

Water Framework Directive

Compliance Assessment of the Alde & Ore Partnership Draft Estuary Plan

(February, 2016)

Final - 11th February 2016

Prepared by Carol Reid BSC.Hons for the Environment Agency

Contents

Executive summary	2
1. Introduction	2
1.1 Purpose of the Water Framework Directive compliance assessment	2
1.2 Environmental objectives of the WFD and quality elements used to assess ecological status	3
1.2.1 Environmental objectives	3
1.2.2 Quality elements	3
2. Preventing deterioration in ecological potential of the Alde and Ore estuary	4
2.1 Step 1 – Baseline data collection	4
2.1.1 The Alde and Ore Estuary Partnership Plan outline	4
2.1.2 Strategic aims and objectives of the AOEP Plan	9
2.1.3 Water bodies within the AOEP Plan area and ecological status	10
2.1.3i Water bodies scoped into Water Framework Assessment	11
2.1.3ii Alde and Ore transitional water body - important conservation features within the AOEP Plan area and the physical processes on which these habitats depend	11
2.1.3iii Freshwater bodies – quality elements at risk and specific concerns	13
2.1.4 Waveney and East Suffolk Chalk and Crag groundwater body status	14
3. Step 2 - Features and Issues	14
3.1 Defining Features and Issues	14
4. Step 3 - Assessment of the AOEP Draft Plan proposals against the Environmental Objectives	18
5. Step 4 - Conclusion of the Water Framework Directive assessment and recommendations	29
References	31
Appendix 1.	32

Executive summary

The EU Water Framework Directive (WFD) was introduced in 2000 and promotes a holistic approach to the management of rivers, lakes, groundwater and coastal waters, and their dependent wildlife habitats. It directs member states to implement measures to prevent the deterioration of surface water and groundwater bodies; new activities in the water environment are required to be assessed against objectives defined in the Directive.

For the Alde and Ore Estuary transitional water body and associated freshwater bodies the hydromorphological parameters that could be changed by the Alde and Ore Estuary Draft Plan proposals, with the potential to impact the Biological Quality Elements (BQEs), were identified. The effect on the relevant ground water body was also considered.

The methodology used for this assessment follows guidance that has been developed by the Environment Agency for the assessment of Shoreline Management Plans under the Water Framework Directive.

It has been concluded that the AOEP Draft Plan proposals will result in a deterioration of surface water Ecological Potential, during the term of the Plan, with the pursuance of the Hold the Line proposals. This is likely to result in a loss of intertidal habitats and species, due to coastal squeeze. Adjacent river water bodies subject to gravity discharge will experience increases in the frequency of tide locking and water depth in response to climate change/sea level rise. Recommendations are made to address these issues to enable the future development of the Plan.

1. Introduction

1.1 Purpose of the Water Framework Directive compliance assessment

The Water Framework Directive came into force in 2000 and establishes a framework for the protection of all ground and surface waters throughout the European Community. It sets objectives for water protection for the future with the overriding driver of obtaining 'good status' for all water bodies within a set timeframe. The Directive was transposed into law in England and Wales by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003. The Environment Agency is the competent authority in England and Wales responsible for delivering the Directive and has recommended that the requirements of the Directive need to be considered at all stages of the river and coastal planning and development process.

The first working draft of the Alde and Ore Estuary Partnership (AOEP) Plan was produced in July 2014 for the sustainability appraisal process. The Plan promotes a resilience approach to sea wall management throughout the estuary where the current sea defence line would be held until 2050 with wall profiles engineered to withstand overtopping. The Plan states that there may be implications for intertidal habitats (coastal squeeze) and recognises the need to address and manage the potential impacts on intertidal habitats.

The compliance assessment will seek to assess the potential hydromorphological change and consequent ecological impact of the AOEP Draft Plan proposals against the environmental objectives of the Water Framework Directive. The assessment will indicate future issues for consideration.

1.2 Environmental objectives of the WFD and quality elements used to assess ecological status

1.2.1 Environmental objectives

The Directive requires that Environmental Objectives are set for all surface and ground waters in each EU Member State to enable them to achieve either 'good status', for natural water bodies, or 'good ecological potential', for heavily modified water bodies (HMWB) and artificial water bodies (AWB). HMWBs are defined as bodies of water that have undergone significant changes in their natural character due to human intervention, and AWBs are surface water bodies which have been created where there were no pre-existing water bodies. As such, neither of these water bodies would be able to achieve the natural conditions required to meet 'good ecological status', but instead would be expected to reach 'good ecological potential' within the specified timeframes.

The environmental objectives of the WFD are summarised below:

- Promote sustainable use of water as a natural resource.
- Aim to achieve at least good status for all waters by 2015. Where this is not possible, good status should be achieved by 2027.
- Prevent deterioration and enhance status of aquatic ecosystems and associated wetlands.
- Conserve habitats and species which directly depend on water.
- Reduce pollution from priority substances.
- Prevent deterioration / reduce pollution of groundwater.
- Contribute to mitigating the effects of floods and droughts.

1.2.2 Quality elements

The ecological status of a water body is determined by assessments of biological, physico-chemical, and hydromorphological 'quality elements', as indicated in Table 1 below.

Quality element	Description
Biological	Presence or absence of algae, plants, invertebrates, fish
Physico-chemical	Quantifying the elements which support the biology: pH, dissolved oxygen, nutrient levels
Hydromorphological	Assessing the quality of physical aspects supporting biological quality of the water body: quantity and dynamics of water flow, sediment composition and transport, channel width

The Water Framework Directive categorises water bodies under five status classes: high, good, moderate, poor or bad depending on the assessment of the quality elements outlined above. High status would require that the biological, chemical and hydromorphological conditions were subject to no or minimal human impacts and is the 'reference condition' against which all other status categories are measured. Good status would indicate a slight deviation from the reference condition, so the further a water body deviates from the reference condition, the poorer its quality. The overall status of a water body is determined by the lowest 'quality element' assessment.

2. Preventing deterioration in ecological potential of the Alde and Ore estuary

There is no specific guidance for appraising estuary plans. For the purpose of assessing the proposals outlined in the AOEP Draft Plan the guidance produced by the EA in April 2009 on how the requirements of the WFD should be taken into account by Shoreline Management Plans has been used as a basis for the evaluation (Environment Agency, 2009). The guidance outlines a four-step process designed to ensure that a coastal plan is compatible with the objectives of the WFD and supports WFD measures for improvement, wherever it is practical to achieve this. The current assessment will follow the four steps of the EA guidance:

- Step 1 - Baseline Data Collection
- Step 2 - Define Features and Issues
- Step 3 - Assess AOEP Draft Plan against WFD Objectives
- Step 4 - Conclusion of the Water Framework Directive assessment and recommendations

2.1 Step 1 – Baseline data collection

2.1.1 The Alde and Ore Estuary Partnership Plan outline

The Alde and Ore Estuary Partnership was formed following the 2009 Alde and Ore Futures project, which consulted widely in the community on the future flood defence management of the estuary. The majority view held that the current configuration of the estuary should be maintained for as long as practically possible.

To achieve this outcome the AOEP have embarked on developing a 'resilience' approach to managing flood defences. This would entail profiling the landward slope to resist breaching in the event of overtopping during a surge event. This is the preferred management option for river walls in the medium term ie over the next 20-50 years.

The AOEP have designed plans for each flood cell and propose to assess the estuary-wide implications of the scheme, including the impact of any areas upstream of defence works and 'for habitat balances'. The defence design will take into account predicted changes in sea level. It is intended to achieve a level of defence that can withstand a surge tide event with a return period of one in two hundred years. Based on current EA sea level rise forecasts, the design specification would be future-proofed to the year 2050.

The Plan area extends over 20 parishes (Figure 1) and encompasses 13 flood cells – defined by the Environment Agency as areas of land that are currently protected by flood defences and are at risk of flooding. The Plan also includes parishes with land affected by the December 2013 surge tide.

Figure 1. Parishes within the AOEP Plan boundary. (Source: Suffolk County Council – Alde & Ore Estuary Partnership Plan Sustainability Appraisal/Strategic Environmental Assessment Scoping Report, July 2015.)



The flood cells are listed in Table 2 and their geographic locations are shown in Figure 2. The perspective of the flood cells in the marshland landscape is illustrated in Figure 3.

Table 2. Environment Agency flood cells. [Source: Environment Agency (2011); Alde and Ore Estuary Partnership (2014). Alde and Ore Estuary Draft Plan.]		
Flood cell		Priority order for proposed sea defence work (based on impact of 2013 surge)
No:	Name	
1	Boyton and Butley Marshes	5
2	Butley Mills	7
3	Chillesford Lodge Marshes	6
4	Orford with Gedgrave and Sudbourne Marshes	3
5	Iken Marshes	4
6/7	6. Snape to Langham Bridge South 7. Snape to Langham Bridge North	1
8	Ham Creek Marshes	8
9	Hazelwood Marshes – breached during December 2013 surge tide and decision made not to repair. Now developing intertidal habitat.	9
10	(North) Haven Marshes (South) Aldeburgh	2
11	King's and Lantern Marshes	Part of Orford Ness Nature Reserve - owned and managed by the National Trust.
12	Havergate Island	Part of Havergate Island nature reserve – owned and managed by the RSPB.
13	Dovey's Island	

Note: There is also a Flood Cell '0' – south of Shingle Street – which lies within the AOEP Plan area and is also included in the Deben Partnership Plan. However, most of this flood cell is located within the parishes of Alderton and Bawdsey and will be covered in a separate partnership plan area involving these communities.

Figure 2. Shows the location of the flood cells and sea defences within the AOEP Plan area. (Source: Alde and Ore Estuary Partnership (2014). Alde and Ore Estuary Plan.)

