoy Sand dominates the foreshore. Unlike the frontages further north, but similar to the frontages further east, this sandbank is connected to the intertidal area of this frontage, reflecting the sediment accretion patterns in the embayment as a whole. The sandbank limits wave energy reaching the foreshore and has an effect on the erosion and accretion of materials along the frontage. The Lynn Deep (the deep

water channel in the middle of the Wash embayment) controls the position of the low water mark along this frontage. It is also responsible for feeding incoming sediment preferentially into the frontage between Rivers Witham and Nene. The trained outfall of the Witham (Haven) joins with the trained outfall of the Welland at Clay Hole and then links with Boston Deepes. This combined outfall of two major rivers has a significant control on the position of the mean low water mark of this frontage. These two trained outfalls also trap sediment which explains the large width of mature saltmarsh (greater than 1.5 kilometres (about 1 mile) in most locations).

Future shoreline behaviour is expected to be influenced by sea level rise. The expectation is that saltmarsh will initially increase both vertically and horizontally while the width of the mudflats will decrease, reflecting a continued trend of coastal squeeze. However, as the rate of sea level rise increases after 2055, the uncertainty about foreshore development increases. The current accretional trend may continue, but there could also be a change to a more erosional future. See appendix F for further details.

The backshore, behind the flood defences, is extensive coastal lowland, mainly consisting of reclaimed intertidal flats and now protected from large-scale flooding by a series of grassed earth embankments. The zone below the 0.5% extreme flood level is about 25 km (about 15 miles) wide and is bordered by high ground to the West; together with the chosen boundaries of the Rivers Witham and Welland, this zone forms a triangle with the narrow end at the shoreline. The zone also includes the flat right bank floodplain of River Witham, almost up to Lincoln. The land generally slopes down away from the shoreline: the elevation is generally around 3 mAOD within 15 km (about 9 miles) from the shoreline, but it is lower (around 2 mAOD) in a band of fenland next to the high ground.

Land use and environment

Coastal strip

The settlement pattern in this reach is similar to that in Unit 2 with a number of small hamlets, including Skeldyke and Bucklegate, as well as other smaller settlements and properties. A network of minor roads exists to serve these settlements and properties.

Land in this area is of high arable agricultural value, this being the main land use in the area. In Spalding (and surrounding areas) there is also a large concentration of fruit/vegetable packing factories, as well as food preparation plants. Amenities in the area include a boat yard / marina at Fosdyke and a land fill at Slippery Gowt. A new distribution/industrial park is being constructed east of the A16 at Kirton and substantial employment is located in the Riverside Industrial Estate in Boston and the Endeavour Way Industrial Estate in Sutterton. The area seaward of the primary flood defence, which comprises a significant area of designated saltmarsh and mudflats, is of high conservation value.

The inland component of the reach contains a zone of archaeological potential at Fosdyke, and amenity benefits are present in the form of the Local Nature and RSPB Reserve at Frampton Marsh.

The two waterways which border this frontage, the Haven and River Welland and thus their offshore approaches, are important routes for commercial shipping and leisure traffic. This is particularly true for the Haven, which allows access to the Port of Boston.

Belt of settlements and hinterland

The belt of settlements and hinterland, again typically on slightly higher land, consists of the larger settlements straddling the A16 (South Boston, Wyberton, Kirton, and Sutterton), and Frampton, Algarkirk and Fosdyke could also be considered as part of this belt. Further inland, additional settlements are present, namely Wigtoft, Swineshead, Bicker, Donington, Quadring, Gosberton, Surfleet and Pinchbeck, and also Spalding which is a major settlement with a regional service centre function. Smaller settlements and disparate properties are also present in the area. All these towns could be considered to be part of the belt of settlements, which is about 10km (6 miles) wide in this area. Further landward, between these settlements and the high ground, there is a strip of lower lying Fenland. Bicker Haven, the former medieval estuary of the River Witham, includes a series of banks and the remains of a salt-making site. Throughout the area as a whole there are also a number of old salt hills.

Several A and B roads are present in this area including the A52, A17 A16, A152 and B1397 as are various minor roads serving the network of settlements. Additional infrastructure includes the Lincoln to Spalding Railway, the various electricity lines and the land drainage system. There are also a number of key man-made waterways/drains such as the South Forty Foot drain.

Land use in the area is predominantly arable agriculture and few natural or landscape features are present in the reach.

The key values are visualised in figure E2.3.

Objectives

The SMP will need to select the policies that provide the best balance between the key values for each stretch of the shoreline, taking account of the established principles. The objectives have been set up to reflect the values and the principles. For this area, the SMP will need to find the right balance between the following potentially competing objectives:

- Communities;
- Area of grade 1 and 2 agriculture;

- Habitats;
- Need for flood and erosion risk management'

whilst taking account of other values such as regional transport routes, drainage and recreation.

Flood and erosion risk

- Minimise flood risk to people, property and the environment.
- Have as little flood and erosion risk management throughout the plan period as possible.
- Maximise the use of the inland lines of (historical) man-made defences.

Communities

- Protect as many settlements as possible.
- Protect as a minimum, throughout the plan period, to an appropriate standard of protection, all established communities in the unit:
 - Boston South of River Witham, Wyberton, Frampton, Kirton, Sutterton, Algarkirk, Fosdyke, Wigtoft, Bicker, Swineshead, Donington, Quadring, Gosberton, Surfleet, Pinchbeck and Spalding;
 - And the area landward from these settlements.

Habitats

- Maintain natural processes relating to mudflats and saltmarsh.
- Maintain and if possible increase the area of mudflats and saltmarsh.
- Ensure that the impact on the UK's area of intertidal habitat is acceptable.

Agriculture

- Protect as much grade 1 and grade 2 lands as possible.
- Ensure that the impact on the UK's area of grade 1 and grade 2 lands is acceptable.

Infrastructure

- Avoid interruption of the functioning of Boston Port throughout the plan period.
- Avoid interruption of the drainage function of Rivers Witham and Welland throughout the plan period.
- Avoid interruption of transport connections and utility supply throughout the plan period.

Timing of policies

Provide sufficient time, if required, for:

- Community adaptation;
- Change of flood risk management practices;
- Relocation of regional infrastructure and navigational infrastructure changes. The planned Fen Waterway Link incorporates a new route to

avoid the tidal passage. The Northern Boston link is already underway (part of the Fen Waterway Link), ensuring continued A-road links between Boston and Spalding and Boston and King's Lynn and links between the communities;

- Research of archaeological features and ecological surveys.

E2.4.4 River Welland to River Nene

Characterisation

Coastal processes and flood risk

This frontage is characterised by a long history of sediment accretion, as the majority of sediment entering the Wash embayment is preferentially deposited in this area. Large sand banks dominate the foreshore, connected to the intertidal area. These limit wave energy reaching the foreshore and have an effect on the erosion and accretion of materials. The Lynn Deep (the deep water channel in the middle of the Wash embayment) controls the position of the low water mark along this frontage. It is also responsible for feeding incoming sediment preferentially into the frontage between Rivers Witham and Nene. The river outfalls at both ends of the frontage combine to trap sediment between them, leading to wide mature saltmarsh areas.

Future shoreline behaviour is expected to be influenced by sea level rise. The expectation is that saltmarsh will initially increase both vertically and horizontally while the width of the mudflats will decrease, reflecting a continued trend of coastal squeeze. However, as the rate of sea level rise increases after 2055, the uncertainty about foreshore development increases. The current accretional trend may continue, but there could also be a change to a more erosional future. See appendix F for further details.

The backshore, behind the flood defences, is extensive coastal lowland, mainly consisting of reclaimed intertidal flats and now protected from large-scale flooding by a series of grassed earth embankments. The zone below the 0.5% extreme flood level is about 35 km (about 22 miles) wide and is bordered by high ground to the South West, around Peterborough. The land generally slopes down away from the shoreline: the elevation is generally around 3 mAOD within 10 km (about 6 miles) from the shoreline, but it is lower further from the shoreline, down to OD between Peterborough and Wisbech.

Land use and environment

Coastal strip

The settlements in this area comprise disparate properties and hamlets, which increase in number and size towards the A17 and Holbeach. The larger settlements in this reach include Holbeach St. Marks, Holbeach St. Matthew and Gedney Drove End adjacent to the shoreline. A network of minor roads exists to serve these properties, which is sparse in the Western

reaches towards the coastline, and more developed towards the East (including the B1359 toward Gedney Drove End) and towards the belt of settlements along the A17.

Land in this area is of high arable agricultural value, this being the dominant land use in the area. There is a strip of grade 2 land right behind the frontline defences, turning to grade 1 further inland. The coastal hinterland in this area is a nationally important breeding habitat for both Marsh and Montagu's Harriers and is therefore designated, while the area seaward of the primary flood defence, which comprises a significant area of designated saltmarsh and mudflats, is of high conservation value. Much of the offshore area is also of significant military importance as a weapons training range.

The Port of Sutton Bridge is of economic importance both locally and regionally. This port is owned by Cobelfret and handles mainly steel, but also smaller volumes of grain and other agri-bulks. Total tonnage handled by the Port of Sutton Bridge in 2006 was just under 600,000. There is virtually no commercial fishing fleet operating out of the port.

Belt of settlements and hinterland

In common with other areas of the Wash, there is a belt of settlements and hinterland on slightly higher land, in this case around the A17 and the A151. It consists of Moulton Sea End, Weston, Moulton, Whaplode, Holbeach, Fleet Hargate, Gedney and Gedney Dike, Long Sutton, Luton and Sutton Bridge.

The belt also contains associated smaller settlements and isolated properties, which are served by a network of minor roads. Infrastructure in the area comprises the A151, which is significant in connecting Spalding to the settlements to the east (those named above), the A17, the A1101 going inland, and in addition various B roads and minor roads. There are also a number of key man-made waterways/drains.

Land use in this area is predominantly arable agriculture, and in addition several orchards are present, especially further toward the east. The main natural, heritage or landscape features are the Fenland landscape, the Rivers Welland and Nene and the major drains that run through the area.

The key values are visualised in figure E2.4.

Objectives

The SMP will need to select the policies that provide the best balance between the key values for each stretch of the shoreline, taking account of the established principles. The objectives have been set up to reflect the values and the principles. For this area, the SMP will need to find the right balance between the following potentially competing objectives:

- Communities;

- Area of grade 1 and 2 agriculture;
- Habitats;
- Need for flood and erosion risk management.

Whilst taking account of other values such as regional transport routes, MoD use of the foreshore, drainage and recreation

Flood and erosion risk

- Minimise flood risk to people, property and the environment.
- Have as little flood and erosion risk management throughout the plan period as possible.
- Maximise the use of the inland lines of (historical) man-made defences.

Communities

- Protect as many settlements as possible.
- Protect as a minimum, throughout the plan period, to an appropriate standard of protection, all established communities in the unit:
 - Moulton Seas End, Holbeach Clough, Holbeach, Fleet Hargate, Gedney, Lutton, Long Sutton, Sutton Bridge, Holbeach St Marks, Holbeach St Matthew and Gedney Drove End;
 - and the area landward from these settlements.

Habitats

- Maintain natural processes relating to mudflats, saltmarsh, sand dunes and coastal lagoons.
- Maintain and if possible increase the area of mudflats, saltmarsh, sand dunes and coastal lagoons.
- Ensure that the impact on the UK's area of intertidal habitat is acceptable.

Agriculture

- Protect as much grade 1 and grade 2 lands as possible.
- Ensure that the impact on the UK's area of grade 1 and grade 2 lands is acceptable.

Infrastructure

- Avoid interruption of the drainage function of Rivers Welland and Nene throughout the plan period.
- Avoid interruption of transport connections and utility supply throughout the plan period.

Timing of policies

Provide sufficient time, if required, for:

- Community adaptation;
- Change of flood risk management practices;
- Relocation of regional infrastructure, ensuring continued A-road links between Boston and King's Lynn and links between the communities;

- Adaptation of Sutton Bridge Port;
- Research of archaeological features and ecological surveys;
- Recreational access to the foreshore.

E2.4.5 River Nene to River Great Ouse

Characterisation

Coastal processes and flood risk

This frontage is characterised by up to 4 km (2.5 miles) wide intertidal flats with saltmarsh in the upper zone. The foreshore is strongly dominated by the outfall of the River Great Ouse at the Eastern end, including the sandbank created by the river's sediments (Seal Sand). This sandbank shields the foreshore and the flood defences from wave attack and its shape influences erosion and accretion patterns. The Lynn Deeps deep water channel controls the position of the low water mark. The two trained river outfalls form transient flow channels through the foreshore.

Future shoreline behaviour is expected to be influenced by sea level rise. The expectation is that saltmarsh will initially increase both vertically and horizontally while the width of the mudflats will decrease, reflecting a continued trend of coastal squeeze. However, as the rate of sea level rise increases after 2055, the uncertainty about foreshore development increases. The current accretional trend may continue, but there could also be a change to a more erosional future. See appendix F for further details.

The backshore, behind the flood defences, is extensive coastal lowland, mainly consisting of reclaimed intertidal flats and now protected from large-scale flooding by a series of grassed earth embankments. The zone below the 0.5% extreme flood level is over 50 km (31 miles) wide and is bordered by high ground to the South, around Ramsey. The land generally slopes down away from the shoreline: from 3 mAOD within 10km (about 6 miles) from the shoreline, to 2 mAOD around 25 km (about 15 miles) from the shoreline, to around OD in the zone along the high ground, almost 50 km (about 30 miles) from the shoreline. This lower lying zone also contains 'islands' of high ground around the main settlements Whittlesey, March and Chatteris.

Land use and environment

Coastal strip

The land in this reach is low lying and within the flood zone and has two and over some lengths, three lines of flood defences.

The settlement pattern in this unit is similar to that of the previous units whereby the area closest to the shoreline is sparsely populated, with a handful of disparate properties. Land in this area is mostly grade 2 agricultural land, and this is the dominant land use in the area. The area seaward of the primary flood defence, which comprises a significant area of

designated saltmarsh and mudflats, is of high conservation value. Much of the offshore area is also of significant military importance as a weapons training range. The Wash National Nature Reserve, which occupies much of the coastal offshore length of the unit, affords significant amenity, educational and conservation value, as does the Peter Scot Walk, which follows the primary flood defence.

There is also a small port at Wisbech which is currently undergoing a revival. This port handles mainly timber and steel and the total tonnage handled by the port in 2006 was just over 100,000. The River Nar, which flows into King's Lynn, is also a significant factor in determining the form and function of the town.

Belt of settlements and hinterland

The belt of communities and hinterland consists of Walpole Cross Keys (connected by the old earth embankment with the other Walpoles along the old estuary of River Nene), Terrington St Clement; and Clenchwarton, all just seaward of the A17. There is a similar belt along the A47, including Terrington and Tilney all Saints. The most significant settlement in the area is Wisbech, which functions as a regional service centre.

The A47, which transects the area, represents a significant transport link of regional significance, as it links Wisbech, and the wider road network to the east, to King's Lynn and the North Norfolk coast. The A17 also performs an important strategic function as a major road link between Norfolk and the North and Midlands via the A1. In addition to this, a network of minor roads is present, connecting the various settlements and disparate properties. The electricity lines present in previous units continue through this area. There are also a number of key man-made waterways/drains.

Land use in the area is predominantly arable agriculture, although in common with the adjacent unit a number of orchards are also present. The Smeeth Lode and Middle Level Main Drain both run through the area, prior to discharging to the River Great Ouse.

The key values are visualised in figure E2.5.

Objectives

The SMP will need to select the policies that provide the best balance between the key values for each stretch of the shoreline, taking account of the established principles. The objectives have been set up to reflect the values and the principles. For this area, the SMP will need to find the right balance between the following potentially competing objectives:

- Communities;
- Area of grade 1 and 2 agriculture;
- Habitats;

- Need for flood and erosion risk management.

Whilst taking account of other values such as regional transport routes, drainage and recreation

Flood and erosion risk

- Minimise flood risk to people, property and the environment.
- Have as little flood and erosion risk management throughout the plan period as possible.
- Maximise the use of the inland lines of (historical) man-made defences.

Communities

- Protect as many settlements as possible.
- Protect as a minimum, throughout the plan period, to an appropriate standard of protection, all established communities in the unit:
 - Walpole Cross Keys, Terrington St Clement, Clenchwarton, West Lynn;
 - And the area landward from these settlements.

Habitats

- Maintain natural processes relating to mudflats, saltmarsh and sand dunes.
- Maintain and if possible increase the area of mudflats, saltmarsh and sand dunes.
- Ensure that the impact on the UK's area of intertidal habitat is acceptable.

Agriculture

- Protect as much grade 1 and grade 2 lands as possible.
- Ensure that the impact on the UK's area of grade 1 and grade 2 lands is acceptable.

Infrastructure

- Avoid interruption of the functioning of King's Lynn Port throughout the plan period.
- Avoid interruption of the drainage function of Rivers Nene and Great Ouse throughout the plan period.
- Avoid interruption of transport connections and utility supply throughout the plan period.

Timing of policies

Provide sufficient time, if required, for:

- Community adaptation;
- Change of flood risk management practices;
- Relocation of regional infrastructure, ensuring continued A-road links between Boston and King's Lynn and links between the communities;
- Research of archaeological features and ecological surveys;

- Recreational access to the foreshore.

E2.4.6 River Great Ouse to Wolferton Creek including King's Lynn

Characterisation

Coastal processes and flood risk

This frontage is characterised by up to 4 km (2.5 miles) wide intertidal flats with saltmarsh in the upper zone. The foreshore is strongly dominated by the outfall of River Great Ouse at the Western end, including the sandbank created by the river's sediments (Seal Sand). This sandbank shields the foreshore and the flood defences from wave attack and its shape influences erosion and accretion patterns. The outfalls of the Great Ouse and Wolferton creek form transient flow channels through the foreshore.

Future shoreline behaviour is expected to be influenced by sea level rise. The expectation is that saltmarsh will initially increase both vertically and horizontally while the width of the mudflats will decrease, reflecting a continued trend of coastal squeeze. However, as the rate of sea level rise increases after 2055, the uncertainty about foreshore development increases. The current accretional trend may continue, but there could also be a change to a more erosional future. See appendix F for further details.

The backshore, behind the flood defences, is coastal lowland, mainly consisting of reclaimed intertidal flats and now protected from large-scale flooding by a series of grassed earth embankments. A 5 km (about 3 miles) wide zone is confined by the earth embankments, the high ground and the town of King's Lynn. The land south of King's Lynn and East of River Great Ouse could in theory also be affected by flooding from the shoreline; the low lying area stretches South, almost as far as Cambridge, with high ground zones around Ely and other settlements.

Land use and environment

The River Great Ouse and the town of King's Lynn mark the transition from the extremely wide low-lying Fenland to a relatively narrow coastal strip backed by high ground: the area of low lying land extends a relatively short distance inland, with the land rising sharply towards the A149 and King's Lynn. The low lying area South of King's Lynn, to the east of River Great Ouse, mainly consists of typical agricultural Fenland landscape. There are also a number of key man-made waterways/drains.

Unlike previous units, settlements within this unit are concentrated within the larger urban area of King's Lynn which includes the villages of North and South Wootton, plus two other villages, Castle Rising and Wolferton. All these settlements are at the foot of and partly on the high ground. King's Lynn is a major settlement with a regional function. King's Lynn also has a port, owned by Associated British Ports (ABP), which handles mainly timber, grain and aggregates, in addition to smaller volumes of scrap, fertiliser and

agri-bulks. Total tonnage in 2006 was just over 600,000. The coastal strip itself contains only very few disparate properties.

Part of the land in this area is of high arable agricultural value (some grade 1, some grade 2, most grade 3), and this is the dominant land use in the area. The area seaward of the primary flood defence, which comprises a significant area of designated saltmarsh and mudflats, is of high conservation value. The other significant natural feature in the unit is the Babingley River, which has some conservation, amenity and angling value, albeit that it is heavily modified in its lower reaches. The Wash National Nature Reserve, which occupies much of the coastal offshore length of the unit, affords significant amenity, educational and conservation value, as does the Peter Scot Walk, which follows the primary flood defence. Part of the area belongs to the Western outlier of the Norfolk Coast Area of Outstanding Natural Beauty, displaying the characteristic combination of flat coastal lowland backed by the ridge of high ground.

The key values are visualised in figure E2.6 and figure E2.7. For this area, there are separate cross sections through King's Lynn toward the Fenland to the South, and through North Wootton onto the high ground.

Objectives

The SMP will need to select the policies that provide the best balance between the key values for each stretch of the shoreline, taking account of the established principles. The objectives have been set up to reflect the values and the principles. For this area, the SMP will need to find the right balance between the following potentially competing objectives:

- Communities;
- Area of grade 1 and 2 agriculture;
- Habitats;
- Port of King's Lynn;
- Need for flood and erosion risk management.

Whilst taking account of other values such as regional transport routes, drainage, landscape and recreation

Flood and erosion risk

- Minimise flood risk to people, property and the environment.
- Have as little flood and erosion risk management throughout the plan period as possible.
- Maximise the use of the inland lines of (historical) man-made defences.

Communities

- Protect as many settlements as possible

- Protect as a minimum, throughout the plan period, to an appropriate standard of protection, all established communities in the unit:
 - the urban area of King's Lynn, including the villages of North and South Wootton, and support the regeneration and development of King's Lynn as a designated Key Centre for Development and Change and Growth Point in the eastern region;
 - the villages of Castle Rising and Wolferton;
 - the area landward from King's Lynn, North and South Wootton, Castle Rising and Wolferton.

Habitats

- Maintain natural processes relating to mudflats, saltmarsh and sand dunes.
- Maintain and if possible increase the area of mudflats, saltmarsh and sand dunes.
- Ensure that the impact on the UK's area of intertidal habitat is acceptable.

Agriculture

- Protect as much grade 1 and grade 2 land as possible
- Ensure that the impact on the UK's area of grade 1 and grade 2 lands is acceptable.

Infrastructure

- Avoid interruption of the functioning of King's Lynn Port throughout the plan period.
- Avoid interruption of the drainage function of River Great Ouse throughout the plan period.
- Avoid interruption of transport connections and utility supply throughout the plan period.

Landscape

- To maintain the integrity of the coastal landscape.

Timing of policies

Provide sufficient time, if required, for:

- Community adaptation;
- Change of flood risk management practices;
- Relocation of regional infrastructure, ensuring continued A-road links between King's Lynn and Hunstanton and links between the communities;
- Research of archaeological features and ecological surveys.

E2.4.7 Wolferton Creek to South Hunstanton

Characterisation

Coastal processes and flood risk

A broad intertidal flat, consisting of mudflats and sandflats, extends over 3 km (about 2 miles) seaward of the ridge. The coastal orientation changes at Snettisham Scalp where a large mussel bed lies on the intertidal flat. The wide intertidal flat limits wave energy that reaches the shoreline. The coastal processes are determined by the offshore sandbanks and by the main deep water channel (Lynn Deeps). In addition, the erosion of the cliffs at Old Hunstanton is likely to act as a sediment source. This area is a general zone of sediment accretion, and there is a general trend of sediment transport from north to south along the frontage.

A managed beach ridge, up to 6 metres high, extends along most of this frontage, backed by an earth embankment. This combined sea defence encloses a low-lying area of about 2.5 km (about 1.5 miles) wide, up to the high ground. Generally speaking, there is a process of accretion along the Northern and Southern part of the frontage, and a process of erosion in the central stretch (around and South of Heacham), caused by a difference in orientation.

Future shoreline behaviour is expected to be influenced by sea level rise, but also by management regimes. In general, it is expected that maintaining the current situation will require increased intervention.

Land use and environment

The land in this area is similar to that of Unit 8 whereby the area of flat, low lying land further narrows moving North, with the land rising sharply near the A149. The towns of Dersingham, Ingoldisthorpe and Snettisham are each at the foot of and partly on the high ground. This is also the case for Heacham, but in contrast to the others this town also has a distinct coastal character, mainly through the large shoreline caravan parks. The only other significant settlement is Shepherd's Port, which also encompasses a large camping and Caravan site. Thus, other than farm tracks, and a minor road between Shepherd's Port and Snettisham and the roads within Heacham, no surfaced roads are present in the reach.

Land in this area is of arable agricultural value, mostly grade 3. This is the predominant land use in the southern part of the unit, but the character is very different from areas further west (smaller fields, less intensive and artificial drainage systems). North of Shepherd's Port, the predominant land use is livestock grazing. Additionally, this area is also famous for its lavender growing (and includes the Lavender Centre at Heacham), and the Carstone Quarry near to Heacham.

As with the previous unit, the foreshore is mainly sandy. This presents significant amenity and recreational value, which is of economic value to the area, as illustrated by the strip of beach houses between the shingle bank and the embankment and by the caravan parks at Heacham and South of Hunstanton. There is also a golf course just South of Hunstanton. The foreshore also has significant habitat value.

Natural features in this reach are Boathouse Creek, the Ingol and the series of saline lagoons which run the length of the unit at the shoreline. These afford the landward part of the unit some limited conservation and recreation (angling) value. North of Shepherd's Port there is a higher level of natural features, with the presence of remnant river channels and creeks, which now form ox-bow lakes landward of the flood bank, and seaward of the floodbank in the form of Heacham Harbour. The Heacham River (a chalk stream) also represents a relatively unmodified river in the context of the Wash SMP area and thus represents some conservation and amenity value. Parts of the area belong to the Norfolk Coast Area of Outstanding Natural Beauty, displaying the characteristic combination of flat coastal lowland backed by the ridge of high ground. Further inland there are various SSSIs such as Dersingham Bog, Heacham Brick Pit, Snettisham Carstone Quarry and Ringstead Downs. The saline lagoons have a priority habitat status under the European Habitats Directive.

The key values are visualised in figure E2.8.

Objectives

The SMP will need to select the policies that provide the best balance between the key values for each stretch of the shoreline, taking account of the established principles. The objectives have been set up to reflect the values and the principles. For this area, the SMP will need to find the right balance between the following potentially competing objectives:

- Communities;
- Beach recreation and tourism facilities;
- Habitats;
- Need for flood and erosion risk management.

Whilst taking account of other values such as regional transport routes and landscape

For this area, there is a set of overall objectives (under the heading **Overall**) but there are also objectives that apply to certain frontages only (under the headings '**Heacham**' and '**Shingle ridge between Heacham and Hunstanton**').

Overall

Flood and erosion risk

- Minimise flood risk to people, property and the environment.
- Have as little flood and erosion risk management throughout the plan period as possible.

