

Able Marine Energy Park

**Environmental Management and
Monitoring Plan: 3. Compensation
habitat – Cherry Cobb Sands
RTE/managed realignment site and
associated wet grassland area**

TABLE OF CONTENTS

TABLE OF CONTENTS	1
1. INTRODUCTION	2
1.1 Process of Finalising Outstanding Targets	2
1.2 Steering Group.....	2
2. ENVIRONMENTAL BASELINE AND IDENTIFIED IMPACTS	4
2.1 Intertidal Habitats	4
2.1.1 Baseline North killingholme marsh (NKM).....	4
2.1.2 Impacts.....	5
2.1.3 baseline cherry cobb sands Saltmarsh	7
2.1.4 impacts	8
2.1.5 baseline for cherry cobb sands intertidal.....	8
2.1.6 impacts	9
2.2 Terrestrial Habitats.....	10
2.2.1 baseline for The compensation site.....	10
2.2.2 Impacts.....	10
2.2.3 baseline for north killingholme haven pits (nkhp).....	11
2.2.4 impacts	13
3. OBJECTIVES.....	14
3.1 Construction.....	14
3.1.1 Rationale & Objectives.....	14
3.2 Regulated Tidal Exchange	19
3.2.1 Rationale & Objectives.....	19
3.3 Wet Grassland and Open Water Area	30
3.3.1 Rationale & Objectives.....	30
3.4 Birds.....	43
3.4.1 Rationale & Objectives.....	43
3.5 North Killingholme Haven Pits	Error! Bookmark not defined.
3.5.1 Rationale & Objectives.....	Error! Bookmark not defined.

1. INTRODUCTION

1. The development of the Able Marine Energy Park (AMEP) east of North Killingholme on the Lincolnshire Coast will partly affect the Humber Estuary Special Area of Conservation (SAC) and the Special Protection Area (SPA) / Ramsar site. Measures to compensate for the effects of AMEP on these European sites have been identified, and are to be implemented on the north bank of the Humber Estuary near Cherry Cobb Sands (CCS).
2. This document is an Ecological Management and Monitoring Plan (EMMP) for the compensation sites and it has been drawn up taking account of guidance on management planning produced by the Conservation Management System (CMS) Consortium (www.cmsconsortium.org). It describes the compensation measures that are required and lists specific objectives which are fundamental to their delivery. Further it includes targets and management actions which support the objectives and the monitoring which will be undertaken to confirm progress towards the objectives, and ultimately confirming that they have been achieved. Limits of acceptable change are defined and any necessary remedial actions which will be undertaken should the monitoring show that these limits have not been met.

1.1 Process of Finalising Outstanding Targets

3. The compensation proposals for AMEP are complex, and the objectives and targets / management options included in this version of the EMMP have been subject to extensive discussions with stakeholders. Prior to the DCO being granted, the EMMP will be further refined through continued regular meetings with key stakeholders about targets / management actions and subsequent monitoring requirements which are yet to be agreed.
4. The EMMP is a live working document which will be in place for as long as it is deemed necessary to achieve the agreed objectives set out in it. Updates to it will be overseen by the Steering Group, whose role is explained below and includes undertaking a complete review of the EMMP every five years.

1.2 Steering Group

5. AHPL will have overall responsibility for the implementation of the EMMP. However, the involvement of other stakeholders is essential for the effective working of the EMMP, and hence AHPL will establish a Steering Group whose role will include the following:
 - to monitor the progress of implementation of the EMMP to ensure that it is meeting the objectives;
 - to consider and recommend remedial measures where those objectives are not being met;

- to provide expert views, opinions and feedback to AHPL about key issues through regular meetings and the making of formal recommendations;
 - to help direct and focus the EMMP and its development in an interactive way including through revisions to targets, monitoring requirements and if necessary the adoption of any remedial actions;
 - to undertake a comprehensive review of the EMMP at least every five years;
 - to co-opt members and working groups if necessary;
 - to ensure a transparent and open process to the implementation of the EMMP with an evident audit trail, and regular updates are produced for dissemination to a wider audience (e.g. via AHPL / HINCA websites).
6. AHPL is seeking an inclusive approach and the Steering Group will comprise the following stakeholders in addition to AHPL:
- Natural England;
 - Environment Agency (EA);
 - The Royal Society for the Protection of Birds (RSPB);
 - Marine Management Organisation(MMO);
 - representatives from the local wildlife trusts;
 - representatives from the local authorities;
 - Humber Industry Nature Conservation Association (HINCA); and
 - Two representatives, one from the local residents and one from local interest groups (which can be rotated as required).
7. In addition to the above the Steering Group can co-opt members and form working groups where appropriate to consider specific issues. The chair of the Steering Group will be HINCA, an organisation of some standing in the Humber area (<http://humberinca.co.uk/introduction.php>) for over a decade, and one which the vast majority of other members of the Steering Group are already members.

An agenda will be drawn up in advance of each Steering Group meeting by AHPL and minutes will be produced after the meeting by them for agreement. The compensation proposals are complex and the Steering Group will meet frequently. Until 2018 EMMP meetings will be held at least every quarter, and then the frequency will be subject to review by the Steering Group. The Steering Group will also be able to call special meetings in response to specific issues / concerns identified based on a majority decision amongst the Group.

2. ENVIRONMENTAL BASELINE AND IDENTIFIED IMPACTS

2.1 Intertidal Habitats

2.1.1 BASELINE NORTH KILLINGHOLME MARSH (NKM)

8. The baseline is described in EX23.3 Part 2 in terms of historical trends, mud type, benthic community and bird populations. The shore was eroding but has entered a phase of accretion since 2000 after the construction of the Humber International Terminal. As a result, over the last 10 years the intertidal area that lies between the MHWN and MHWS elevations has increased from 3.27 ha to 18.95 ha, an increase of 15.68 ha. The sediments are composed of a high proportion of fine silts giving soft and sloppy mud. The upper shore is subject to colonisation by *Spartina anglica* dominated saltmarsh. Table 1 summarises the benthic population (details of the methodology are given in Annex 10.1 of the Environmental Statement (ES). Biomass is wet (blotted) weight in grams. Further data is provided in the Marine EMMP (MEMMP).

Table 1: Intertidal Abundance and Biomass of Principal Species

abundance								
species	(12 x 0.01m ² samples)	per m ²	species	(12 x 0.01m ² samples)	per m ²	species	(12 x 0.01m ² samples)	per m ²
<i>Tubificoides benedii</i>	268	2233	<i>Tubificoides benedii</i>	271	2258	<i>Streblospio shubsolii</i>	91	758
<i>Hediste diversicolor</i>	114	950	<i>Corophium volutator</i>	202	1683	<i>Corophium volutator</i>	88	733
<i>Corophium volutator</i>	109	908	Nematoda	93	775	Nematoda	21	175
<i>Streblospio shubsolii</i>	50	417	<i>Streblospio shubsolii</i>	50	417	<i>Tubificoides swirencoides</i>	16	133
Nematoda	49	408	<i>Macoma balthica</i>	47	392	<i>Tubificoides benedii</i>	15	125
biomass								
Upper shore			Mid shore			Lower shore		
species	(12 x 0.01m ² samples)	per m ²	species	(12 x 0.01m ² samples)	per m ²	species	(12 x 0.01m ² samples)	per m ²
<i>Hediste diversicolor</i>	2.86	23.83	<i>Macoma balthica</i>	1.55	12.92	<i>Macoma balthica</i>	0.21	1.75
<i>Corophium volutator</i>	0.42	3.50	<i>Corophium volutator</i>	0.45	3.75	<i>Corophium volutator</i>	0.13	1.08
<i>Macoma balthica</i>	0.27	2.25	<i>Tubificoides benedii</i>	0.2	1.67	<i>Hediste diversicolor</i>	0.07	0.58
<i>Tubificoides benedii</i>	0.17	1.42	<i>Hydrobia ulvae</i>	0.02	0.17	<i>Mysella bidentata</i>	0.06	0.50
<i>Streblospio shubsolii</i>	0.01	0.08	<i>Streblospio shubsolii</i>	0.01	0.08	<i>Streblospio shubsolii</i>	0.03	0.25
Total biomass per m²		31.08			18.58			4.17

2.1.2 IMPACTS

- Details of agreed impacts are provided in the Statement of Common Ground (SoCG) on the Shadow Habitat Regulations Assessment (sHRA). Habitat losses are detailed in Annex B and summarised in Table 2.