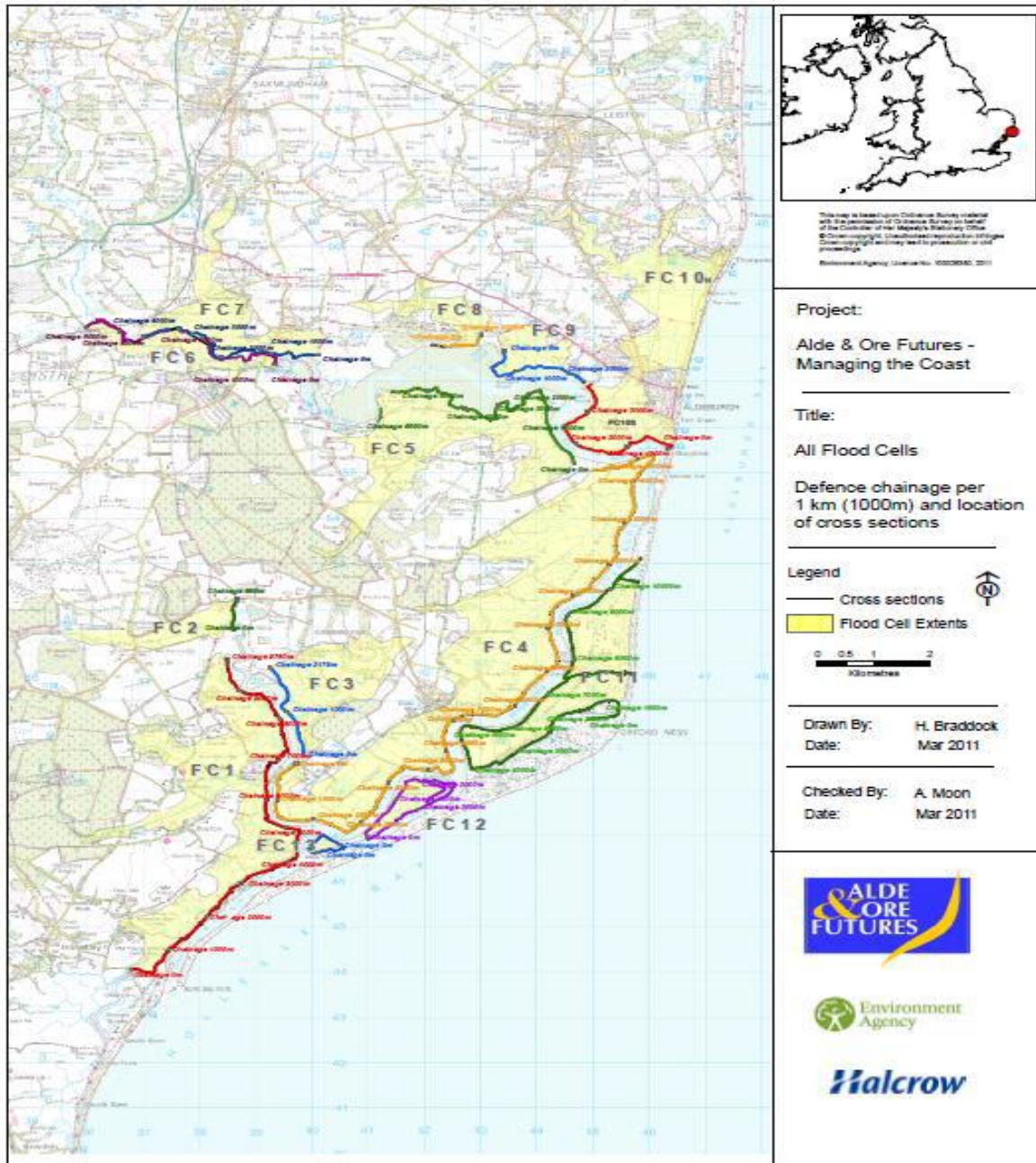
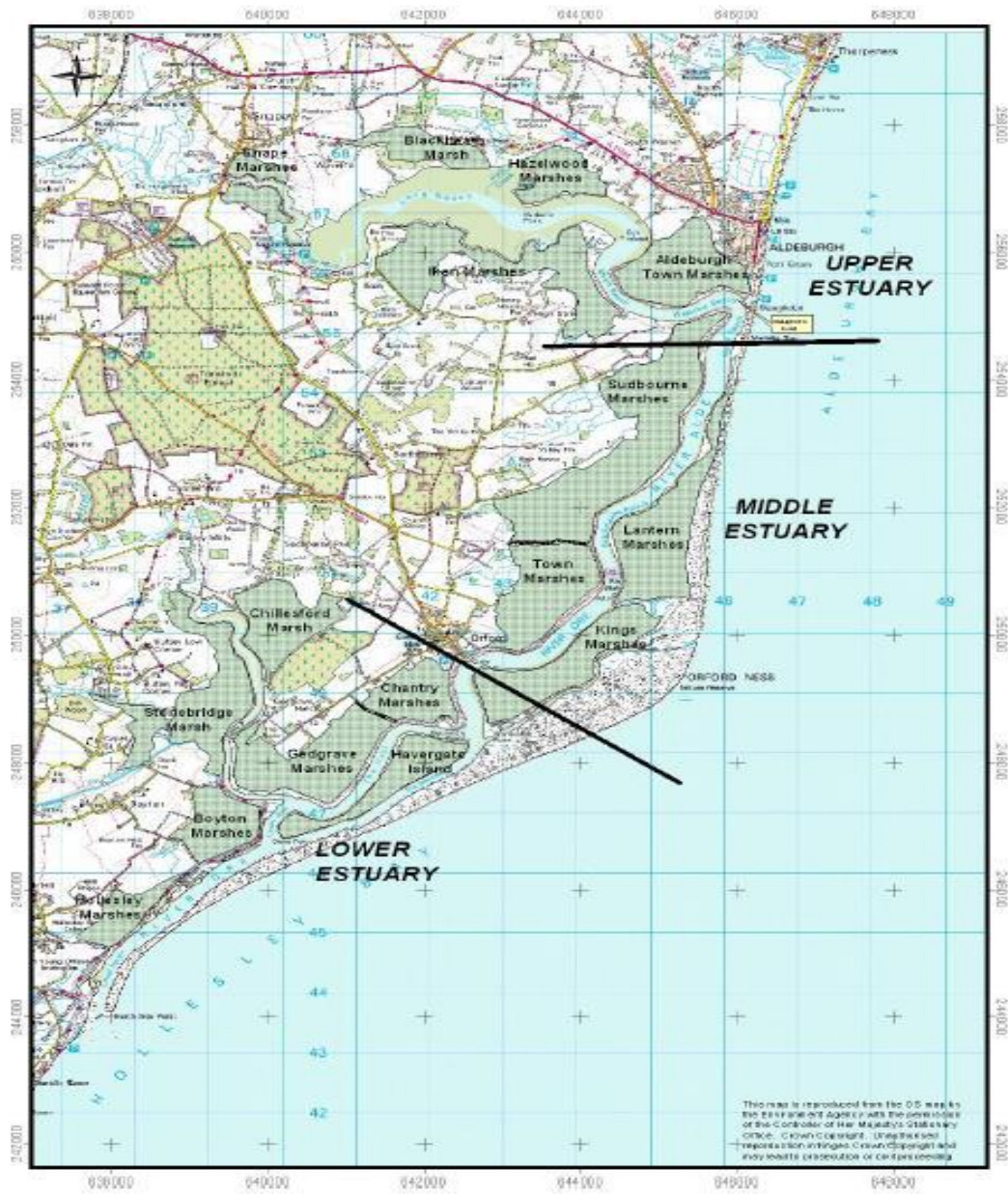


Figure 3. Marshes within the Plan area. [Source: Suffolk County Council (2015). Alde & Ore Estuary Partnership Plan Sustainability Appraisal/Strategic Environmental Assessment Scoping Report.]



2.1.2 Strategic aims and objectives of the AOEP Plan

The strategic aims and objectives of the AOEP Plan, outlined in the 2014 draft, are as follows:

1. To manage the estuary and adjoining land as a whole¹ so as to ensure, in so far as is reasonable, and in compliance with any mitigatory or compensatory measures set out in the sustainability appraisal, the maintenance of broadly the current configuration of the estuary and its significant contribution to the local economy, the environment, the community and the amenity value of the area.
2. To ensure within the management of the estuary as a whole and, in so far as is lawful and reasonably practicable, flood and river defences of a standard that will withstand overtopping without breaching during a tidal surge of a 1 in 200 year frequency given the sea level rise predicted up to the year 2050².
3. In close association³ with the EA, to develop a rolling⁴ and prioritised programme of overall works for the estuary, including routine maintenance and minor repairs, maintaining and enhancing the current environment as far as is possible, consistent with the achievement of the above standard of flood and river defences by the year 2025.
4. To ensure that the rolling and prioritised programme of works takes fully into account the following key considerations:
 - a. Regularly updated assessments of the impact on the estuary as a whole for each vulnerable section of the flood and river defences if that section were to be breached.
 - b. Priorities determined according to vulnerability, probable consequences including built or natural environmental, ecological, economic, social or cultural concerns and funding availability.
 - c. Respect for the implications of Government cost benefit analyses where Central Government funding may be involved and respect for local priorities where funding other than from Central Government may be involved.
 - d. The use, where appropriate, of local resources⁵.
5. To develop a partnership approach⁶ to the management of the estuary and to consult⁷ locally⁸ in respect of individual projects or works and with the wider local community⁹ at regular intervals on more general matters. To co-operate with those

¹ This phrase mean as an interrelated set of river defences and not as a collection of independent ones. It echoes the phrase in Terms of Reference 1 and footnote 18 of the AOEP constitution (dated May 2013).