Communities

- Protect as many settlements as possible
- Protect as a minimum, throughout the plan period, to an appropriate standard of protection, all established settlements in the unit:
 - Dersingham, Ingoldisthorpe, Snettisham, Heacham (permanent dwellings);
 - and the area landward from these settlements.

Habitats

- Maintain natural processes relating to sand and shingle shorelines, mudflats, saltmarsh, sand dunes and coastal lagoons.
- Maintain and if possible increase the area of mudflats, saltmarsh, sand dunes and coastal lagoons.
- Allow for natural interaction between beaches and dune systems.
- Ensure that the impact on the UK's area of intertidal habitat is acceptable.

Coastal processes

- To prevent interruption of the role of coastal processes in supplying sediment to the neighbouring frontages.

Landscape

- To maintain the integrity of the coastal landscape.

Timing of policies

Provide sufficient time, if required, for:

- Community adaptation;
- Change of flood risk management practices;
- Relocation of regional infrastructure, ensuring continued A-road links between King's Lynn and Hunstanton and links between the communities;
- Research of archaeological features and ecological surveys.

Heacham

- To balance the long-term costs of ongoing sea wall maintenance with the long-term impacts on tourism values and the long-term costs of loss or relocation of the caravan parks.
- If temporary tourist facilities cease to be defended in future epochs, defences will be provided for an adequate period for possible relocation within the auspices of the land use planning system.
- To avoid negative impacts on the coastal processes in neighbouring sections.

Shingle ridge between Heacham and Hunstanton

- To balance the costs of ongoing shingle ridge maintenance with the costs of loss or relocation of the beach huts.
- If temporary tourist facilities will cease to be defended in future epochs, defences will be provided for an adequate period for possible relocation within the auspices of the land use planning system.

E2.4.8 Hunstanton

Characterisation

Coastal processes and flood risk

The frontage at Old Hunstanton contains sandstone and chalk sea cliffs between 10 and 20 m in height, fronted by a sandstone foreshore platform. The geology of the cliffs itself mainly controls the rate of erosion. Former low cliffs at the southern end are now landscaped and defended by sea walls, fronted by a beach. An offshore bank (Sunk Sand) extends over 4 km (2.5 miles) from the coast with a large dry area at low water.

Future shoreline behaviour is expected to be influenced by sea level rise. It is expected that cliff erosion will continue around its current rate of 1 m per 5 or 10 years, possibly increasing to locally over 1 m per year after 2055. For the beach area, it is likely that the current trend of vertical erosion will continue and increase, although this could be reduced in case of increased erosion of the cliffs or due to increased shelter provided by favourable movements or developments of Sunk Sand.

Land use and environment

Hunstanton is a regional commercial centre. It is also a coastal resort, with all associated features, including a town beach, promenade, seaside amenity area and holiday parks providing high quality year round tourist accommodation and facilities. The A149 runs on the landward side of the town and also has a regional function. There is residential development at approximately 100m from the cliffs in North Hunstanton.

The key values are visualised in figure E2.9 and figure E2.10. For this area, there are separate cross sections through Hunstanton town and through the cliffs at North Hunstanton.

Objectives

The SMP will need to select the policies that provide the best balance between the key values for each stretch of the shoreline, taking account of the established principles. The objectives have been set up to reflect the values and the principles. For this area, the SMP will need to find the right balance between the following potentially competing objectives:

- Communities;

- Beach recreation and tourism;
- Impact through coastal processes on neighbouring frontages;
- Need for flood and erosion risk management.

Whilst taking account of other values such as regional transport routes, landscape, habitats and geological interest

For this area, there is a set of overall objectives (under the heading **Overall**) but there are also objectives that apply to certain frontages only (under the subsequent underlined headings).

Overall

Flood and erosion risk

- Minimise flood and erosion risk to people, property and the environment.
- Have as little flood and erosion risk management throughout the plan period as possible.

Communities

- To maintain Hunstanton as a viable town, seaside resort and regional commercial centre throughout the plan period.

Landscape

- To maintain the integrity of the coastal landscape.

Holiday Centres and caravan parks south Hunstanton

- To balance the long-term costs of ongoing sea wall maintenance with the long-term impacts on tourism and its value to the local economy, taking into account the long-term costs of loss or relocation of the established holiday centres and caravan parks.
- If temporary tourist facilities cease to be defended in future epochs, defences will be provided for an adequate period for possible relocation within the auspices of the land use planning system.

Town centre / boulevard

- To maintain the existing level of intertidal beach area throughout the plan period.

Cliffs

- To protect as much of the existing development from cliff erosion as possible.
- To maintain natural processes relating to cliffs.
- To prevent interruption of the role of cliff erosion in supplying sediment to the neighbouring frontages and offshore zone.

Figure E2.1 Gibraltar Point to River Witham Cross Section Diagram

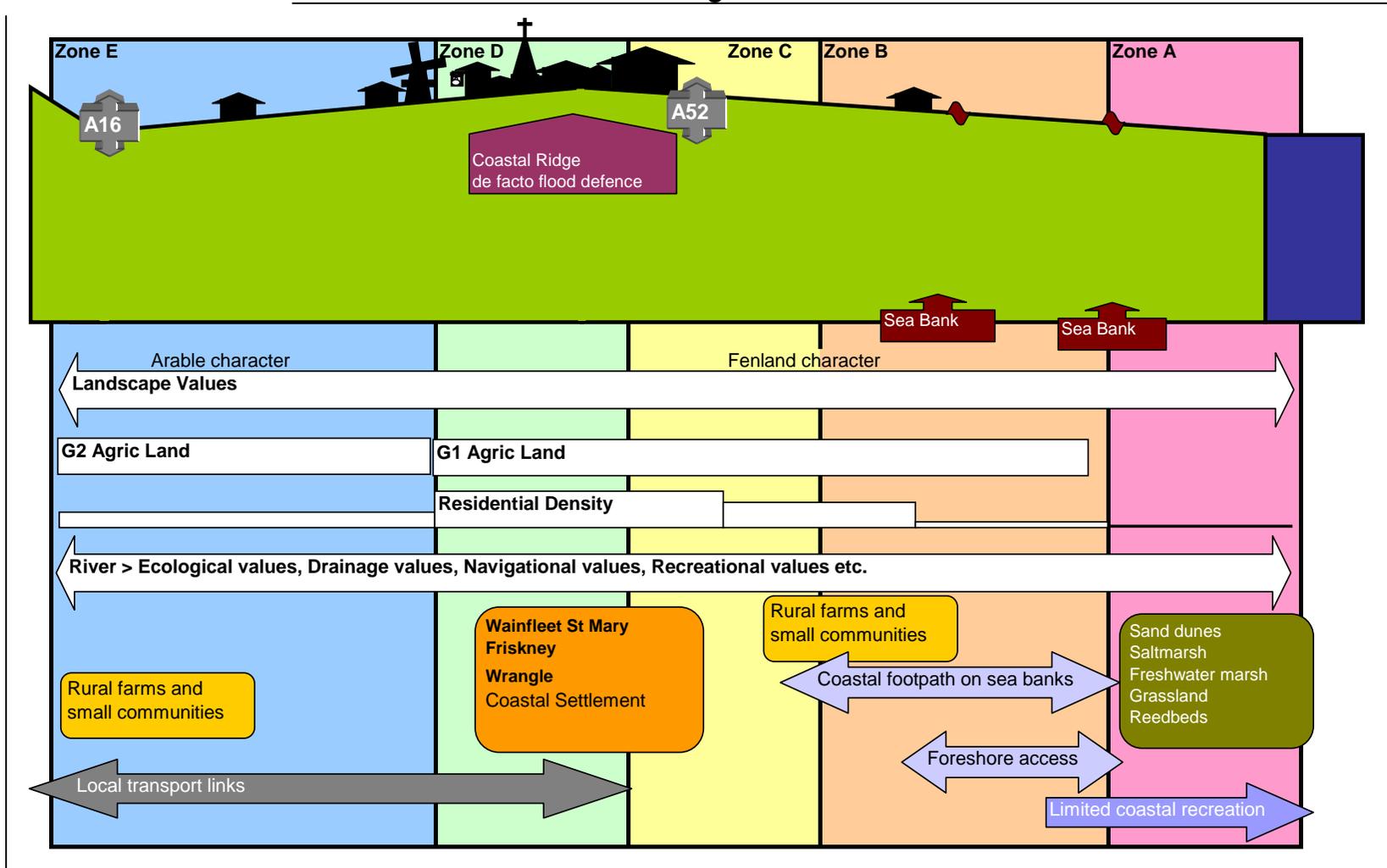


Figure E2.2 Wrangle to River Witham Cross Section Diagram

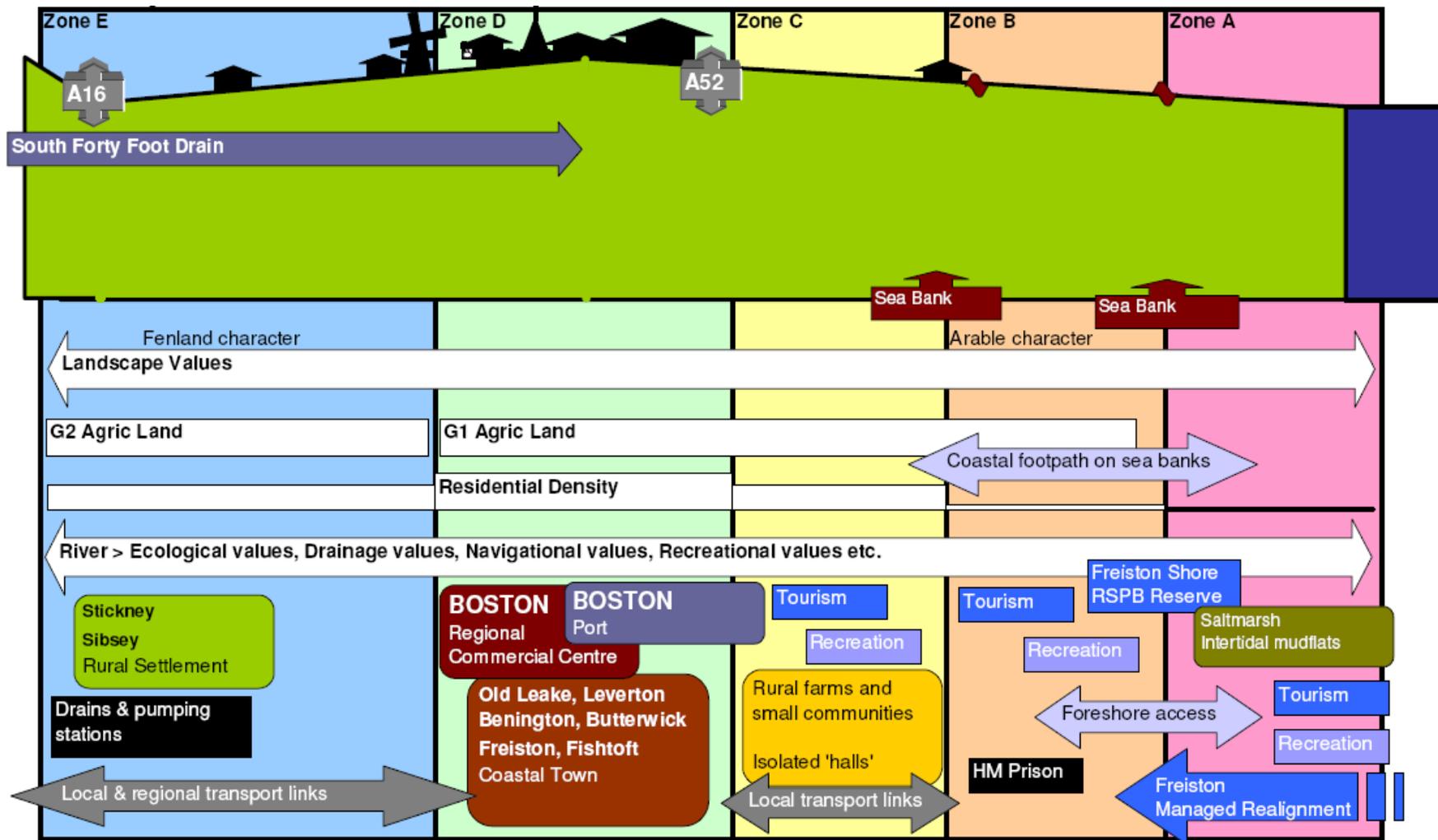


Figure E2.3 River Witham to River Welland Cross Section Diagram

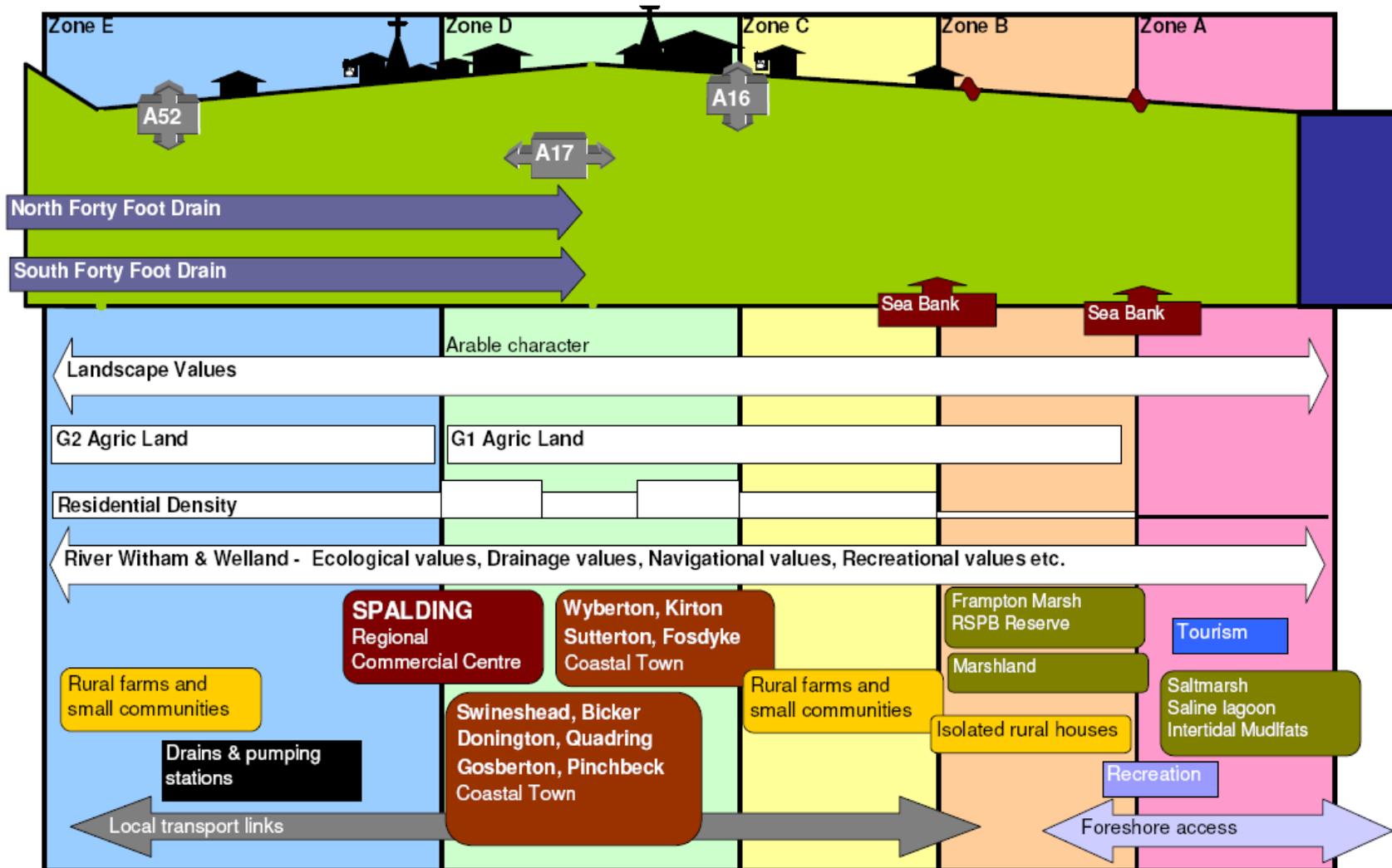


Figure E2.4 River Welland to River Nene Cross Section Diagram

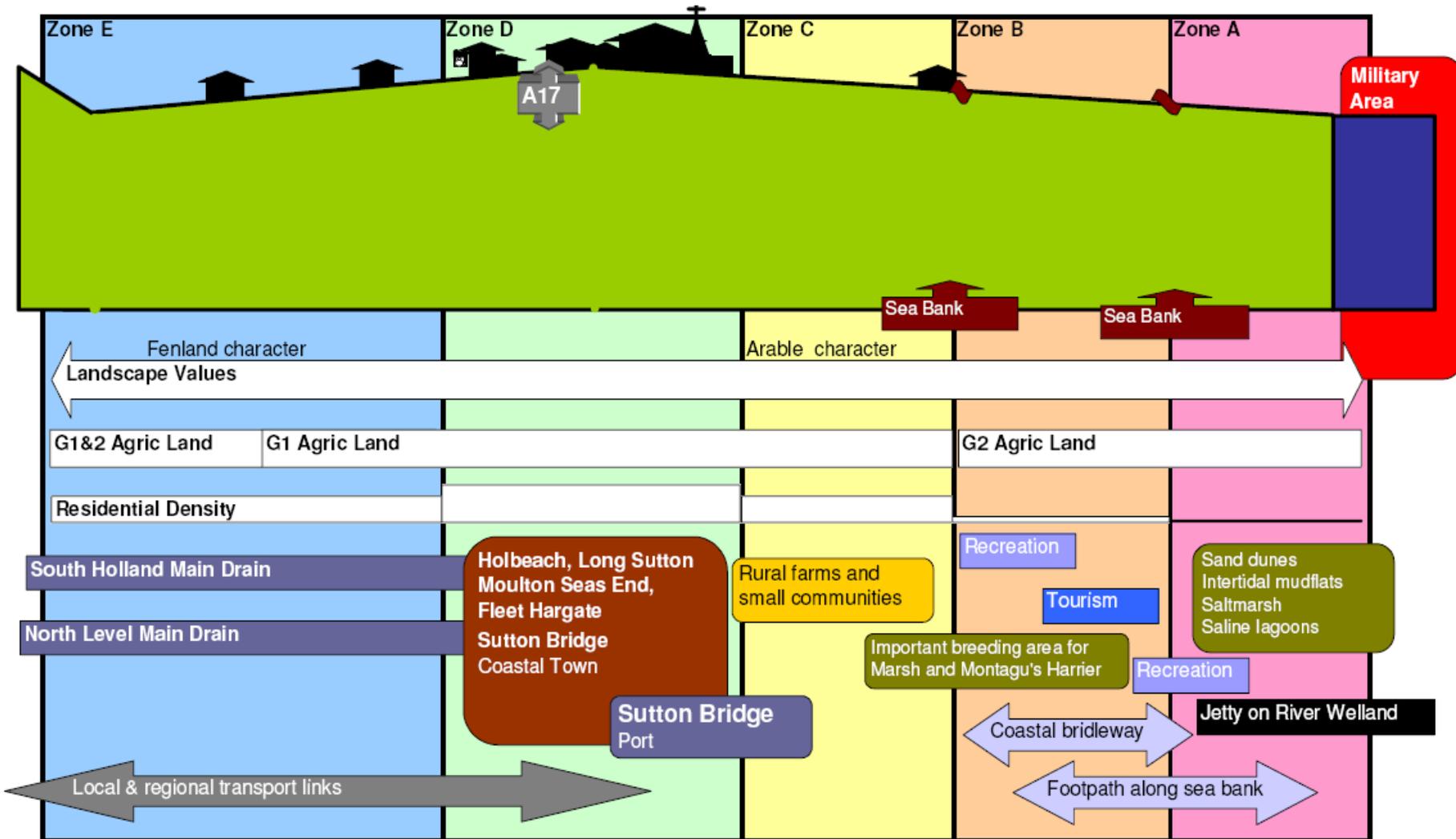


Figure E2.5 River Nene to River Great Ouse Cross Section Diagram

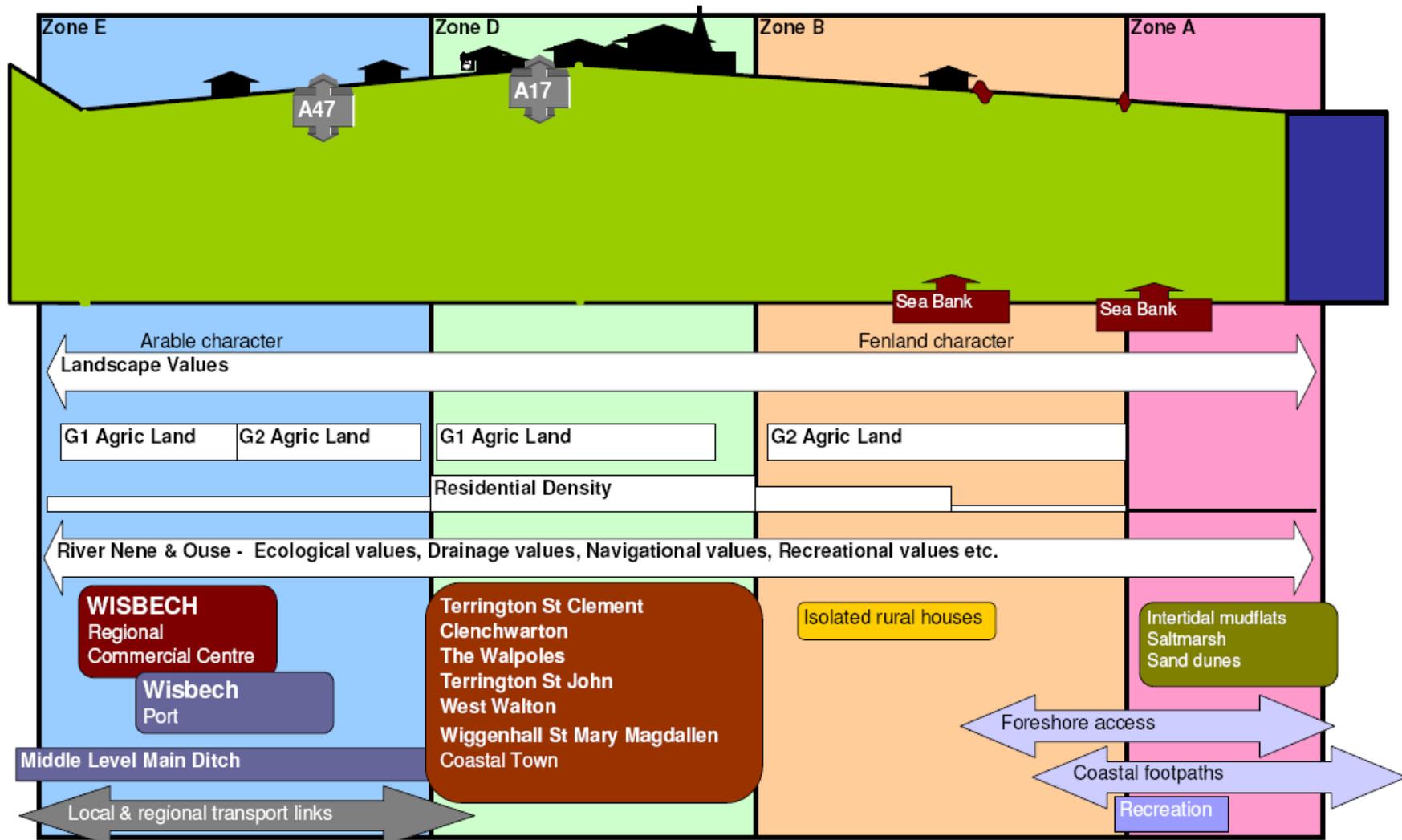


Figure E2.6 River Great Ouse to Wolferton Creek (King's Lynn only) Cross Section Diagram

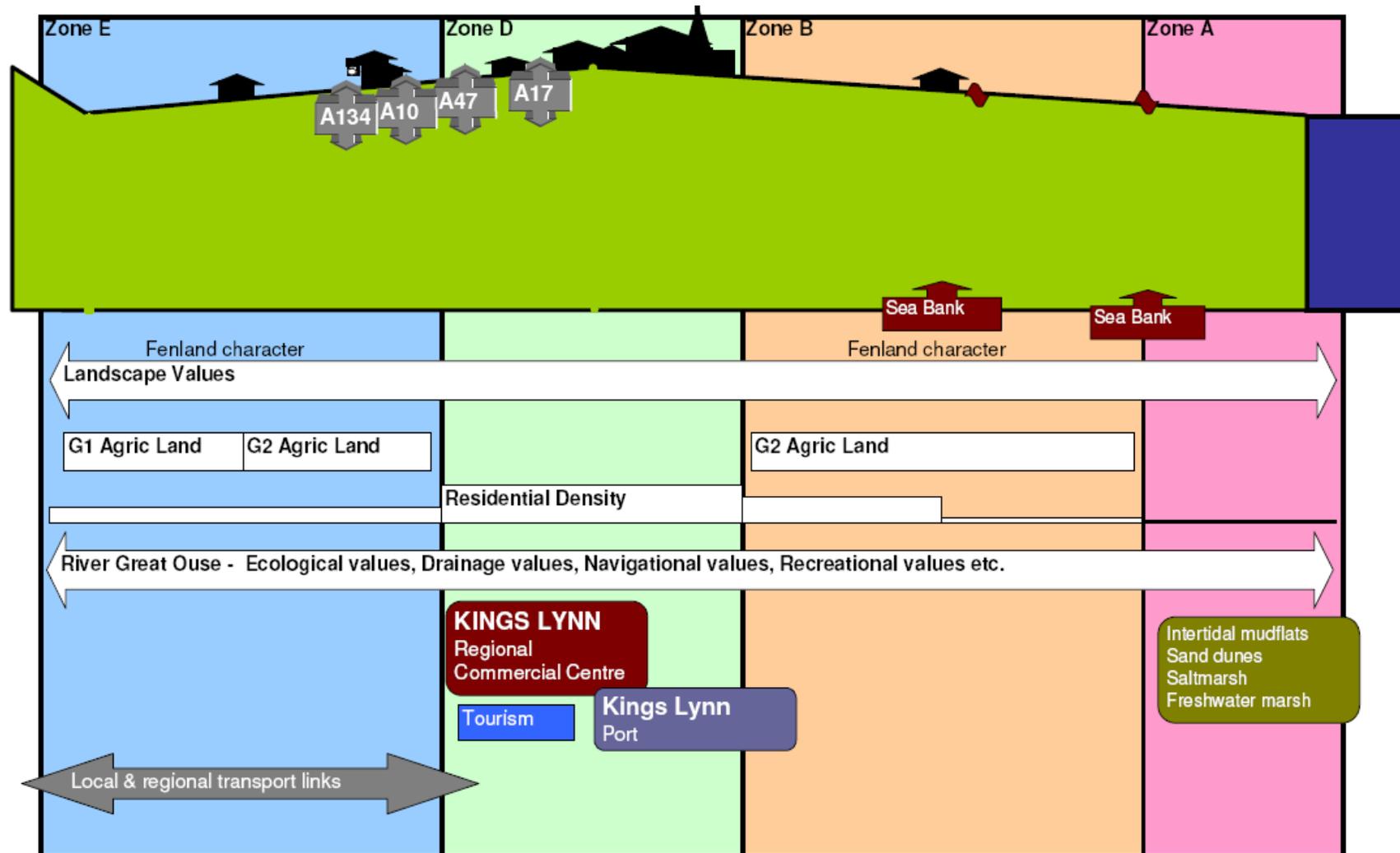


Figure E2.7 River Great Ouse to Wolferton Creek (North Wootton only) Cross Section Diagram