Table 2: Direct (SAC/ SPA) and Indirect (SPA) habitat loss (ha)

	HABITAT TYPE		
	Saltmarsh	Intertidal Mudflat	Sub-tidal (Estuary)
Short Term	-2	-41.1	-13.5
Medium Term (0-30 years)	3.8	-39	-14
Long Term (0-100 years)	3.8	-44	-9

10. A combination of direct and indirect losses associated with the site together with long term losses in the Humber identified by the Environment Agency provide a requirement to replace a long term loss of 101.5 ha of habitat of which 88 ha is intertidal and 13.5 ha is sub-tidal. This total reflects the SPA habitat losses which are higher than those of the SAC as they include functional loss of use to birds through disturbance. They also reflect the requirement to replace intertidal habitat on 2:1 basis (due to uncertainty) and other habitats on a 1:1 basis.
11. Nine species of bird were identified as likely to be displaced by direct habitat loss and functional disturbance to the extent that an impact on site integrity was anticipated. This assessment was based on peak counts. These peaks were all recorded from the Through the Tide Counts (TTTC) reported in Chapter 11 of the ES. These peaks were all higher than the Five year mean peaks reported from WeBs counts for the period 2004/05-2008/09.

Table 3: Bird Species

Species	Humber Qualifying Population	Humber Min & Max Peaks (WeBS 2004/5-2008/09)	NKM Peak & % of Humber population represented by Peak
Avocet (breeding)	493	374-652	4 (0.8%) TTTC
Bar-tailed Godwit	5926	1490-5926	123 (3.2%) TTTC
Black-tailed Godwit	3887	2435-5323	2566 (66%) TTTC
Curlew	4440	3071-5180	158 (3.6%) TTTC
Dunlin	21518	14733-26305	1029 (4.8%) TTTC
Lapwing	18756	11700-27421	325 (1.7%) TTTC
Redshank	5445	3886-8494	540 (9.9%) TTTC
Ringed Plover	2168	781-2168	210 (9.7%) TTTC
Shelduck	5314	2892-5804	109 (2.0%) TTTC

12. Effects arising from piling on marine mammals and sea lamprey are dealt with in the Marine EMMP (MEMMP).

2.1.3 BASELINE CHERRY COBB SANDS SALTMARSH

13. The baseline is recorded in Annex 35.1 of the Environmental Statement (ES). A description of the saltmarsh that will be affected by the works is included in Annex 34.1 of the ES, and briefly summarised below.
14. The upper saltmarsh in the vicinity of Cherry Cobb Sands varies in width from five metres seaward from the base of the existing sea defences at Stone Creek in the south of the site, up to 330 m at the Outstray in the north of the site (2010 data). In a similar manner, the width of the mid saltmarsh zone also varies from 60 m in the south to around 300 m in the north of the site.

15. There is dense saltmarsh vegetation cover in the upper and mid saltmarsh zones, with little or no signs of erosion, which indicates that the habitat quality is good. These zones are dominated by sea couch grass *Elytrigia atherica* (*Elymus pycnanthus*) with other species of note including sea plantain *Plantago maritima*, red fescue *Festuca rubra* and Orache *atriplex* sp. A network of saltmarsh creeks runs through these zones, allowing water to drain off following high tide as well as allowing freshwater from the land to discharge into the estuary.
16. The lower saltmarsh zone is extensive, stretching up to 800 m from the edge of the mid saltmarsh zone. It is thought that this zone is gradually accreting. The lower saltmarsh is dominated by 'pioneer' species including annual glasswort *Salicornia europea* agg. and common cord grass *Spartina anglica*.

2.1.4 IMPACTS

17. Creation of the compensation site will require the removal of 2ha of saltmarsh for the channel in the immediate term. In the medium to long term there will be no impacts as saltmarsh will accrete as a consequence of the development and compensation site.
18. Compensation for saltmarsh losses will be provided in the managed re-alignment (MR) component of the compensation site.

2.1.5 BASELINE FOR CHERRY COBB SANDS INTERTIDAL

19. Bird surveys (EX35.14) undertaken between August 2010 and April 2011 by the Institute of Estuarine and Coastal Studies (IECS) in an area which covered both the intertidal habitats at CCS and in the inland farmland which will form the compensation site, showed that the foreshore was used by important numbers of one or more of the qualifying interest species of the SPA/Ramsar site throughout the period August to April. Species such as shelduck, grey plover, curlew, redshank, knot and dunlin were present in numbers usually well in excess of 1% of the Humber Estuary SPA/Ramsar population at both high and low tides in almost all the months surveyed. Curlew was also present on the compensation site fields in important numbers over the autumn passage period (September – October). Other species such as teal, lapwing and golden plover were present in numbers exceeding 1% in October and December to March, with black tailed godwit present in December and January, and bar-tailed godwit in most months between November and April. Passage interest included ringed plover and greenshank both of which were present on the foreshore in important numbers in August, ruff in September, and little egret on the foreshore in October. WeBS counts (see Section 35.7.9 of the ES) show that important numbers of some species can occur even over the summer months (eg ringed plover in May and dunlin in July).

20. EX34.2 provides some information on the temporal and spatial distribution of benthic communities within the Humber estuary, including abundance data for the Cherry Cobb sands area. This is summarised in the Table 4 below;

21.

Table 4: Prey Abundance at Cherry Cobb Sands

Mean per m ²	2000	2001	2002
<i>Abra tenuis</i>	1367	937	0
<i>Corophium volutator</i>	51	51	0
<i>Crangon crangon</i>	0	25	0
<i>Cyathura carinata</i>	51	0	0
<i>Enchytraeidae</i>	10937	83443	8759
<i>Eteone longa</i>	228	76	152
<i>Hediste diversicolor</i>	582	1367	1190
<i>Hydrobia ulvae</i>	152	0	329
<i>Macoma balthica</i>	3165	4557	6203
<i>Manayunkia aestuarina</i>	3823	25	0
<i>Nematoda</i>	0	39595	0
<i>Nephtys</i>	0	25	0
<i>Nephtys hombergii</i>	0	0	51
<i>Paranais litoralis</i>	101	0	0
<i>Pygospio elegans</i>	0	51	1975
<i>Scrobicularia plana</i>	0	0	456
<i>Streblospio shrubsolii</i>	0	51	0
<i>Tubificoides benedii</i>	14532	6582	1215
Total	34987	136785	20329

22. Key prey species for black-tailed godwit are highlighted in yellow and occur in higher abundance than south shore sites during the same period.

2.1.6 IMPACTS

23. Works to create the compensation site are not predicted to have significant effects on the SPA bird species. This is largely due to the visual and acoustic screening of the works which is expected from the existing sea defence wall, the diversion inland of the coastal footpath which will remove a source of disturbance to birds on intertidal habitats (which may be having effects at present) without increasing the effects on birds on inland fields, and the timing of the works to cover predominantly the summer months. This is a period when the intertidal habitats are typically less well used by waterbirds, the birds have more choice of location in which to forage and roost, and there is more daylight and good benthic invertebrate food availability across the intertidal mudflats. In addition the creation of the new

embankment is several hundred metres away from the edge of the intertidal habitat which is very extensive.

24. Mitigation to reduce impacts includes timing of the work so that potentially disturbing activities closest to intertidal bird populations occur April to October.