² This reflects the UKCP09 prediction for sea level rise which means that a 1 in 200 year flood in 2050 is expected to be higher than a 1 in 200 year flood in 2012.

³ This phrase respects the overarching statutory (albeit permissive) powers of the Environment Agency.

⁴ In the sense of being regularly reviewed and amended as appropriate.

⁵ This echoes Terms of Reference 2 a ii of the AOEP interim constitution. It suggests where appropriate the use of local labour, contractors, materials, machinery or equipment etc as well of course as local finance.

⁶ This echoes Guiding Principle 4a of the AOEP interim constitution.

⁷ This echoes Terms of Reference 3 of the AOEP interim constitution.

⁸ This would include, where appropriate, consulting on the basis of an individual flood cell or group of flood cells.

⁹ This might include having a 'reference group' of a very wide range of communities of interest in the estuary area with which the AOEP might wish to engage for their views periodically.

responsible for emergency measures, and in particular support EA and SCC in raising awareness of flood risk issues in the estuary and in promoting emergency plans with parish councils that increase community resilience.

2.1.3 Water bodies within the AOEP Plan area and ecological status

The Alde and Ore Estuary falls within the Anglian River Basin District. Water bodies within the AOEP area are listed in Table 3 along with their current ecological potential and status objective for 2027.

Table 3. Status objectives of water bodies within the AOEP Plan area. [Source: (EA, 2009). River Basin Management Plan. Anglian River Basin District. Annex B: Water Body Status Objectives.]						
WFD water body code	Name	Flood cell	Hydro-morphological designation	Current ecological status/potential	Current chemical status	Status objective
Rivers						
GB205035040150	Black Ditch	1 – Boyton/Butley	Not designated A/HMWB	Moderate	Does not require assessment	GES by 2027
GB105035040160	Tang	1 – Boyton/Butley	Not designated A/HMWB	Moderate	Poor	GES by 2027
GB105035040190	Butley River	2 – Butley Mills	HMWB	Moderate potential	Does not require assessment	GES by 2027
GB105035040170	Tributary of Butley River	3 – Chillesford Lodge	HMWB	Moderate potential	Does not require assessment	GES by 2027
GB105035077790	Alde and Ore (Tidal)	4 - Orford	Artificial	Moderate potential	Does not require assessment	GES by 2027
GB105035040180	Alde and Ore (Tidal)	4 - Orford	Not Designated A/HMWB	Moderate potential	Does not require assessment	GES by 2027
GB105035077800	Alde and Ore (Tidal)	5 - Iken	HMWB	Moderate potential	Does not require assessment	GES by 2027
GB105035045950	Alde	6 & 7 - Snape	Not Designated A/HMWB	Moderate potential	Does not require assessment	GES by 2027
GB105035045970	Ore	6 & 7 - Snape	Not Designated A/HMWB	Moderate potential	Does not require assessment	GES by 2027
GB105035046060	Alde	6 & 7 - Snape	Not Designated A/HMWB	Moderate potential	Does not require assessment	GES by 2027
GB105035045980	Fromus	6 & 7 - Snape	Not Designated A/HMWB	Poor	Does Not Require Assessment	GES by 2027
GB105035045960	Alde and Ore (Tidal)	8 – Ham Creek	HMWB	Moderate potential	Does not require assessment	GES by 2027
Estuarine						
GB520503503800	Alde and Ore	1 - 10	HMWB ¹¹	Moderate potential	Does not require assessment	GES by 2027
Coastal						
GB650503520002	Suffolk	-	HMWB	Moderate potential	Good	GEP by 2027
Ground water						
GB40501G4	Waveney	-	N/A	Poor	Poor	Good by

Table 3. Status objectives of water bodies within the AOEP Plan area. [Source: (EA, 2009). River Basin Management Plan. Anglian River Basin District. Annex B: Water Body Status Objectives.]

WFD water body code	Name	Flood cell	Hydro-morphological designation	Current ecological status/potential	Current chemical status	Status objective
00600	and East Suffolk Chalk and Crag					2020

2.1.3i Water bodies scoped into Water Framework Assessment

Although all the water bodies in the AOEP area have been listed above in Table 3, the coastal water body has been scoped out of the Assessment as the schemes put forward in the AOEP Plan are concerned with the estuarine water body and adjoining land, potentially impacting the estuarine, river water and ground water bodies.

2.1.3ii Alde and Ore transitional water body - important conservation features within the AOEP Plan area and the physical processes on which these habitats depend

Flood cells 9, 11 and 12 lie within the boundaries of the following nationally and internationally important protected sites: the Alde - Ore Estuary Site of Special Scientific Interest (SSSI) and the Leiston-Aldeburgh SSSI, and the following Marine Protected Areas: Alde-Ore Estuary Wetland of International Importance (Ramsar site); Alde-Ore Estuary Special Protection Area for Wild Birds; Alde, Ore and Butley Estuaries Special Area of Conservation (SAC); and Orford Ness - Shingle Street SAC. All other flood cells in the Plan are situated adjacent to the designated site boundaries).

The geographical coverage of the Alde-Ore Estuary SSSI and Marine Protected Areas extends from Bawdsey to Aldeburgh and includes the Butley, Alde and Ore Rivers, Orfordness, Shingle Street, and Havergate Island. The key habitats protected by these sites are: estuarine mudflats, saltmarsh, shingle beaches and ridges, and saline lagoons. These habitats are also supporting features for overwintering breeding, wintering and passage wildfowl and waders, and specialist plants and invertebrates. The Orford Ness – Shingle Street SAC, within this complex, was designated for its drift-line and perennial vegetation associated with the mobile shingle structures; and saline lagoons. Havergate Island, owned and managed by the RSPB, and Orford Ness, owned and run by the National Trust, are integral parts of the Orfordness-Havergate National Nature Reserve. The Leiston-Aldeburgh SSSI lies to the north of Aldeburgh town and is notified for a mosaic of habitats including acid grassland, heath, woodland, fen and the vegetated shingle bar stretching between Aldeburgh and Thorpeness.

Extent and quality of foreshore habitats

The extent and quality of the foreshore habitats adjacent to the flood cells are influenced by sea level rise, coastal squeeze and dynamic sediment processes. Equating SSSI units in the Alde and Ore estuary SSSI to flood cells and applying the findings of an aerial mapping study of saltmarsh losses and gains (IECS, 2011), Natural England condition assessments (2009), and a National Vegetation Classification survey of the Alde-Ore SSSI estuary complex (Natural England, 2013), gives an indication of changes in saltmarsh extent and quality in the flood units in recent years (Appendix 1). The comparison of aerial photographs suggests that the pattern of change is generally erosion of the marsh edge with accretion within mud pans and creeks. Though saltmarsh was found to have increased in extent by the aerial study over a seven-year period, it emphasised the important contribution made by the realignment sites at Havergate Marshes and Orford Ness (north-east of Lantern Marshes) to this positive result. By including the saltmarsh created as a result of developing

new intertidal sites, the study recorded an overall gain in extent of 5.79 ha. However, if the contribution of these sites is removed from the total, the gain reduces to approximately 1 ha which leaves little margin for error. The saltmarsh extent survey only covered the period 2000 to 2007, but is the most up-to-date information available. It, of course, does not account for changes resulting from the December 2013 storm surge.

A complete understanding of saltmarsh change also requires field study which can detect changes in saltmarsh quality and height. A recent report, commissioned by Natural England (2013), mapped the saltmarsh communities in the Alde, Ore and Butley Rivers and made the following observations:

- Saltmarshes adjacent to the sea wall were often undergoing a decrease in height due to more frequent tidal inundations and tidal scouring, and creeks were widening due to edge erosion. This was particularly evident in the saltmarshes east of Iken marshes, below Aldeburgh Marshes, and along the Sudbourne Marshes section to Town Marshes.
- Along the base of the sea wall there were many areas where *Spartina anglica* (common cord-grass) was increasing in abundance and density. *Spartina anglica* was spreading throughout its range and was out-competing pioneer and lower saltmarshes species. (*Spartina anglica* is able to withstand periods of submergence of up to nine hours. It is therefore able to colonise low-lying mud flats below the range of other saltmarsh plants.)
- It appeared that the low-mid marsh saltmarsh community was spreading into the mid-high marsh, as the saltmarsh experiences more frequent inundations.
- Saltmarsh cliff retreat was evident all along the Alde-Ore SSSI with obvious signs of erosion at this leading edge. Accretion was not noted specifically anywhere in the estuary.

Sea level rise

The predicted annual rate of sea level rise in East Anglia (based on a low emissions scenario) gives a possible range of 2.2 to 6.1 mm/ year, with the lower error limit being only slightly higher than recent historical rates (Pye, 2005). At the lower end of the scale this represents an absolute increase of 22 cm over the next 100 years, and this would have a very significant effect on estuarine processes and the morphology of the Alde-Ore estuary. Over the term of the AOEP Plan, the predicted increase would be approximately half of this value (7.7cm). Over this time the tidal prism¹⁰ and tidal velocities are likely to increase, and,

¹⁰ The tidal prism is the volume of water exchanged through a coastal or transitional system typically measured between Mean Low Water Spring tides (MLWS) and Mean High Water Springs (MHWS). The tidal prism of an estuary or tidal inlet is dependent on the geometry of the basin in terms of surface area and mean water depth, the tidal range, and, to a lesser extent, freshwater inflow. The tidal prism is an indicator of the volume of water within a water body while the residence time of water and sediment exchange potential are dependent upon the inlet dimensions and water exchange capacity at varying stages of the tidal cycle. Changes in accommodation space, tidal regime and the geometry of the water body can lead to fundamental alterations to the habitats that the water body can support. As most coastal and transitional systems (geomorphological features and habitats) are in a state of dynamic equilibrium with the tidal prism, any changes to the prism will manifest as changes to these features at the scale of the entire system, though the impact of these changes on any one feature may vary at a variety of spatial and temporal scales across the system. (Environment Agency – <http://evidence.environment-agency.gov.uk/FCERM/en/SCO60065/Decisiontree/Hydromorphologicalchanges/H16.aspx>)

with tidal energy confined within a relatively small area by the sea defences, enlargement of the existing channels and further erosion of the high intertidal saltmarshes and mudflats would be inevitable (Pye, 2005).