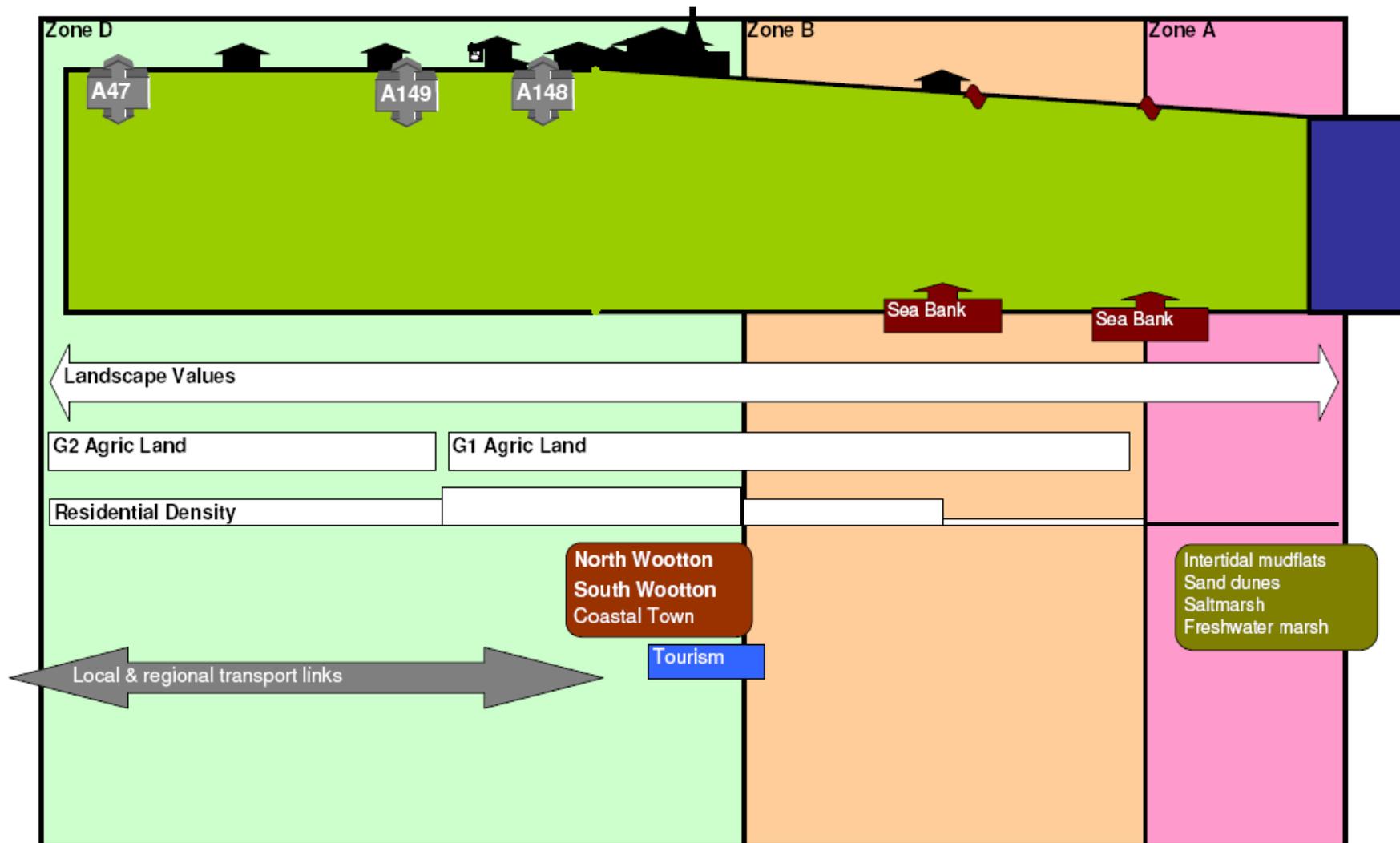


Figure E2.8 Wolferton Creek to South Hunstanton Cross Section Diagram

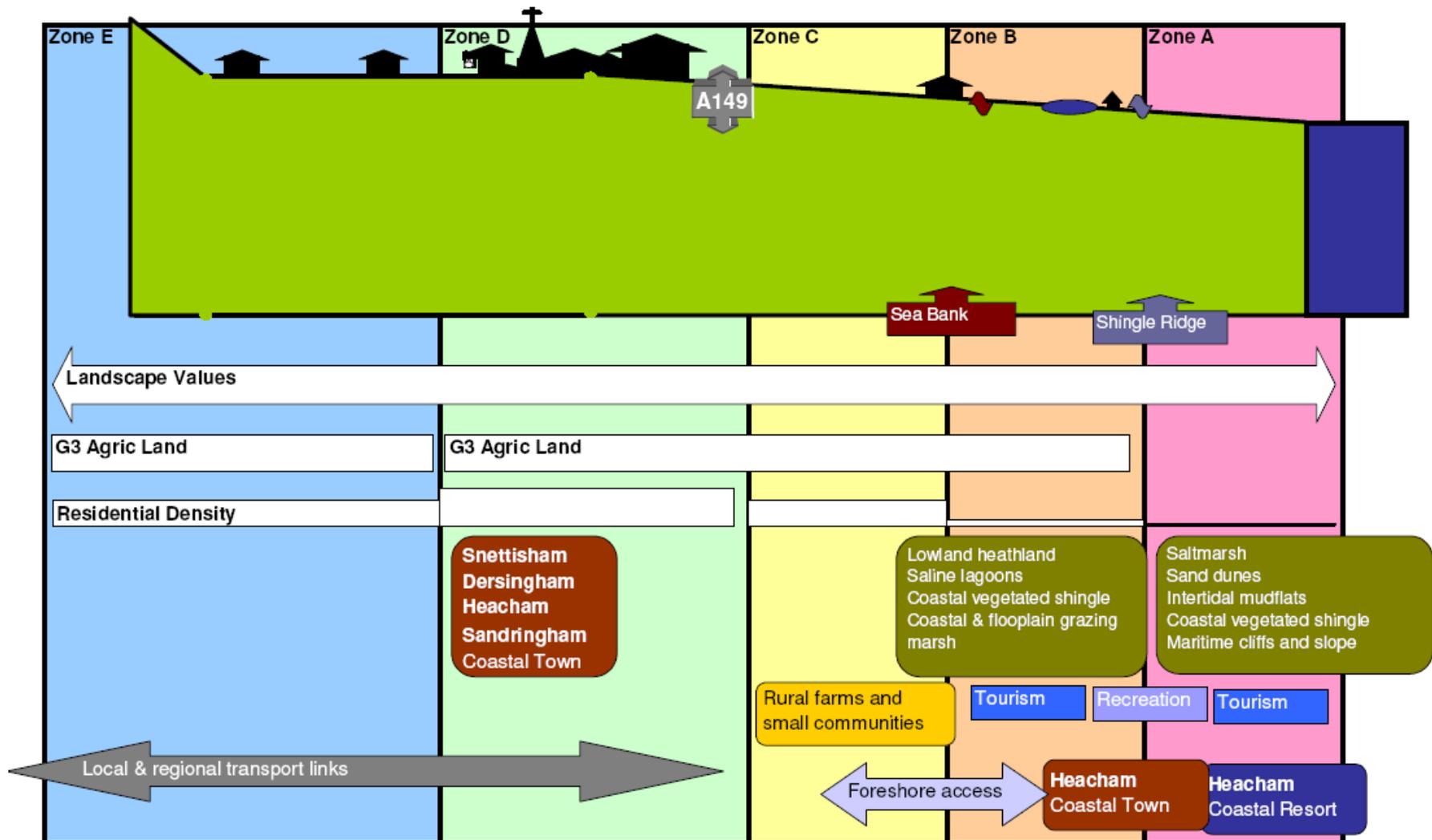


Figure E2.9 Hunstanton Town Cross Section Diagram

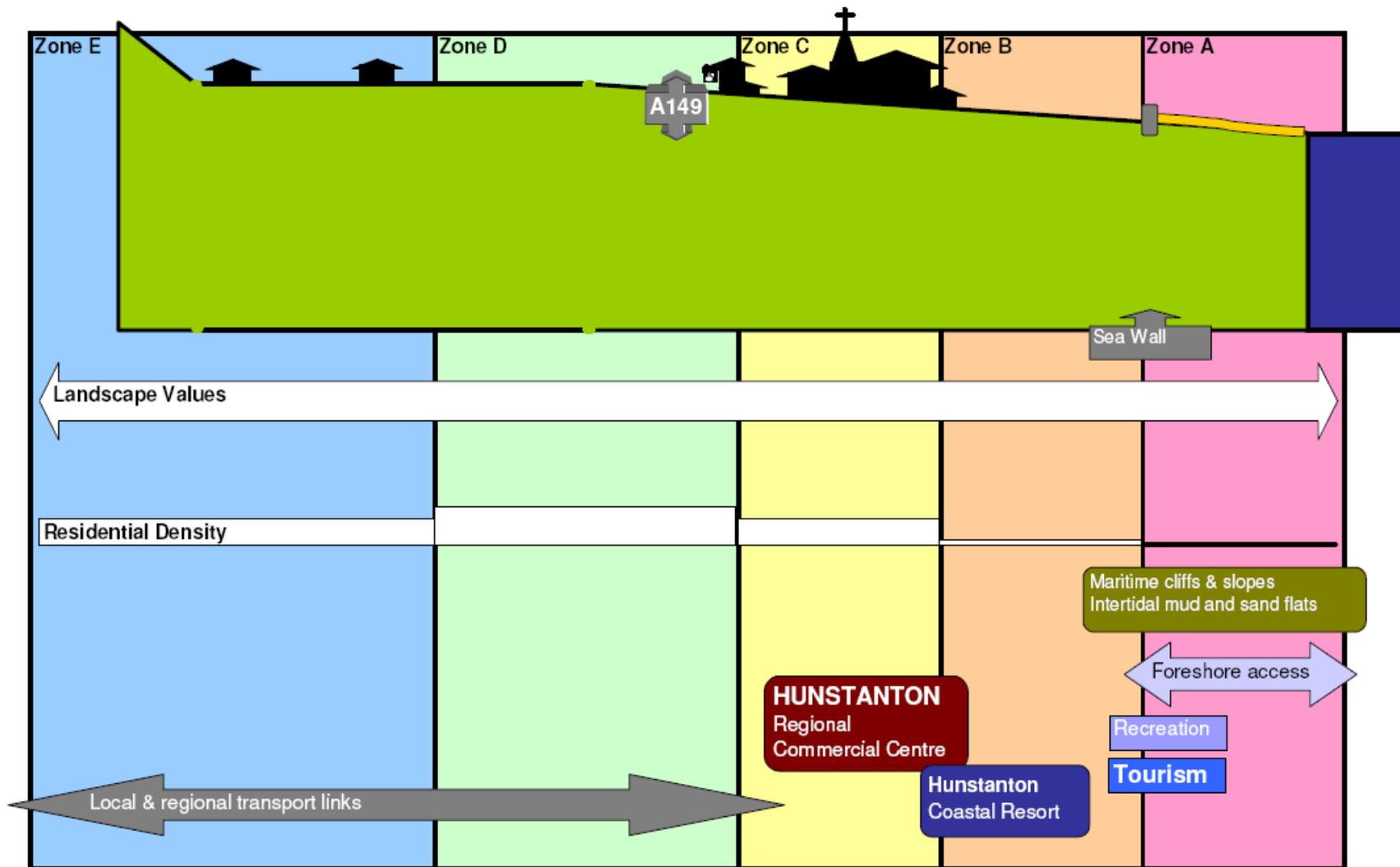


Figure E2.10 Hunstanton Cliffs Cross Section Diagram

E3 POLICY DEVELOPMENT

E3.1 Introduction

This section reports on the development of Policies, as defined by Task 3.1 of the SMP Guidance. This involved the definition of the policy options to be appraised. This started with the definition of the ‘playing field’, identification of the policies that are sufficiently relevant and realistic to justify the effort of full appraisal. This was followed by the identification of a number of ‘policy packages’ that spanned the playing field and were sufficiently distinct to represent the fundamental choices that the SMP has to make.

To avoid confusion about some of the policy appraisal terminology a specific Policy Appraisal Glossary for some of the main terms has been developed, as detailed in section E3.2.

E3.2 Policy Appraisal Terminology

E3.2.1 Policy

This describes the way that a shoreline is managed. In line with SMP guidance, four policies are available:

- No active intervention (NAI)
- Hold the line (HTL): keep the existing line (even if changing the standard of protection)
- Advance the line (AtL): build new defences on the seaward side of the existing defences
- Managed realignment (MR): allowing the shoreline to move backwards or forwards, with management to control or limit movement. In practice, and for clarity, we suggest to only use this policy for landward movement of the defence; any seaward movement can be defined as AtL.

However, these SMP policies focus purely on the location of the shoreline. In addition, there are areas in The Wash SMP where policy decisions for the shoreline may also have implications for tidal flooding inland of the defence. To take account of this potential risk it was decided by the SMP partnership group to also set flood risk management policies alongside those for the management of the shoreline.

Inland flood risk from rivers and other sources is assessed by Catchment Flood Management Plans (CFMPs), and each policy used in these plans is defined as ‘*a sustainable aspiration or proposed overall direction to manage current and future flood risk in a sustainable manner*’.

Considering these succinct definitions already existed, capturing a range of future flood risk management intents, the SMP partnership group suggested

using them to support the SMP. Therefore The Wash SMP draws from the following CFMP-defined flood risk policies:

- P1: No active intervention
- P2: Reduce existing flood risk management actions, accepting increase of risk over time
- P3: Continue with existing or alternative actions to manage flood risk at the current level, accepting that flood risk will increase over time from this baseline
- P4: Take further action to sustain the current level of flood risk into the future (responding to the potential increase in risk from climate change)
- P5: Take further action to reduce flood risk.

Note that these policies do not in themselves justify any activity, or investment, and do not prescribe any particular standard of protection (which requires a more detailed analysis and appraisal), but they do of course set the direction of intent for approaches to risk management.

Also, in determining tidal flood risk within the SMP, we have taken the CFMP policy headline only to capture a description of the intended approach to managing the risk over the plan period. Therefore it should be noted that:

- the flood risk policies described in this SMP have not been appraised in the same manner as the policies derived for inland flood risk within CFMPs;
- the policy wordings differ slightly to how they appear in the CFMPs themselves due to being adapted for use in shoreline management, and;
- flood risk policies have been used across each epoch, in a way that is different to their use in CFMPs.

The final policy for each relevant policy unit will be a combination of the location-based SMP policies across all epochs and the long-term sea flooding risk management policy, e.g:

- HtL (P3): Hold the defence in its current location and maintain risk at its current level, accepting increase of risk due to future changes,

or:

- HtL (P4): Hold the defence in its current location, sustaining the risk at its current level, ensuring it does not increase in the future etc

N.B. The CFMPs surrounding The Wash SMP (River Witham, River Welland, River Nene and Great Ouse) also consider tidally influenced fluvial flooding. Although there may be an overlap between the CFMPs and SMP, there is no conflict. The CFMPs have all selected a Policy 4 for the inland areas around The Wash, and in the single Policy Development Zone of The Wash where a flood risk policy was applied, it too opted for a policy to sustain the current level of risk (of flooding from the sea) into the future. All these high level plans promote a case for an integrated flood risk management approach where the interaction between river and tidal flooding will be considered in more detail.

E3.2.2 Scenario

This is defined in the SMP guidance as a full set of policies for the whole SMP frontage and for the three epochs. We have developed Baseline scenarios that use only one policy for the whole area and all epochs, but a scenario can consist of any combination of policies in space and time. Note that this use of the word scenarios does not relate to possible future developments of external factors such as climate change or economic development. To avoid confusion, we suggest to use the word 'policy package' instead of scenario.

E3.2.3 Intent of Management

This describes the vision for the future of shoreline management in a certain frontage, for all epochs. We have introduced this concept in earlier notes because there is a risk that policy development and appraisal is too strongly focused on, and therefore restricted by, the defined policies. Especially for the Wash, it would not be sufficient to, for example, decide that Managed realignment is the right policy for a certain unit in a certain epoch: Managed realignment can mean a wide range of fundamentally different futures, and the SMP will also have to make decisions at that level, instead of leaving this to more detailed strategies. In addition, we feel that decision making should have a basis in a spatial and integrated vision, which can then be translated to the specific policies for the purpose of management.

E3.2.4 Policy Development Zones

A Policy Development Zone (PDZ) describes a length of frontage within which the features, issues and objectives are the same and therefore their response to a particular Policy Package will not largely differ. Four PDZs have been defined for the Wash SMP as listed below and shown in figure E3.1.

- PDZ1: Gibraltar Point – Wolferton Creek.
- PDZ2: Wolferton Creek – South Hunstanton.
- PDZ3: Hunstanton Town.

- PDZ4: Hunstanton Cliffs.

These PDZs are the frontages for which the Playing Field and Policy Options have been defined.

Figure E3.1 Policy Development Zone Location Map



E3.3 Playing Field

E3.3.1 Introduction

This section deals with Task 3.1a and 3.1b from the SMP Guidance. This concerns the identification of the policy options that are sufficiently relevant and realistic to justify the effort of full appraisal. This streamlining process is needed, because otherwise there would be an almost infinite number of combinations of policies in space (frontages) and time (epochs). So this task helps to make the SMP process more efficient. In addition, following a stepwise approach helps all involved to develop an understanding of the issues and to prepare for the level of decision making that is required in the SMP.

The essence of the task is to identify:

- **Obvious** policy choices for certain frontages and epochs - this would 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 would streamline the process by limiting the number of options that need appraisal.

It is also important to note that this task does not yet make decisions about policy: we only need to identify the policies that need full appraisal.

E3.3.2 General Issues

Policies to Cover Both Shoreline Location and Level of Flood Risk

SMP policies as defined in the guidance mainly concern the location of the shoreline. For The Wash SMP with its large tidal flood risk, policy decisions will also have to take flood risk levels into account. This means that the policies will have to be described by a combination of SMP policy and CFMP-defined policy. See section E3.2.1.

Role of Current Legislation for Future Epochs

An important issue at this stage of the SMP is the role of current legal restrictions for future epochs. This is particularly relevant for European sites (SACs, SPAs), which cover the whole frontage of Wash SMP and pose a legal requirement to avoid deterioration of its habitats. These legal requirements mean that any negative impact (if not compensated fully within the project area) is only legally possible in case of 'Imperative Reasons of Overriding Public Interest' (IROPI). For most designations, these reasons can concern socio-economic issues. For particular habitats and species however (so-called Annex I habitats), the only acceptable IROPI concerns Health and Safety; such annex I habitats are present in part of the Wash SMP area. Taking the 'IROPI' route is an option, but it is not an easy option and it has not happened much yet. This also means that there is no clearly developed

good practice yet. An issue to consider is whether in this situation, flood risk can be treated as a health and safety issue.

The SMP guidance (Volume 1) indicates that SMPs should take full account of the need to meet current legal obligations such as the Habitats regulations, also for epoch 2 and epoch 3. The Appropriate Assessment that we will carry out in parallel will check the policies against these requirements and we intend to use the AA to make the right decisions.

The question is to what extent these requirements should limit the 'playing field' at this stage of the SMP process. The SMP needs to develop realistic policies that provide the best balance of all values and interests. For the first epoch, current legal constraints mean that policies which clearly lead to deterioration of designated habitats (i.e. Advance the line) are not realistic (and in addition, there are probably no significant drivers to do so). However, for later epochs the drivers may be different and there could be significant drivers for Advance the line which need to be balanced against habitat interests.

Initial discussion in the CSG clearly raised the issues but did not arrive at a decision. The 'easy way' on the short term would be to discount Advance the line based on the SMP guidance. However, we are concerned that a decision like this, given emerging insights in future land use, needs more thorough justification, possibly through full policy appraisal.

Wide defence zones

There is much (international) research going on into the development of wide flood defence zones; this concept uses multiple lines, including existing (relic) inland lines, and associated land use change within the defence zone, to plan for future sea level rise. Such solutions could be realistic for the Wash in future epochs, and could be relevant at the level of the SMP. This could be seen as a combination of Hold the line and Managed realignment. This option is not explicitly discussed for the playing field definition, but we suggest to include it in the next step, in decisions about the Intent of management (see section E3.2).

Drivers and Constraints for Policies

All policies have drivers (reasons for) and constraints (reasons against). It is useful to start considering these at this stage, as we start the policy appraisal process. They are listed in table E3.1 for all four policies, as applied to Wash SMP.

Table E3.1 Drivers and Constraints for SMP Policies

Policy	Drivers	Constraints
No active intervention	Flood risk management budget Habitats	Existing land use: communities, agriculture, infrastructure
Advance the line	None for epoch 1 Possibly agriculture for epoch 2 / 3 Tourism near Hunstanton?	Habitats (designations, requirement of IROPI procedure)
Hold the line	Existing land use: communities, agriculture, infrastructure	Flood risk management, budget, Habitats
Managed realignment	Habitat Flood risk management budget? Not if new defence is built from scratch; possibly if built on existing defences or through Wide defence zones	Existing land use: communities, agriculture, infrastructure

E3.3.3 Playing Field

This section contains the description of the suggested playing field for policy appraisal. For four areas with fundamentally uniform characteristics (at the level of this analysis), all four SMP policies and all relevant CFMP-defined flood risk policies are discussed, leading to a suggested definition of the playing field.

PDZ1 Gibraltar Point to Great Ouse Outfall

This is a large area with many different and varying features, but it can be discussed under one heading for the purpose of this analysis.

No active intervention is no realistic option for this whole frontage. The work on the Baseline Scenarios has shown that this would lead to failure of most of the flood defences in the first or second epoch, leading to uncontrolled increase of flood risk. Given the large potential extent of flood risk, this contravenes the agreed principles to take into account adaptation and to develop policies to enable sustainable development. It also contravenes the objectives to keep providing protection to established settlements.

Note: on some frontages it could be an option to stop management of an existing front line defence, using an existing secondary line or high ridge for protection. However, this would be defined as a Managed realignment policy.

Is it realistic to consider **Advance the line** anywhere? AtL is not realistic for epoch 1: there are currently no significant drivers for land reclamation, and the presence of highly designated habitats in front of the defences in the whole SMP area will in practice prevent any advance move. However, for later epochs, a possible need for increase of agricultural land could be a driver (which may become clearer in the coming months, e.g. through the Foresight Land Use study). As mentioned in section 3 of this note, the CSG and EMF need to make a fundamental decision on how to deal with the issue of applying current legislation to future epochs, and how to deal with the IROPI route.

In any case, the SMP will have to deal somehow with the recently announced Wash Barrier plan. Note: the EMF has indicated that significant effort would be justified.

Hold the line is the current overall policy and is a realistic option for the whole area and for all epochs, so it needs to be assessed in policy appraisal.

Regarding **Managed realignment**, note that for this SMP, in practice, MR means landward realignment (see section E3.2). MR is a realistic option for all of the SMP area and for all epochs, and needs to be assessed in policy appraisal. However, we can use the Principles and Objectives already at this stage to limit the possible maximum landward extent to which the shoreline could realistically be realigned:

- All epochs: all established settlements (listed in the Objectives report) and the area landward of them will continue to receive appropriate protection throughout the plan period. This limits the landward extent for Managed realignment. The exact geographical limit depends on the area that is required as a minimum to safeguard the sustainability of the settlement (which could be more or less than the urbanised area). We suggest that this more detailed analysis is carried out in the next stage (definition of policy scenarios). Figure E3.2 shows the urbanised area of all identified established settlements.
- Earlier epochs: the principles and objectives indicate that sufficient time has to be provided to allow adaptation to shoreline management changes. It would be helpful if at this stage, we could use this principle to set realistic boundaries for realignment in the earlier epochs. A suggested approach could be:
 - First epoch (up to 2025):
 - no (permanent) residential property – relevant for farms throughout the SMP area
 - no ongoing infrastructure – relevant for roads (A17, possible other roads) and utilities (e.g. power lines from Boston to Nene outfall).
 - Additional features to take into account would be freshwater designations and Scheduled Ancient Monuments, but none of these are present between the existing shoreline and the band of established settlements.

- Figure E3.3 shows all the elements relevant for this assessment: permanent dwellings (and larger concentrations) and ongoing infrastructure.
- Second epoch (up to 2055): no concentrations of residential properties (e.g. 5 or more properties). Figure E3.4 shows all three concentrations ('hamlets' as defined in Ordnance Survey classification).

In addition, we could assume that any realignment is only realistic (in economic terms) if the shoreline is realigned to an existing (relic) defence line or to natural high ground (see table E3.1 Drivers for Managed realignment). Figure E3.5 shows all existing lines of defence (both current and relic), plus relevant high ground.

In terms of **flood risk related (CFMP-defined) policies**: Policy P1 (No active intervention) is not relevant, for the same reasons as SMP policy NAI. For the remaining 4 policies, there needs to be discussion whether the two extremes, P2 (reduce management activity) and P5 (increase management activity to reduce risk despite future changes) are sufficiently realistic for epoch 1, and possibly later epochs, to require appraisal. The current Standard of Protection is typically based on the indicative standards as defined in the Project Appraisal Guidance. Based on experience with CFMPs for similar areas, P2 is unlikely to be acceptable, while P5 is unlikely to be affordable.