2.2 Terrestrial Habitats

2.2.1 BASELINE FOR THE COMPENSATION SITE

25. The compensation site comprises the Regulated Tidal Exchange (RTE) and Cherry Cobb Sands Wet Grassland (CCSWG) and is described in EX28.3 parts 3 & 4. The existing baseline is provided in Chapter 35 of the ES but updated in EX28.3 Part 6 to reflect the movement of the wet grassland and roost site from Old Little Humber Farm to CCSWG. The current use of the area is arable farmland. The landscape was assessed as having low ecological value. No water voles were present but colonisation by transient animals cannot be ruled out.
26. A badger survey is reported in Annex 35.8 of the ES and updated by EX35.13. It found two main social groups associated with two main setts and a number of outlying and subsidiary setts, with some evidence of a decline in use between surveys.

2.2.2 IMPACTS

27. These are described in EX28.3 Part 6 EIA Review and it is concluded that ecological impacts will be largely the same as those predicted in the original ES and be negligible or of minor adverse significance only.
28. Badger surveys indicated the proposals would result in the loss of 4 outlying setts associated with the group of badgers based at Sett 28, and 5 outlying setts associated with the group of badgers based at Sett 11. None of the affected setts received high levels of use from badgers in either 2011 or 2012, and none were located close to a key seasonal food source or other resource likely to be crucial to the badgers' survival. Given the availability of alternative setts elsewhere within their range, this loss would be unlikely to have a detrimental impact on badgers. A licence to close outlier setts will be required but overall the increase in foraging habitat will be beneficial.
29. Minor construction impacts could occur for reptiles without mitigation.
30. The greatest change in impacts related to the revised Compensation Scheme is apparent during the operation of the scheme, where there will be minor changes to views from a nearby property (Fair View) because of the widened embankment around the RTE scheme, and a minor change to the landscape as a result of the wind pumps at the wet grassland site.

2.2.3 BASELINE FOR NORTH KILLINGHOLME HAVEN PITS (NKHP)

31. Operational impacts are dealt with in the Terrestrial EMMP (TEMMP).
32. Baseline information on NKHP is in Chapter 11 of the ES and in the sHRA. The site holds significant numbers of the Humber bird population, and these are summarised in Table 5;
- 33.

Table 5: NKHP TTTC & WeBs Peaks

Species	Humber population	Peak / Mean of Peak count	Proportion Of Humber Population (%)	Month	Data Source
Assemblage	140197	4112	2.9	Aug	TTTC
		3787	2.7	Sep	WeBS
Avocet	493	16	3	Mar	TTTC
		27	5.5	Mar	WeBS
Bar-tailed godwit	(5926)	1	<0.1	Aug, Sep, Oct	TTTC
		-	-	-	WeBS
Black-headed gull	(7865)	41	0.5	Aug	TTTC
		-	-	-	WeBS
Black-tailed godwit*	3887	3 800	97.8	Aug	TTTC
		3 338	85.9	Sep	WeBS
Canada goose	580	-	-	-	TTTC
		1	0.1	Apr	WeBS
Common sandpiper	(46)	1	2.2	Jul, Aug	TTTC
		-	-	-	WeBS
Coot	1166	2	0.2	May, Feb, Mar	TTTC
		3	0.3	Mar	WeBS
Cormorant	(219)	1	0.5	Aug	TTTC
		1	0.3	Sep	WeBS
Curlew*	4440	7	0.2	Oct, Mar	TTTC
		12	0.3	Feb	WeBS
Dunlin	21518	270	1.3	Oct	TTTC
		380	1.8	Nov	WeBS
Golden plover	46926	1	<0.1	Aug	TTTC
		-	-	Feb	WeBS
Great black-backed gull	226	1	0.4	Jan	TTTC
		-	-	-	WeBS
Grey heron	74	3	4.1	Oct	TTTC
		3	4.1	Sep, Oct	WeBS
Knot	41772	12	<0.1	Aug	TTTC

Species	Humber population	Peak / Mean of Peak count	Proportion Of Humber Population (%)	Month	Data Source
		-	-	-	WeBS
Lapwing*	18756	5 276	<0.1 1.5	Oct Nov	TTTC WeBS
Little egret	38	1 -	2.6 -	Jun,Jul -	TTTC WeBS
Little grebe	92	- 1	- 0.9	- Sep	TTTC WeBS
Little ringed plover	6	2 -	34 -	Apr -	TTTC WeBS
Mallard	2096	34 71	1.6 3.4	Oct Sep	TTTC WeBS
Moorhen	146	4 2	2.7 1.6	Jul Sep	TTTC WeBS
Mute swan	288	1 1	0.3 0.3	Jul,Oct,Jan Feb	TTTC WeBS
Oystercatcher	3528	4 2	0.1 <0.1	Mar Aug	TTTC WeBS
Redshank	5445	249 215	4.6 3.9	Aug Aug	TTTC WeBS
Ringed plover	(2168)	- 1	- 0.1	- Aug	TTTC WeBS
Ruff	64	- 1	- 0.9	- Sep	TTTC WeBS
Shelduck	5314	9 7	0.2 0.1	May Mar	TTTC WeBS
Shoveler	145	61 29	42.1 20	Oct Dec	TTTC WeBS
Smew	2	1 -	50 -	Jan -	TTTC WeBS
Snipe	118	6 4	5.1 3.4	Oct Oct	TTTC WeBS
Teal	2865	46 30	1.6 1.0	Oct Nov	TTTC WeBS
Tufted duck	417	1 1	0.2 0.2	Jul Sep	TTTC WeBS
Water rail	7	2 -	28 -	Jun -	TTTC WeBS

34.

2.2.4 IMPACTS

35. No direct impacts are predicted but the loss of intertidal feeding arising from the development may reduce the attractiveness of NKHP as a roost site and lead to displacement resulting in an effect on site integrity.

3. OBJECTIVES

3.1 Construction

3.1.1 RATIONALE & OBJECTIVES

36. Construction impacts at NKM are dealt with in the MEMMP, and those at NKHP in the Terrestrial EMMP (TEMMP).
37. Impacts have been identified during the construction of the compensation site (RTE and CCSWG) and objectives to ensure appropriate mitigation and legal compliance during construction are required.
38. Impacts requiring mitigation have been identified for intertidal birds, breeding birds, reptiles, badgers (licensing of sett closures will be required), and water voles (probably not present but pre-survey required given records of transient populations in locality).
39. The agricultural fields that form the proposed compensation site are only used by curlew in any numbers on a regular basis. It has been agreed with Natural England that the birds currently supported on the agricultural fields that comprise the compensation site can be supported in adjacent fields. Much of the work on the inland embankment will have been completed prior to the main period of use during the autumn passage, and construction work will not be ongoing across the whole 3 km of the new embankment all at once. Hence there will be adjacent fields that will not be subject to disturbance from the works that will be available for the birds to use throughout the period they are likely to be present.
40. The intertidal area was surveyed as described in EX35.14. However this data represents peak counts only over a single non-breeding season. Targets based on WeBs data are difficult to use as the WeBs count area extends from Paull to Cherry Cobb Sands. One option may be to take the peak counts recorded in EX35.14 and apply a natural variability test derived from the standard deviation of the WeBs count data for Autumn (22% of the 5 year mean peak) and winter (42% of the 5 year mean peak). Further discussions with NE will take place to establish a suitable reference point against which disturbance can be measured.
41. The construction of RTE sluices requires piling. If programming of works does not allow piling to be undertaken during April to July then auger piling will be used in conjunction with a method statement agreed with Natural England.
42. Good construction practice and adherence to Pollution Prevention Guidance will be embedded into any works undertaken on site.

Objective C1: Construction will comply with legal requirements and best practice with regard to reptiles and water voles.