The maintenance of high quality estuarine habitats such as saltmarshes and mudflats is essential to achieve and maintain GEP (good ecological potential) of the Alde and Ore transitional water body (currently assigned a moderate GEP rating).

2.1.3iii Freshwater bodies – quality elements at risk and specific concerns

For freshwater bodies within the AOEP Plan area the quality elements at risk and specific concerns are indicated in Table 4.

Table 4. Specific concerns identified for freshwater bodies.			
Waterbody ID	Potentially affected quality elements	Specific concerns	Additional notes
GB205035040150 Black Ditch	Physico-chemical, Hydromorphological	Phosphate (Moderate)	
GB105035040160 Tang	Biological, Physico-chemical, Hydromorphological	Macrophytes (Poor), Dissolved Oxygen (Bad), Hydrological regime (Does not support good)	
GB105035040190 Butley River	Biological, Physico-chemical, Hydromorphological	Hydrological regime (Does not support good)	
GB105035040170 Tributary of Butley River	Hydromorphological, Surface Water	Hydrological regime (Does not support good)	
GB105035077790 Alde and Ore (Tidal)	Hydromorphological, Surface Water	Hydrological regime (Does not support good), MMA (increase in-channel morphological diversity)	
GB105035040180 Alde and Ore (Tidal)	Hydromorphological, Surface Water	Hydrological regime (Does not support good)	
GB105035077800 Alde and Ore (Tidal)	Hydromorphological, Surface Water	Hydrological regime (Does not support good), MMA (increase in-channel morphological diversity and management of the risk of fish entrainment in intakes for hydropower turbines or water resource purposes (or pumping stations) where there is downstream fish migration)	
GB105035045950 Alde	Biological, Physico-chemical, Hydromorphological	Fish (Moderate), Macrophytes (Moderate), Dissolved Oxygen (Moderate), Hydrological regime (Does not support good)	Renamed "Alde-Ore d/s confluence" in RBMP"
GB105035045970 Ore	Biological, Physico-chemical, Hydromorphological	Fish (Poor), Macrophytes and Phytobenthos combined (Moderate), Phosphate (Poor), Hydrological regime (Does not support good)	Has experienced deterioration since 2009

Table 4. Specific concerns identified for freshwater bodies.

Waterbody ID	Potentially affected quality elements	Specific concerns	Additional notes
GB105035046060 Alde	Biological, Physico-chemical	Fish (Poor), Macrophytes and Phytobenthos combined (Moderate), Dissolved oxygen (Poor)	
GB105035045980 Fromus	Biological, Physico-chemical	Fish (Poor), Invertebrates (Moderate), Dissolved oxygen (Moderate), Phosphate (Poor)	
GB105035045960 Alde and Ore (Tidal)	Hydromorphological, Surface Water	Hydrological regime (Does not support good), MMA (Appropriate channel maintenance strategies and techniques - minimise disturbance to channel bed and margins)	

2.1.4 Waveney and East Suffolk Chalk and Crag groundwater body status

The plan area lies within the Waveney and East Suffolk Chalk and Crag groundwater body. In the AOEP area the uppermost solid geology comprises the Red Crag, Coralline Crag and London Clay formations. The Crag aquifers are designated as Principal Aquifer by the Environment Agency. These are overlain by a variety of glacial, fluvial and marine drift deposits. The permeability of these deposits is variable, giving rise to vulnerability ranging from low to high. An area of the plan to the north lies within a groundwater source protection zone. The Waveney and East Suffolk Chalk and Crag groundwater body has been designated as being at overall Poor WFD status and 'At Risk' from saline intrusion which could affect the quality of the abstraction.

3. Step 2 - Features and Issues

3.1 Defining Features and Issues

Step 2 is concerned with identifying the relationships between Biological Quality Elements, and their physical dependencies, for each of the Water Framework Directive waterbodies.

For the Alde and Ore transitional water body and the freshwater bodies, the hydromorphological or physical parameters that could potentially be changed by the AOEP Draft Plan proposals, and the Biological Quality Elements that are dependent upon these, are outlined in Assessment Tables 1a and 1b. The key features and issues for the transitional and fresh water bodies in the Plan area are summarised in Assessment Tables 2a and 2b, with the water body classification and Environmental Objectives listed in the final column.

Assessment Table 1a. Biological Quality Indicators for the Alde – Ore transitional water body.		
Biological Quality Element (BQE)	Potential for change in physical or hydromorphological parameter	Alde – Ore transitional water body
Macroalgae	Episodicity (at low end of velocity spectrum)	√
	Salinity	√
	Abrasion (associated to velocity)	√
Angiosperms	Inundations (tidal regime)	√
	Sediment loading	√
	Land elevation	√
	Salinity	√
	Abrasion (associated to velocity)	√
Benthic/macro invertebrates	Beach water table	√
	Light	√
	Groundwater connectivity	√
	Availability of leaf litter/organic debris	√
	Connectivity with riparian zone	√
Fish	Heterogeneity of habitat (substrate, provision of shelter)	√
	Continuity for migration routes	√
	Substrate conditions	√
	Presence of macrophytes	√
	Accessibility to nursery areas (elevation of saltmarsh, connectivity with shoreline/riparian zone)	√

Assessment Table 1b. Biological Quality Indicators for river water bodies.

Biological Quality Element (BQE)	Potential for change in physical or hydromorphological parameter	All river water bodies cited in Table 4.
Phytoplankton	Turbidity	√
	Thermal regime	√
	Water depth	√
	Residence time	√
Macrophytes	Substrate conditions	√
	Riparian shade and structure	√
	Turbidity	√
	Episodicity of flows and inundation	√
	Light quality and quantity	√
	Shoreline complexity or heterogeneity	√
	Longitudinal position	√
	Slope	√
Phytobenthos (diatoms only)	No hydromorphological elements determined	√
Benthic/macro invertebrates	Light	√
	Groundwater connectivity	√
	Availability of leaf litter/organic debris	√
	Connectivity with riparian zone	√
Fish	Heterogeneity of habitat (substrate, provision of shelter)	√
	Continuity for migration routes	√
	Substrate conditions	√
	Presence of macrophytes	√
	Accessibility to nursery areas (connectivity with riparian zone)	√

GB205035040150	Black Ditch
GB105035040160	Tang
GB105035040190	Butley River
GB105035040170	Tributary of Butley River
GB105035077790	Alde and Ore (Tidal)
GB105035040180	Alde and Ore (Tidal)
GB105035077800	Alde and Ore (Tidal)
GB105035045950	Alde
GB105035045970	Ore
GB105035046060	Alde
GB105035045980	Fromus
GB105035045960	Alde and Ore (Tidal)

Assessment Table 2a. Water Framework Directive Features and Issues for the Alde-Ore transitional water body.		
Feature	Issue	Water body classification and environmental objectives
Biological Quality Element (BQE)	Potential for change in hydro-morphological or physical parameter classification	
Macroalgae	Potential changes to macroalgae through changes in abrasion (associated to velocity) as a result of AOEP Draft Plan proposals. For example, changes to control structures or defences may result in changes in wave and current dynamics and subsequent changes in abrasion patterns.	<p><i>Classification:</i> Moderate potential</p> <p><i>Environmental objectives:</i></p> <ul style="list-style-type: none"> ◦ WFD1: No changes affecting High Status sites. There are no High Status sites in the AOEP area, so Environmental Objective WFD1 is not applicable for this assessment. ◦ WFD2: No changes that will cause failure to meet surface water Good Ecological Potential or result in a deterioration of surface water Ecological Potential. ◦ WFD3: No changes which will permanently prevent or compromise the environmental objectives being met in other water bodies. ◦ WFD4: No changes that will cause failure to meet good groundwater status or result in a deterioration groundwater status.
Angiosperms	There is potential for changes in the frequency of tidal inundations, sediment loading, land elevation and abrasion (associated to velocity) which may impact upon angiosperms that are present in the Alde and Ore Estuary.	
Benthic/macro invertebrates	AOEP Draft Plan proposals have the potential to impact upon invertebrates through erosion of intertidal and subtidal habitat.	
Fish	Potential impacts on fish due to changes in substrate conditions and/or accessibility to nursery areas.	