Figure E3.2 Urbanised Area of all Identified Established Settlements

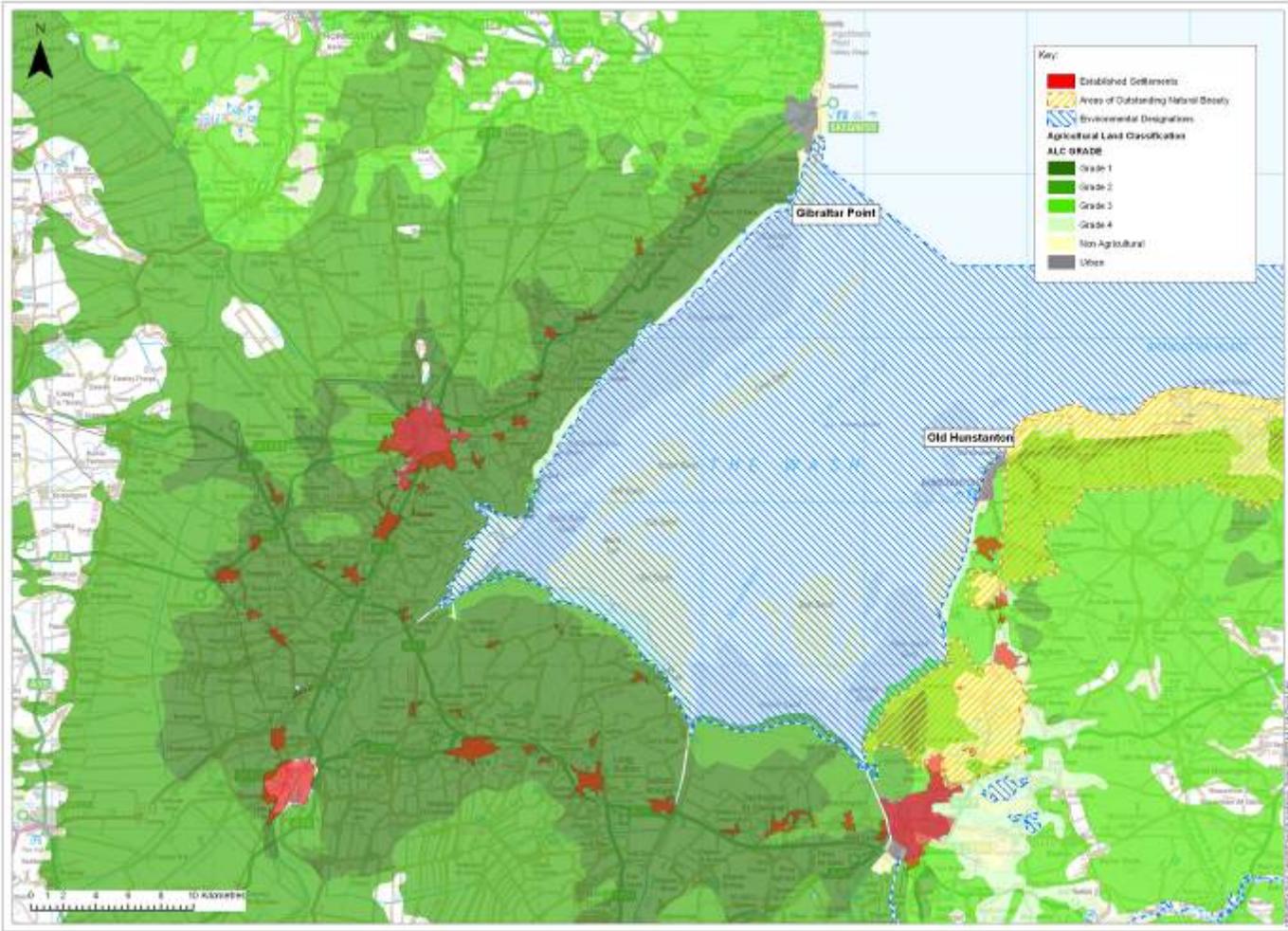


Figure E3.3 Elements Relevant for the Assessment

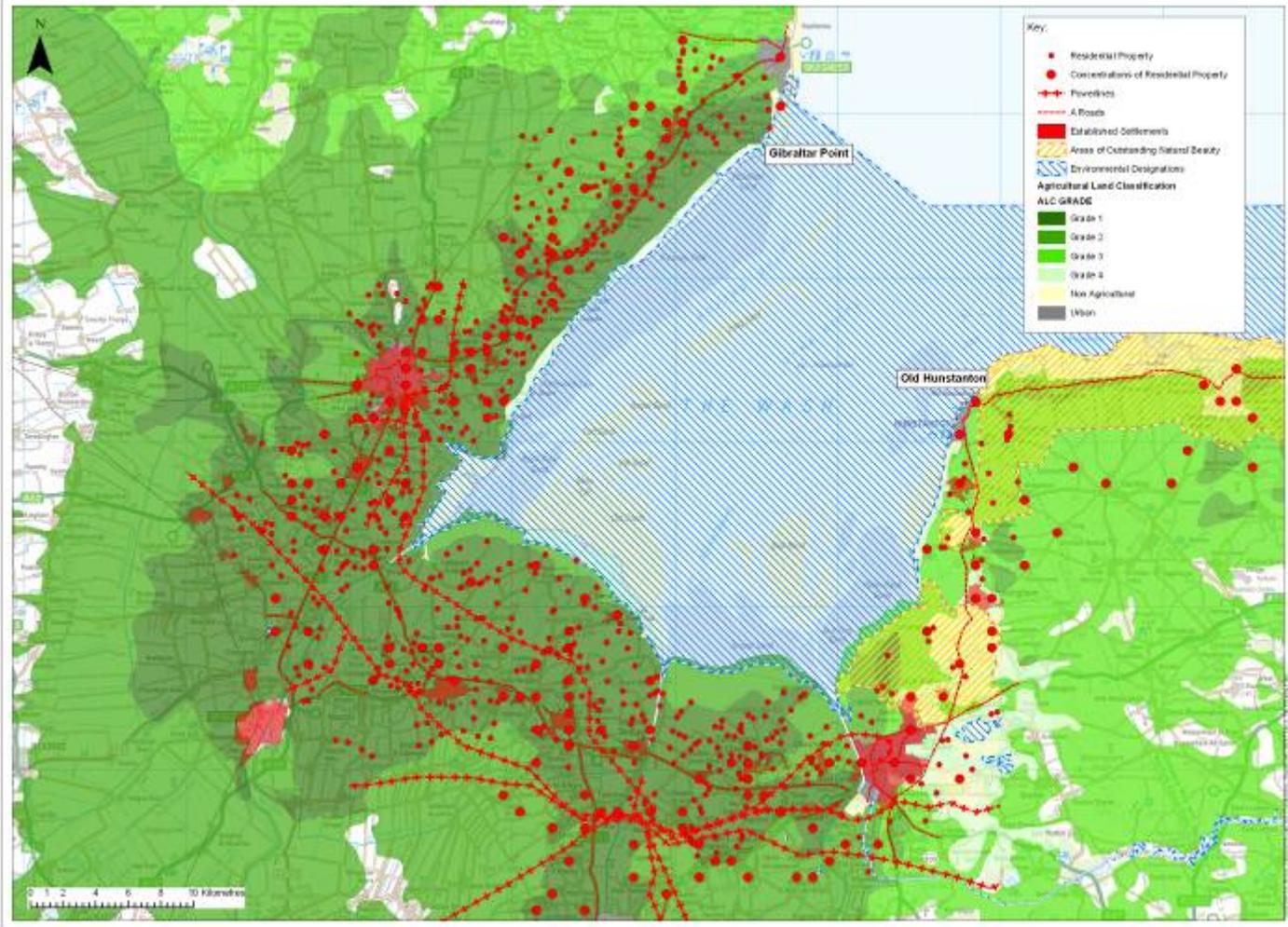


Figure E3.4 Concentrations of Residential Property (5 or more properties)

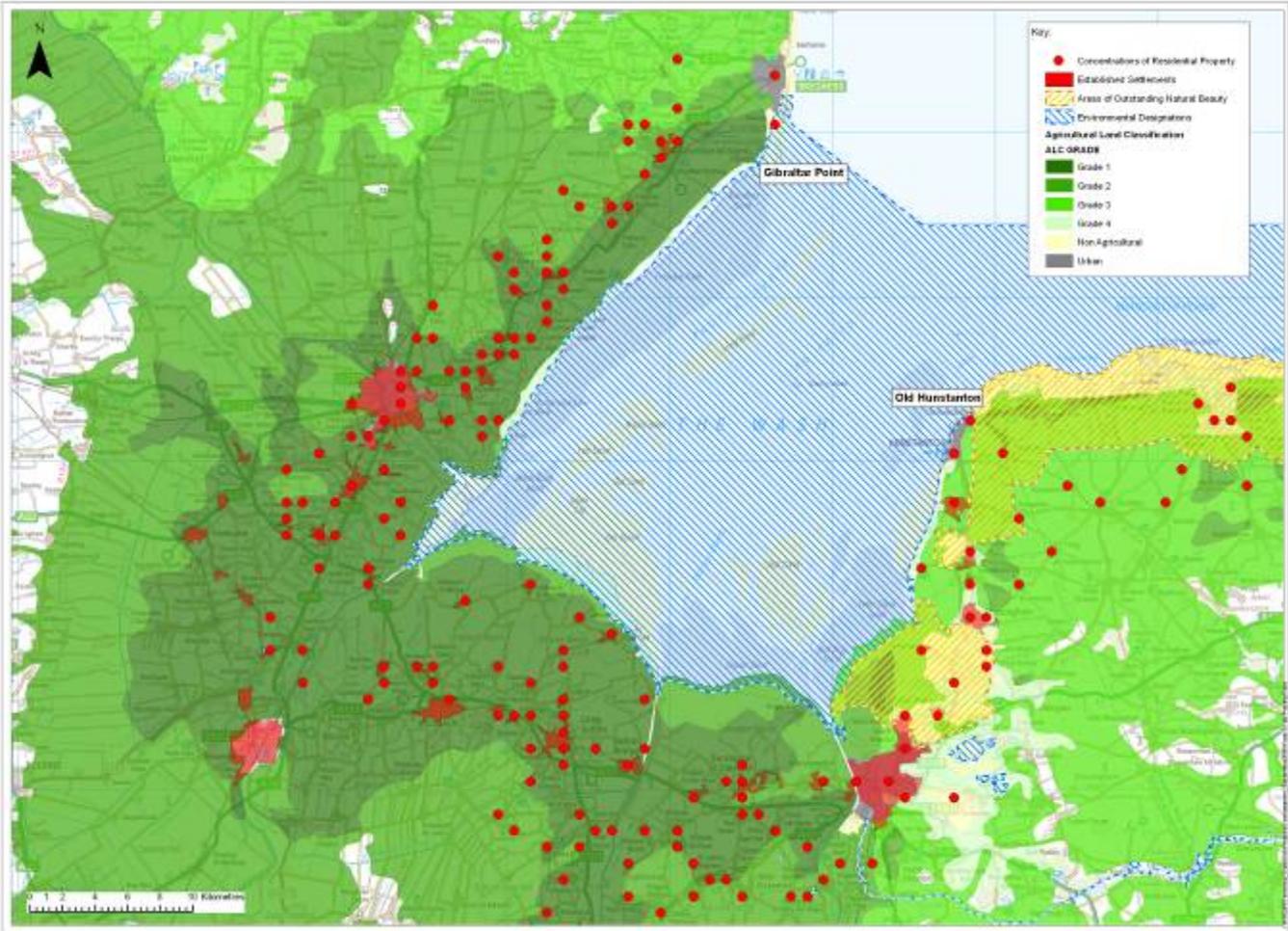
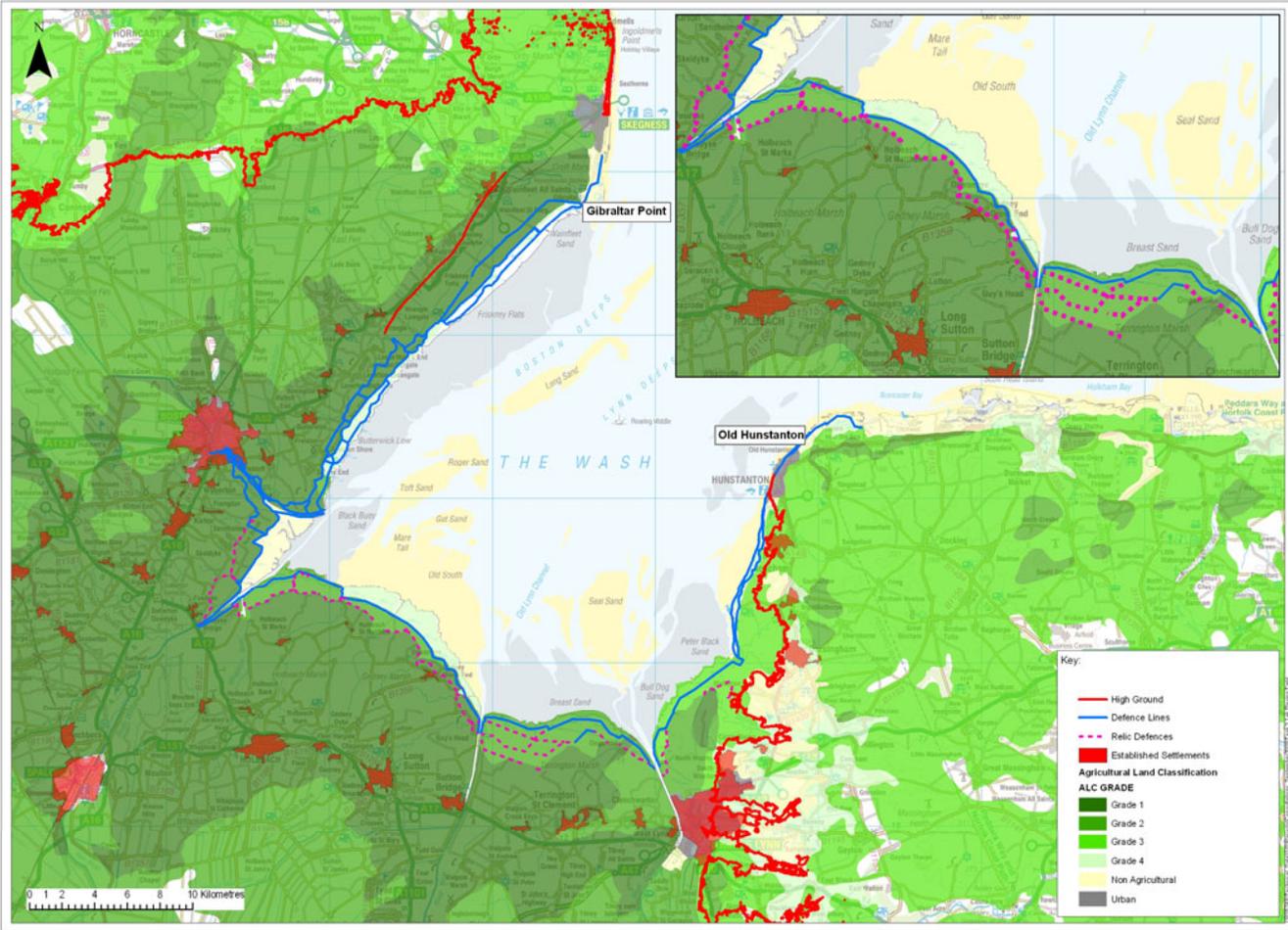


Figure E3.5 All Existing Defence Lines (Current and Relic)



PDZ1 and PDZ2 Great Ouse Outfall to (but excluding) Hunstanton

The issues are roughly similar to the area west of River Great Ouse, but at a smaller scale: the flood zone is narrower, the established settlements and infrastructure are partly on high ground, there is less high grade agricultural land. Other main differences are the increased level of tourism and the partial designation as an AONB.

Regarding the role of established settlements: King's Lynn has a similar impact on the playing field as the settlements west of River Great Ouse, as the core of the settlement is in the floodzone and there is an extensive low-lying area behind it. However, the situation may be different for the other established settlements in this frontage (Heacham, Snettisham, Ingoldisthorpe, Dersingham). The majority of these settlements is on higher ground; contrary to the low-lying settlements west of the Great Ouse it is possible that they could still function as a settlement if a small part would lose protection. We suggest that this needs a more detailed assessment in policy appraisal.

Per SMP policy:

- **No active intervention** is not a realistic option for epoch 1 as this would lead to uncontrolled increase of flood risk and would contravene related principles and objectives. It needs some discussion whether it is a realistic option for later epochs, even if restricted to sections that don't pose a risk of flooding to King's Lynn, and after sufficient time for adaptation.
- **Advance the line** is certainly not realistic for epoch 1. Depending on the chosen approach with regard to current legislation, it could be an option for later epochs south of Wolferton Creek (with agriculture as a driver). It is less obvious north of Wolferton Creek (unless tourism would be a realistic driver); we suggest that this is not realistic.
- **Hold the line** is the current policy and is a realistic option for all epochs that needs to be assessed in policy appraisal.
- **Managed realignment** is a realistic option for all epochs that needs to be assessed in policy appraisal. Regarding the definition of maximum limits of realignment:
 - All epochs: as mentioned, the principles and objectives dictate that King's Lynn will remain protected. For the rest of the area, the absolute limit is the high ground (which would then be similar to a No active intervention policy, depending on the details of the implementation).
 - Earlier epochs: the same concepts as west of Great Ouse outfall could be used to define limits of realignment, based on the principle that the policies need to provide time for adaptation.
 - As in the area west of Great Ouse, there are various old inland embankments that could be re-established, either as a new line of defence or as part of a Wide defence zone.

For this frontage, the **flood risk related (CFMP-defined) policies** are only relevant at SMP level up to Wolferton Creek Policy P1 (No active intervention) is not relevant for epoch 1 but possibly for the later epochs, with the same caveats and for the same reasons as SMP policy NAI. P2 is unlikely to be acceptable and could be seen as unrealistic, certainly for epoch 1. For the remainder (PDZ2), this requires strategy level assessment.

PDZ3 Hunstanton

Per policy:

- **No active intervention** is not a realistic option for epoch 1 as this would lead to uncontrolled increase of flood and erosion risk in the town centre and boulevard and would contravene related principles and objectives. Discussion is needed whether it is a realistic option for later epochs. The question is whether there is any chance that Hunstanton can be sustained as a viable town, seaside resort and regional commercial centre with any form of retreated shoreline, even after sufficient time for adaptation and within the framework of agreed principles and objectives.
- **Advance the line** is certainly not realistic for epoch 1. Depending on the chosen approach with regard to current legislation, it could be an option for later epochs (possibly with tourism as a driver). If tourism is no realistic driver for Advance the line, then this policy could be discounted; this needs some discussion.
- **Hold the line** is the current policy and is a realistic option for all epochs that needs to be assessed in policy appraisal.
- **Managed realignment:** Again, the question is whether there is any chance that Hunstanton can be sustained as a viable town, seaside resort and regional commercial centre with any form of retreated shoreline, even after sufficient time for adaptation and within the framework of agreed principles and objectives. Note that the drivers for this policy are less obvious here: the possible creation of habitats is irrelevant for this frontage, so the only obvious driver would be increased working with natural processes (and the associated reduction of flood risk management).

For this frontage, the **flood risk related (CFMP-defined) policies** have not been considered; this requires strategy level assessment.

PDZ4 Hunstanton Cliffs

Per policy:

- **No active intervention** is the current policy and is a realistic option for all epochs that needs to be assessed in policy appraisal.
- **Advance the line** is not realistic for epoch 1. Depending on the chosen approach with regard to current legislation, it could be an option for later epochs (possibly with tourism as a driver). If this is unrealistic, this policy could be discounted.

- **Hold the line** is a realistic option for all epochs that needs to be assessed in policy appraisal.
- **Managed realignment** could be a realistic option for later epochs if cliff erosion starts to threaten infrastructure and properties.

For this frontage, the **flood risk related (CFMP-defined) policies** are not relevant as, due to the high ground, flood risk is not an issue.

E3.4 Defining Policy Packages

E3.4.1 Introduction

This section contains the definition of the playing field and associated confirmed policy packages for appraisal, as agreed with the CSG and EMF. There were two main tasks associated with the definition of policy scenarios. Firstly it was necessary to define the options for appraisal, and secondly the alignments of these defined policy packages were outlined 'on the ground'.

E3.4.2 Defining Options for Appraisal

PDZ1 Gibraltar Point to Wolferton Creek

Table E3.2 provides a re-cap of the playing field for this area, including a justification for the policies that were excluded at this stage.

Based on this playing field, the CSG recommended that the following four policy packages were taken to appraisal:

- **Maximum landward realignment:** Landward Managed realignment to the maximum extent per epoch as defined in the Playing field (see section E3.3), including land use adaptation as required;
- **'Habitat-led' realignment:** Setting a target size for the increase of intertidal habitat per epoch and find the most appropriate frontages to achieve this;
- **Hold the line;** keep the existing alignment for all frontages and for all three epochs;
- **Local rebalancing:** rationalise the alignment of the defence (if needed) to optimise the value for agriculture, habitats and other interests.

Table E3.2 Playing field Gibraltar Point to Wolferton Creek

SMP Policy	Yes / No	Comments
No active intervention	No	Ruled out for all epochs. Defended area is very extensive. NAI would lead to uncontrolled increase in flood risk all the way to the high ground. Land use adaptation within the SMP's planning horizon is not realistic.
Advance the line	No	Large scale seaward movement is ruled out for all epochs. There are large disadvantages (loss of intertidal habitats; technically very difficult; sustainability of defences; increased flood defence management), and potential drivers (e.g. future need for land) are considered insufficient. Note that smaller scale seaward movement can be considered as part of Managed realignment.
Hold the line	Yes	This is the current policy so it has to be appraised.
Managed realignment	Yes	<p>This is sufficiently realistic to justify appraisal. However, it is not realistic beyond a certain maximum extent:</p> <ul style="list-style-type: none"> • Epoch 1: need to keep defending as a minimum all dwellings, A-roads and power lines, see figure E3.3. It is not realistic to assume that such features can be relocated within epoch 1. Appraisal is needed to decide about the area seaward from there (including high grade agricultural land). • Epochs 2 and 3: need to keep defending the established settlements as defined in the Objectives (see figure E3.2), and the area landward from there. The justification for this is that there is no realistic flood defence line between the belt of settlements around the Wash and the high ground far inland. Appraisal is needed to decide about the area seaward from the established settlements (including hamlets, individual dwellings, infrastructure and high grade agricultural land). <p>Note that Managed realignment can also contain localised seaward realignment</p>

The SMP for The Wash will also have to make policy decisions about levels of flood risk, particularly for PDZ1. See section E3.2.1 for the definition of the Catchment Flood Management Plan-defined policies. The CSG recommended the following for this area:

- Policy P2: not realistic as this will lead to unacceptable increase in flood risk
- Policy P3 and P4: realistic, to be appraised. Note that P4 means increasing management to sustain the same level of risk, compensating for future changes.
- Policy P5: not realistic because of currently acceptable standards and risk.

PDZ2 Wolferton Creek – South Hunstanton

Table E3.3 provides a re-cap of the playing field for this area, including a justification for the policies that were excluded at this stage.

Table E3.3 Playing field Wolferton Creek to South Hunstanton

Policy	Yes / No	Comments
No active intervention	No	Ruled out for all epochs. NAI would lead to uncontrolled increase in flood risk up to the high ground. There is a need for appraisal of a policy package where land use is adapted in the early epochs, after which the defences would no longer be maintained. However, this requires significant (land use) management and therefore is better described as Managed realignment instead of No active intervention.
Advance the line	No	Large scale seaward movement is ruled out for all epochs. There are large disadvantages and there is no significant driver for this area that would make this policy realistic. Note that smaller scale seaward movement can be considered as part of Managed realignment.
Hold the line	Yes	This is the current policy so it has to be appraised.
Managed realignment	Yes	This is sufficiently realistic to justify appraisal. However, it is not realistic beyond a certain maximum extent: <ul style="list-style-type: none"> Epoch 1: need to keep defending as a minimum all dwellings and the A149. See figure 2. It is not realistic to assume that such features can be relocated within epoch 1. Appraisal is needed to decide about the area seaward from there (including agricultural land). <ul style="list-style-type: none"> Epochs 2 and 3: for this frontage the high ground acts as the maximum extent of realignment for the later epochs. This maximum realignment needs to be appraised, including the requirement of significant land use adaptation (both for the settlements on the edge of the high ground and the tourism facilities). Note that Managed realignment can also contain localised seaward realignment

Based on this playing field, the CSG recommended that the following four policy packages were taken forward to appraisal:

- **Maximum landward realignment:** landward Managed realignment to the maximum extent per epoch as defined in the Playing field (see section E3.3), including land use adaptation as required;
- **Realignment to existing 2nd line of defence:** abandoning the first defence line (shingle bank) following adaptation of land use in between the lines;
- **Wide defence zone:** optimising the use of the two lines as a combined defence, including adaptation of land use in between the lines;

- **Hold the line;** keep the existing alignment for all frontages and for all three epochs.

PDZ3 Hunstanton Town

Table E3.4 provides a re-cap of the playing field for this area, including a justification for the policies that were excluded at this stage.

Table E3.4 Playing Field Hunstanton Town

Policy	Yes / No	Comments
No active intervention	No	Ruled out for all epochs. NAI would lead to uncontrolled increase in flood risk up to the high ground. There is a need for appraisal of a policy package where land use is adapted in the early epochs, after which the defences would no longer be maintained. However, this requires significant (land use) management and therefore is better described as Managed realignment instead of No active intervention.
Advance the line	No	Large scale seaward movement is ruled out for all epochs. There are large disadvantages and there is no significant driver for this area that would make this policy realistic. Note that smaller scale seaward movement can be considered as part of Managed realignment.
Hold the line	Yes	This is the current policy so it has to be appraised.
Managed realignment	Yes	This is sufficiently realistic to justify appraisal. However, it is not realistic beyond a certain maximum extent: <ul style="list-style-type: none"> • Epoch 1: need to keep defending as a minimum all dwellings and the main road through Hunstanton (B1161, Southend Road). It is not realistic to assume that such features can be relocated within epoch 1. Appraisal is needed to decide about the area seaward from there (including the seafront). • Epochs 2 and 3: for this frontage the high ground acts as the maximum extent of realignment for the later epochs. This maximum realignment needs to be appraised, including the requirement of land use adaptation.

Based on this playing field, the CSG recommended that we take the following two policy packages were taken forward to appraisal:

- **Maximum landward realignment:** landward Managed realignment to the maximum extent per epoch as defined in the Playing field (see section E3.3), including land use adaptation as required;
- **Hold the line;** keep the existing alignment for all frontages and for all three epochs.