Target	<ul style="list-style-type: none"> No killing or injuring of protected species
Management	<ul style="list-style-type: none"> Strip habitat fortnightly to ensure habitat remains unsuitable for colonisation Ecological briefing for workforce (including recognition, contact procedures, action to be taken)
Monitoring	<ul style="list-style-type: none"> Undertake pre-construction survey of suitable habitat for reptiles and water voles
Who	<ul style="list-style-type: none"> Survey by suitably experienced surveyor Briefing by Environmental manager/ Ecological Clerk of Works
When	<ul style="list-style-type: none"> Pre-construction
Limits of Acceptable Change	<ul style="list-style-type: none"> N/A
Remedial Action	<ul style="list-style-type: none"> Cease work if animals found in work area and consult with Environmental Manager
Notes	Likelihood of either reptiles or water voles being present is low given habitat.

Objective C2: Prevent harm to breeding birds.

Target	<ul style="list-style-type: none"> No killing or injuring of nests, eggs, or chicks of wild birds.
Management	<ul style="list-style-type: none"> Remove suitable nesting habitat to north of existing sea wall (i.e. protected from disturbance to birds on intertidal area) during September-March. Strim areas fortnightly to reduce suitability. Ecological briefing for workforce (including recognition, contact procedures, action to be taken) Where potential nesting habitat remains (e.g. close to intertidal) and works take place during April-August site to be checked for nesting birds.
Monitoring	<ul style="list-style-type: none"> Undertake pre-construction survey of suitable habitat for nesting birds
Who	<ul style="list-style-type: none"> Survey by suitably experienced surveyor Briefing by Environmental manager/ Ecological Clerk of Works
When	<ul style="list-style-type: none"> Pre-construction
Limits of Acceptable Change	<ul style="list-style-type: none"> N/A
Remedial Action	<ul style="list-style-type: none"> Cease work if nesting birds found in work area and consult with Environmental Manager. Any active nests not to be disturbed until young have fledged and capable of sustained flight.
Notes	

Objective C3: Ensure construction is legally compliant in relation to badgers

Target	<ul style="list-style-type: none"> • Safe and licensed exclusion of badgers from setts. • Provision of suitable foraging habitat • Provision of 10 earth mounds for sett building at base of RTE northern bund and/or around CCSWG site
Management	<ul style="list-style-type: none"> • Undertake repeat survey to inform licence application. • Licence application (licences are usually only issued for period 1st July-30th November). • Closure of setts under licence. • Adherence to mitigation in licence and EX35.13
Monitoring	<ul style="list-style-type: none"> • Pre-construction to validate 2012 survey • Post construction walkover survey to check colonisation of earth mounds and sett and latrine usage.
Who	<ul style="list-style-type: none"> • Monitoring by suitably experienced consultant • Environmental Manager responsible for licensing issues and adherence to conditions.
When	<ul style="list-style-type: none"> • Repeat survey for licence application February-March 2013 • Licence application June-July 2013. • Creation and planting of mounds, planting of fruit and berry bearing shrubs at wet grassland from winter 2012/13. At RTE this process to take place in winter 2014/15. • Sett closure July-November 2013. • Post construction surveys annually for five years to cease after 3 years if population stable.
Limits of Acceptable Change	<ul style="list-style-type: none"> • 10% reduction in total number of subsidiary or outlying setts used within three years. • 5% reduction in annex setts used within two years • Cessation of use of any main sett within one year
Remedial Action	<ul style="list-style-type: none"> • Bait survey to inform analysis • If declines associated with foraging resource introduce supplementary feeding during periods of drought or other hardship • Increase foraging resource (further planting)
Notes	<p>Vegetation on mounds, particularly that at CCSWG should be unsuitable for raptors and corvids (i.e. should comprise weak stemmed and low growing cover such as raspberry and bramble). No planting should be undertaken on top of any bunds to avoid providing hunting perches for raptors and corvids.</p>

Objective C4: Minimise construction disturbance to SPA populations

Target	<ul style="list-style-type: none"> No disturbance to feeding or roosting birds on the intertidal area
Management	<ul style="list-style-type: none"> Construction work will begin with sea wall area and bunds nearest to proposed CCSWG roost site to provide visual and acoustic screen. This will be carried out during April-October. Piling will be undertaken between April-July (or if this cannot be achieved augur piling will be used). During November-March all work will take place within screen provided by sea wall.
Monitoring	<ul style="list-style-type: none"> Numbers of birds within the compensation site and intertidal area will be counted on a monthly basis. The reference target will be agreed with NE.
Who	<ul style="list-style-type: none"> Suitably experienced surveyor for monitoring. Ecological manager/ Ecological Clerk of Works to manage construction.
When	<ul style="list-style-type: none"> Monitoring During construction
Limits of Acceptable Change	<ul style="list-style-type: none"> To be agreed with NE (see discussion under rationale)
Remedial Action	<ul style="list-style-type: none"> Review construction methods
Notes	See Rationale regarding reference data issues

3.2 Regulated Tidal Exchange & Managed Realignment

3.2.1 RATIONALE & OBJECTIVES

43. In order to provide for birds displaced from NKM by construction of AMEP a compensation package that consists of a wet grassland and roost site in close proximity to existing and newly created intertidal feeding areas will be provided.
44. It has been agreed with the Regulators that compensation must be put in place to recreate 94.6 ha of habitat (73.4 ha of intertidal mudflat, and 21.2 ha of sub-tidal (estuary)) for the SAC, and 101.5 ha for the SPA.
45. The RTE & MR will be constructed to provide initially 88 ha of mudflat and a long term mudflat resource of a minimum of 44 ha. The MR component of the scheme will comprise 30.6ha of which up to 27ha is anticipated to revert to saltmarsh. SAC targets for the saltmarsh component are that it recreates typical saltmarsh and mudflat characteristics in terms of topography, zonation and species to that of the middle Humber.
46. Targets for the mudflat relate to its sediment quality and benthic communities. In turn these underpin its ability to provide functional feeding habitat for displaced bird species (see objective B1)
47. Long term sustainable mudflat will require managing to maintain principal parameters, and the construction of the four cell RTE structure reflects the need to maintain sufficient mudflat habitat even when being managed.
48. Benthic targets are currently based on mean biomass levels recorded in the 2010 survey plus a 20% increment as suggested by NE during the hearing of 12th/13th November 2012 to reflect possible overwinter losses.
49. If fish monitoring is required this will be agreed with the Environment Agency.
50. Management will be targeted to produce suitable sediment types and maintain wetness both to assist feeding birds and reduce saltmarsh encroachment within the RTE. Natural processes will be allowed to develop within the MR part of the site.
51. The warping up phase will be used to inform future management and allow an operations manual to be produced based on experience of the live system.

Objective COMP1: Construction of site and sluices

Target	<ul style="list-style-type: none"> • Delivery of site to include four RTE fields each of 18ha size, with ponds and channel areas of about 1.5ha per field, operational sluices to enable impoundment of a field at near peak spring tide level and operational sluices to enable drainage of impounded water from one field to another. • Leakage into underlying soils to be less than 200mm over a 10 day period from an initial impounded depth of water of 1,000mm.
Management	<ul style="list-style-type: none"> • Construction to be undertaken by appointed contractor, managed by APHL
Monitoring	<ul style="list-style-type: none"> • Topographic survey to define extent of site • Engineering analysis to confirm sluice performance and leakage into underlying soils and through bund
Who	<ul style="list-style-type: none"> • Survey by suitably qualified surveyor • Analysis by suitably qualified engineer
When	<ul style="list-style-type: none"> • Prior to and during the construction period
Limits of Acceptable Change	<ul style="list-style-type: none"> • The RTE part of the site must provide a minimum of 66ha of mudflat area. This could be provided in three or more fields. Sluices to be sized accordingly. • Initial level of the RTE fields to be between +1.9m OD and +2.0m OD.
Remedial Action	<ul style="list-style-type: none"> • Over consolidation of field surface to reduce leakage.