Assessment Table 2b. Water Framework Directive Features and Issues for river water bodies.			
Feature		Issue	Water body classification and environmental objectives
Water body	Biological Quality Element (BQE)	Potential for change in hydro-morphological or physical parameter classification	
Black Ditch GB205035040150 Tang GB105035040160 Butley River GB105035040190 Tributary of Butley River GB105035040170 Alde and Ore (Tidal) GB105035077790 Alde and Ore (Tidal) GB105035040180 Alde and Ore (Tidal) GB105035077800 Alde GB105035045950 Ore GB105035045970 Alde GB105035046060 Fromus GB105035045980 Alde and Ore (Tidal) GB105035045960	Phytoplankton	Potential for effects on phytoplankton due to possible changes in residence time, water depth, thermal regime and turbidity as a result of AOEP proposal.	<p><i>Classification:</i> All moderate potential except for Fromus (GB105035045980) which is classified as 'Poor'.</p> <ul style="list-style-type: none"> ◦ WFD1: No changes affecting High Status sites. There are no High Status sites in the AOEP area, so Environmental Objective WFD1 is not applicable for this assessment. ◦ WFD2: No changes that will cause failure to meet surface water Good Ecological Potential or result in a deterioration of surface water Ecological Potential. ◦ WFD3: No changes which will permanently prevent or compromise the environmental objectives being met in other water bodies. ◦ WFD4: No changes that will cause failure to meet good groundwater status or result in a deterioration groundwater status.
	Macrophytes	Potential for effects on macrophytes due to possible changes in slope, longitudinal position, shoreline complexity or heterogeneity, light quality and quantity, episodicity of flows and inundations, turbidity, riparian shade and structure and substrate conditions as a result of AOEP proposal	
	Phytobenthos (diatoms only)	Potential for effects on phytobenthos as a result of AOEP proposal.	
	Benthic/Macro invertebrates	Potential for effects on benthic/macroinvertebrates due to possible changes in light and groundwater connectivity as a result of AOEP proposal.	
	Fish	Potential for effects on fish due to possible changes in heterogeneity of habitat (substrate, provision of shelter), continuity of migration routes, substrate conditions, presence of macrophytes and accessibility to nursery areas (connectivity with riparian zone) as a result of AOEP proposal.	

4. Step 3 - Assessment of the AOEP Draft Plan proposals against the Environmental Objectives

Proposals or activities which have the potential to have an impact on ecology (as defined by the biological, physico-chemical and hydromorphological Quality Elements listed in Annex V of the Directive) will need consideration in terms of whether they could cause deterioration in Ecological Potential. It is, therefore, necessary to consider possible changes to the relevant water bodies within the AOEP Plan area.

Assessment Table 3 is the main section of the assessment. It evaluates the impact of the AOEP Draft Plan proposals for each Flood Cell against the relevant BQEs identified in Assessment Tables 1a and 1b, and takes account of the effect the proposals may have on ground water body status. It also provides some explanation as to whether the Water

Framework Directive Environmental Objectives (explained in table below) have been met. Further to this, an assessment of the effect of potential failure at the water body scale can be made.

Environmental objectives	Description
WFD1	No changes affecting High Status sites. There are no High Status sites in the AOEP area, so Environmental Objective WFD1 is not applicable for this assessment.
WFD2	No changes that will cause failure to meet surface water Good Ecological Status/Potential or result in a deterioration of surface water Ecological Status/Potential.
WFD3	No changes which will permanently prevent or compromise the environmental objectives being met in other water bodies.
WFD4	No changes that will cause failure to meet good groundwater status or result in a deterioration groundwater status.

Assessment Table 3. Assessment of AOEP Draft Plan proposals against the Environmental Objectives of the Water Framework Directive.						
Flood cell	Location	AOEP proposal	WFD assessment of deterioration	Environmental objectives met?		
				WFD 2	WFD 3	WFD 4
1 Boyton/Butley	From Hollesley Bay Young Offenders Institution, along west shore of the Ore Estuary and Butley River to Butley Low Corner.	HTL Maintain and improve defences.	<p>Defences are earth embankments; riverward and landward faces are relatively steep in places. They are generally in fair condition, though in some places the embankments are low and provide poor standard of protection; there are also undefended sections, eg Flybury Point. Includes RSPB reserves: Boyton Marshes and Hollesley Marshes.</p> <p>BQEs present in this Flood Cell are angiosperms associated with saltmarsh and shingle habitats (latter west shore of the Ore) There is likely to be some loss of this intertidal habitat due to rising sea levels and coastal squeeze. There is potential for deterioration in surface water Ecological Potential in estuarine water body, Alde & Ore (GB520503503800), as a result of the AOEP proposal.</p> <p>Sea water overtopping the sea wall, during storm events would lead to changes in river water chemistry and associated biological quality elements (BQEs) in adjacent river water bodies Black Ditch (GB205035040150) and the Tang (GB105035040160). However the impact of saline intrusion is likely to be short-term with the water bodies regaining their freshwater status over time. As the WFD is concerned with non-temporary effects it has been concluded that there would be no deterioration in ecological potential due to saline intrusion.</p> <p>The HTL policy could result in increased frequency of tide locking and subsequent water depth in adjacent river water bodies Black Ditch (GB205035040150) and the Tang (GB105035040160) in response to climate change/sea level rise, therefore potentially failing Environmental Objective WFD 3.</p>	X	X	√

Assessment Table 3. Assessment of AOEP Draft Plan proposals against the Environmental Objectives of the Water Framework Directive.						
Flood cell	Location	AOEP proposal	WFD assessment of deterioration	Environmental objectives met?		
				WFD 2	WFD 3	WFD 4
			The Plan proposal to Hold the Line and build 'resilient' sea defences should limit the amount of sea water entering the Waveney and East Suffolk Chalk and Crag groundwater body during storm events. Therefore WFD4 would not be compromised by the AOEP Draft Plan proposal to Hold the Line.			
2 Butley Mills	At the head of the Butley Creek upstream of the road between Chillesford and Butley Mills.	HTL	<p>Defences are earth embankments adjacent to the road. Riverward and landward faces have recently been upgraded with removal of large trees and the defence heightened to 3.30mAOD, currently around 50% of the wall is up to this level with the rest due to be completed in June/July.</p> <p>The HTL policy could result in increased frequency of tide locking and subsequent water depth in adjacent river water body Butley River (GB105035040190) in response to climate change/sea level rise, therefore potentially failing Environmental Objective WFD 3.</p> <p>Sea water overtopping the sea wall, during storm events would lead to changes in river water chemistry and associated biological quality elements (BQEs) in adjacent river water body, Butley River (GB105035040190). However the impact of saline intrusion is likely to be short-term with the water body regaining its freshwater status over time. As the WFD is concerned with non-temporary effects it has been concluded that there would be no deterioration in ecological potential due to sea water overtopping the sea wall.</p> <p>The Plan proposal to Hold the Line and build 'resilient' sea defences should limit the amount of sea water entering the Waveney and East Suffolk Chalk and Crag groundwater body during storm events. Therefore WFD4 would not be compromised by the AOEP Draft Plan proposal to Hold the</p>	N/A	X	√

Assessment Table 3. Assessment of AOEP Draft Plan proposals against the Environmental Objectives of the Water Framework Directive.						
Flood cell	Location	AOEP proposal	WFD assessment of deterioration	Environmental objectives met?		
				WFD 2	WFD 3	WFD 4
			Line.			
3 Chillesford Lodge Marshes	East bank of the Butley River between Sudbourne Park and Gedgrave Hall	HTL maintain but upgrade prior to 2021	<p>HTL option is likely to impact on waterbody status in estuarine water body Alde & Ore (GB520503503800) - sea level rise will lead to the loss of intertidal habitats saltmarsh (Angiosperms) and intertidal mud flats (benthic invertebrates), therefore failing Environmental Objective WFD2.</p> <p>This flood cell is pumped. Therefore, the HTL policy would not result in increased frequency of tide locking and subsequent water depth in adjacent river water body, Tributary of the Butley River (GB105035040170), in response to climate change/sea level rise. Environmental Objective WFD 3 would be met.</p> <p>Sea water overtopping the sea wall, during storm events would lead to changes in river water chemistry and associated biological quality elements (BQEs) in adjacent river water body, Tributary of the Butley River (GB105035040170). However the impact of saline intrusion is likely to be short-term with the water body regaining its freshwater status over time. As the WFD is concerned with non-temporary effects it has been concluded that there would be no deterioration in ecological potential due to sea water overtopping the sea wall.</p> <p>The Plan proposal to Hold the Line and build 'resilient' sea defences should limit the amount of sea water entering the Waveney and East Suffolk Chalk and Crag groundwater body during storm events. Therefore WFD4 would not be compromised by the AOEP Draft Plan proposal to Hold the Line.</p>	X	√	√

Assessment Table 3. Assessment of AOEP Draft Plan proposals against the Environmental Objectives of the Water Framework Directive.						
Flood cell	Location	AOEP proposal	WFD assessment of deterioration	Environmental objectives met?		
				WFD 2	WFD 3	WFD 4
4	Orford village (generally seaward of Broad Street) and marshes to the NE and SW. Flood cell represents approximately ¼ of the total length of sea wall in the estuary extending from the lower third of the Butley River to the bend in the river at Slaughden.	HTL Upgrade to maintain the existing configuration of the river. Will require major work before 2021.	<p>Most defences are earth embankments in fair condition although the riverward face is relatively steep in places. There are also some short sections of concrete defences that pass through and around the properties between Orford Quay and the town itself. Over all, the defences provide a low standard of protection due to some particularly low sections.</p> <p>HTL of the existing defences would contribute to the continued erosion of the intertidal foreshore in estuarine water body Alde & Ore (GB520503503800). Over the term of the Plan sea level rise and coastal squeeze is likely to impact saltmarsh and benthic invertebrates, therefore failing Environmental Objective WFD2.</p> <p>This flood cell is pumped. Therefore, the HTL policy would not result in increased frequency of tide locking and subsequent water depth in adjacent Alde & Ore tidal river water bodies (GB105035077790 and GB105035040180) in response to climate change/sea level rise. Environmental Objective WFD 3 would not be compromised.</p> <p>Sea water overtopping the sea wall, during storm events would be unlikely lead to significant changes in river water chemistry and associated biological quality elements (BQEs) in adjacent Alde & Ore tidal river water bodies (GB105035077790 and GB105035040180) .</p> <p>The Plan proposal to Hold the Line and build 'resilient' sea defences should limit the amount of sea water entering the Waveney and East Suffolk Chalk and Crag groundwater body during storm events. Therefore WFD4 would not be</p>	X	√	√