PDZ4 Hunstanton Cliffs

Table E3.5 provides a re-cap of the playing field for this area, including a justification for the policies that were excluded at this stage.

Table E3.5 Playing Field Hunstanton Cliffs

Policy	Yes / No	Comments
No active intervention	Yes	This is the current policy so it has to be appraised.
Advance the line	No	There is no driver for this policy so it is not realistic.
Hold the line	Yes	A policy of protection against cliff erosion will need to be appraised.
Managed realignment	Yes	This is not relevant for cliff erosion in this situation.

Based on this playing field, the CSG recommended that we take the following three policy packages were taken forward to appraisal:

- **No active intervention:** apply this policy for all three epochs, including land use adaptation as required;
- **No active intervention up to maximum:** apply this policy up to the point where it threatens features on top of the cliffs (road, dwellings) and then Hold the line;
- **Hold the line:** keep the existing alignment for all frontages and for all three epochs.

E3.4.3 Defining Alignment of Policy Packages

PDZ1 Gibraltar Point to Wolferton Creek

PP1a Maximum landward realignment

Definition:

Landward Managed realignment to the maximum extent per epoch as defined in the playing field (see below), including land use adaptation as required

Maximum extents:

Epoch 1 – land seaward of all dwellings, A-roads and power lines (including the North Sea camp prison).

‘On the ground’ this generally means realigning to the most landward identifiable complete defence line (secondary or tertiary defence lines in most cases). In some cases, however, this maximum realignment would mean that an isolated farm or stretch of power line would be located seaward of the new defence line. In these cases the defence line will remain as per the existing situation. Where there is no adequate former defence line, for

example where realignment could actually take the new defence line further landward than an old defence line, totally new defence lines will have to be constructed. The new defence line for this policy package at the end of epoch 1 is shown in figure E3.6, figure E3.7 and figure E3.8.

Epochs 2 and 3 – land seaward of established settlements. This generally means realigning right back to the major A roads, as this generally links in with the line of established pub and churches settlements. Between Gibraltar Point and the River Great Ouse there are some locations where there are bands/areas of slightly higher ground (usually approximately 0.5m higher) and these have been used as the future defence line for epoch 2 and 3. Between the River Great Ouse and Wolferton Creek, the 5 m contour has generally been followed as the new defence line, but as this is higher ground there will not be the need for construction of a new defence. The new defence line for this policy package in epoch 2 and 3 is shown in figure E3.6, figure E3.7 and figure E3.8.

PP1b 'Habitat-led' realignment

Definition:

Set a target size for the increase of intertidal habitat per epoch and find the most appropriate frontage to achieve this. To determine the target size of intertidal habitat required to compensate the loss per epoch, the results of the Baseline Scenarios assessment were used. The results are shown in table E3.6. The intertidal area has been assumed as the area between the current defence line and the position of Mean Low Water (MLW) for present day and calculated for future epochs (using Defra 2006 sea level rise guidance).

The approach used to define the maximum extents per epoch is not characterised by a gradual landward realignment of the defence, as it makes more sense to look at each PDZ individually, and realign back to a sensible location on an epoch by epoch basis.

Table E3.6 Predicted Intertidal Habitat Change

Year	Intertidal area change (ha)
Present day to 2025 (end epoch 1)	-118
2025 to 2055 (end epoch 2)	-555
2055 to 2105 (end epoch 3)	-948
Total	-1620

Maximum extents:

Epoch 1 – realignment back to the secondary defence line from the Plummer’s Hotel at Freiston Shore, around the eastern side of North Sea Camp, to join the primary defence along the banks of the River Witham.

Epoch 2 – realignment back to the secondary defence line from Butterwick Pullover (car park at northern extent of Freiston Shore realigned site) to

pumping station directly east of Leverton Lucasgate, and from The Horseshoe at Wrangle Marsh to the pumping house at Wainfleet St Mary.

Epoch 3 – into epoch 3, final realignment would be necessary. This consists of realignment back to the secondary defence line between The Horseshoe on the southern bank of the River Welland to the car park at Lawyer’s Creek, and between the right hand bank of the River Nene to approximately 4km eastwards. This will also include a localised defence line change between the pumping house at Wainfleet St Mary towards Gibraltar Point in a north-eastward direction.

The results of this ‘Habitat-led’ realignment policy package by the end of epoch 3 would generally equal the overall results created by the Local rebalancing package. The new defence line for this policy package is shown in figure E3.9. figure E3.10 and figure E3.11.

PP1c Hold the line

Definition:

Keep the existing alignment for the PDZ and for all three epochs.

Maximum extents:

No need to discuss further – as per current defence lines.

PP1d Local rebalancing

Definition:

Rationalise the alignment of the defence (if needed) to optimise the value for agriculture, habitats and other interests.

Maximum extents:

Along the north-western edge of the Wash between Gibraltar Point and the River Witham, there is an area of grade 4 agricultural land located between the primary defence and then secondary defence. It is suggested that in epoch 1 or 2, realignment should occur back to the secondary defence to remove any areas of grade 4 land, and therefore provide some compensation for the loss of intertidal habitats that is likely to occur in the later epochs. This increased saltmarsh area will also provide a greater protection to the earth embankments in terms of dissipating wave energy.

Between the Rivers Witham and Welland, there is a significant width of saltmarsh and the agricultural land directly behind the primary defence is grade 1. Due to this significant width of saltmarsh, there is the potential here for reclamation (localised seaward movement of the defence line). This would create a larger area of grade 1 agricultural land (approximately an additional 600 hectares). The potential for creating Grade 1 or 2 agricultural lands on this reclaimed area is an uncertainty, although there is evidence that this high grade agricultural land creation is certainly feasible.

Therefore there is no Local rebalancing between the Rivers Welland and Great Ouse, with the exception of a small section of defence line seaward of Gedney Drove end that can be subject to localised 'straightening'.

Between the River Great Ouse and Wolferton Creek, there are no obvious sites for Local rebalancing, although it has been noted that the agricultural behind the current primary defence is grade 3, and therefore this provides some potential for realignment at a later stage.

The timing of implementation of the Local rebalancing discussed above would be led by available budget and other practical considerations, but in terms of landward realignment extents it fits in with the agreed playing field for epoch 1. It could therefore be undertaken sometime during epoch 1 as there would be sufficient time for the necessary modelling and design of the advance and realignment sites.

The new defence line for the Local rebalancing policy package is shown in figure E3.12, figure E3.13 and figure E3.14.

It is important to note here that the Local rebalancing PP lines have been based on the existing official Agricultural Land Classification grades. However this information is old (based on the revised guidelines and criteria for grading of the quality of agricultural land published in 1988) and it is thought that the data contains a number of gaps and simplifications. However, this is something that is beyond of the scope of the SMP and can be looked into at strategy level.

PDZ2 Wolferton Creek to South Hunstanton

PP2a Maximum landward realignment

Definition:

Landward Managed realignment to the maximum extent per epoch as defined in the playing field (see below), including land use adaptation as required.

Maximum extents:

Epoch 1 – Hold the current defence line (shingle ridge and earth embankment or concrete defence/promenade).

It is important to note here that in this PP there will have to be an explicit effort by all involved to start the adaptation process for 'beach huts' and caravan parks, and that this may take shorter than until the end of epoch 1.

Epochs 2 and 3 – back to the high ground. The new defence line in epochs 2 and 3 will be along the 5m contour, and therefore there will not be the need for construction of a new physical defence line.

The new defence line for the maximum realignment policy package for this PDZ is shown in figure E3.15.

PP2b Realignment to Existing Second Defence Line

Definition:

Abandon the first line of defence (the shingle bank) following adaptation of land use between the two defence lines.

Maximum extents:

No need to discuss further – as per current landward defence line (with cessation of management of the shingle ridge). Towards the north of this PDZ, where there is only one defence line (concrete defence/promenade), this PP will involve holding this defence line (so no change).

It is important to note here that in this PP there will have to be an explicit effort by all involved to start the adaptation process for ‘beach huts’, and that this may take shorter than until the end of epoch 1.

PP2c Wide defence zone

Definition:

Optimise the use of the two existing lines of defence (the shingle bank and the earth embankment) as a combined defence, including adaptation of land use between the two defence lines.

Maximum extents:

No need to discuss further – as per current defence lines. Specific details relating to defence standard etc will be discussed at a later stage. Towards the north of this PDZ, where there is only one defence line (concrete defence/promenade), this PP will involve holding this defence line (so no change).

It is important to note here that in this PP there will have to be an explicit effort by all involved to start the adaptation process for ‘beach huts’ and caravan parks, and that this may take shorter than until the end of epoch 1.

PP2d Hold the line

Definition:

Keep the existing alignment for the PDZ and for all three epochs.

Maximum extents:

No need to discuss further – as per current defence lines.

PDZ3 Hunstanton Town

PP3a No active intervention

Definition:

Apply this policy for all three epochs, including land use adaptation as required. This PP will allow the higher ground to erode naturally, and the

defences will not be intentionally removed. A PP involving No active intervention where the defences are actively removed has not been brought to this point in the appraisal process due to the extensive impact such an option would have on the overall functioning of Hunstanton.

Maximum extents:

No need to discuss further – the Baseline Scenarios report discusses erosion rates and the predicted position of the cliff line in the future epochs. A summary of the average predicted erosion rates over the three epochs is provided in table E3.7. It is important to note that these average rates mask localised areas of higher/lower rates. More details on these localised differences can be found in the Baseline Scenarios report.

This PP would affect a number of tourist-related assets and residential properties into the later epoch. This will require adaptation of these assets and this adaptation will be taken into account in the appraisal.

Table E3.7 Predicted Cliff Erosion Rates (taken from appendix F)

Year	Average cliff erosion rate (myr ⁻¹)
Epoch 1	Defences will gradually deteriorate
Epoch 2	0.53
Epoch 3	0.83

PP3b No active intervention up to a limit

Definition:

Apply this policy up to a point where it threatens features on top of the higher ground (roads and dwellings), and then apply a policy of Hold the line. Initially, when there is No active intervention, the cliffs will be allowed to erode naturally, and are not intentionally removed. As for PP3a, a PP involving No active intervention where the defences are actively removed has not been brought to this point in the appraisal process due to the extensive impact such an option would have on the overall functioning of Hunstanton.

Maximum extents:

For the southern section of this PDZ, where the tourist facilities and houses are located directly landward of the defences, Hold the line will be implemented here. For the northern section, where development is located further landward, the limit line extends from the current defence line, landward along Beach Terrace Road to join the B1161. Thereafter, the B1161 will be used as the limit line. It is likely that this limit line in the northern part of this PDZ will not be reached until epoch 3.

The position of where the line will need to be held is shown in figure E3.16. Note that in reality it is likely that a more fluent line will be chosen; this needs elaboration at strategy level.

PP3c Hold the line

Definition:

Keep the existing alignment for the PDZ and for all three epochs.

Maximum extents:

No need to discuss further – as per current line of defence (location of seawall, promenade and wave return wall).

PDZ4 Hunstanton Cliffs

PP4a No active intervention

Definition:

Apply this policy for all three epochs, including land use adaptation as required.

Maximum extents:

No need to discuss further – the Baseline Scenarios report discusses erosion rates and the predicted position of the cliff line in the future epochs. A summary of the average predicted erosion rates over the three epochs is provided in table E3.8. It is important to note that these average rates mask localised areas of higher/lower rates. More details on these localised differences can be found in the Baseline Scenarios report.

Table E3.8 Predicted Cliff Erosion Rates (taken from appendix F)

Year	Average cliff erosion rate (myr⁻¹)
Epoch 1	0.25
Epoch 2	0.53
Epoch 3	0.83

PP4b No active intervention up to a limit

Definition:

Apply this policy up to a point where it threatens features on top of the cliffs (roads and dwellings), and then apply a policy of Hold the line.

Maximum extents:

The position at which Hold the line will be implemented can be defined by the route of the B1161 and then the A149 towards the north of the PDZ as there are no dwellings seawards of these two roads. It is predicted that following failure of the seawall and promenade (end of epoch 1 or beginning epoch 2) there will be high erosion rates along the currently protected cliff section. The currently unprotected cliffs will continue to erode at current rates (with small increases due to sea level rise). However for both sections, erosion is not likely to affect the B1161 until epoch 3, which is when a policy of Hold the line will need to be implemented.

The position of where the Hold the line option will need to be implemented is shown in figure E3.17. Note that in reality it is likely that a more fluent line will be chosen; this needs elaboration at strategy level.

PP4c Hold the line

Definition:

Keep the existing alignment for the PDZ and for all three epochs.

Maximum extents:

No need to discuss further – as per current cliff line. Note that this will involve constructing defences to halt the current trend of erosion of the Hunstanton cliffs.

Figure E3.6 PDZ1 PP1a Maximum landward realignment

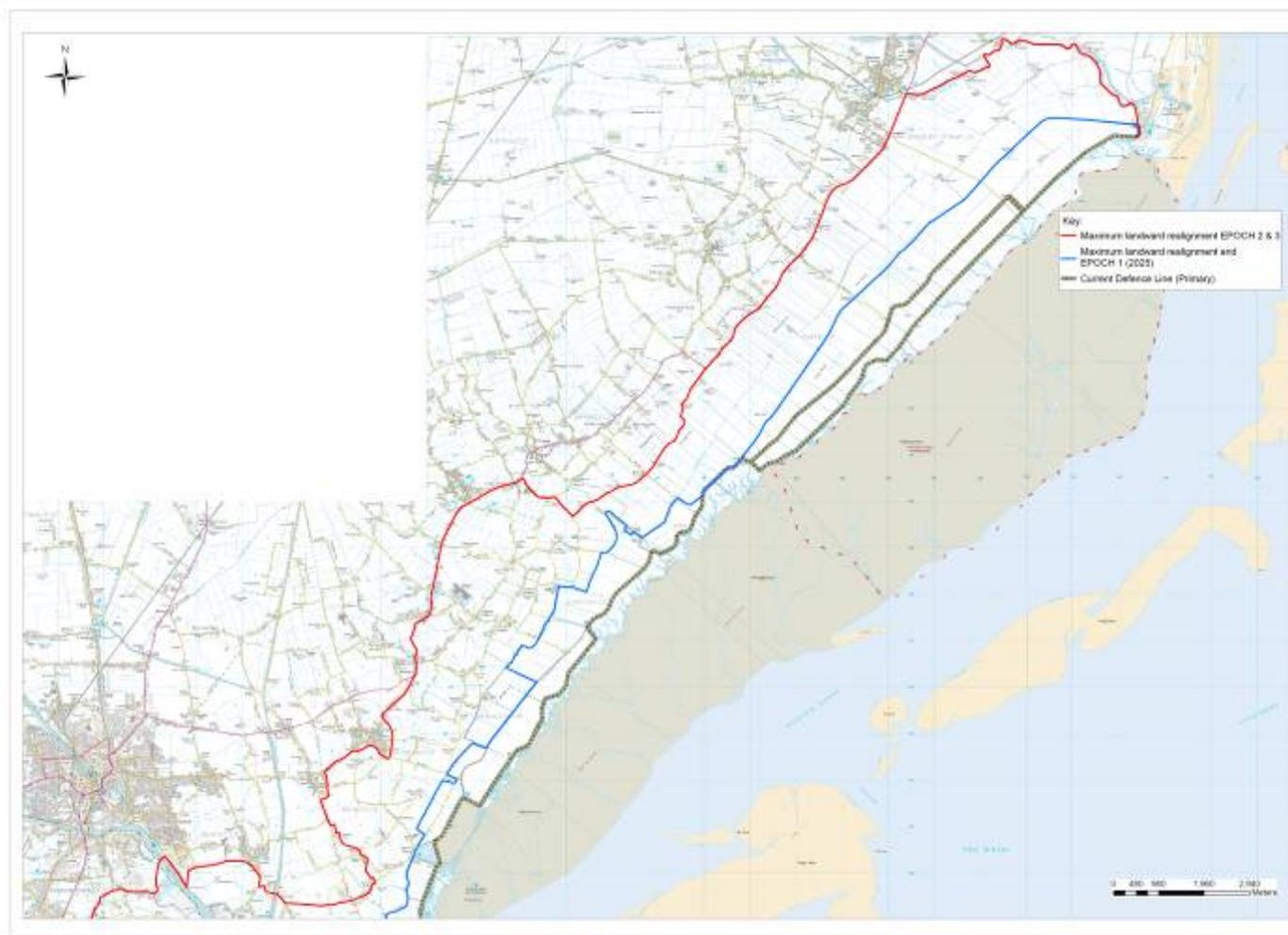


Figure E3.7 PDZ1 PP1a Maximum landward realignment contd.

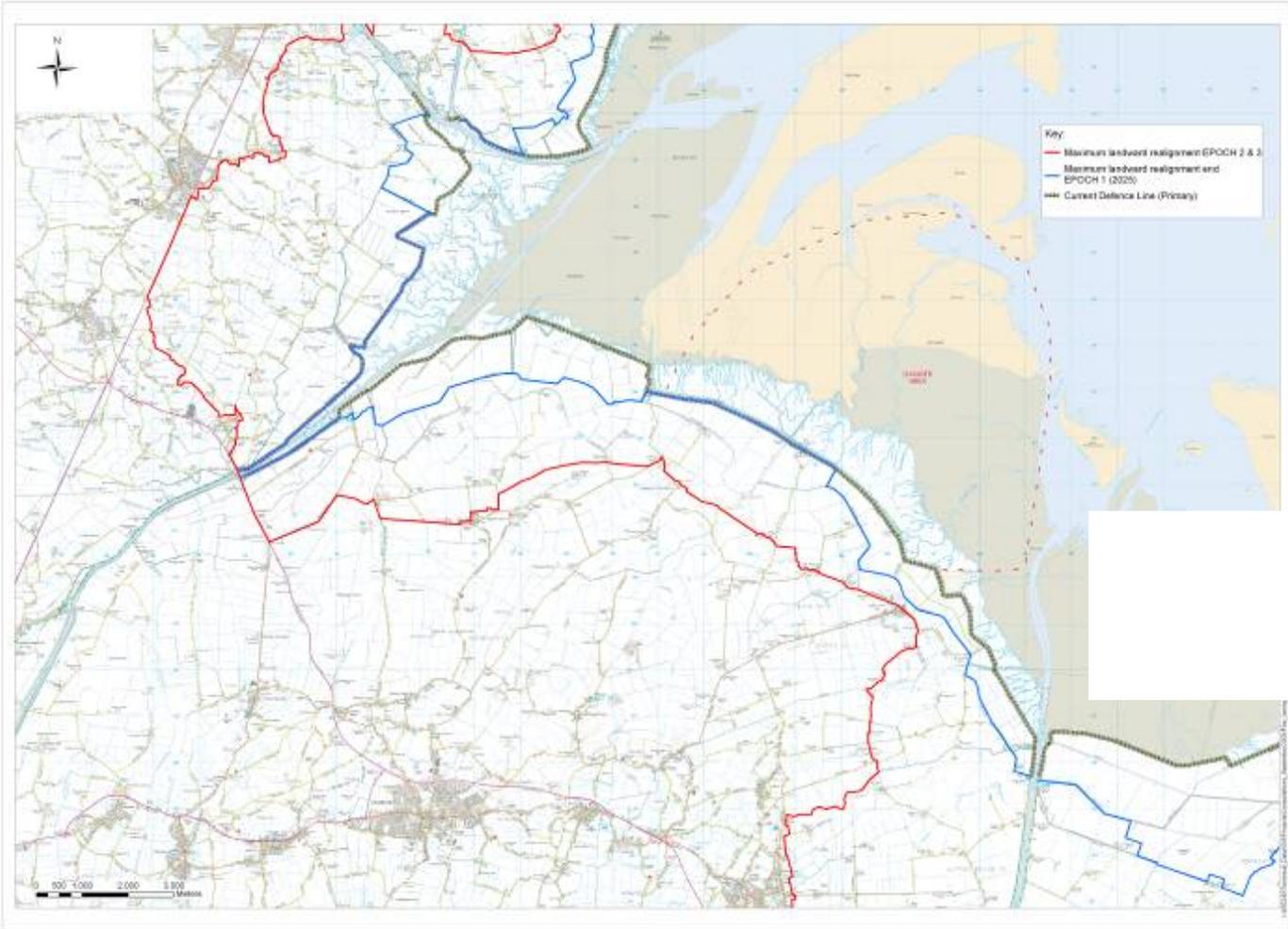


Figure E3.8 PDZ1 PP1a Maximum landward realignment contd.

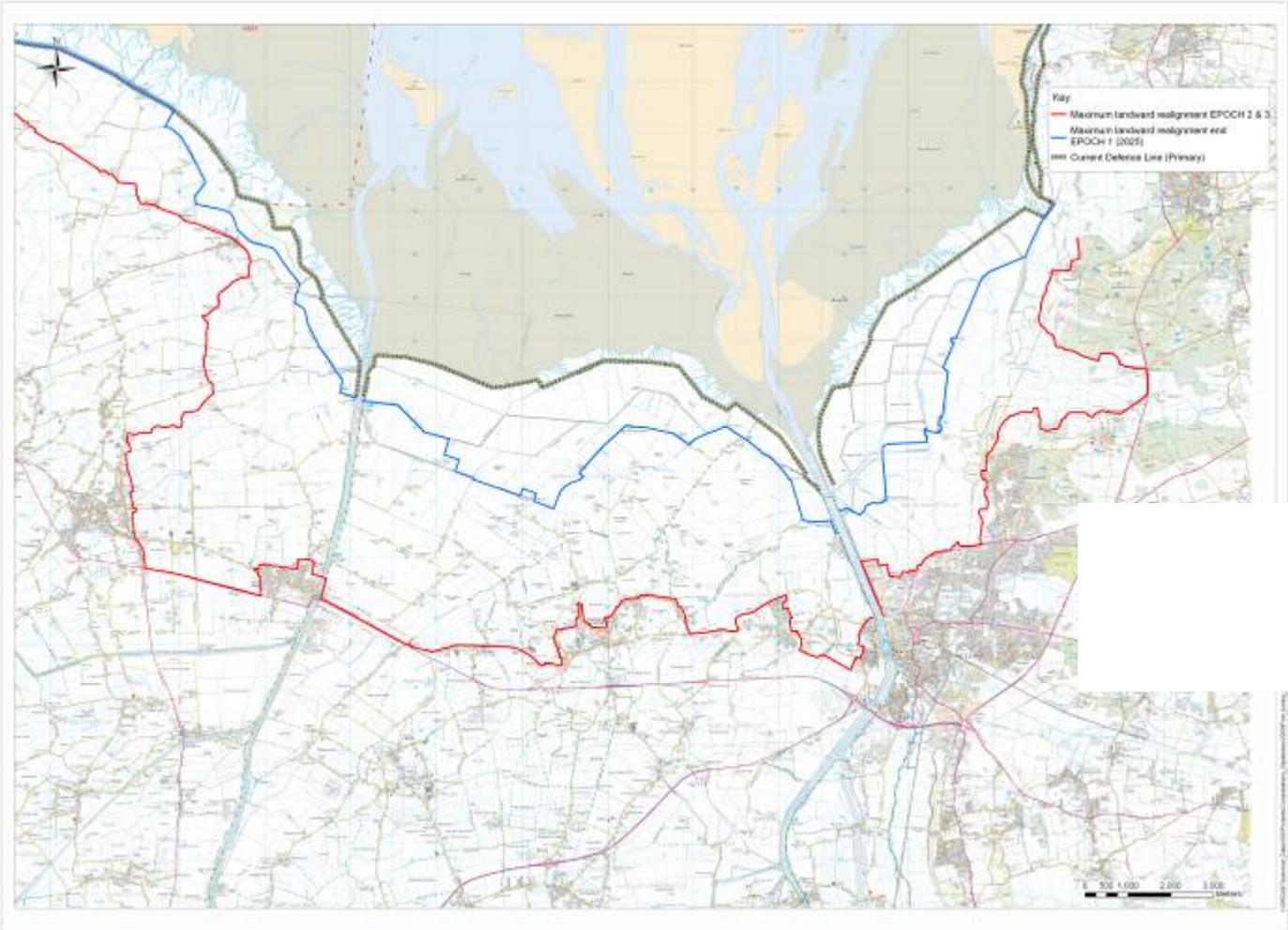


Figure E3.9 PDZ1 PP1b 'Habitat-led' realignment

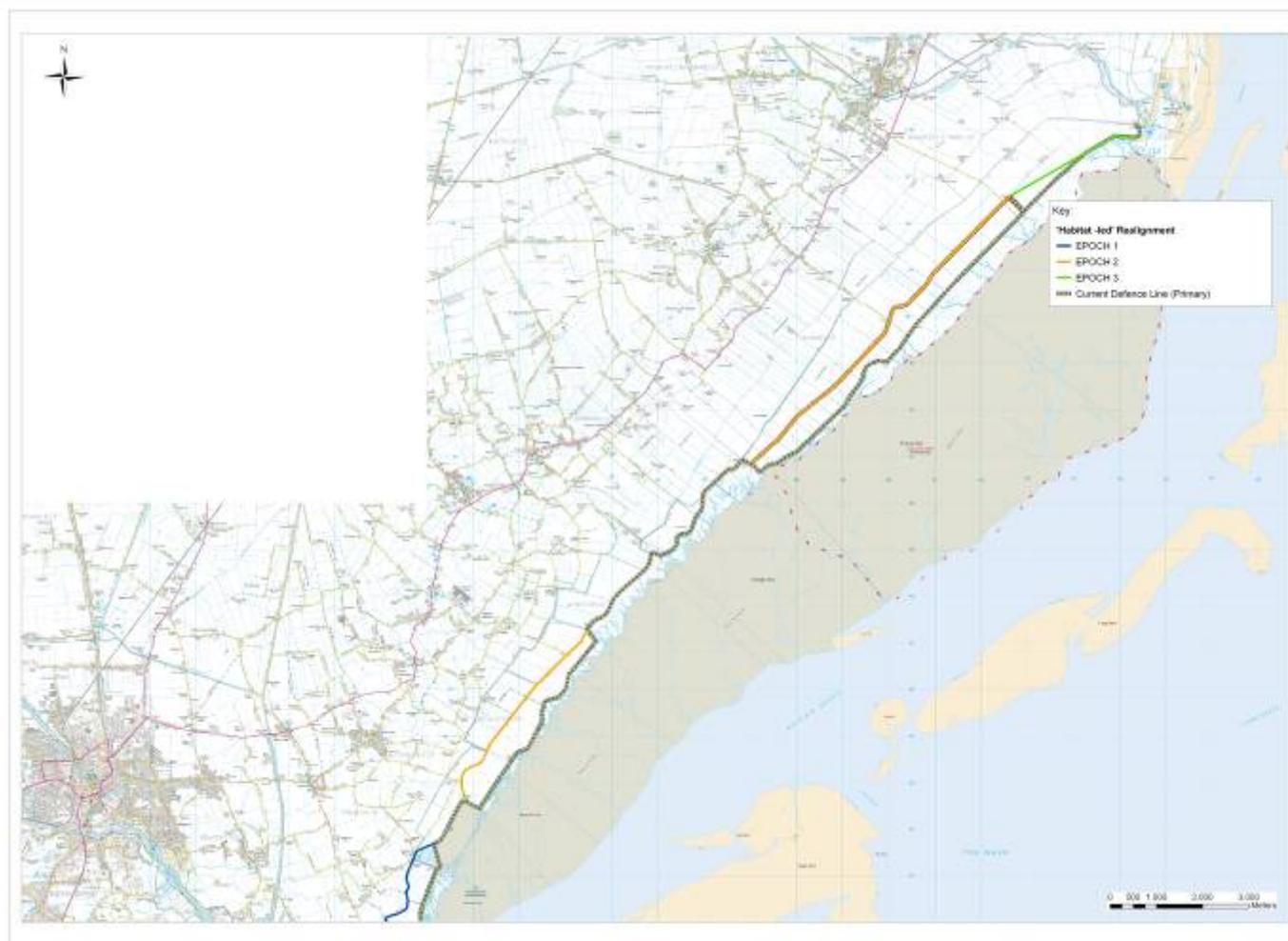


Figure E3.10 PDZ1 PP1b 'Habitat-led' realignment contd.