Objective COMP2: Warping up of RTE fields

Target	<ul style="list-style-type: none"> • Warping up of RTE fields by an average of 100mm depth of marine muds
Management	<ul style="list-style-type: none"> • By site managers: <ul style="list-style-type: none"> ○ After construction inlet sluices for the RTE fields are in general to be operated fully open to facilitate rapid accretion of muds across the RTE fields. ○ After the first winter period following breaching of the realignment site the sluices are to be operated in normal operational mode to avoid extended drying of the mudflat resource over the neap tide period.
Monitoring	<ul style="list-style-type: none"> • Levels over the RTE fields are to be monitored using a combination of water level monitoring, marked stakes and LiDAR or other monitoring techniques. Method statement to be prepared for the surveying.
Who	<ul style="list-style-type: none"> • Survey by suitably qualified surveyor
When	<ul style="list-style-type: none"> • Basic survey of field levels at monthly intervals during warping-up, LiDAR surveys on opportune basis of 1 to 3 year interval
Limits of Acceptable Change	<ul style="list-style-type: none"> • If average mud levels in the field achieve 100mm before the end of the first winter period after breaching sluices are to begin to be operated in normal operational mode.
Remedial Action	<ul style="list-style-type: none"> • If warping up is seen to be occurring very slowly the three additional outlet sluices could be opened up to increase exchange.

Objective COMP3: Operating Manual for water level management

Target	<ul style="list-style-type: none"> • Operating Manual for water level management by site managers
Management	<ul style="list-style-type: none"> • By site manager and suitably qualified engineer: <ul style="list-style-type: none"> ○ During the initial warping up phase sluice operation, impoundment and flushing are to be trialled ○ Operating Manual to be developed and used as the basis for operational management of site during remainder of warping up period. ○ Operational Manual to be reviewed after first year of operations.
Monitoring	<ul style="list-style-type: none"> • Water level monitoring • Recording of sluice settings
Who	<ul style="list-style-type: none"> • By site managers assisted by suitably qualified surveyor
When	<ul style="list-style-type: none"> • Operating Manual to be prepared within 6 months of site being breached. • Operating Manual to be reviewed within 18-24 months of site being breached. • Operating Manual to be reviewed every 24 months thereafter.
Limits of Acceptable Change	<ul style="list-style-type: none"> • Operating Manual provides the basis for adaptive management of water levels within the RTE fields. In combination with the sediment management plan for the RTE fields this provides the means of maintaining the sustainable compensatory mudflat resource.
Remedial Action	<ul style="list-style-type: none"> • Review of Operating Manual and modification of operating procedures

Objective COMP4: Sediment Management for RTE fields

Target	<ul style="list-style-type: none"> • Development and implementation of sediment management plan for RTE fields
Management	<ul style="list-style-type: none"> • By site manager and suitably qualified engineer: <ul style="list-style-type: none"> ○ To be developed following observation of rates and patterns of mud accretion in the RTE fields. ○ To be optimised over time to optimise mudflat functionality in the RTE fields based on the results of other monitoring. • Dredging and bed levelling to be undertaken by suitably experienced organisation
Monitoring	<ul style="list-style-type: none"> • Bed level monitoring • Photographic records • Particle size and density of accumulating material • Accumulation in channels and pond areas
Who	<ul style="list-style-type: none"> • By site managers assisted by suitably qualified surveyor
When	<ul style="list-style-type: none"> • Sediment management plan to be developed within 24-36 months of site being breached. • Implementation of plan, possibly involving initial trials, to be undertaken 5-10 years after breaching of site. • Sediment management plan to be reviewed every 24 months thereafter.
Limits of Acceptable Change	<ul style="list-style-type: none"> • Sediment management provides the basis for adaptive management of mudflat levels within the RTE fields. In combination with the water level management this provides the means of maintaining the sustainable compensatory mudflat resource.
Remedial Action	<ul style="list-style-type: none"> • Trialling and implementation of sediment management measures earlier than expected. • Methods and techniques expected to evolve over time. Could involve floating and/or land based techniques.

Objective COMP5: Monitoring of bathymetry outside the RTE fields

Target	<ul style="list-style-type: none"> • Topographic monitoring of realignment site, Cherry Cobb Sands Creek, entrance to Stine Creek and wider Foul Holme Sands environment
Management	<ul style="list-style-type: none"> • By site manager
Monitoring	<ul style="list-style-type: none"> • Survey by LiDAR of local and wider area at 1-3 year intervals • Regular (1-2 monthly) photographic surveys of realignment site, Cherry Cobb Sands Creek and Stone Creek form fixed points. • Topographic surveys at up to a total of five sections across Cherry Cobb Sands Creek and the entrance to Stone Creek
Who	<ul style="list-style-type: none"> • Site Manager and suitably qualified surveyor
When	<ul style="list-style-type: none"> • At regular intervals as outlined above. • Photographic record and topographic surveys to commence at time of consent to establish baseline conditions
Limits of Acceptable Change	<ul style="list-style-type: none"> • Changes in Cherry Cobb Sands channel cross section to be within limits assessed in 2nd Interim Report on compensation site or recorded natural variability whichever is the greater. • Siltation in the entrance to Stone Creek that can be attributed to development or operation of the compensation site to be assessed for removal by AHPL.
Remedial Action	<ul style="list-style-type: none"> • Modifications to monitoring locations as required and in agreement with EAG • Bed levelling or dredging in the entrance to Stone Creek.

Objective COMP6: The RTE site will contain similar infaunal communities to those found at NKM as defined by characteristic species in abundance and biomass (WWg/m²)

Target	<ul style="list-style-type: none"> Similar faunal community to that found at North Killingholme Marshes (provisional targets based on May 2010 characterisation data) An average Wet Weight per m² in September of 28.6g of <i>Hediste diversicolor</i>, 15.5g of <i>Macoma balthica</i> and 4.5g of <i>Corophium volutator</i>. 																
Management	<ul style="list-style-type: none"> Breach of sea defence to be made if possible within the peak benthic larval recruitment phase (March – May) Bed levelling to be conducted post spawning/recruitment phase of key species; 																
Monitoring	<ul style="list-style-type: none"> Quantitative targets to be defined and agreed following completion of full baseline (pre-construction) surveys. Possible metrics to include: Abundance and biomass dominance (key species such as <i>Hediste diversicolor</i>, <i>Macoma balthica</i> and <i>Corophium volutator</i>). Provisional biomass target (WWg/m²) based on May (2010) characterisation (in line with NE guidance a nominal increase of 20% is included within the figures below as this is considered to provide for the autumn peak); <table border="1" data-bbox="470 1182 1305 1429"> <thead> <tr> <th>Species</th> <th>High shore</th> <th>Mid shore</th> <th>Low shore</th> </tr> </thead> <tbody> <tr> <td><i>Hediste diversicolor</i></td> <td>28.60</td> <td>n/a</td> <td>0.7</td> </tr> <tr> <td><i>Macoma balthica</i></td> <td>2.70</td> <td>15.50</td> <td>2.10</td> </tr> <tr> <td><i>Corophium volutator</i></td> <td>4.20</td> <td>4.50</td> <td>1.3</td> </tr> </tbody> </table> <ul style="list-style-type: none"> Overall benthic invertebrate biomass (wet weight / m²) to exceed agreed thresholds; Abundance of specific size classes of key species (e.g. <i>Macoma balthica</i> > 2 mm <20mm, <i>Hediste diversicolor</i>) to exceed agreed thresholds; Biotope composition to align with the NKM and wider Humber complex: LS.LMu.Mest.HedMac (<i>Hediste diversicolor</i> and <i>Macoma balthica</i> in littoral sandy mud) in the upper shore and LS.LMu.MEst.HedMacScr (<i>Hediste diversicolor</i>, <i>Macoma balthica</i> and <i>Scrobicularia plana</i> in littoral sandy mud). Samples taken to support the compensation site benthic invertebrate monitoring programme will be collected by means of hand coring, Guidelines to be used in the design and subsequent 	Species	High shore	Mid shore	Low shore	<i>Hediste diversicolor</i>	28.60	n/a	0.7	<i>Macoma balthica</i>	2.70	15.50	2.10	<i>Corophium volutator</i>	4.20	4.50	1.3
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	<p>reporting of benthic monitoring are the Guidelines for the Conduct of Benthic Studies at Marine Aggregate Extraction Sites (Ware and Kenny, 2011) and the Marine Monitoring Handbook (Davies et al, 2001) unless statutory agency advice indicates an alternative approach.</p>
Who	<ul style="list-style-type: none"> • Environmental Manager and suitably qualified surveyor
When	<ul style="list-style-type: none"> • Monitoring to be undertaken annually in May and September (spring/autumn) for the first five years • Monitoring can cease if the target is achieved for three consecutive years after the first five years of monitoring provided that the management regime remains materially unchanged.
Limits of Acceptable Change	<ul style="list-style-type: none"> • Community must be characterised by the target species with a minimum AFDW biomass (conversion factors to be used in line with standard guidance) • Intertidal mudflats across 60 ha
Remedial Action	<ul style="list-style-type: none"> • Alter sluice management to ensure adequate larval transport and suspended sediment transportation into the cells.
Notes	<p>It should be noted that the taxonomic richness and abundance found at the NKM site had significantly lower numbers than would be ordinarily associated with LS.LMu.Mest.HedMac and as such is considered an impoverished variant of the biotope.</p>