Assessment Table 3. Assessment of AOEP Draft Plan proposals against the Environmental Objectives of the Water Framework Directive.						
Flood cell	Location	AOEP proposal	WFD assessment of deterioration	Environmental objectives met?		
				WFD 2	WFD 3	WFD 4
			compromised by the AOEP Draft Plan proposal to Hold the Line.			
5 Iken Marshes	South side of the river Alde from the Anchorage at Iken downstream to the high ground directly opposite Aldeburgh Marshes.	HTL EA will continue to maintain in the short term (up to about 20 years) to protect the population of avocets, a qualifying feature of the Alde and Ore Estuary SPA. AOEP propose to upgrade thereafter.	<p>Potential to cause the loss of intertidal habitats such as saltmarsh (Angiosperms) and mudflats (benthic invertebrates), therefore failing Environmental Objective WFD2 in estuarine water body Alde & Ore (GB520503503800).</p> <p>This flood cell is pumped. Therefore, the HTL policy would not result in increased frequency of tide locking and subsequent water depth in adjacent Alde & Ore tidal river water body (GB105035077800) in response to climate change/sea level rise. Environmental Objective WFD 3 would be met.</p> <p>Sea water overtopping the sea wall, during storm events would be unlikely lead to significant changes in river water chemistry and associated biological quality elements (BQEs) in adjacent Alde & Ore tidal river water body (GB105035077800).</p> <p>The Plan proposal to Hold the Line and build 'resilient' sea defences should limit the amount of sea water entering the Waveney and East Suffolk Chalk and Crag groundwater body during storm events. Therefore WFD4 would not be compromised by the AOEP Draft Plan proposal to Hold the Line.</p>	X	√	√
6 & 7 Snape to	Runs from the top of the Alde estuary behind	HTL Upgrade. Houses and farmland	The hold the line proposal, over the term of the Plan, will increase tidal energy and velocity and impact saltmarsh	X	X	√

Assessment Table 3. Assessment of AOEP Draft Plan proposals against the Environmental Objectives of the Water Framework Directive.						
Flood cell	Location	AOEP proposal	WFD assessment of deterioration	Environmental objectives met?		
				WFD 2	WFD 3	WFD 4
Langham Bridge	the 'horse-shoe' of defences that extend east from the tidal sluice at Snape.	flooded during December 2013 surge. EA have secured funding from 'national post flooding funds' for preparatory investigative work for the Snape Village flood defence. Discussions with AOEP and all concerned locally will need to confirm the agreed design and costs. A & O futures approach was to raise defences on existing or slightly straightened line to be funded by a combination of public and private money.	<p>(angiosperms) downstream, therefore failing Environmental Objective WFD2 in estuarine water body Alde & Ore (GB520503503800).</p> <p>The HTL policy could result in increased frequency of tide locking and subsequent water depth in adjacent river water bodies Alde (GB105035045950 and GB105035046060), Ore (GB105035045970) and Fromus (GB105035045980) in response to sea level rise, therefore potentially failing Environmental Objective WFD 3.</p> <p>Sea water overtopping the sea wall, during storm events would lead to changes in river water chemistry and associated biological quality elements (BQEs) in adjacent river water bodies Alde (GB105035045950 and GB105035046060), Ore (GB105035045970) and Fromus (GB105035045980). However the impact of saline intrusion is likely to be short-term with the water bodies regaining their freshwater status over time. As the WFD is concerned with non-temporary effects it has been concluded that there would be no deterioration in ecological potential due to overtopping.</p> <p>The Plan proposal to Hold the Line and build 'resilient' sea defences should limit the amount of sea water entering the Waveney and East Suffolk Chalk and Crag groundwater body during storm events. Therefore WFD4 would not be compromised by the AOEP Draft Plan proposal to Hold the Line.</p>			
8 Ham Creek	North side of the upper estuary approx half way between Snape and Aldeburgh	HTL The important asset to protect is the aquifer used for irrigation of land further afield and the landowners have taken	Defences are earth embankments; the riverward face is relatively steep in places. They are in fair condition and provide a low standard of protection; The concrete block work providing erosion protection is in very poor condition. Walls were badly affected with the December 2013 surge	X	X	√

Assessment Table 3. Assessment of AOEP Draft Plan proposals against the Environmental Objectives of the Water Framework Directive.						
Flood cell	Location	AOEP proposal	WFD assessment of deterioration	Environmental objectives met?		
				WFD 2	WFD 3	WFD 4
		on the maintenance of the wall themselves.	<p>with breaches and back slips to the walls. These have been repaired.</p> <p>Sea level rise will result in the potential loss of intertidal habitat, due to submergence, in estuarine water body Alde & Ore (GB520503503800). This has the potential to impact on angiosperms and benthic/macrobenthos and therefore fail Environmental Objective WFD2.</p> <p>The HTL policy could result in increased frequency of tide locking and subsequent water depth in adjacent Alde & Ore tidal river water body (GB105035045960) in response to climate change/sea level rise, therefore potentially failing Environmental Objective WFD 3.</p> <p>Sea water overtopping the sea wall, during storm events would be unlikely lead to significant changes in river water chemistry and associated biological quality elements (BQEs) in the adjacent Alde & Ore tidal river water body (GB105035045960).</p> <p>The Plan proposal to Hold the Line and build 'resilient' sea defences should limit the amount of sea water entering the Waveney and East Suffolk Chalk and Crag groundwater body during storm events. Therefore WFD4 would not be compromised by the AOEP Draft Plan proposal to Hold the Line.</p>			

Assessment Table 3. Assessment of AOEP Draft Plan proposals against the Environmental Objectives of the Water Framework Directive.						
Flood cell	Location	AOEP proposal	WFD assessment of deterioration	Environmental objectives met?		
				WFD 2	WFD 3	WFD 4
9 Hazelwood Marshes	North bank of the upper estuary just inland from Aldeburgh, between the estuary and the A1094 Saxmundham Road. Majority of cell owned by Suffolk Wildlife Trust.	It is not intended to repair the breaches in the sea wall which occurred during the December 2013 surge tide.	Defences were earth embankments: riverward and landward faces are relatively steep in places. The walls provide a low standard of protection. In the December surge 2013 the walls were breached and the marsh is now regularly flooded and can no longer be considered a freshwater marsh. The BQEs will be met by default and have not arisen as a result of mitigatory measures offered by the AOEP Draft Plan.	√	N/A	N/A
10 North Aldeburgh - North Thorpeness and Haven Marshes	Landward of shingle ridge that runs between Aldeburgh and Thorpeness. This flood cell stops short of those areas currently affected by cliff erosion.	To be considered.	From A & O Futures document (ref) : The shingle ridge is expected to continue to provide protection to properties in this area in the future some work will be needed to maintain the sluice and it will be possible to use national funding for this. The ridge is expected to move slowly landward over the next hundred years and it may be expected to protect properties to the south of Thorpeness and the North of Aldeburgh. This is not expected for at least 20 years although long predictions are uncertain. Any new defences will probably need to be funded by a combination of public and private funding. Not assessed - no AEOP Plan proposal. Open coast - potential to disrupt active process site and vegetated shingle habitat (angiosperms).	N/A	N/A	N/A

Assessment Table 3. Assessment of AOEP Draft Plan proposals against the Environmental Objectives of the Water Framework Directive.						
Flood cell	Location	AOEP proposal	WFD assessment of deterioration	Environmental objectives met?		
				WFD 2	WFD 3	WFD 4
10 South Aldeburgh - Aldeburgh Marshes and Aldeburgh town frontage to Slaughden	The southern side of Aldeburgh fronting both the coast and estuary.	HTL From A & O Futures: Cost to upgrade the walls £371,202.00. The strategy proposed intends to bring the walls to a standard so that they are resilient to overtopping in 2050 from a 1:200 year event. Unlike other flood cells, Flood Cell 10 is dependent on defences from the sea as well as from the river.	The AOEP is not able to undertake coastal flood defence works, which will remain the province of the EA. The HTL option would exacerbate saltmarsh loss and would not allow for the development of alternative options which could lead to the restoration of a more natural configuration of the adjacent shingle barrier on estuarine water body Alde & Ore (GB520503503800), therefore failing Environmental Objective WFD2.	X	N/A	N/A
11 King's and Lantern Marshes		Dependent on discussions with the National Trust.	Defences are earth embankments; riverward and landward faces are relatively steep in places. They are generally in fair condition; though in some places the embankments are low and provide poor standard of protection. After the December 2013 surge the American Wall at the north end of the cell breached and the northern part of the site remain inundated including the area owned by Babcocks. Planned to repair breaches in sea wall in 2014. Not assessed - no AOEP Plan proposal.	N/A	N/A	N/A
12 & 13 Havergate Island	Island(s) at, and just upstream of, the confluence of the Butley Creek and the main estuary, approximately opposite Gedgrave Marshes.	For discussion with RSPB (landowner)	Defences are earth embankments: They are in fair condition and provide low standard of protection. Breaches occurred during the December 2013 surge. Not assessed - no AOEP Plan proposal currently.	N/A	N/A	N/A

5. Step 4 - Conclusion of the Water Framework Directive assessment and recommendations

It was not possible to assess Flood Cells against the environmental objectives where proposals for their future management had not been stated; this affected units 10 (North Aldeburgh section), and land owned by the RSPB and the National Trust in Flood Cells 11, 12 and 13. All other Flood Cells were assessed. The realignment at Hazlewood Marshes (Flood Cell 9), due to the unplanned breaches of the sea wall, is likely to promote the development of intertidal habitats and may potentially improve the water body status of the Alde and Ore transitional water body and have a positive effect on the Biological Indicators. As a result BQEs are likely to be met by default and not as a result of mitigatory measures offered by the AOEP Plan.