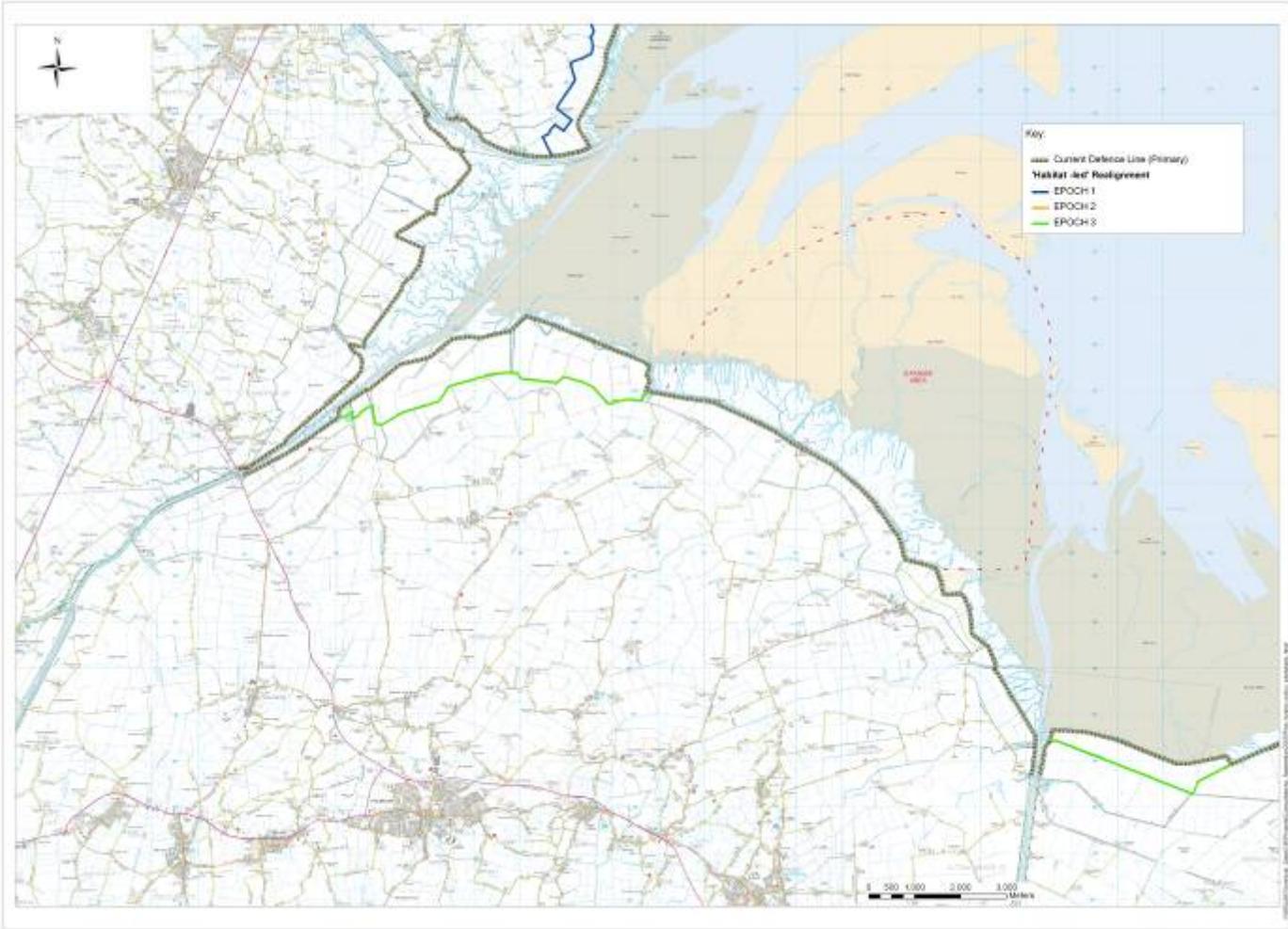


Figure E3.11 PDZ1 PP1b 'Habitat-led' realignment contd.

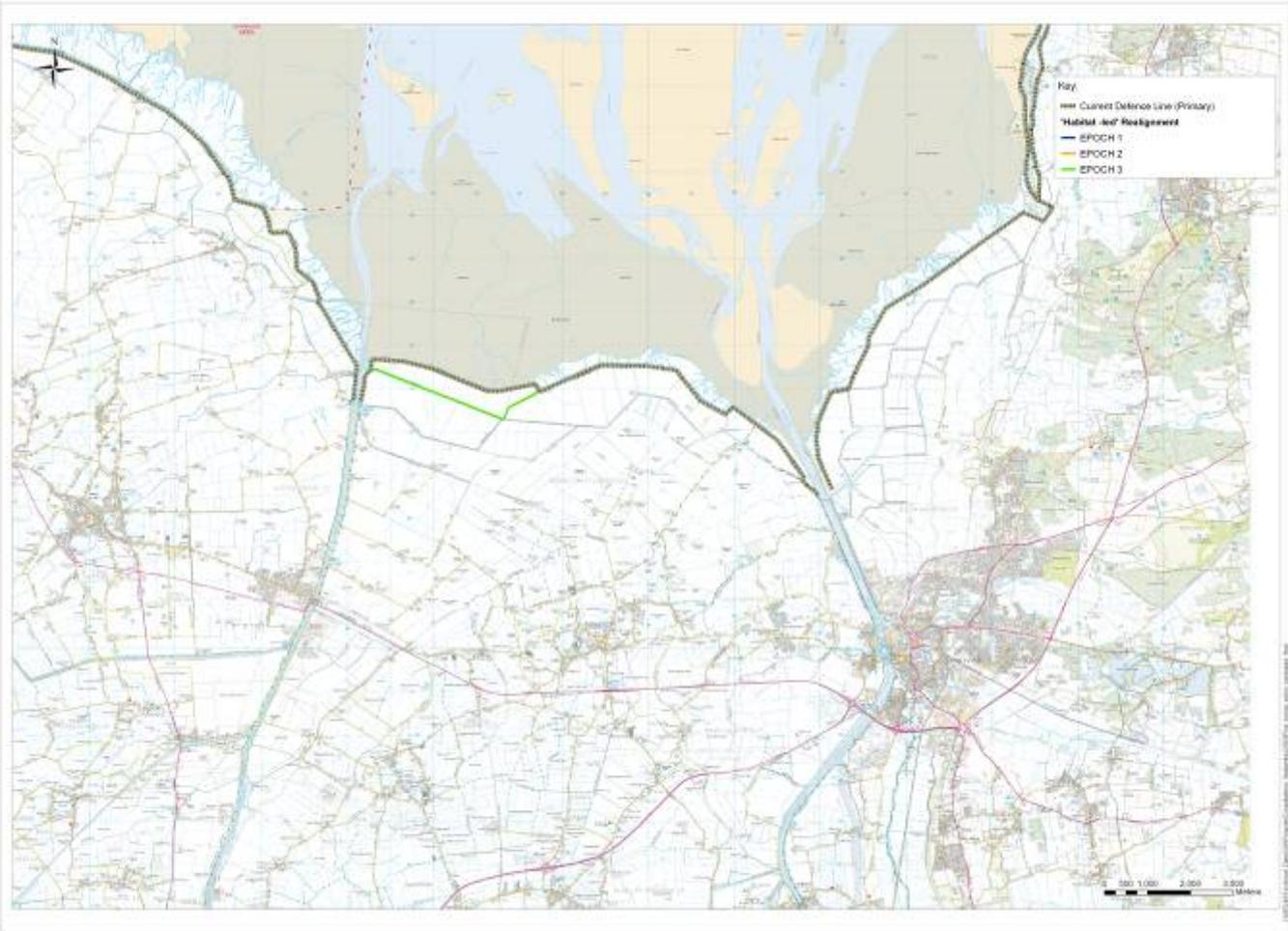


Figure E3.12 PDZ1 PP1d Local rebalancing

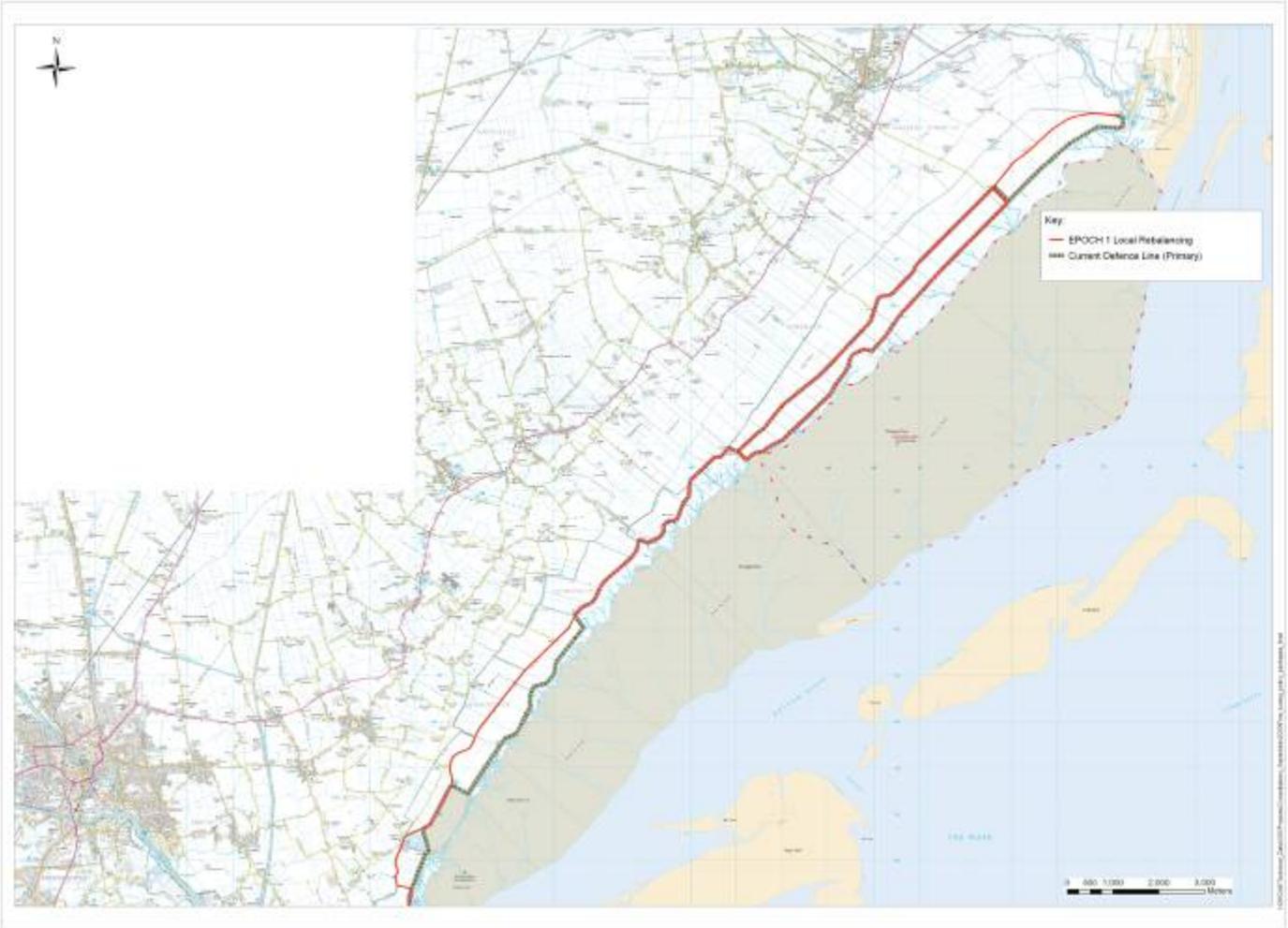


Figure E3.13 PDZ1 PP1d Local rebalancing contd.

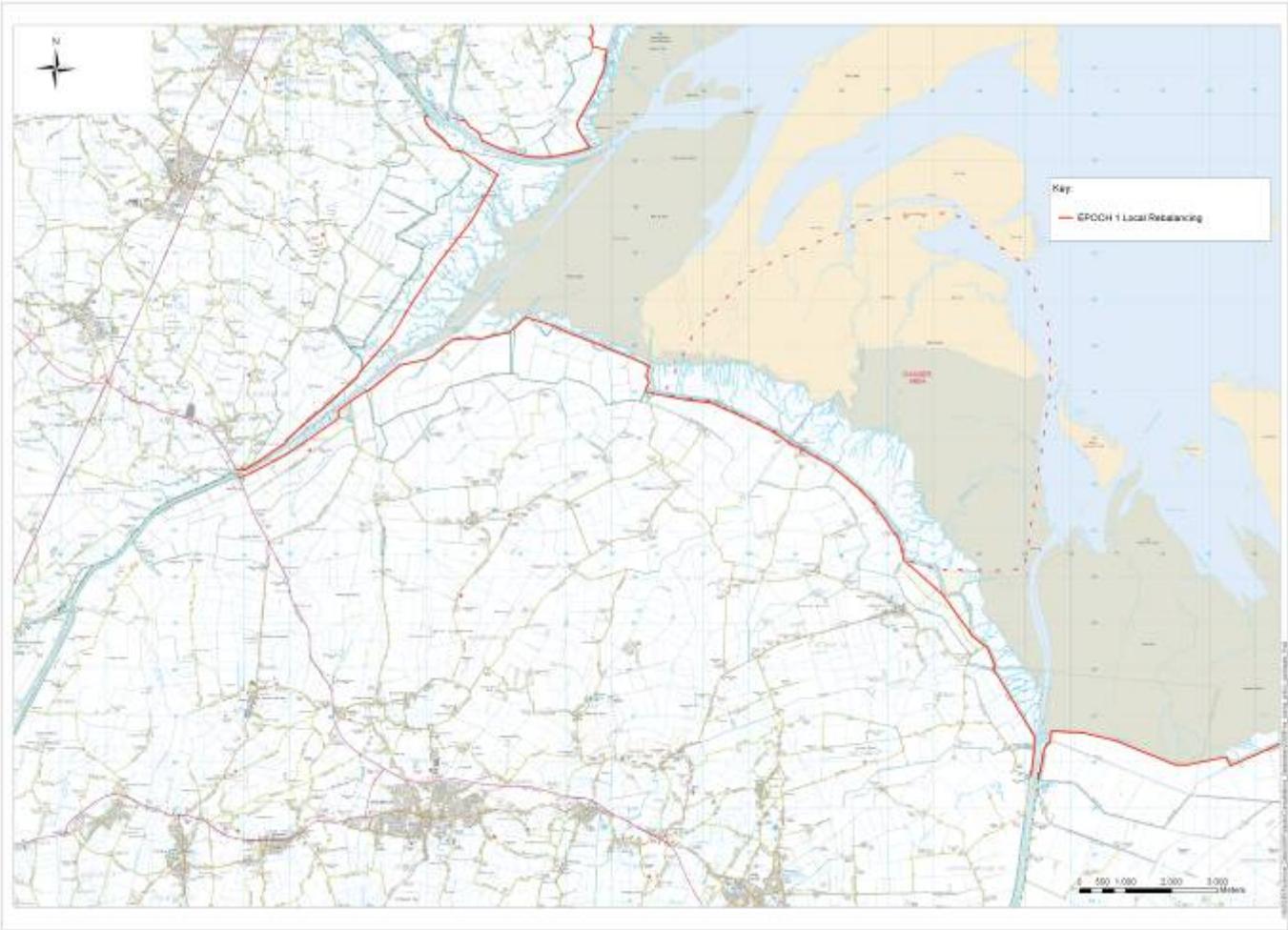


Figure E3.14 PDZ1 PP1d Local rebalancing contd.



Figure E3.15 PDZ2 PP2a Maximum landward realignment



Figure E3.16 PDZ3 PP3b No active intervention up to a limit



Figure E3.17 PDZ4 PP4b No active intervention up to a limit



E4 POLICY APPRAISAL

E4.1 Development of Policy Appraisal Methodology

E4.1.1 Baseline Scenarios Testing

In order to develop and test the methodology for policy appraisal an additional Task was introduced to this SMP. This additional task aimed to assess the agreed Objectives, as detailed in section E2, under the two Baseline Scenarios (NAI and WPM). This additional task provided an assessment of the two Baseline Scenarios, which was partly relevant for the actual policy scenarios, and also helped in the development of realistic scenarios. This task allowed the CSG and Environment Agency to comment on the methodology and format/presentation of the results.

Following on from this Task, the agreed methodology, as detailed below (section E4.1.2), was used to assess the fulfilment of the Objectives against the Policy Packages. The results of this assessment are provided in section E4.2.

E4.1.2 Agreed Methodology

Inputs

The policy appraisal methodology uses the outcomes of a number of preceding Tasks, as detailed below:

- **Approach for appraisal**, as detailed in section E4.1;
- **Objectives**, as detailed in section E2.4.
- **Playing Field and Policy Packages**, as detailed in section E3.3 and section E3.4.2.
- **Alignment of Policy Packages**, as detailed in section E3.4.3.
- **Coastal Processes for Policy Packages**, as described in detail in appendix F.

For the purpose of practical applicability in the appraisal process, a number of minor changes were made to the agreed Objectives:

- As the appraisal has been carried out at the level of the Policy Development Zones, the objectives for some of the individual frontages have been combined. The individual objectives, as far as relevant, have still been taken into account in determining the scores, which has been reflected in the narrative that accompanies the scores in the appraisal tables.
- The “Minimise flood risk to people, property and the environment”, has been removed from this assessment to ensure that the intent of the Objective Category is consistent.
- The ‘balancing’ Objectives specific to frontages 6 and 7 (River Great Ouse to South Hunstanton) should focus on the need, and possibility, of

relocation of the various tourist assets (caravan parks, holiday homes and holiday centres), as opposed to the funds and effort that society spends on flood and erosion risk management (which is covered by a specific Objective).

- In frontage 6a (River Great Ouse to Wolferton Creek, King’s Lynn cross-section), the “To avoid negative impacts on coastal processes in neighbouring sections” objective has been incorporated into the “To prevent interruption of the role of coastal processes in supplying sediment to the neighbouring frontages” Objective, because they are effectively focusing on the same subject.

Assessment

Firstly there is an assessment which will consider each Objective individually for each PDZ. The scores are then aggregated into scores for groups of Objectives (or Key Values) at a PDZ level.

Assessment per Objective

For this part of the Task, each individual Objective agreed in Stage 2 was assessed against the predicted shoreline evolution discussed in the Assess Shoreline Response report (appendix F), and results were indicated by a combination of a number/colour. As a result, each Objective was then given a score out of 9 and the appropriate colour was assigned to the Objective for easy reference. Where possible scores were based on tangible features/aspects, such the number of properties lost for the “protect as many settlements as possible” objective. Table E4.1 shows the scoring system to be applied.

Table E4.1 Assessment per Objective Scoring

Decreasing fulfilment of Objective	Score	Description	Associated Colour
	9	The scored Objective will be fulfilled by the Policy Package	Green
	8		
	7		
	6	The scored Objective will be partially fulfilled by the Policy Package	Yellow
	5		
	4		
	3	The scored Objective will not be fulfilled by the Policy Package	Red
	2		
1			

For each PDZ, this assessment was undertaken for each agreed Policy Package, and for all three epochs (present day to 2025, 2025 to 2055, and 2055 to 2105).

A narrative was also included for each Objective for further explanation of the impact of the Policy Package on the specific Objective.

Table E4.2 was used to present the results of the assessment per objective.

Table E4.2 Assessment per Objective Results Presentation

Objective	Epoch 1 (2025)		Epoch 2 (2055)		Epoch 3 (2105)	
	Score	Explanation	Score	Explanation	Score	Explanation
1. XXX	5	Text	4	Text	1	Text
2. XXX	9	Text	7	Text	6	Text

Where possible, specific quantitative indicators were used to assign scores. For some Objectives, this concerns the probability of flooding of a particular feature (such as an isolated hamlet or sewage treatment works). For this assessment Extreme Water Levels (EWLs) were used, as provided in the Baseline Scenarios report (see appendix F), including predicted sea level rise if relevant.

The timing of policies related objective scores were not assigned for each epoch, but instead for a policy package as a whole. This is due to the fact that the policy package itself will determine the timing, and therefore a score can only be assigned to each timing related overall Objective.

Aggregate Assessment per Category of Objectives

For this section, the emphasis was on overall values or aspects (aggregated objectives) instead of the individual objectives. As with the assessment per objective, the predicted shoreline evolution was used. Results were presented in a similar way to that shown in table E4.2 but instead of column one being titled "Objective", it was instead used to define an Objective Category. The score for each Objective (within a PDZ or sub-PDZ) was averaged, giving an overall score (out of 9) and associated colour for each epoch.

It is also important to incorporate the timing related objectives into the overall score for each epoch. It was important to ensure that the timing related scores were given the same weight as any other individual objective.

The aggregate assessment was also visualised schematically. This provided an overview of an individual PDZ or sub-PDZ for all policy packages, and used a symbol to represent the overall score per epoch for each Category of Objectives. The symbol was then shaded in green, orange, or red, to visualise how well a policy package scored against each Category of Objectives for each epoch.

Fine-Tuning

As part of the methodology, an iterative process of fine-tuning was included. This involved production of a 'first-cycle' of full assessment tables and graphics for each PP for each PDZ, acceptance by the Environment Agency, and then presentation of these results at the following CSG. A 'second-cycle' followed which incorporated the relevant CSG comments and the results were presented at the following EMF meeting.

E4.1.3 Validation of Assessment Results

The approach described in section E4.1 is relatively mechanistic. In order to use the outcomes in a meaningful way, a process of validation was required, especially in the first cycle of the appraisal. For example, for the first cycle of policy appraisal, a summary and analysis of the appraisal results was produced along with a second set of validated scores and graphics which contained a few changes compared to the scores derived from the method. Both sets of scores (actual and validated) were discussed with the CSG and EMF, and from this a second cycle of appraisal was carried out.

E4.1.4 Flood Risk Policies

Within this SMP, CFMP-defined flood risk policies have been used. This concept was introduced in section E3.2.1. The appraisal of the flood risk policies within this SMP was linked to the same set of objectives. The relevance of each objective differs for each PDZ. For example, for PDZ1 (Gibraltar Point – Wolferton creek) the standards are high and are likely to remain so (as defined in the playing field), and this means that the decision will be based on risk to people and property versus flood risk management investment. For the other PDZs, other aspects such as the impact of defence standards on defended fresh water habitats also plays a role.

The appraisal of the flood risk policies was treated differently from the standard SMP policies: the main elements of the decision have been described under a separate heading in section E4.2.1, and where relevant they have been mentioned in the appraisal tables' narrative, but they are not explicitly included in the scores or graphics.

E4.2 Policy Appraisal Results

The appraisal was carried out according to the agreed approach as discussed in the previous section (section E4.1), using qualitative scores per objective supported by a narrative, and aggregated to scores per aspect, which were then present graphically to visualise the balance of values that each policy package achieves.

The appraisal was carried out by Policy Development Zone and for Policy Packages. Each PP reflects an 'Intent of Management' for the PDZ and consists of a combination of the four policies, combined with risk policies.

This section focuses on the outcomes of the second cycle of the Policy Appraisal process.

Due to the size of the appraisal tables, it is not felt that benefit will be gained by including the full set of appraisal tables in this section. As a result this section will only present the assessment tables for one example PP for one PDZ (Maximum landward realignment for PDZ), for the purpose of illustration. However the schematics for all PPs for each PDZ have been included. The assessment tables are present in table E4.3 to table E4.5. Figure E4.1 to figure E4.4 present the final schematics for the four PDZs. The full appraisal tables for the draft Plan's policies are included in appendix G.

E4.2.1 Flood Risk Policies

This is only relevant for PDZ1. The difference between the two potential flood risk policies concentrates on the balance between flood risk management costs and risk to people and properties. Significant reduction of the standard (due to climate change) would not be sustainable due to the number of people, properties and activities in the defended area. PPs with realignments will mean that the defence moves closer to the settlements, which increases risk to people and hence could require a higher standard.

Table E4.3 PDZ1 (Gibraltar Point to Wolferton Creek) PP1a Maximum landward realignment (General Objectives)

Objective	Epoch 1 (2025)		Epoch 2 (2055)		Epoch 3 (2105)	
	Score	Explanation	Score	Explanation	Score	Explanation
Flood and Erosion Risk Management						
Maximise the use of existing man-made or natural defences (e.g. saltmarsh): the inland lines of (historical) defences and the ridge of high ground between Wainfleet and Wrangle	7	All realigned defences in epoch 1 will follow historical man-made defence lines; therefore this would be scored as 7. Realignment will also use an increased area of natural defence (in terms of saltmarsh creation); this would therefore be scored as 7. Therefore the overall score for this Objective is 7.	3	The defence line in epoch 2 is determined by the position of the established settlements, so it cannot follow existing man-made defence lines; therefore this would be scored at 2. Realignment will, however, create a significantly increased area of natural defence; therefore this would be scored at 8. There the overall score for this Objective is 5. It is worth noting that there is the potential to use the higher ridge of land located in the vicinity of Wrangle and Wainfleet.	7	There is no change in defence line from epoch 2 to 3; however there is the creation of a significant amount of natural defence (saltmarsh) which is likely to experience accretion in epoch 1. Towards the end of this epoch there is the possibility that increasing sea level rise may act to start a trend of erosion of the saltmarsh.
Have as little flood and erosion risk management throughout the plan period as possible	4	Although this PP will use existing historical defence lines, these defences will need to be strengthened and raised in most cases, leading to a significant amount of cost and effort in terms of flood risk management.	2	Realignment in this PP will require construction of an entirely new defence line, which will be extremely expensive.	8	There is no change in defence line from epoch 2 to 3; therefore costs in this epoch will only be associated with ongoing maintenance of existing defences.