Objective COMP7: The RTE site will contain similar sediment distribution patterns to those found at NKM as defined by Particle Size Distribution (PSD)

Target	<ul style="list-style-type: none"> Sediment distribution to provide Sandy mud and mud as found at Transect 3 of the characterisation survey. (79%-95% mud, 4.5%-20% sand) to provide the envelope of Particle Size Distribution
Management	<ul style="list-style-type: none"> Management of warping up and sluice gates to maintain desired sediment and fluidity of sediment
Monitoring	<ul style="list-style-type: none"> Samples taken to support the sediment monitoring programme will be collected by means of hand coring, When the full distribution has been constructed the sample should be assigned a description based on the Folk classification system (Folk, 1974) and/or the Wentworth classification system (Wentworth, 1922). Guidelines to be used in the design and subsequent reporting of benthic monitoring are the Guidelines for the Conduct of Benthic Studies at Marine Aggregate Extraction Sites (Ware and Kenny, 2011) and the Marine Monitoring Handbook (Davies et al, 2001) unless statutory agency advice indicates an alternative approach.
Who	<ul style="list-style-type: none"> Environmental Manager and suitably qualified surveyor
When	<ul style="list-style-type: none"> Monitoring for sediment to be undertaken annually in autumn for the first five years Monitoring to occur during the autumn survey once every three years thereafter if limits of acceptable change have not been exceeded in the first five years Return to annual monitoring for three years following exceeding the limits of acceptable change
Limits of Acceptable Change	<ul style="list-style-type: none"> A shift of 2 classifications within the folk system i.e. from mud to sand; OR a shift outside of the desired sediment envelope as defined by the NKM PSD data.
Remedial Action	<ul style="list-style-type: none"> Sluice gate management and dredging of material

Objective COMP8: Ensure Compensation site delivers SAC habitat objectives of 73.4 ha of intertidal and 21.2 ha of Estuarine habitat.

Target	<ul style="list-style-type: none"> Deliver a minimum of 21.2 ha of saltmarsh to replace estuary and sub-tidal. Such saltmarsh to be typical of the middle Humber estuary. Within 10 years pioneer and lower saltmarsh community to have established over 10 ha with a minimum of 70% of plant species found within similar communities on
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	<p>Humber</p> <ul style="list-style-type: none"> • Within 15 years zonation to include middle saltmarsh community. Minimum of 70% of the plant species present over similar zonation patterns in Humber. Saltmarsh to cover >15 ha. • Deliver a minimum of 73.4 ha of intertidal mudflat in the immediate term and a minimum of 44 ha of sustainable mudflat in the long term
Management	<ul style="list-style-type: none"> • Management of RTE as described in Comp 1-7 above to deliver intertidal mud. • Natural processes to occur in MR section of compensation site to allow accretion and establishment of saltmarsh although remedial action may be required if targets are not met.
Monitoring	<ul style="list-style-type: none"> • Monitoring of levels, processes, sediment and invertebrates as described in Comp 1-7 to be undertaken in MR on same basis. • Monitoring of vegetation on fixed vertical transects between creek and RTE wall. • Use of m² quadrats at fixed points to collect data on <ul style="list-style-type: none"> ○ % cover (inc. bare ground) ○ Species composition ○ Presence of macroalgae ○ Photographs of each quadrat. • Use of fixed point photography of each transect from RTE wall to creek using fixed compass bearing for broadscale recording.
Who	<ul style="list-style-type: none"> • Environmental Manager and suitably qualified surveyor
When	<ul style="list-style-type: none"> • Vegetation Monitoring annually in late summer (to aid species identification) for first 10 years. After this date frequency to reviewed by steering group • Fixed point photography annually for first 5 years then frequency to be reviewed by steering group.
Limits of Acceptable Change	<ul style="list-style-type: none"> • Less than 10ha of saltmarsh formed within first 10 years • Absence of lower saltmarsh within 10 years or middle saltmarsh within 15 years • Species composition of zones is less than 70% that of Humber reference sites (e.g. Cherry Cobb sands saltmarsh).
Remedial Action	<ul style="list-style-type: none"> • Creation of artificial creek system within MR to improve dewatering • Use of brushwood or similar fencing to assist in trapping sediment • Beneficial use of sediment from within RTE to aid saltmarsh formation in MR • Planting up of saltmarsh

3.3 Wet Grassland and Open Water Area

3.3.1 RATIONALE & OBJECTIVES

52. There are no similar sized RTE schemes which have been created, and especially ones designed to support birds.
53. Creation of wet grassland is a well-established process, and hence there is greater certainty about the ability to develop it, and also about the biomass that will be available as a result for shorebirds and especially black-tailed godwits.
54. Wet grassland is a habitat type which is known to be used by foraging black-tailed godwits, especially as the winter progresses and intertidal food resources can become depleted. There is little grassland around the Humber Estuary at present and its provision will provide a valuable additional food resource, which will also be available to the birds at high tide.
55. The provision of the roost site (formed by islands in the open water area at the southern end of the wet grassland site) close to existing mudflats at CCS will mirror the close proximity of NKHP to the mudflats at NKM. The close proximity between a secure roost site and feeding resources is thought to be important in the use of the NKM foreshore by black-tailed godwits, especially during the autumn moulting period. The roost site at CCS is expected to facilitate more extensive use of CCS by black-tailed godwits.
56. The wet grassland and open water areas at CCS are therefore included as part of the compensation package to provide additional foraging and roosting habitat in case of any under performance of the RTE.
57. Objectives are therefore based around the construction, management and maintenance of both the roost site and wet grassland to deliver suitable functionality for black-tailed godwits in particular.

Objective WG1: The site will contain wide, open expanses of wet grassland habitat with unobscured views of the surrounding area

Target	<ul style="list-style-type: none"> Wet or damp grassland vegetation community across 26ha of the CCSWGS
Management	<ul style="list-style-type: none"> Sowing with an appropriate seed mix and leaving uncut and ungrazed for 3 to 6 months, as appropriate 0.2 livestock units per hectare per year in April to June inclusive in Year 1; AND 0.3 livestock units per hectare per year in April to June inclusive in all subsequent years; OR Equivalent management by cutting the grassland No fertilisers to be used except if needed to boost earthworm biomass No herbicides to be used except if needed to control problem plant species
Monitoring	<ul style="list-style-type: none"> 60 permanent quadrats to be established measuring 1m x 1m within the wet grassland area Plant species and abundance to be recorded for each quadrat Mapping of the extent of wet or damp grassland
Who	<ul style="list-style-type: none">
When	<ul style="list-style-type: none"> Monitoring to undertaken annually in June for the first five years Monitoring can cease if the target is achieved for three consecutive years after the first five years of monitoring provided that the management regime remains unchanged.
Limits of Acceptable Change	<ul style="list-style-type: none"> At least one species characteristic of wet or damp grasslands must be present in 50 of the 60 permanent quadrats Wet grassland vegetation community across 20ha of the CCSWGS
Remedial Action	<ul style="list-style-type: none"> Raise sluice heights to increase soil moisture content, providing incidence or extent of flooding does not exceed limits of acceptable change
Notes	