Excepting the Flood Cells discussed in the above paragraph, the AOEP Plan is likely to lead to the loss of intertidal habitat and associated species over the Plan period. It has been determined in Step 3 that there is the likelihood that the AOEP Plan proposals will have an effect on the Biological Quality Elements, in terms of deterioration and/or failure to improve, which will be significant at the water body level in the Alde and Ore transitional water body and in freshwater bodies discharging into the estuary under natural flow conditions.

During the consultation period, the AOEP and the advisory authorities (Suffolk County Council, Natural England and the Environment Agency) met to discuss the steps required to progress the Plan through the Water Framework Directive and Habitats Regulation Assessment. Based on the policies proposed, the Plan cannot be considered to be compliant with the Water Framework Directive. However, the inclusion of the measures outlined below, within the main body of the Plan, demonstrates a commitment from the AOEP to work with the various advisory authorities to deliver a programme of monitoring, review and compensation as and when required.

This means that the following measures must be taken into consideration when forming the conclusion for this assessment:

- The Alde and Ore Estuary Partnership will enter into a formal monitoring programme for the Estuary, its habitats, water quality and wildlife dependent upon those habitats. Such a programme will need to be approved by Natural England and the Environment Agency. Consideration should also be given to the responsible partner who will determine the rate at which deterioration, of the BQE, requires intervention as well as the level of mitigatory activities required.
- The Alde and Ore Estuary Partnership will enter into a formal commitment (within the Alde and Ore Estuary Plan) to provide replacement habitat if that need is identified in the monitoring programme mentioned in the above. The monitoring and review group will be established in Year 1 of the Plan and will be responsible for identifying and agreeing triggers at which intervention is required. The monitoring and review group should identify potential locations for realignment, area and a line of sight for future activities.

- If monitoring and review indicate that there is likely to be a net loss of key habitats (in terms of quantity or quality), then replacement habitat will be created by the AOEP. As part of this review, saltmarsh restoration projects undertaken by AOEP must be monitored. These projects would need to demonstrate measurable saltmarsh growth if they are to contribute to the saltmarsh budget in the estuary. In the event that net losses are being recorded overall then replacement habitat will be created. Funding and potential locations will be identified by the monitoring and review group in the early years of implementation.
- Saltmarsh restoration work is currently being carried out by the AOEP and further restoration work is planned. If it can be demonstrated, through monitoring, that this technique is encouraging silt deposition and is not having a detrimental impact, this could continue into future years, with advice being sought from Natural England and the Environment Agency.
- The AOEP have identified a number of milestones within their Plan that includes: an assessment of the Plan's impacts every five years; a review of the Plan every ten years; reassessment of the Plan in 2050.

It is acknowledged in this conclusion that 60 ha of new intertidal habitat have been created at Hazlewood marshes following the December tidal surge. Natural England have advised that this will make a significant contribution to offsetting coastal squeeze. It is also noted that there may be opportunities to work with the RSPB to create habitat at Boyton Marshes which, for future years, may also contribute to offsetting potential impacts of the Plan.

The requirements of the Water Framework Directive have been measured against the AOEP Plan at a strategy level due to the uncertainties of how the Plan will be implemented in future years. Taking into consideration the high level nature of this assessment and the AOEP's commitment to deliver the measures it can be concluded that, at a strategic level, the Plan is compliant with the Water Framework Directive.

However, this statement of compliance is on the understanding that:

1. Individual projects and schemes, within the estuary, will be subject to the appropriate permissions and will require a project level Water Framework Directive assessment. This action may in turn generate its own monitoring and mitigation plan to offset potential deterioration/failure to improve on the BQE's. There are a number of uncertainties in the Plan regarding implementation timescales, feasibility and financial inputs. These uncertainties will need addressing before any project level assessments can be undertaken. Any project level assessments should be linked back to the delivery of the measures outlined in this strategic approach to a Water Framework Directive assessment.
2. The measures will be an integral part of the development of any project/scheme and failure to deliver these measures will result in the Plan being non-compliant with the Water Framework Directive.
3. If there is a significant change in the aspirations or policies of the Plan, then compliance with the Water Framework Directive will need to be reassessed.

The Environment Agency, Natural England and Suffolk County Council will continue to work with the AOEP to develop the Plan and to ensure that legal obligations are satisfied for the Water Framework Directive.

References

Alde and Ore Estuary Partnership (2014). Alde and Ore Estuary Plan.

Environment Agency (2009). River Basin Management Plan. Anglian River Basin District. Annex B: Water Body Status Objectives.

Environment Agency (2009). Assessing Shoreline Management Plans against the Requirements of the Water Framework Directive – Guidance and Background Information.

Environment Agency (2011). Alde & Ore Futures - Managing the Coast - Strategic Environmental Assessment: Draft Environmental Report.

Institute of Estuarine and Coastal Studies (IECS; 2011). Suffolk Estuarine SSSIs – Assessment of Changes in Extent of Saltmarsh Over the Period 1999/2000 to 2006/2007, Volumes 1 & 2. Report to Natural England.

Natural England (2009). Condition of SSSI units.
<https://designatedsites.naturalengland.org.uk/ReportUnitCondition.aspx?SiteCode=S1003208&ReportTitle=ALDE-ORE ESTUARY>

Natural England (2013). NVC Survey of Alde-Ore Estuary SSSI/SPA/SAC. Project Reference No: LB13/14-84030-AldeOre. Completed by Abrehart Ecology. Part of the IPENS programme (LIFE11NAT/UK/000384IPENS) financially supported by LIFE, a financial instrument of the European Community.

Pye, K (2005) Alde and Ore Estuary Flood Management Strategy - Assessment of Background Evidence and Recommendations for Further Action. Kenneth Pye Associates Ltd.

Appendix 1.

Alde and Ore Estuaries: Condition of saltmarsh in Flood Cells based on saltmarsh extent survey (IECS, 2011), Natural England condition assessments (2009) and a National Vegetation Survey (Natural England, 2013) – flood cells equated to SSSI units. [Note: This is not a detailed assessment (which would require comparison of GIS layers for the map-based surveys) but provides an indication of saltmarsh changes both in extent and quality).				
Name of flood cell	Flood cell no	Corresponding SSSI units	IECS report comments (with NE condition assessment comments where indicated)	NVC survey description of plant communities in flood cell (with NE condition assessment comments where indicated)
Boyton/Butley Marshes (Butley River)	1	31, 28, 29, 43	The saltmarsh area in the up-river extent of the flood cell has remained stable over the seven-year reporting period. The marsh has receded along its seaward edge east of Carmen's Wood and in the middle reaches of the river. On the lower Butley, the marsh is continuous along the west bank. Saltmarsh has colonised mud pans adjacent to Burrow Hill and accretion of the marsh edge is evident north of the Boyton Dock to the Ferry Bridge. However, recession of the marsh has occurred around Boyton Marshes. The saltmarsh fringing the River Ore has experienced losses at the northern end and south-western margins, with accretion of the seaward edge in the middle section. Overall, the study mapped an increase in extent of over half a hectare along this stretch.	<p>31 - Drift line vegetation with transition to high saltmarsh and grassland. Sea purslane marsh with thrift and sea lavender; sea purslane marsh. Rare shingle to saltmarsh transitional habitats.</p> <p>28 – Sea purslane and saltmarsh grass communities; transitions to grassland; nationally scarce golden samphire; saltmarsh grass with sea lavender and thrift.</p> <p>29 – Low – mid marsh with saltmarsh grass and sea purslane with invasive <i>Spartina anglica</i> (common cord-grass) in degraded condition – east of Carmen's Wood; native annuals; thrift/sea lavender/saltmarsh grass/ transition to grassland (rare on Alde-Ore); sea purslane comm.</p> <p>43 – Sea purslane community; saltmarsh grass comm; mid-upper comm – saltmarsh grass/sea lav/thrift; low-mid marsh; transitions to grassland</p>
Butley Mills	2	44	Lowland fen, marsh and swamp – habitat not part of mapping remit.	44 – Head of Butley River units swamp reed bed encroaching heavily on saltmarsh – squeezing out remaining saltmarsh (NVC). NE - wet woodland with fen/marsh/swamp part of the estuary complex. Limited freshwater input. Reed bed with sedges and rushes – reedbed invasive into saltmarsh. Desmoulins's whorl-snail <i>Vertigo moulinsiana</i> RDB3 mollusc in reedbed. Saltmarsh rush with red fescue.