Objective	Epoch 1 (2025)		Epoch 2 (2055)		Epoch 3 (2105)	
	Score	Explanation	Score	Explanation	Score	Explanation
Communities						
Protect as a minimum, throughout the plan period, to an appropriate standard of protection, all established settlements ¹ , and the area landward from these settlements	8	All established settlements will be protected, except during extreme events. This PP also supports the regeneration and development of King's Lynn as a designated key centre for development and change and Growth Point in the eastern region. The appropriate standard is determined by the flood risk policy (P3 or P4), but this will have limited impact in epoch 1.	5	Into this epoch, the smaller non-established settlements (encompassing 1,828 properties in total), and the infrastructure linking these small isolated settlements, will no longer be protected and will have to be abandoned. This is likely to have a significant impact on the established settlements. Score could start to decrease further if P3 policy is chosen.	5	As with epoch 2.
Protect as many settlements as possible.	8	All settlements will be protected in epoch 1, except during extreme events. Currently there are 29 properties lost in this epoch as a result of the realignment, however this PP should protect all settlements in the first epoch, and therefore local sections of the defences need to be changed in the third round of fine-tuning.	2	Only the established will be protected into epochs 2 and 3. Isolated farms and settlements, situated seaward of the strategic settlements will have a probability of flooding of greater than 1:1yr and, will have to be abandoned before realignment takes place.	2	As with epoch 2.

¹ Wainfleet All Saints, Wainfleet St Mary, Friskney, Wrangle, Old Leake, Leverton, Benington, Butterwick, Freiston, Fishtoft, Boston, Wyberton, Frampton, Kirton, Sutterton, Algarkirk, Fosdyke, Wigtoft, Bicker, Swineshead, Donington, Quadring, Gosberton, Surfleet, Pinchbeck and Spalding, Moulton Seas End, Holbeach Clough, Holbeach, Fleet Hargate, Gedney, Lutton, Long Sutton, Sutton Bridge, Holbeach St Marks, Holbeach St Matthew, Gedney Drove End, Walpole Cross Keys, Terrington St Clement, Clenchwarton, West Lynn, King's Lynn, North and South Wootton, Castle Rising and Wolferton.

Objective	Epoch 1 (2025)		Epoch 2 (2055)		Epoch 3 (2105)	
	Score	Explanation	Score	Explanation	Score	Explanation
Habitats						
Maintain natural processes relating to mudflats, saltmarsh, sand dunes and saline/coastal lagoons (where present)	8	Natural processes will be reinstated as a number of banks are breached and the natural coastal processes can begin to dominate between the current defence line and the newly realigned defence line. Saltmarsh development will still be constrained at the landward edge by the realigned defence.	8	As with epoch 1, but with a larger area of saltmarsh due to the further landward realignment in epoch 2. Saltmarsh development will still be constrained at the landward edge by the realigned defence.	9	As with epoch 2.
Maintain and if possible increase the area of mudflats, saltmarsh, sand dunes and saline/coastal lagoons (where present)	8	Potential area of saltmarsh and mudflat will be increase by approximately 7,400 hectares in epoch. This change will be gradual in epoch 1, as it is likely that the earth embankments will be breached at specific isolated locations.	8	Area of saltmarsh and mudflat will be increased by a further 20,900 into epoch 2. The change will be gradual, as with epoch 1.	7	No change in total saltmarsh/mudflat area, but the former reclaimed areas will gradually develop into saltmarsh. There may be erosion of the saltmarsh at its seaward edge and a subsequent loss of saltmarsh due to sea level rise, but it is not thought that this would be significant in terms of total saltmarsh area gained

Objective	Epoch 1 (2025)		Epoch 2 (2055)		Epoch 3 (2105)	
	Score	Explanation	Score	Explanation	Score	Explanation
Agriculture						
Protect as much grade 1 and grade 2 land as possible. The flood risk policy has no significant impact as the defence standard only influences the grade of land under 1:20 years	3	In epoch 1, there will be approximately 2,200 hectares of Grade 1, and 3,700 hectares of Grade 2, agricultural land lost (assuming a 1:1yr water level and no residual protection provided by abandoned defences) between the current defence line and the epoch 1 maximum realigned defence. It is therefore assumed that this land would no longer be classed as agricultural land.	1	In epoch 2, there will be approximately 19,700 hectares of Grade 1, and 6,200 hectares of Grade 2, agricultural land lost (assuming a 1:1yr water level and no residual protection provided by abandoned defences) between the epoch 1 maximum realigned defence and the new epoch 2 defence. As with epoch 1, it has been assumed that this land would no longer be classified as agricultural land.	1	As with epoch 2.
Ensure that the impact on the UK's area of grade 1 and grade 2 land is acceptable: ensure that there is at least X area in epoch 1 / 2 / 3	3	In epoch 1, approximately 0.6% and 0.2% of the total Grade 1 and Grade 2 land in England will be lost between the frontline defence and the epoch 1 maximum realigned defence	1	In epoch 2, approximately 5.6% and 0.3% of the total Grade 1 and Grade 2 land in England will be lost between the epoch 1 maximum realigned defence and the new epoch 2 defence	1	As with epoch 2.

Objective	Epoch 1 (2025)		Epoch 2 (2055)		Epoch 3 (2105)	
	Score	Explanation	Score	Explanation	Score	Explanation
Infrastructure						
Avoid interruption of the functioning of Boston Port and King's Lynn Port throughout the plan period (note that Sutton Bridge Port is only dealt with in the relevant Timing of Policies Objective, and does not have an individual Objective)	4	This PP is likely to change the course of the lower reaches of the Rivers Witham and Great Ouse, and therefore dredging will be required to maintain a navigable channel out into the Wash. It has been assumed here that this will include maintenance of the current training walls, and construction of additional training walls if necessary.	1	As with epoch 1, but with an increasing level of maintenance/dredging required due to the further change in defence location and the potential changes brought about by climate change.	1	As with epoch 2, but with an increasing level of maintenance/dredging required due to the potential changes brought about by climate change. This PP does not involve any further movement of defences in the vicinity of the ports in epoch 3.
Avoid interruption of the drainage function of Rivers Witham, Welland, Nene and Great Ouse throughout the plan period	4	This PP is likely to change the course of the lower reaches of the Rivers Witham, Welland, Nene and Great Ouse, and therefore dredging will be required to maintain the rivers' drainage function. It has been assumed here that this will include maintenance of the current training walls, and construction of additional training walls if necessary.	1	As with epoch 1, but with an increasing level of maintenance/dredging required due to the further change in defence location and the potential changes brought about by climate change.	1	As with epoch 2, but with an increasing level of maintenance/dredging required due to the potential changes brought about by climate change. This PP does not involve any further movement of defences in the vicinity of the rivers in epoch 3.
Avoid interruption of transport connections and utility supply throughout the plan period – ROADS (where present)	6	All through-going roads will be protected under this PP for epoch 1. The only roads that will be lost are those that provide access to the foreshore and to the various fields.	1	Into epoch 2, all major A-roads will be protected, although a large number of the roads that link the smaller isolated farms and settlements will be lost in epoch 2.	1	As with epoch 2.

Objective	Epoch 1 (2025)		Epoch 2 (2055)		Epoch 3 (2105)	
	Score	Explanation	Score	Explanation	Score	Explanation
Avoid interruption of transport connections and utility supply throughout the plan period – ELECTRICITY PYLONS (where present)	9	There are no electricity pylons located between the current defence line and the epoch 1 maximum realigned defence in this PDZ.	1	Into epoch 2, there will be a large number of pylons that will be at risk of flooding and will therefore need to be moved (with an associated high cost). These are located between Boston and King's Lynn.	1	As with epoch 2.
Avoid interruption of transport connections and utility supply throughout the plan period – SEWAGE TREATMENT WORKS (where present) and other Anglian Water infrastructure	9	There are no sewage treatment works or significant Anglian Water infrastructure located between the current defence line and the epoch 1 maximum realigned defence in this PDZ.	1	For the realignment area in this epoch, there is a risk to the sewage treatment works at Wythes Lane (Freiston), Boston (banks of River Witham), Tolls Lane (Holbeach), Sutton Bridge and Clockcase Road (Clenchwarton, banks of River Great Ouse) during epoch 2. There will also be an impact on a significant number of Anglian Water assets (water hydrants, water mains, air valves). Therefore plans would need to be made to move these works in epoch 1, which would be very costly.	1	As with epoch 2.

Objective	Epoch 1 (2025)		Epoch 2 (2055)		Epoch 3 (2105)	
	Score	Explanation	Score	Explanation	Score	Explanation
Avoid interruption of transport connections and utility supply throughout the plan period – PRISON (where present)	9	There are no prisons located between the current defence line and the epoch 1 maximum realigned defence in this PDZ.	1	There is a risk to the North Sea Camp prison during epoch 2. Therefore plans would need to be made to move the prison sometime in epoch 1. Due to the distance of relocation required, this would be extremely costly.	1	As with epoch 2.
Avoid interruption of transport connections and utility supply throughout the plan period – RAILWAY LINE (where present)	9	The Boston-Skegness railway line will be protected, unless there is an extreme event.	9	As with epoch 1	9	As with epoch 1
Landscape						
To maintain the integrity of the coastal landscape	6	This Objective is present to represent the AONB designation in this PDZ (located between the right hand bank of the River Great Ouse and Wolferton Creek/Dersingham). This PP allows the species and habitats of the AONB to be maintained and enhanced (due to the realignment).	7	As with epoch 1, but with a further increase in natural area due to the further landward realignment.	7	As with epoch 2, but with the realigned area gradually becoming more natural.

Table E4.4 PDZ1 (Gibraltar Point to Wolferton Creek) PP1a Maximum landward realignment (Timing of Policies Objectives)

Objective	Overall Score (all epochs)	Explanation
Provide sufficient time, if required, for community adaptation	3	Maximum realignment will only affect the smaller isolated farms and settlements into epochs 2 and 3; although this provides adequate time for adaptation of these settlements during epoch 1, it is vital to note that the impact of abandoning these isolated settlements (of which there is a significant number) on the established settlements and the wider Wash SMP2 area would be significant.
Provide sufficient time, if required, for change of flood risk management practices	5	This PP means realignment generally back to the most landward identifiable complete defence line (secondary or tertiary) in epoch 1. These defence lines will need strengthening and crest height improvements in most cases. Into epoch 2, there will be the need to construct entirely new defences in most cases. It is feasible that this work can be carried out in epoch 1, and then breaching of the epoch 1 defence line can be undertaken at the beginning of epoch 2.
Provide sufficient time, if required, for relocation of regional infrastructure and navigational infrastructure changes, ensuring continued A-road and rail transport links between Boston and Skegness, Boston and Spalding, Boston and King's Lynn, King's Lynn and Hunstanton, and links between the communities	9	Under this PP there will not be the need for relocation of regional infrastructure or navigational infrastructure (such as the planned Fen Waterway Link, which includes the Northern Boston link). If the probability of flooding becomes too great during the later epochs, this PP will provide sufficient time for relocation of this infrastructure.
Provide sufficient time, if required, for adaptation of Sutton Bridge Port	3	This PP will require relocation of Sutton Bridge Port, but only into epoch 2. However the impact of relocating this port facility and associated infrastructure is likely to be significant.
Provide sufficient time, if required, for recreational access to the foreshore	7	The recreation along this PDZ is generally associated with walking along the earth embankments and bird watching. There is more small-scale recreational activities associated with crabbing, samphire picking and collecting shellfish. This PP will require changes to allow users to continue to access the earth embankments and foreshore as the location of the defences will be changed in epochs 1 and 2. However this is something that can be integrated into the design of the new defences.
Provide sufficient time, if required, for relocation / adaptation of MoD use of the foreshore (where applicable)	9	This PP will not really affect the MoD's use of the foreshore as it is currently mainly used as a practice bombing range. The policy is only likely to increase the potential area that can be used as a bombing range.

Objective	Overall Score (all epochs)	Explanation
Provide sufficient time, if required, for relocation / adaptation of prison facilities (where present)	2	Due to the fact that even by epoch 1, the prison has greater than a 1:1yr probability of flooding, and then by epoch 2 the majority of the surrounding area would be uninhabitable, this PP does not provide sufficient time for relocation/adaptation of the prison facilities due to the long-distance relocation
Provide sufficient time, if required, for relocation / adaptation of sewage works (where present) and other Anglian Water infrastructure	1	The sewage works and other significant Anglian Water assets will not be affected during epoch 1 but are likely to be flooded during epoch 2. This will allow some time for relocation, but this relocation must occur without delay at the start of epoch 1 to ensure that there function is maintained.
Provide sufficient time, if required, for appropriate levels of recording of historic assets if preservation in situ cannot be achieved	6	For this PDZ there are 192 (0 are of national ² , 12 are of regional ³ importance, 71 are of local ⁴ importance and 109 are classed as unimportant ⁵) historical assets at risk as a result of the realignment in epoch 1 and a further 71 (1 is of national importance, 24 are of national importance, 32 are of local importance and 14 are classed as unimportant) historical assets at risk as a result of the realignment and saltmarsh erosion into epochs 2 and 3. This PP would, however result in gradual changes to the shoreline and backshore, therefore there would be plenty of time for adequate levels of recording of these historic assets (bearing in mind these features have already been identified and located) using a staged approach (focusing on the epoch 1 maximum realignment area at the beginning of epoch 1, and then concentrating on the epoch 2 and 3 realignment area towards the end of the epoch 1).

² **National importance** – the highest status of cultural heritage site, such as scheduled monuments, listed buildings Grade I and II and well preserved historic landscapes.

³ **Regional importance** – includes the bulk of cultural heritage sites with reasonable evidence of occupation, ritual, industry etc, listed building Grade II, and reasonably preserved historic landscapes.

⁴ **Local importance** – cultural heritage sites with some evidence of human activity, but in a fragmentary or poor state, buildings of local importance, and dispersed elements of historic landscapes (such as cropmarks).

⁵ **Unimportant** – insufficient evidence or data to make an informed judgement of importance, where a building site is considered to have no significance, or represents a monument known only from documentary sources with no specific identifiable location.

Table E4.5 PDZ1 (Gibraltar Point to Wolferton Creek) PP1a Maximum landward realignment (Assessment per Key Value)

Objective Category	Overall Score – epoch 1	Overall Score – epoch 2	Overall Score – epoch 3
Flood and Erosion Risk Management	5	3	7
Communities	6	3	3
Habitats	8	8	8
Agriculture	3	1	1
Infrastructure	6	3	3
Landscape	6	7	7
Recreational Access to Foreshore	7		
Historic Environment	6		