Target	<ul style="list-style-type: none"> No scrub (including bramble) or trees across the entirety of the CCSWGS
Management	<ul style="list-style-type: none"> 0.2 livestock units per hectare per year in April to June inclusive in Year 1; AND 0.3 livestock units per hectare per year in April to June inclusive in all subsequent years; OR Equivalent management by cutting the grassland
Monitoring	<ul style="list-style-type: none"> Mapping of the extent of the woody vegetation
Who	<ul style="list-style-type: none"> Environmental manager
When	<ul style="list-style-type: none"> Monitoring to undertaken annually in June for the first five years Monitoring to occur in June once every three years thereafter if limits of acceptable change have not been exceeded in the first five years
Limits of Acceptable Change	<ul style="list-style-type: none"> No more than 5% scrub or trees across the entirety of the CCSWGS
Remedial Action	<ul style="list-style-type: none"> Cutting down vegetation and treatment of stumps with herbicide

Objective WG2: The site should contain open water with at least one island suitable for roosting black-tailed godwits at high tide

Target	<ul style="list-style-type: none"> An open water area of 4 to 5ha in size and an average depth of 0.35m to 0.7m in depth, according to season
Management	<ul style="list-style-type: none"> Topping up with water from external drains to maintain water level and extent to target levels, as and when required Adjustment of sluice height to retain water at the appropriate depth, during the winter period Adjustment or cessation of irrigation rate to keep extent and depth of open water within target levels, during the late summer/autumn period
Monitoring	<ul style="list-style-type: none"> Mapping the extent of the open water area Recording the depth of the water within the open water area
Who	<ul style="list-style-type: none"> Environmental manager
When	<ul style="list-style-type: none"> Monitoring of water extent and depth to occur a minimum of twice weekly during the first year; and Monitoring of water extent and depth to occur a minimum of twice monthly, and more frequently during periods of irrigation, in the next four years; Monitoring can cease if the target is achieved for three consecutive years after the first five years of monitoring provided that the management regime remains unchanged.
Limits of Acceptable Change	<ul style="list-style-type: none"> No less than 3ha of open water extent No less than 0.25m average depth
Remedial Action	<ul style="list-style-type: none"> Topping up with water from external drains and cessation of irrigation Re-instating the integrity of the slowly or impermeable lining of the open water area, if necessary

Target	<ul style="list-style-type: none"> No more than 10% dense stands of rushes (<i>Juncus</i> spp), tall sedges (<i>Carex</i> spp), reeds (<i>Phragmites australis</i>, <i>Phalaris arundinacea</i>, <i>Glyceria maxima</i>, <i>Typha</i> spp) within the open water area
Management	<ul style="list-style-type: none"> Cutting dense stands of rushes, sedges and reeds in late summer/Autumn, if present
Monitoring	<ul style="list-style-type: none"> Mapping the extent of rushes, tall sedges and reeds within the open water area
Who	<ul style="list-style-type: none"> Environmental manager
When	<ul style="list-style-type: none"> Monitoring to undertaken annually in June for the first five years Monitoring to occur in June once every three years thereafter if limits of acceptable change have not been exceeded in the first five years
Limits of Acceptable Change	<ul style="list-style-type: none"> No more than 20% dense stands of rushes, tall sedges and reeds within the open water area
Remedial Action	<ul style="list-style-type: none"> Cutting or excavating and removal of stands of rushes, tall sedges and reeds to give a maximum of 5% cover within the open water area
Notes	<ul style="list-style-type: none"> Cutting and removal of swamp vegetation to be undertaken outside the bird breeding season

Target	<ul style="list-style-type: none"> The open water area is to contain freshwater for the purpose of irrigation
Management	<ul style="list-style-type: none"> Only extracting freshwater from the external drains to top up the open water area, which may require adjustments in the extraction point and timing
Monitoring	<ul style="list-style-type: none"> Measuring salinity within the external drains Measuring salinity within the open water area
Who	<ul style="list-style-type: none"> Environmental manager
When	<ul style="list-style-type: none"> Monitoring of salinity to occur continuously using data loggers during the first year Monitoring of salinity to occur continuously during the late summer/autumn period for the next four years Monitoring can cease if the limits of acceptable change have not been exceeded in the first five years
Limits of Acceptable Change	<ul style="list-style-type: none"> Salinity of the open water area less than 1‰
Remedial Action	<ul style="list-style-type: none"> Adjust extraction regime to return salinity of the open water area to within acceptable limits

Target	<ul style="list-style-type: none"> • Two vegetation free islands within the open water area
Management	<ul style="list-style-type: none"> • Islands to be capped with butyl rubber and shells/cobbles/gravel to limit vegetation growth • Removal of vegetation annually in June, if limits of acceptable change are exceeded
Monitoring	<ul style="list-style-type: none"> • Mapping of the extent of the vegetation on each island
Who	<ul style="list-style-type: none"> • Environmental manager
When	<ul style="list-style-type: none"> • Monitoring to be undertaken annually in June for the first five years • Monitoring to occur in June once every three years thereafter if limits of acceptable change have not been exceeded in the first five years
Limits of Acceptable Change	<ul style="list-style-type: none"> • Up to 25% short perennial or ephemeral vegetation but no shrubs, trees or tall ruderal vegetation in the period July to March
Remedial Action	<ul style="list-style-type: none"> • Cut and treat shrubs, trees or tall ruderal vegetation as appropriate; OR • Remove and replace shells/cobbles/gravel cap if islands are repeatedly colonised and management becomes difficult

Objective WG3: The soil will be moist throughout the months of August to April to concentrate invertebrates at the surface and to ensure that the soil remains soft enough to be probed by waders

Target	<ul style="list-style-type: none"> • Soil penetration resistance less than 6kg on average in each month from July to March
Management	<ul style="list-style-type: none"> • Maintenance of damp but unflooded grassland through appropriate sluice management and irrigation
Monitoring	<ul style="list-style-type: none"> • Monitoring to be undertaken at 100 standard sample locations spread across CCSWGS
Who	<ul style="list-style-type: none"> • Environmental manager
When	<ul style="list-style-type: none"> • Monitoring to occur once per month from July to November annually for 5 years; and • Monitoring can cease if the target is achieved for three consecutive years after the first five years of monitoring provided that the management regime remains unchanged.
Limits of Acceptable Change	<ul style="list-style-type: none"> • Soil penetration resistance less than 8kg on average in each month from July to March
Remedial Action	<ul style="list-style-type: none"> • Increase irrigation rate in order to increase soil moisture content and reduce soil penetration resistance • Raise sluice heights to increase soil moisture content and reduce soil penetration resistance

Target	<ul style="list-style-type: none"> • Soil moisture content greater than 100% of dry weight on average in each month from July to March
Management	<ul style="list-style-type: none"> • Maintenance of damp but unflooded grassland through appropriate sluice management and irrigation
Monitoring	<ul style="list-style-type: none"> • Monitoring to be undertaken at 100 standard sample locations spread across CCSWGS
Who	<ul style="list-style-type: none"> • Environmental manager
When	<ul style="list-style-type: none"> • Monitoring to occur once annually in the month of September for 5 years; and • Monitoring can cease if the target is achieved for three consecutive years after the first five years of monitoring provided that the management regime remains unchanged.
Limits of Acceptable Change	<ul style="list-style-type: none"> • Soil moisture content greater than 80% of dry weight on average in each month from July to March
Remedial Action	<ul style="list-style-type: none"> • Increase irrigation rate in order to increase soil moisture content • Raise sluice heights to increase soil moisture content

Objective WG4: The site should be largely free of winter flooding to prevent floodwaters from killing soil invertebrates.