Alde and Ore Estuaries: Condition of saltmarsh in Flood Cells based on saltmarsh extent survey (IECS, 2011), Natural England condition assessments (2009) and a National Vegetation Survey (Natural England, 2013) – flood cells equated to SSSI units. [Note: This is not a detailed assessment (which would require comparison of GIS layers for the map-based surveys) but provides an indication of saltmarsh changes both in extent and quality).				
Name of flood cell	Flood cell no	Corresponding SSSI units	IECS report comments (with NE condition assessment comments where indicated)	NVC survey description of plant communities in flood cell (with NE condition assessment comments where indicated)
Chillesford Lodge Marshes (Butley River)	3	28, 29, 42	The saltmarsh has remained fairly stable within this flood cell with slight recessions along the seaward edge of the marsh. Accretion was noted around the fragmented saltmarsh areas and within the body of the marsh in the upper section.	28 - Low mid-marsh, annual glasswort, <i>Spartina anglica</i> ; sea purslane/saltmarsh grass; saltmarsh grass/sea lavender/thrift. 29 – No fronting saltmarsh between The Cliff and west of Bob Ward’s Carr. Short stretch of degraded low transitional marsh next to sea wall grading into sea purslane/saltmarsh grass above The Cliff. 42 – <i>Spartina anglica</i> dominant component within the sea aster and saltmarsh grass communities. Sea rush; sea purslane.
Orford with Gedgrave and Sudbourne Marshes (Alde, Ore & Lower Butley Rivers)	4	10, 11, 24, 25, 28	Most of the saltmarsh on the north and east banks of the Alde in this flood cell remained stable over the seven-year study period. However, saltmarsh loss was mapped near Orford jetty. Natural England reported erosion along the seaward fringe of the saltmarsh west of Orford with frequent salt pans and large, deep creeks extending to the base of sea wall. Some accretion was noted by the mapping study at Chantry Point. Saltmarsh is continuous along the sea wall in the lower Butley River section of this flood cell. Losses have occurred on the outer boundary of the marsh near The Cliff at Gedgrave.	10 – Degrading marsh along frontage opposite Aldeburgh marsh with <i>Spartina</i> encroaching into saltmarsh grass marsh and sea aster marsh. Mostly the same SW of Slaughden, where it extends round the bend. 11 – Northern extent of linear saltmarsh: low - mid marsh. No saltmarsh on headland sections; no saltmarsh – stretch opposite radio station. Saltmarsh in embayments – sea purslane/sea lav/sea thrift. Sea purslane/saltmarsh grass & <i>Spartina anglica</i> above section opposite radio station. Pioneer marsh immediately south of this. 24 – Short extent of linear marsh Town Marshes to north of Orford Village – low to mid marsh with annual species & sea purslane/sea lavender/sea thrift. No saltmarsh fronting sea wall Orford village to Chantry Marshes. 25 - Chantry Point and Tide gauge to east – embayments with low-mid marsh. No fronting marsh opposite wider section of Havergate. Marsh strip around Inset Point – low to mid marsh (sea purslane and saltmarsh grass); high to mid - saltmarsh grass/sea lavender/thrift). 28 – Lower Butley River east bank around Chantry Marshes – low-mid marsh with sea purslane and saltmarsh grass.

Alde and Ore Estuaries: Condition of saltmarsh in Flood Cells based on saltmarsh extent survey (IECS, 2011), Natural England condition assessments (2009) and a National Vegetation Survey (Natural England, 2013) – flood cells equated to SSSI units. [Note: This is not a detailed assessment (which would require comparison of GIS layers for the map-based surveys) but provides an indication of saltmarsh changes both in extent and quality).				
Name of flood cell	Flood cell no	Corresponding SSSI units	IECS report comments (with NE condition assessment comments where indicated)	NVC survey description of plant communities in flood cell (with NE condition assessment comments where indicated)
Iken Marshes (Alde River)	5	3, 5, 8	IECS reported that erosion is concentrated along the seaward margins particularly at Troublesome Reach, north of the Anchorage, where the main channel cuts close to the bank, north of Iken; along the floodbank south of Long Reach; and north of Iken Marshes. Degenerative changes also occurred north-west of Stanny Farm and within the fragmented saltmarsh west of Cob Island. Some accretion has occurred elsewhere along the seaward edge margins and within the creek systems, with a very stable area in the centre of the marsh adjacent to Yarn Hill. Natural England's condition monitoring visit noted that coastal squeeze is actively occurring in the SSSI units represented in this flood cell with degraded and eroding saltmarsh. On balance there appeared to be a net loss of saltmarsh in this cell.	3 – Around The Anchorage – <i>Spartina anglica</i> on marsh edge and annual glasswort inside – actively eroding. Internally – high marsh -sea rush & sea arrowgrass and grassland transition & saltmarsh rush/red fescue. 5. – The Anchorage east – Iken Marshes – leading edge <i>Spartina anglica</i> with sea purslane type marsh behind plus saltmarsh grass community; sea rush/sea arrow grass comm; transition to grassland. 8 – Iken Marshes north – sea purslane/saltmarsh grass/ <i>Spartina anglica</i> . To east no fronting marsh. Opposite Hazlewood Marshes – sea purslane/ <i>Spartina anglica</i> .
Snape to Langham Bridge (head of Alde River)	6 & 7	1, 2	North bank of Flood Cell not mapped. On the south bank saltmarsh accretion at the Maltings.	1 – Snape just east of bridge to Snape Warren, north bank - historic breach site (post 1945) dominated by reed bed which is encroaching into saltmarsh. <i>Spartina anglica</i> developing on the foreshore as single-species stands; annual glasswort; transitional grassland. 2 - West part upper river, south bank, Snape – dominated by reedbed encroaching saltmarsh. Flood cell also extends west of bridge.
Ham Creek Marshes	8	6	The most stable area of saltmarsh was found within Ham Creek, with an increase of saltmarsh at the seaward edge along the majority of the flood cell. Natural England's ground truthing verifies this. A notable area of erosion has developed since 2000 to the south of Black Heath. Natural England's ground truthing verifies this.	6 - Narrow foreshore below Black Heath - sand sedge dune community, plus low-mid marsh with annuals, and <i>Spartina anglica</i> . Ham Creek – <i>Spartina anglica</i> ; reed bed; red fescue/saltmarsh rush.
Hazelwood Marshes	9	9	NE described a degraded and eroded marsh fronting the sea wall. The breaching of the defences at Hazlewood Marshes on the December 2013 surge tide occurred on the southern	9 – No fringing marsh Hazlewood Marshes; to east, narrow fringing marsh between sections of exposed wall - <i>Spartina anglica</i> ; sea aster marsh & low-mid marsh.

Alde and Ore Estuaries: Condition of saltmarsh in Flood Cells based on saltmarsh extent survey (IECS, 2011), Natural England condition assessments (2009) and a National Vegetation Survey (Natural England, 2013) – flood cells equated to SSSI units. [Note: This is not a detailed assessment (which would require comparison of GIS layers for the map-based surveys) but provides an indication of saltmarsh changes both in extent and quality].				
Name of flood cell	Flood cell no	Corresponding SSSI units	IECS report comments (with NE condition assessment comments where indicated)	NVC survey description of plant communities in flood cell (with NE condition assessment comments where indicated)
			sea wall which, as indicated, had very little marsh protection.	
North Aldeburgh - North Thorpeness and Haven Marshes	10	Leiston-Aldeburgh SSSI (8,15,16,17,19,20)	Not mapped by IECS. Shingle structure – active process site. Cliffs north of Thorpeness and Sizewell. Gabion revetment at base of sandy cliff at Thorpeness end. Losses in extent due to natural processes. Shingle vegetation impacted by trampling.	Not surveyed.
South Aldeburgh - Aldeburgh Marshes and Aldeburgh town frontage to Slaughden	10	9, 10	Erosion along leading edge throughout, particularly east of sewage works; some accretion internally.	9 (west of Aldeburgh Marshes) - <i>Spartina anglica</i> along leading edge and invasive in sea purslane/saltmarsh grass community. 10 - <i>Spartina anglica</i> invasive in sea purslane/sea lavender/sea thrift marsh; flood cell extends to saltmarsh south of Slaughden.
King's and Lantern Marshes (Orford Ness – owned and managed by the National Trust)	11	11,12,19,23,24	The realignment scheme undertaken at Lantern Upper Marsh in 1999 has resulted in the growth of 3 ha of saltmarsh. The process of saltmarsh development began with the colonisation of algae over the mudflats and channels, shown in the 2000 aerial photograph. By 2007, the aerials clearly indicate saltmarsh establishment. The majority of saltmarsh on the east bank of Lantern Marshes has remained stable over the seven years with the exception of the southern and northern extremities of the marsh at Pig Pail Bridge. At King's Marshes the margins extending along the River Ore have eroded, particularly at the Chinese Wall Bridge and to the north of Stoney Ditch Point. The saltmarsh vegetation around Stoney Ditch and Stoney Ditch Point remained stable during the study period with some slight losses recorded along the seaward margins. Both internal marsh erosion - creating mud pans - and lateral edge losses had developed on the Orford Ness extent.	Not surveyed.

Alde and Ore Estuaries: Condition of saltmarsh in Flood Cells based on saltmarsh extent survey (IECS, 2011), Natural England condition assessments (2009) and a National Vegetation Survey (Natural England, 2013) – flood cells equated to SSSI units. [Note: This is not a detailed assessment (which would require comparison of GIS layers for the map-based surveys) but provides an indication of saltmarsh changes both in extent and quality].				
Name of flood cell	Flood cell no	Corresponding SSSI units	IECS report comments (with NE condition assessment comments where indicated)	NVC survey description of plant communities in flood cell (with NE condition assessment comments where indicated)
Havergate Island (owned and managed by RSPB)	12 & 13	25,26	Havergate Island (RSPB reserve) – a managed realignment was carried out over a 9 ha area. Saltmarsh is developing in the managed realignment site at the north-east end of Havergate Island. The MR site, breached in 1999, accounts for approximately 3ha of saltmarsh gain. However, this flood cell also experienced the highest loss of saltmarsh with around 1ha disappearing throughout the cell due to widening creek systems. The Orford spit is located to the south of the island.	Not surveyed.
Dovey's (owned and managed by RSPB – Havergate Island reserve)	13	25	Some advancing saltmarsh has been mapped at the western end of Dovey's (located at the southwest tip of Havergate Island). However, there has also been marsh edge erosion to the east of Dovey's.	Not surveyed.