Figure E4.1 PDZ1 Schematic Diagram

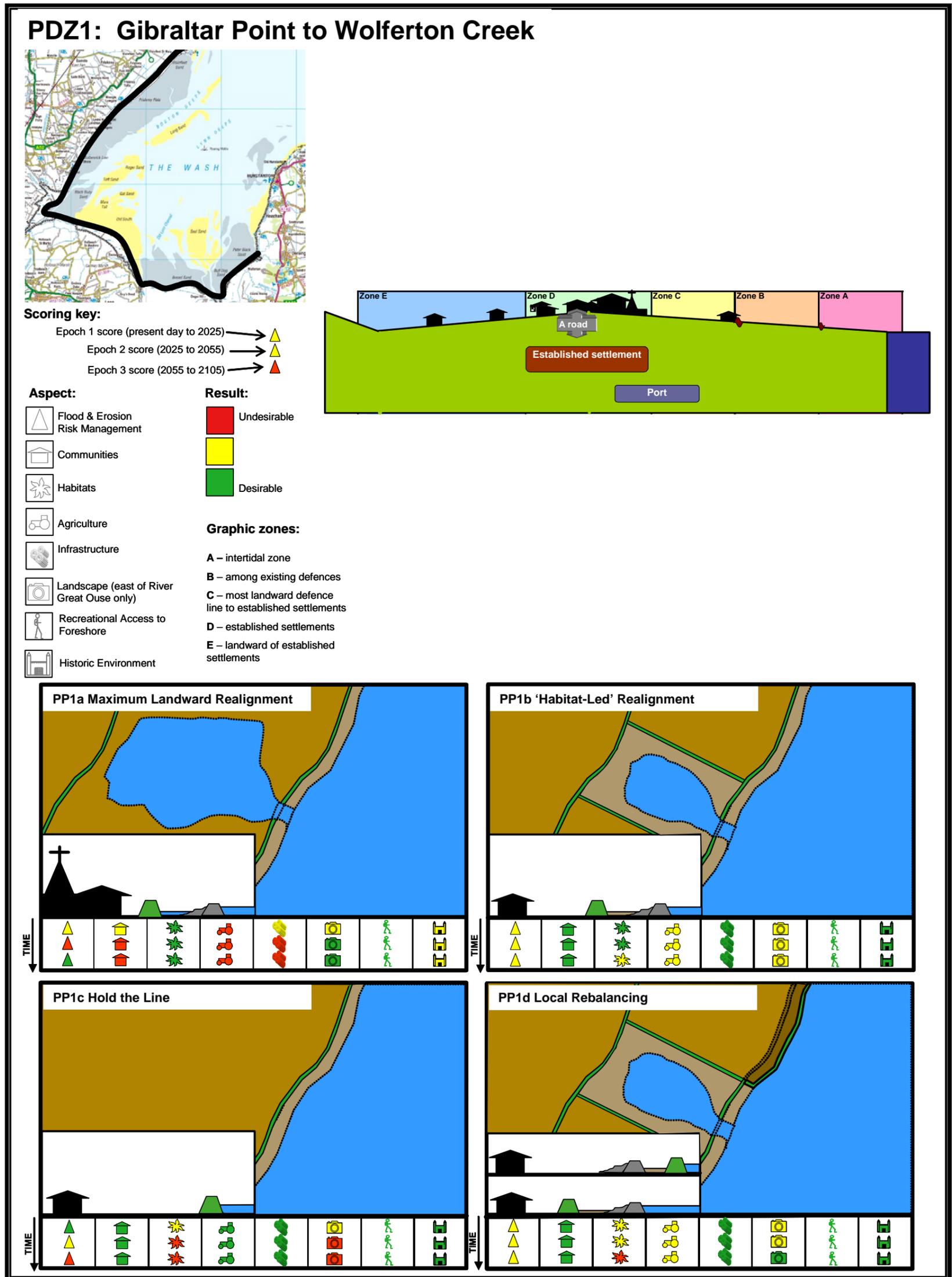


Figure E4.2 PDZ2 Schematic Diagram

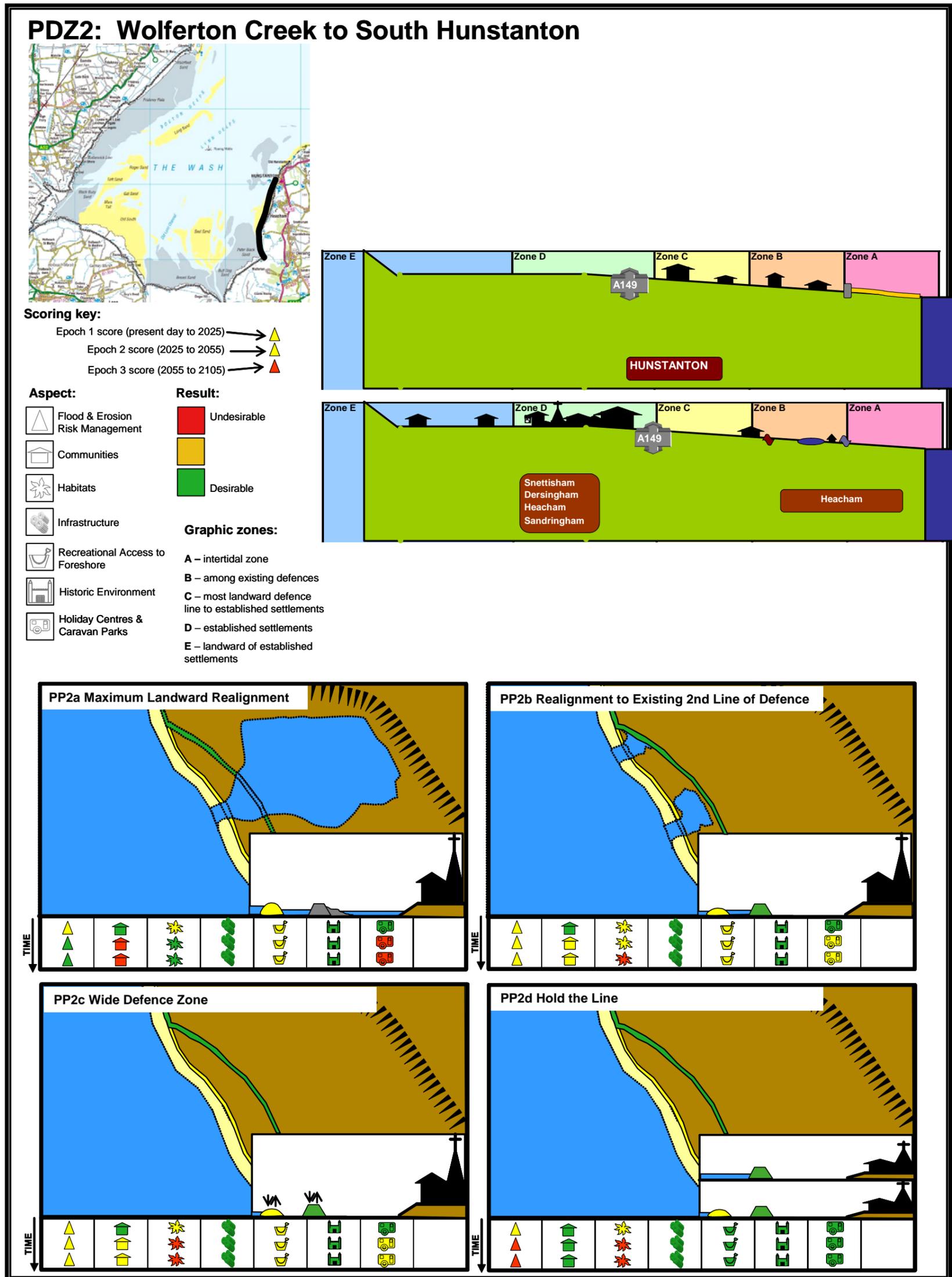


Figure E4.3 PDZ3 Schematic Diagram

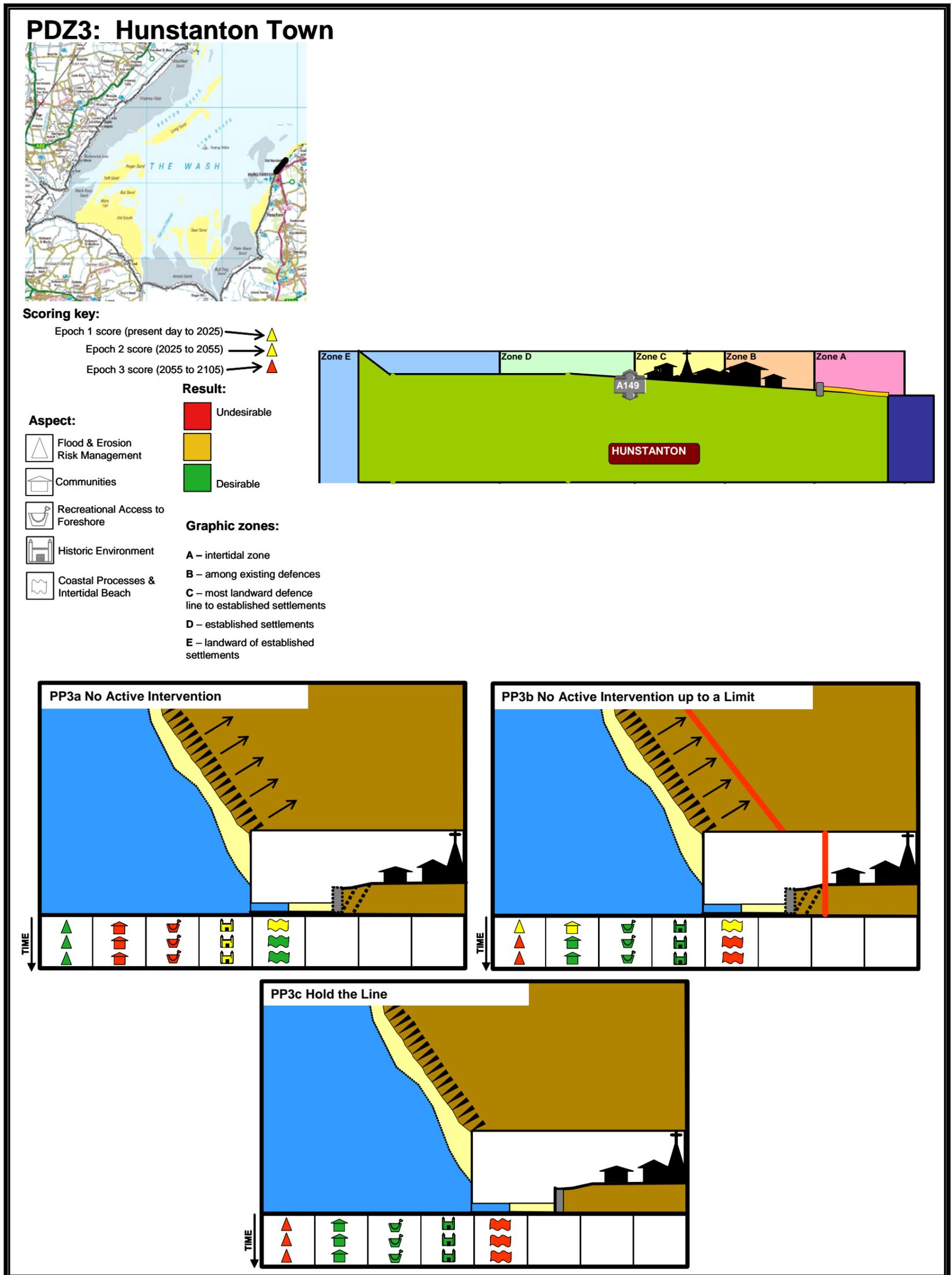
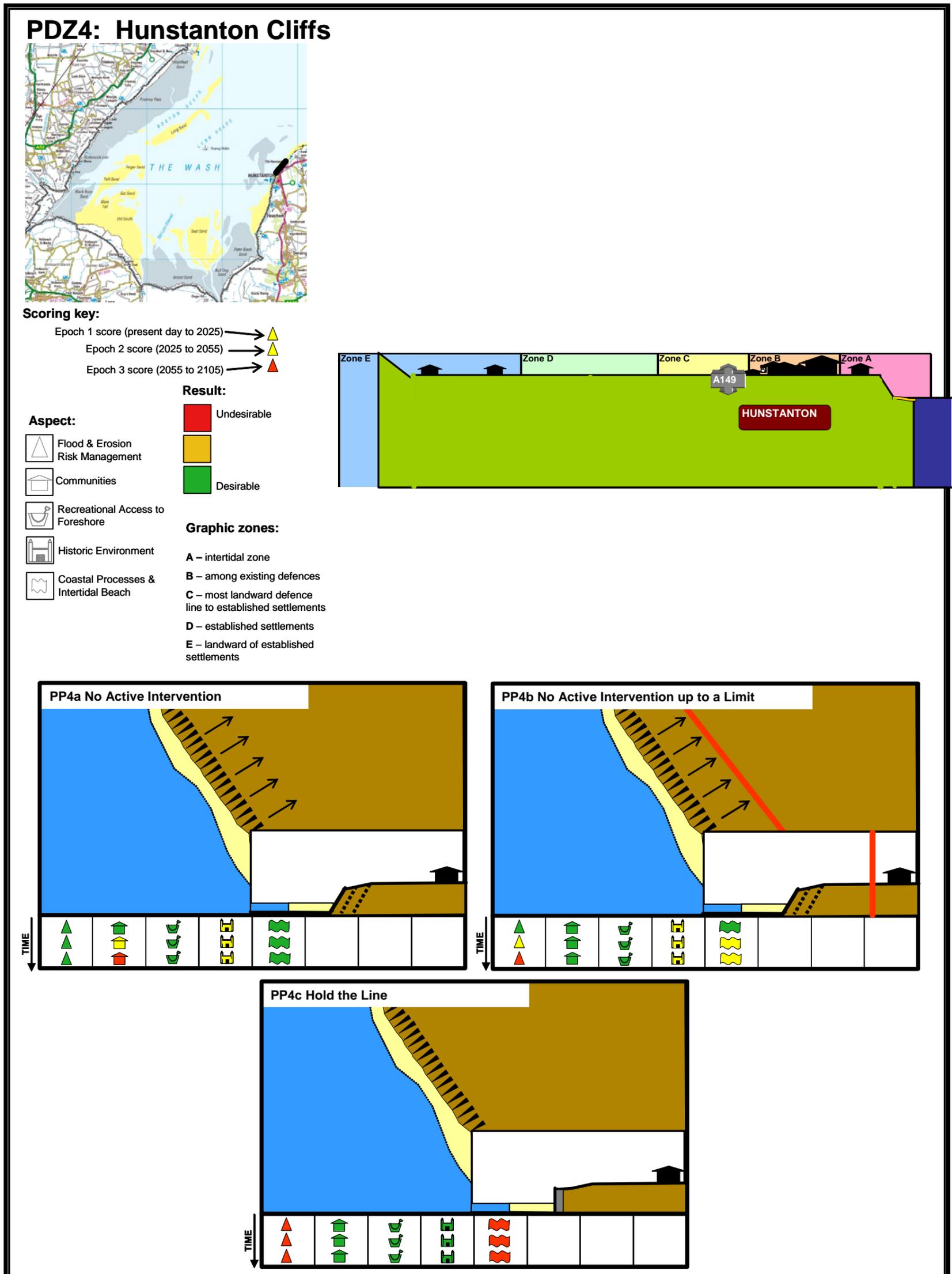


Figure E4.4 PDZ4 Schematic Diagram



E4.2.2 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 packages against the objectives, and how could this uncertainty be managed in the SMP process. A more specific sensitivity analysis will be provided for the preferred policy package.

Climate change

Sea level will certainly continue to rise, but the rates are uncertain, especially for epoch 3. The rate of sea level rise does not only influence the speed of morphological developments, but in the case of saltmarsh development, also whether there is accretion or erosion. SMP policy development is very sensitive to this direction of saltmarsh development: the predicted accretion in the first epochs and the subsequent reversal of processes toward coastal squeeze is an important driver for policy selection. A faster rate would lead to coastal squeeze setting in earlier; a slower rate could prolong the current trend of accretion.

This uncertainty should be managed by choosing 'no-regret' policies for the short term, combined with reviewing the SMP policies as new sea level rise information becomes available (obviously, the SMP does not have to define an action to improve sea level rise predictions). The impact on policy appraisal is likely to be limited, because the playing field definition for this SMP has already limited the potential negative impacts of policies. The main issue would be whether the larger scale realignments in the Maximum landward realignment packages, leading to irreversible land use changes, are robust.

Behaviour of coastal processes

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

- Development of intertidal areas in response to sea level rise: based on the measured profiles from the EA's monitoring programme it is quite certain that the current trend 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: the predicted accretion in the first epoch and the subsequent reversal of processes toward coastal squeeze is an important driver for policy selection.
- Influence of Managed realignment on foreshore, neighbouring frontages and wider Wash: our analysis has assumed that this impact is only limited and local (increased channel formation in front of the breaches). Monitoring from Freiston Shore and similar 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 are 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, policy appraisal needs to look at no-regret options for the short term.

E5 FROM POLICY APPRAISAL TO DRAFT POLICY

E5.1 Introduction

Following the first two cycles of policy appraisal, **tentative** PPs were identified for PDZ1 and PDZ2 and **preferred** PPs were identified for PDZ3 and PDZ4. These were as follows:

PDZ1 Gibraltar Point to Wolferton Creek

- Epochs 1 to 3 – Realignment to fulfil, but not exceed, the legal requirements as per the Habitats Directive.

PDZ2 Wolferton Creek to South Hunstanton

- Epoch 1 – Hold the line, but with an expressed intent to move to the Wide defence zone PP by the beginning of epoch 2.
- Epoch 2 – Wide defence zone, by sustaining the land use behind the bank but reduce/cease maintenance of the shingle ridge.
- Epoch 3 – continue to hold the new Wide defence zone line.

PDZ3 Hunstanton Town

- Epoch 1 – Hold the line.
- Epochs 2 and 3 – Hold the line, but ensure continued monitoring of the developing Hunstanton promontory to assess its sustainability.

PDZ4 Hunstanton Cliffs

- Epochs 1 and 2 – No active intervention.
- Epoch 3 – Hold the line to protect cliff top properties and the B1161.

Full details of the preferred PPs for PDZ3 and PDZ4 are provided in appendix G.

It was agreed by the CSG and EMF that, due to the high proportion of missing data and uncertainties for PDZ1 and PDZ2, particularly in relation to Natural England's stance with respect to habitat compensation and loss, preferred policies could not be reached. As a result, an extended period of policy appraisal was carried out for these two PDZs which allowed a sufficient amount of the uncertainties and data gaps to be addressed.

These data gaps and uncertainties included:

- Development of a conceptual model to predict the future intertidal development for PDZ1.
- The impact of loss of saltmarsh on the sustainability of the defences in PDZ1.
- Assessment of the degree to which the current flood defences in the Wash effect the offshore sand banks.
- Coastal processes in PDZ2.

- The impact of the different PPs on the saline lagoons and Snettisham Scalp.
- More detailed economic assessment to highlight the financial impacts of the PPs.

This section provides an overview of the assessments undertaken to attempt to fill these data gaps and address these uncertainties. For elements that involve coastal processes and shoreline interactions, full details are provided in appendix F, and only a brief summary is included in this section. This overview focuses on the impacts of the findings on the tentative PPs. This is subdivided into PDZ1 and PDZ2. At the end of each PDZ section, overall conclusions are drawn from the additional work undertaken and an explanation is provided with regards how we then moved from tentative PPs to a preferred PP for PDZ1 and PDZ2. The preferred PP for PDZ1 can therefore be found in section E5.2.4 and the preferred PP for PDZ2 can be found in E5.3.5.

E5.2 PDZ1 Gibraltar Point to Wolferton Creek

The main gaps and uncertainties for PDZ1 concerned:

- The development of salt marsh and mud flat in the medium and long term, and the current level of uncertainty around this;
- The role of the foreshore in flood defence;
- The impact of policies on sand banks in the Wash.

These issues are described in the following sections. Section E5.2.4 describes how these assessments have informed policy development.

E5.2.1 Future Intertidal Development

Section F6.2.1 of appendix F provides a detailed account of the assessments carried out to determine an envelope of possible development of the saltmarsh and mudflat in epoch 2 and 3. This section summarises the results, looking at the two extreme ends of the envelope (accretional and erosional futures), and comparing the two.

Accretional Future

A conceptual accretional model was developed that assumes a continuation of current rates of accretion, until constrained by the presence of deep channels or the availability of sediment. This provides one extreme end of an envelope of possible futures for the Wash.

The boundaries for the two intertidal areas are defined as follows:

- Saltmarsh: from seabank to the saltmarsh/mudflat boundary;

- Mudflat: from saltmarsh/mudflat boundary to the mean low water (MLW) mark. The location of the MLW mark can change due to two factors:
 - Vertical movement of the mudflat surface;
 - Sea level rise.

Associated rates of future development have been determined as follows:

- Sea level rise: based on Defra guidance;
- Saltmarsh/mudflat boundary: for epoch 1, present day rates based on monitoring; for epochs 2 and 3, present rates extrapolated based on the predicted acceleration of sea level rise;
- Mudflat surface level: for epoch 1, present day rates; for epochs 2 and 3, extrapolated present rates (as for the saltmarsh/mudflat boundary).

The resulting total areas of change, taking into account constraints due to sediment availability and presence of deep channels, are provided in table E5.1:

Table E5.1 Accretional Model Results - Intertidal Change

Epoch	Total intertidal change (ha)		
	Saltmarsh	Mudflat	Intertidal
1	+1,110	-878	+231
2	+2,846	-3,078	-233
3	+6,583	-6,799	-216
Totals	+10,538	-10,756	-217

Erosional Future

In order to provide the other extreme end of the envelope of possible futures for the Wash, an erosional conceptual model was also developed. This model assumes a continuation of current rates of accretion in the short term (epoch 1), but that in the medium and long term there would be a reversal of current trends leading to erosion of both the saltmarsh and mudflat and therefore a landward movement of the saltmarsh/mudflat boundary. The boundaries for the saltmarsh and mudflat areas were defined as described in section E5.2.1.

Associated rates of future development have been determined as follows:

- Sea level rise: based on Defra guidance;
- Saltmarsh/mudflat boundary: for epoch 1, present day rates based on monitoring; for epoch 2, assumed no overall movement; for epoch 3, results of modelling by Pethick (2002) updated to take into account Defra sea level rise figures;
- Mudflat surface level: for epoch 1, present day rates based on monitoring; for epochs 2 and 3, results of modelling by Pethick (2002) updated to take into account Defra sea level rise figures.

The resulting total areas of change, taking into account constraints due to sediment availability and presence of deep channels, are provided in table E5.2.

Table E5.2 Erosional Model Results - Intertidal Change

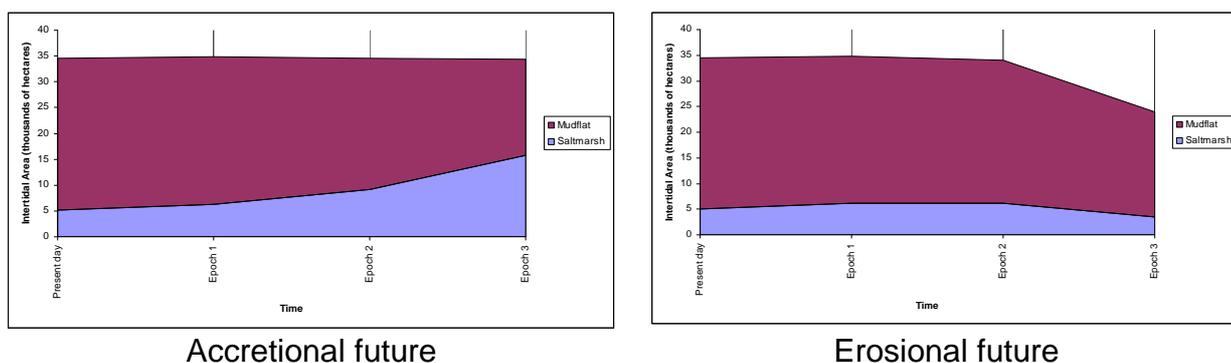
Epoch	Total intertidal change (ha)		
	Saltmarsh	Mudflat	Intertidal
1	+1,110	-878	+231
2	0	-769	-769
3	-2855	-7214	-10,069
Totals	-1745	-8861	-10,607

Comparison

The accretional and erosional model results present the range of possible future intertidal developments if the current alignment were held throughout the epochs.

The graphs in figure E5.1 illustrate the absolute and relative changes to the total saltmarsh and mudflat areas, throughout the three epochs and for both futures.

Figure E5.1 Schematic Representation of Accretional and Erosional Futures



Based on this, we can draw the following conclusions about the intertidal development in the Wash if the current alignment were held throughout the epochs:

Epoch 1: We expect a small overall increase of intertidal area, with some gain of saltmarsh at the expense of mudflat. This is based on extrapolation of current trends, and is relatively certain.

From epoch 2 onward however, there are marked differences.

- At the accretional end of the scale, the total intertidal area is practically unchanged because the vertical growth of the mudflat keeps pace with sea level rise. It is unlikely to grow significantly due to the presence of the channels. Local changes in both directions are of course going to happen, but these have not been picked up by our approach; however, this suffices as a broad scale assessment. The accretional approach also assumes continued growth of the saltmarsh (within the constraint of sediment availability). This then comes at the expense of mudflat area. The current ratio of 15% saltmarsh and 85% mudflat could change to an almost 50 / 50 ratio in epoch 3.
- At the erosional end of the scale, the total intertidal area reduces because the mudflat experiences erosion while sea level rises. Within this total, assuming onset of saltmarsh erosion, the ratio of saltmarsh and mudflat could remain similar to the current situation.
- In reality, the future is likely to be a combination of these two scenarios, but not necessarily on a linear scale between the two. For example, it is within the range of possible futures that both the total intertidal area remains roughly constant, but also the saltmarsh / mudflat ratio.

For the sustainability of the flood defences, the presence of saltmarsh is most important. From the point of view of habitats, both the saltmarsh and the mudflat provide their own contribution, but their ratio is also important. These considerations will have to be taken into account in the development of future shoreline management in the coming years.

E5.2.2 Role of Foreshore in Flood Defence

Saltmarsh has an important flood defence function, mainly because it reduces water depth on the foreshore, which limits the height of the waves that can reach the banks. The future presence of saltmarsh around The Wash is uncertain. If it were to reduce, then the higher wave attack would lower the standard of protection. Sustaining the existing standard would require stronger frontline defences or landward realignment.

This section aims to illustrate the scale of the impact of foreshore loss, in terms of the size of required defences and associated costs. It assesses six sites around the western and southern fringes of the Wash. The baseline for the analysis is the flood defence performance that the existing seabanks provide under the water levels and waves currently expected in extreme storm events (which is to withstand a 1:200 per year storm event). In this note we assess how the water levels and waves in this extreme event are expected to increase, both with and without the presence of saltmarsh, and how this impacts the flood defence function of the earth embankments. Finally, we have developed outline designs for the defence improvements that would be needed to sustain the current standard, both with a frontline defence and a landward realignment, including ballpark cost estimates.

The analysis shows that for both scenarios (with and without saltmarsh), the defences will need raising to keep pace with the expected sea level rise of just over 1m up to 2105. In addition, a loss of saltmarsh would allow much larger waves to reach the earth embankments. Holding the defence in its current alignment would require crest raising of approximately 3.5 m (including 1m for sea level rise), plus a revetment on the lower slope. There are various alternatives, but they would be similarly extensive. If the defence was realigned, it may be possible to upgrade existing relict secondary defences; these would still need significant crest raising and strengthening to meet the requirements (approximately 3 m), but there would be no need for a revetment.

The ballpark cost estimate shows that foreshore loss is very expensive. In addition, comparing the two high level options for the situation without saltmarsh, the construction costs of landward realignment are significantly lower. However, the estimate only includes construction costs, and not the potential costs required for compensation of land owners (in a realignment option) or habitat compensation (in a Hold the line option).

Further details are provided in appendix F (section F6.2.2).

E5.2.3 Impact of Defences on Offshore Banks

This section will focus on the effect of the flood defences on the sand banks of the Wash SMP2 area. This is important from the point of view of the (designated) habitats that the sand banks provide. For this purpose, a sand bank is defined as the accumulations of sediment which are exposed at low water (therefore those defined by the Mean Low Water mark) and which are detached from the main intertidal expanse (saltmarsh and mudflats).

These sand banks are formed of coarse sand and are a sediment sink. They are aligned parallel to the axis of main tidal flow and are located between the mutually evasive ebb and flood dominated channels. They have a tendency to migrate away from their steeper face. As well as being important in terms of the geomorphological functioning of the Wash SMP2 area (they have a major influence on the physical processes and sediment flow patterns within the Wash embayment) they also have a specific environmental designation (Special Area of Conservation) and support a large variety of biota, including polychaetes, bivalves and crustaceans.

The only negative effects associated with continued Hold the line are likely to be as a result of sea level rise. Sea level rise is likely to cause the mean low water mark to move landward up the intertidal profile and will gradually reduce the amount of sand bank exposed at low water. The increased volume of water flowing through the main tidal channels also has the potential to deepen the channels themselves and thus cause the sand banks to move away from their steep faces, further reducing the total area of sand bank exposed at low water.

Further, more significant, negative effects would be experienced if one of the more 'extreme' SMP policies were implemented. These are summarised below. Note that these 'extreme' policies were already discounted at this stage in the SMP:

- Full scale Advance the line:
 - Squeeze of entire geomorphic system;
 - Likely to effect intertidal area more than functioning of sand banks;
- Large-scale landward realignment or No active intervention:
 - Initial large increase in tidal prism.
 - Associated increased erosion of channel sides and therefore erosion of sand banks.
 - Into later epochs, increase in sedimentation with decrease in tidal prism.
 - Associated decreased erosion of channels sides and therefore reduction in loss of sand banks (but not enough to compensate for increase in tidal prism due to realignment).
- No active intervention of river outfalls:
 - Total change of geomorphic functioning of Wash embayment.
 - Reduction in influence of flood and ebb channels.

In conclusion, the tentative preferred PP for PDZ1 (realignment to fulfil, but not exceed, the legal requirements of compensation for the loss of intertidal habitat) will cause a continued slight decrease in tidal prism throughout epoch 1 (assuming Hold the line throughout the epoch). This will result in a continuation (or even decrease) of current rates of erosion across the sand banks and channels. This is obviously dependent on the rates of sea level rise. Into epochs 2 and 3, assuming relatively small-scale realignments, there will be an increase in tidal prism, and coupled with sea level rise, there is the potential for erosion of the channels and therefore erosion of the sand banks.

Further details are provided in appendix F (section F6.2.3).

E5.2.4 Overall Conclusions – PDZ1

These additional assessments for PDZ1 have illustrated the significant uncertainties surrounding the medium- and long-term rate of sea level rise, the response of the intertidal area and the role of the flood defences. A decision to either Hold the line or realign would have very large consequences, on both sides of the current defence line, and they are difficult to reverse. Against the background that the future needs of society for agricultural land, habitats and other land uses are also uncertain, it was decided that it would not be appropriate to define a firm policy for the medium and long term. Therefore the medium- and long-term policies are conditional

on the results of ongoing monitoring and research. As a result, the tentative policy for PDZ1 (realignment to fulfil, but not exceed, the legal requirements as per the Habitats Directive in epochs 1, 2 and 3) has not been taken forward. The draft policy for PDZ1 is therefore as follows:

- Epoch 1 – hold the defences in their current position and sustain their flood defence function.
- Epochs 2 & 3 – either Hold the line or Managed realignment, depending on the results of monitoring and research into climate change, shoreline response and the role of defences.

E5.3 PDZ2 Wolferton Creek to South Hunstanton

E5.3.1 Introduction

The main gaps and uncertainties for PDZ2 concerned:

- The impact of the tentative policies on the saline lagoons and on Snettisham Scalp;
- The economic viability of the tentative policies;
- Involvement of local stakeholders and businesses.

E5.3.2 Impact of Shoreline Management on Snettisham Scalp and the Saline Lagoons

Section F6.3 in appendix F gives an overview of coastal processes and current management practices. Based on that, it assesses in some detail the expected impact of three management scenarios on the Scalp and on the saline lagoons: With Present Management, No active intervention, and the Wide defence zone approach suggested as a tentative SMP policy.

The main conclusions and impact on policy development are as follows:

- The current shingle recycling approach is under annual review from Natural England and the RSPB, and has thus far been acceptable.
- A change of approach to No active intervention in the medium term (as suggested in the tentative Wide defence zone policy) is likely to cause some (however limited) growth of Snettisham Scalp. The shingle ridge that protects the saline lagoons would become more natural, although it has to be noted that the extent of current maintenance is very limited. The additional shelter provided by the expected growth of the Scalp is likely to compensate at least partly for the increased flood risk to the lagoons due to climate change and the No active intervention policy that the Wide defence zone would entail for the medium and long term.

E5.3.3 Economic Assessment

Following liaison with a number of key stakeholders for PDZ2 it was agreed that a more detailed economic assessment would be undertaken in order to provide more certainty surrounding the costs of potential options for the frontage. The SMP guidance (Defra 2006) states that a high-level economic assessment should be undertaken for each of the preferred policies in order to assess whether the policy is economically viable, marginally viable, or not viable. For PDZ2 a more detailed assessment was also undertaken. This assessment looked into the Wide defence zone option and made comparisons with the costs of continuing to manage both the shingle ridge and earth embankment (Hold the line) throughout the three epochs. The full results of this economic appraisal are provided in detail in appendix H (see section H3.2).

The main conclusion of these assessments, and the impact on policy development, is that both a continuation of the existing approach and a move to a Wide defence zone approach are marginally viable, and would be difficult to afford. This has informed the decision to propose the establishment of a process to jointly develop a long-term sustainable solution.

E5.3.4 Pre-Consultation Stakeholder Meeting

A pre-consultation stakeholder meeting was held on 24 August 2009 for the caravan site owners and local residents who are directly affected by shoreline management decisions along this frontage. This meeting was well attended, was extremely positive, and marked the first stage in developing a process of cooperation between the partner organisations and all people and businesses with an interest in the area. On the basis of this meeting there are strong indications that the caravan site owners and residents would be willing to make significant funding contributions to achieve a Hold the line policy.

E5.3.5 Overall Conclusions – PDZ2

The results of the additional investigations for PDZ2 have shown that the current approach of using the shingle ridge as a frontline defence will be difficult beyond the short term. This is due to a number of factors:

- It may not be affordable;
- There is already a significant risk to life for the people right behind the defence;
- The environmental impacts could become unacceptable.

This illustrates that the situation in this PDZ is very complicated. The standard policy options don't suffice. Developing a long-term sustainable and realistic solution requires more knowledge than the SMP process

currently has or can produce, and it requires a longer and more integrated decision making process than this SMP review can provide. In this case, the role of the SMP has to be to initiate and then support this integrated decision making process, with full involvement of all partner organisations and local stakeholders.

E6 POST-PUBLIC CONSULTATION

E6.1 Introduction

Following public consultation, a few changes were made that are relevant for policy development and appraisal. These have been incorporated throughout in the SMP's main document and other appendices. However, for this Appendix, which tells the story of policy development and appraisal, it was considered preferable to leave intact the draft version of the appendix which explains how the draft SMP was developed, and add this section E6 to explicitly explain the changes that were made after consultation.

The two main changes after consultation concern the role of the Historic environment in appraisal and the policy and wording for PDZ1.

These changes were presented, discussed and agreed at a meeting with the Client Steering Group and were then formally agreed at the following Elected Members Forum Meeting. These changes and additions are discussed briefly below, including a summary of the impact on the wording of the preferred policy.

E6.2 Historic Environment

The response of English Heritage and Norfolk Landscape Archaeology to the public consultation raised concerns about the role of the Historic environment in the SMP, particularly for the part of the SMP in Norfolk. This has been addressed by additional data collation and analysis, working closely together with Norfolk Landscape Archaeology and English Heritage. The results have been incorporated throughout the SMP, particularly in the main SMP document, the Theme review (appendix D) and the Appraisal results (appendix G), which contain additional data and reflect the revised analysis.

For the Appraisal process described in this appendix, the most important change is the addition of a policy appraisal objective:

- Preserve historic environment assets *in situ* where feasible

This is in addition to the objective used in the draft SMP, which has been slightly modified as a result of consultation responses, as below:

- Provide sufficient time, if required, for appropriate mitigation of loss or damage to historic environment assets if preservation *in situ* cannot be achieved

The impact of the additional data and the use of the additional objective in policy appraisal is reflected in Appendix G (appraisal tables of final policies) and in the main SMP document, particularly section 2.2 (description of land use and environment), section 3.2 (description of the implications of the plan, particularly under the heading Historic environment) and in the policy statements. The most important impact concerns PDZ4 (Hunstanton Cliffs),

where the increased recognition of historic assets has contributed to the need for further study to confirm medium- and long-term policy.

E6.3 Policy Development Zone 1

RSPB's response to the draft SMP described that they were in agreement with the draft policies but did not agree with the introduction of the caveat regarding the legal framework. They wanted more emphasis on the fact that managed realignment **will** be required in Epochs 2 and 3 under an erosional scenario. RSPB felt that this would ensure that a clear and transparent outline of the action to be taken under an erosional scenario is provided. As a result the wording of the policy was changed slightly to say that a Hold the line policy in an erosional future is likely to lead to a legal requirement to compensate for the loss of intertidal habitats, as well as a need to review defence sustainability and performance.

The full text of the draft Plan and policies is in sections 3 and 4 of the main SMP document.

E7 REFERENCES

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