Target	<ul style="list-style-type: none"> Less than 10% flooding across the wet grassland area at any time (excluding the scrape and open water area)
Management	<ul style="list-style-type: none"> Appropriate sluice height and irrigation flow rate adjustment
Monitoring	<ul style="list-style-type: none"> Mapping the extent of flooding
Who	<ul style="list-style-type: none"> Environmental manager
When	<ul style="list-style-type: none"> Minimum of twice weekly during the first year; and Minimum of twice monthly, and more frequently during periods of irrigation, in the next four years; Monitoring can cease if the target is achieved for three consecutive years after the first five years of monitoring provided that the management regime remains unchanged.
Limits of Acceptable Change	<ul style="list-style-type: none"> Less than 20% flooding across the wet grassland area at any time (excluding the scrape and open water area)
Remedial Action	<ul style="list-style-type: none"> Appropriate sluice height and irrigation flow rate adjustment to enable flood waters to drain away

Objective WG5: The site will have a high density of macro-invertebrate fauna to provide food for wading birds.

Target	<ul style="list-style-type: none"> Average earthworm biomass levels of 65gm⁻² (wet weight) in less than 5 years and maintained thereafter
Management	<ul style="list-style-type: none"> Maintenance of damp but unflooded grassland through appropriate sluice management and irrigation
Monitoring	<ul style="list-style-type: none"> Annual collection of 100 soil samples measuring 25 x 25 x 10cm at standard sample locations, with subsequent soil biomass calculations
Who	<ul style="list-style-type: none"> Environmental manager
When	<ul style="list-style-type: none"> Annually in September until target is achieved and then for three years thereafter Monitoring may cease if earthworm biomass levels greater than target levels for more than three consecutive years
Limits of Acceptable Change	<ul style="list-style-type: none"> Minimum average earthworm biomass levels of 50gm⁻² (wet weight) after 3 years
Remedial Action	<ul style="list-style-type: none"> Addition of organic matter as a top dressing to promote biomass increase Adjustments to soil moisture content or extent of flooding as appropriate
Notes	<ul style="list-style-type: none"> Biomass target is derived from approximate average of natural, unflooded wet grasslands (Ausden et al, 2001)¹

¹ Ausden, M., Sutherland, W. J. and James, R. (2001), The effects of flooding lowland wet grassland on soil macroinvertebrate prey of breeding wading birds. *Journal of Applied Ecology*, 38: 320–338.

Objective WG6: The wet grassland will be managed to give a suitable sward for wading birds throughout the months of August to March

Target	<ul style="list-style-type: none"> • Average sward height of 10cm across the CCSWGS each month from July to March
Management	<ul style="list-style-type: none"> • 0.2 livestock units per hectare per year in April to June inclusive in Year 1; AND • 0.3 livestock units per hectare per year in April to June inclusive in all subsequent years; OR • Equivalent management by cutting the grassland
Monitoring	<ul style="list-style-type: none"> • Measurement of sward height at 100 sampling points
Who	<ul style="list-style-type: none"> • Environmental manager
When	<ul style="list-style-type: none"> • Monitoring to occur once per month from July to November annually for 5 years; and • Monitoring can cease if the target is achieved for three consecutive years after the first five years of monitoring provided that the management regime remains unchanged.
Limits of Acceptable Change	<ul style="list-style-type: none"> • Average sward height of 15cm across the CCSWGS each month from July to March
Remedial Action	<ul style="list-style-type: none"> • Increase livestock density to achieve shorter swards at the end of June; OR • Increase length of time livestock are present on CCSWGS to end July; OR • Introduce rotational grazing/cutting from July to September across the CCSWGS; OR • Cut grass once in August/early September.

Target	<ul style="list-style-type: none"> No more than 10% dense stands of rushes (<i>Juncus</i> spp), tall sedges (<i>Carex</i> spp), reeds (<i>Phragmites australis</i>, <i>Phalaris arundinacea</i>, <i>Glyceria maxima</i>) or tall ruderal vegetation (thistles, docks etc) in the North and Middle Fields (including the scrape)
Management	<ul style="list-style-type: none"> 0.2 livestock units per hectare per year in April to June inclusive in Year 1; AND 0.3 livestock units per hectare per year in April to June inclusive in all subsequent years; OR Equivalent management by cutting the grassland
Monitoring	<ul style="list-style-type: none"> Mapping of the extent of the species listed above
Who	<ul style="list-style-type: none"> Environmental manager
When	<ul style="list-style-type: none"> Monitoring to undertaken annually in June for the first five years Monitoring to occur in June once every three years thereafter if limits of acceptable change have not been exceeded in the first five years Return to annual monitoring for three years following exceeding the limits of acceptable change
Limits of Acceptable Change	<ul style="list-style-type: none"> No more than 15% cover of dense stands of rushes, tall sedges, reeds or tall ruderal vegetation in the North and Middle Fields (including the scrape)
Remedial Action	<ul style="list-style-type: none"> Flailing the areas dominated by unwanted vegetation twice in the year that the limit of acceptable change is exceeded; OR Herbicide application for severe infestations of rushes

3.4 Birds

3.4.1 RATIONALE & OBJECTIVES

58. The objective is to maintain populations of displaced birds. Previous sections describe objectives, management actions, and monitoring of the compensation package required to achieve this.
59. The compensation package is centred on a secure wet roost that will allow birds to exploit existing mudflat resources on the north shore immediately as well as the new wet grassland and RTE as these develop functionality.
60. The development of the full package will be incremental and how birds respond to it will require monitoring of all potential resources available to them.
61. These resources include the mudflat remaining at NKM. The total area is 77ha of which 31.5ha will be directly lost to AMEP and 11.6ha predicted to be functionally lost to disturbance. Use of the remaining area will need to be part of the monitoring programme.
62. Early provision of the roost at CCS will require monitoring of the existing mudflat between Paull and Cherry Cobb for evidence of increased use and potential competition effects.
63. The reference area for monitoring bird numbers will therefore include not only the developing RTE and wet grassland but also the remaining mudflat at NKM and existing intertidal area between Paull and Cherry Cobb Sands.
64. As the requirement of the legislation is to maintain the overall coherence of the Natura 2000 network the reference figure for the displaced species is the overall number of birds on the Humber of each species in the first instance.
65. As the compensation site develops functionality it will be required to support the peak count (see Table 3) of the birds displaced from NKM within the range of natural variability. Functionality from construction for the CCSWG will be reached with 2-4 years and up to 6 years of the RTE.
66. Natural variability is defined as the standard deviation from the peak five year mean. As the peak figures were derived from and compared with WeBs data for 2004/05-2008/09 these can be used to derive the variability. It is likely the reference figure will need to be updated during the lifetime of the plan and a rolling 5 year peak mean could be substituted with the agreement of NE.
67. As there is a danger that rapid declines could be masked by natural variability then remedial action would be required after any one year where declines exceeded natural variability, or after two years of consecutive decline even where this was within the range of natural variability.

Objective B1: The Humber wide populations of displaced species (see Table 3) remain within the range of natural variability

Target	<ul style="list-style-type: none"> No change in Humber waterbird assemblage and populations of the nine displaced species outside of range of natural variability. When RTE & CCSWG reach full functionality (i.e. when biomass and physical targets are met) they support peak counts of each species as identified in Table 3.
Management	<ul style="list-style-type: none"> Provide secure roost in first instance at CCS Develop RTE and CCSWG
Monitoring	<ul style="list-style-type: none"> Through the Tide Counts at NKM, CCS, CCSWG and RTE
Who	<ul style="list-style-type: none"> Suitably experience surveyors
When	<ul style="list-style-type: none"> Twice monthly on a spring and a neap tide
Limits of Acceptable Change	<ul style="list-style-type: none"> Any one year where declines exceeded natural variability Two years of consecutive decline even where this was within the range of natural variability
Remedial Action	<ul style="list-style-type: none"> Review data to ascertain if population is being maintained within Humber Review data on national population to ascertain if population maintained within UK If evidence of range decline provide additional compensation

